

Acknowledgements

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LONG-RANGE MANAGEMENT PLAN

WILLOUGHBY STATE FOREST

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SECTION I

Introduction

Overview of Lands Management by the Vermont Agency of Natural Resources

Purposes of Land Ownership

On behalf of the State of Vermont, the Agency of Natural Resources manages state-owned land for a variety of purposes, ranging from the protection of important natural resources to public uses of the land in appropriate places.

Natural resources include, but are not limited to, biodiversity, wildlife habitat, natural communities, water bodies, wetlands, undeveloped land, scenery, and aesthetic values.

Public uses include, but are not limited to, recreation, access to state lands or waters, environment-related businesses, flood control, education, research, and sustainable use of renewable resources such as hunting, fishing, trapping, and forest management.

Outcome of Long Range Management Plans

The Vermont Agency of Natural Resources manages state lands in a sustainable manner by considering all aspects of the ecosystem and all uses of the natural resources. (Agency Strategic Plan 2001-2005)

The agency has a mandate to serve as the principal land steward for properties owned or managed by its three departments—Environmental Conservation; Fish and Wildlife; and Forests, Parks and Recreation.

The development of long-range management plans (LRMP) for agency lands represents a key step in providing responsible stewardship of these valued public assets. Each LRMP identifies areas where different uses are to be allowed and describes how these uses will be managed to ensure protection of natural resources. The following over-arching management standards further both agency and department missions and are applied to the development of long-range management plans for all ANR lands.

Biological Diversity: Agency lands are managed to both maintain and enhance the variety and abundance of plants, animals and other life forms at scales ranging from local to regional.

Ecosystem Health: Agency lands are managed to ensure ecosystem functions, health, and sustainability. Threats and stresses are monitored, evaluated, and reported regularly.

Legal Constraints: Agency lands are managed in accordance with the purposes for which they were acquired. Many agency lands were purchased with federal funds that require management to be directed for specific purposes. These requirements and other legal

restrictions, such as conservation easements, are supported in all planning and management activities.

Natural Resource Science: The foundation for management decisions on agency land consists of comprehensive ecological assessments as developed and documented in long-range management plans.

Wildlife Management: Wildlife management activities are directed at protecting and enhancing wildlife habitat for species needing to be conserved as well as those of public interest and utilization.

Recreational Uses and Needs: Agency lands are managed to create, maintain, and enhance sustainable recreational uses. Permitted or allowed activities are dependent upon site capabilities and public need. Wildlife management areas continue to give priority to wildlife dependent activities.

Sustainable Forestry: Agency lands are managed to ensure forest health and sustainability. Vegetation management and utilization strategies based on natural communities and appropriate silvicultural guidelines ensure that trees, forests, and forest ecosystems remain healthy.

Public Involvement: State lands are a public resource. The public is involved in all aspects of decision-making on state lands, including acquisition, policy development, management planning, and the implementation of policies, plans, and regulations. In developing long-range plans, the agency considers interests outlined in local, regional, and state plans, including town plans, regional plans, watershed plans, and species recovery and management plans, and works to resolve conflicts between plans as may be appropriate or necessary.

Historical/Cultural and Scenic Values: Agency lands are managed to be sensitive to historical, cultural, and scenic values. Due to protection under state law and federal regulations, sites of archaeological or historical significance are equal in status to any other legal constraints applicable to the lands.

Best Management Practices: Lands under agency management serve as exemplary stewardship models for the public and private sectors in Vermont. Whenever possible, best management practices that are utilized are visible and easy to understand.

Regional Availability of Resources and Activities: Because every parcel of agency land cannot accommodate all the uses that the public might want, the agency works to ensure that the following uses are made available on a regional basis: sustainable forest harvest; sustainable recreational activities; wildlife-oriented activities; protection of biodiversity and natural communities; and activities that reflect historical and cultural values.

Plan Structure

This long-range management plan follows the agency's planning format. It is divided into several sections.

Section I is the **Introduction**, which includes the Agency and Department missions and an overview of lands management.

Section II is the **Parcel Description**. Found in this section is a summary of the parcel land use history, the history of acquisition, location and setting information, as well as locator maps and the parcel base map. Also included is a summary of the natural resources found on the property as well as other special resources. How this plan relates to regional and town plans is also in the section.

Section III is a **Summary of Public Input** to this plan.

Section IV covers **Management Strategies, Actions, and Implementation**. This section presents the ANR land classification scheme and applies it to the forest. Specific management objectives and strategies are presented by land classification area and by resource discipline. Prescribed management activities are also included in this section.

Section V is the **Monitoring and Evaluation** portion of the plan, which will develop over time and provide a way of tracking accomplishments.

Section VI is the **Appendix**. Found in the appendix is a complete description of the public comment process and responsiveness summary as well as the full resource analyses, forest management guidelines, glossary, pertinent policies, legal constraints, and additional maps.

Mission Statements Which have Guided the Development of this Plan

Vermont Agency of Natural Resources

The mission of the Agency of Natural Resources is "to protect, sustain, and enhance Vermont's natural resources, for the benefit of this and future generations." (Agency Strategic Plan, 2001-2005)

Four agency goals address the following:

- To promote the sustainable use of Vermont's natural resources;
- To protect and improve the health of Vermont's people and ecosystems;
- To promote sustainable outdoor recreation; and
- To operate efficiently and effectively to fulfill our mission.

Departments

Vermont Department of Environmental Conservation Mission Statement - 2001-2005

To preserve, enhance, restore, and conserve Vermont's natural resources, and protect human health, for the benefit of this and future generations.

Vermont Department of Fish and Wildlife Mission Statement - 2001-2005

The mission of the Vermont Fish and Wildlife Department is the conservation of all species of fish, wildlife, and plants and their habitats for the people of Vermont. To accomplish this mission, the integrity, diversity, and vitality of their natural systems must be protected.

Vermont Department of Forests, Parks and Recreation Mission Statement - 2001-2005

The mission of the Department of Forests, Parks, and Recreation is to practice and encourage high quality stewardship of Vermont's environment by monitoring and maintaining the health, integrity, and diversity of important species, natural communities, and ecological processes; managing forests for sustainable use; providing and promoting opportunities for compatible outdoor recreation; and furnishing related information, education, and services.

SECTION II

Parcel Description

Location/Size/Biophysical Setting

Located predominantly in the towns of Sutton and Westmore, the forest is approximately 7682 acres in size. It is easily accessible from State Routes 5 and 5A and is in close proximity to three population centers: St. Johnsbury, Lyndonville, and Newport. Two separate parcels in Sutton (113 acres and 52 acres) along with a parcel in Newark (52 acres) and in Westmore (292 acres) are also part of the State Forest. The forest is bisected by Lake Willoughby, with Mount Hor (2648 feet) to the west and Mount Pisgah (2751 feet) to the east. It is located on the divide between the Saint Lawrence and Connecticut River watersheds.

Vermont is divided into eight different biophysical regions, based on areas of similar climate, geology, topography, soils, natural communities, and land use history. Willoughby State Forest is located on the western edge of Northeastern Highlands biophysical region. This region includes most of Essex County and eastern portions of Orleans and Caledonia.

Natural Features

The most spectacular attraction of this area is Lake Willoughby and the adjacent cliffs of Mount Hor (2648 feet) and Mount Pisgah (2751 feet) that rise from the lake. This area possesses significant ecological, recreational, and aesthetic values. The highest peak in the forest is Bald Mount at 3315 feet in elevation. Lake Willoughby is 1653 acres in size with a maximum depth of 308 feet, making it one of the deepest lakes in the northeastern United States. This cold-water fishery is widely acclaimed for producing trophy-size lake trout.

The “cliffs” area of these two mountains has received national recognition. In 1967, 3000 acres of land and water were designated a National Natural Landmark by the U.S. Department of the Interior. In 1967, this national landmark was expanded to 4666 acres (3744 acres of land and 922 acres of water), following state acquisition of a large parcel of land owned by J.C. Wymess. It has also been designated a State Natural Area. Most of the shoreline in this area is state-owned and undeveloped. There are a variety of rare plants located in the vicinity of the cliff areas of Mount Hor and Mount Pisgah. They include arctic-alpine species common to northern latitude areas of the tundra region. The cliffs of Mount Pisgah are one of Vermont’s historic peregrine falcon eyries. After a 30-year absence, peregrine falcons returned to this site in 1985.

Another state natural area is located on the eastern end of Marl Pond. The Marl Pond Natural Area is 10 acres in size. It is a calcareous forested wetland with mature Northern White Cedar and several rare plant species.

There are 77 acres of water (small ponds) within or forming the boundaries of the forest. They include Bean, Wheeler, Vail, Duck, Blake, Marl, and Dolloff ponds. The Vermont Department of Fish and Wildlife manages these ponds for trout fishing during the angling season. A system of forest roads and woods trails provide access to these ponds.

The geologic formation of Lake Willoughby and the adjacent cliffs is unique. The formation process has different interpretations by geologists and remains a favorite area for field trips. The lake lies in a trough, cut in granite by an exceptionally fine example of glacial scouring. It is a significant and scenic example of glacial erosion.

History of Acquisition

Most of Willoughby State Forest—5153 acres—was purchased with federal monies coming from the Land and Water Conservation Fund. These lands have been and will continue to be managed consistent with the conditions set forth in the Land And Water Conservation Fund Act. Created by Congress in 1964, the ***Land and Water Conservation Fund*** (LWCF) provides money to federal, state, and local governments “to purchase land, water, and wetlands for the benefit of all Americans.” The initial acquisition consisted of a checkerboard of tracts totaling 1700 acres. These original holdings were located north of State Route 5A, around Mount Pisgah, and an irregular strip along State Route 5 in the town of Westmore. During the 1960s, the State purchased more than 5000 acres in the towns of Sutton and Westmore in several transactions with different landowners. These purchases connected the original tracts and gave the public complete ownership of the twin peaks Mount Pisgah and Mount Hor. The boundaries of the forest remained unchanged until 1980, when a 16-acre inholding was acquired in the town of Sutton.

In 2000, the State acquired a 292-acre parcel on Bald Mountain in the town of Westmore. This parcel is subject to the conditions of a conservation easement between the Vermont Agency of Natural Resources Department of Forests, Parks and Recreation and the ***Vermont Housing and Conservation Board***. The property includes the upper slopes and peak of this prominent mountain. Also in 2000, the State acquired a .22-acre parcel of land contiguous to the forest in the town of Westmore. This narrow strip of land is situated at the south end of Lake Willoughby and is located between the lake shore and State Route 5A. Deed restrictions as accepted by the state require that it be kept open for public access to the lake. In the spring of 2001, the ANR accepted a 90-acre donation through ***The Nature Conservancy*** with a conservation agreement. This parcel of land is located on the Wheeler Pond Road in the town of Sutton. Contiguous to the Willoughby State Forest, this parcel is primarily wooded and affords good wildlife habitat.

During this planning process the ANR acquired a 660-acre parcel of land with over 6500 feet of shoreline on May Pond in the town of Barton. This parcel of land borders, and has been added to, the Willoughby State Forest. It was acquired through The Nature Conservancy and is subject to a Grant of Development Rights, Conservation Restrictions and Public Access Easement that was signed on January 7, 2003. Because of the timing of this acquisition and the fact that it came late in the planning process, a complete assessment of the natural and cultural resources will be conducted after the completion of this planning effort. The ANR will amend this Stewardship Plan and solicit public comment prior to the implementation of stewardship activities on this parcel of land.

History of Land Use and Management

Prior to state ownership, much of this property was industrial forestland. J.C. Wymess owned and actively managed a large part of the forest and had ties to the Groveton Paper Company in Groveton, New Hampshire. The forest continues to be actively and sustainably managed under state ownership. Timber sale records date back from the late 1950s to the present. Some of the forest was also once used for agriculture. Stonewalls and stone cellar holes within the forest are evidence of this past use.

The Civilian Conservation Corps (CCC) once had a camp within the forest near Dolloff Pond. A few remains of the camp still exist to this day. Work accomplished by the crews in the forest includes the construction of the “CCC Road”, approximately four miles long. They also established plantations of Norway spruce, white spruce and red pine totaling more than 150 acres. All of these plantations have received at least two thinnings.

The Youth Conservation Corps has also been active with projects in the forest. From 1975 through 1980, when it was a federally funded program, summer enrollees were housed at the “Cheney House,” a state-owned house located at the south end of Lake Willoughby. When federal funding for this program stopped, summer crews no longer stayed here nor worked in the forest. In 1991, the newly established Vermont Youth Conservation Corps (VYCC), formed a community-based partnership with Lyndon State College, several state agencies, the town of Westmore, and many local volunteers, to restore, protect, and reoccupy the house. The VYCC used the Cheney House as a residential base camp from 1991 to 1999. Crews are active again in the forest working on a diversity of projects, including hiking trail construction and maintenance, enhancing wildlife habitat, and cultural restoration.

The “cliffs” area of Mount Pisgah and Mount Hor has received national recognition. In 1967, 3000 acres of land and water was designated a National Natural Landmark by the U.S. Department of the Interior. In 1977, it was expanded to 4666 acres (3744 acres of land and 922 acres of water), following State acquisition of a large parcel of land owned by J.C. Wymess of Groveton Paper Company.

During the mid-1970s the Vermont Legislature initiated and funded the “Household Fuelwood Program.” This program came about as a result of world oil supply shortages and increased prices. The program allows individuals to purchase and cut five-cord firewood lots on state lands. Demand for firewood in the forest was substantial, selling between 400 to 500 cords each year. It gradually tapered off as oil prices stabilized. The program has allowed the Department the opportunity to improve access and residual stand quality by thinning young vigorous stands and removing poor quality trees. It still remains a popular program.

The Portland Pipeline, a portion of which transects this state forest, was built around the time of World War II. It extends from Portland, Maine to Montreal, Quebec. Just over one mile of this line is located on the forest and runs parallel and adjacent to Route 5. The Portland Pipeline Company operates and maintains the 60-foot cleared line under securement of an easement with the State of Vermont. A 12-inch and 18-inch line was installed during the

1940s. A 24-inch line was added in 1965. These lines have been used for transporting crude and refined oil as well as natural gas.

Relationship to Town and Regional Plans

The long-range management plan for Willoughby State Forest is consistent with and complements existing town and regional plans. The plans include the Northeastern Vermont Development Association (NVDA) Regional Plan, adopted in 2000, the Westmore Town Plan, adopted in 1995, and the Sutton Town Plan, adopted in 1996. The regional plan and the Sutton town plan were under revision and expected to be re-adopted during the time period in which the Willoughby State Forest plan was being written.

Part of the vision for this region is expressed in the NVDA plan as "maintaining the environment and the rural character of the area" with recognition that these "are critical to creating a healthy economy for the Northeast Kingdom." The NVDA region also has "the opportunity and responsibility to maintain the long-held Northeast Kingdom traditions." The Willoughby Lake area is identified in the plan as one of the region's Recreation Activity Centers.

The NVDA plan also recognizes that "planned recreational development contributes substantially to our economic well-being and is a sustainable use of our natural resources." Development in the region's municipalities is broadly defined to include actions such as the buying of land by public agencies. Considerations for development in towns throughout the region include effects on the tax rate; effects on aesthetics, open space and scenery; effects on the safety of highways and highway construction and maintenance; the preservation of natural terrain, critical habitats, wetlands, rare species, and shorelines of lakes and streams.

The Westmore Plan recognizes the importance of Willoughby State Forest as a "crown jewel" among state-owned lands. It makes reference to this state forest as a magnet for tourists and a source of wood-fiber for the timber industry. The plan also notes a shift in the regional economy towards recreation and tourism, as public access to private lands is lost elsewhere. This plan lists a series of 14 policy statements that mirror issues of concern also addressed in the Willoughby State Forest Plan and the NVDA Plan.

Of particular interest is the "Overall Vision" portion of the plan, which states that "land use regulations should be kept to a minimum and enacted only on those areas critically important to maintaining the quality of life in Westmore and to protect the public health, safety and welfare." The plan emphasizes the need to protect water quality, critical habitat and other natural resources to support forestry, farming and tourism. The vision statement encourages greater self-reliance on local "value-added" industries utilizing local resources to ensure a self-sustaining economy.

The goals of the Sutton Town Plan include the protection of habitats, ecologically sensitive areas and surface water quality. The Willoughby State Forest is a local resource that is an integral part of these visions. The large expanses of contiguous forest found at the forest are uniquely suited to conserve and protect biological diversity and wildlife habitats. Manage-

Figure 1 – State Locator Map

Figure 2 – Area Base Map

ment of the forest contributes to the water quality of the lake, which produces some of the largest lake trout in Vermont along with populations of rainbow trout, landlocked Atlantic salmon, rainbow smelt, burbot, yellow perch and round whitefish.

The wide variety of recreational pursuits taking place at Willoughby State Forest contributes to the local economy. The 7682 acres in Willoughby State Forest provide a natural environment where a diversity of recreational activities as well as sustainable utilization of wildlife and forest products can occur. This state forest affords opportunities and supports traditional uses, including hunting, fishing, and trapping.

Future Acquisition/Disposition

It is the State's policy to acquire additions to ANR state lands parcels that are (1) necessary for maintaining or enhancing the integrity of existing state holdings, (2) lands such as in-holdings and other parcels that serve to consolidate or connect existing state holdings and contain important public values and/or facilitate more efficient ANR land management, (3) parcels that enhance or facilitate public access to ANR lands, and (4) parcels that serve an identified facility, infrastructure, or program need. All new acquisitions or dispositions of land to Willoughby State Forest will be guided by the "Vermont Agency of Natural Resources Lands Conservation Plan October 1999."

A future acquisition priority is a small in-holding, approximately five acres, with shoreline frontage on Lake Willoughby located at the southwestern end of the lake.

SECTION III Summary of Public Involvement

The citizen participation process for the Willoughby State Forest long-range management plan was conducted consistent with ANR and Department of Forests, Parks and Recreation policy, procedures and guidelines. Public involvement, or citizen participation, is a broad term for a variety of methods through which the citizens of Vermont have input into public land management decisions. The Agency of Natural Resources is committed to seeking that input. Expressions of citizen interest come in many forms. These include letters, surveys, personal comments, telephone calls, emails, and more formal methods, such as public meetings. All public input received for the future stewardship of Willoughby State Forest has been considered in the preparation of this plan.

First Meeting: This meeting was held on June 13, 2001. The purpose of this meeting was to share resource information and solicit comments to help guide the Department in developing a draft plan. The meeting was held at the Fellowship Hall in Westmore. A 30-day comment period was provided, closing on July 13, 2001. A summary of public comments received at the meeting and during the 30-day comment period was sent to all attendees and posted on the Agency of Natural Resources web site.

Second Meeting: This meeting was held on September 12, 2002. The purpose of this meeting was to present and receive comment on the **Proposed Draft Plan**. The meeting was held in the Burke Mountain Room at Lyndon State College. A 30-day comment period was provided, closing on October 15, 2002. A responsiveness summary to comments received at the meeting and during the 30-day comment period was developed and was included in the draft plan (Appendix).

Draft Plan: The draft plan was completed by April 1, 2003 followed by an original 30-day public comment period that was extended to June 1, 2003. A copy of the draft plan was posted on the Agency of Natural Resources web site. Copies were also made available upon individual request and distributed for review at the Newark, Sutton and Westmore town clerks offices, the Northeastern Vermont Development Association, the Saint Johnsbury District Forestry office and Waterbury headquarters office.

SECTION IV

Management Strategies, Actions And Implementation

Land Classification

Four levels of land use have been identified for the lands managed by the ANR. These land use categories indicate where different levels of use will be emphasized on the land. In this section of the plan, the recommended levels of use will be shown for all the land area in this parcel. This section also describes generally how the land will be managed so that the activities occurring on the land are compatible with the category assigned. The four categories are 1) Highly Sensitive; (2) Unique or Special Use; (3) General Use; and (4) Intensive Use. Examples or occurrences of sub-units within each broad land classification category have also been defined and are identified and mapped (Figure 3) in this process.

As part of the planning process, the lands, resources, and facilities held by the ANR are evaluated and assigned to the appropriate land use category. Assignment of land use areas for Willoughby State Forest is based on a thorough understanding of the resources available and the application of the over-arching lands management standards presented in the introduction section of the plan. The resources include natural communities, plants, and wildlife, as well as recreation, historic, timber, and water resources. The 11 lands management standards or principles include maintaining biodiversity and involving the public, as well as implementing legal constraints such as easements wherever they are applicable.

This system is a tool that helps to determine management emphasis and provides guidance in making management decisions for any particular land classification unit. In some cases, a land unit may fit into more than one land classification category. Where this is the case, classification and management emphasis is determined according to the relative importance, sensitivity, values, and functions of the resource(s) within the land unit under consideration. Other uses and management activities will be allowed, as long as they are compatible with and do not detract from the emphasized management priority for any land classification unit. Refinements and changes to land classification areas are subject to change over time as a result of technological advances, additional resource and scientific information becoming available and changing societal needs.

Land Classification Categories For ANR Land

- 1) Highly Sensitive Area** – An area with uncommon or outstanding biological, ecological, geological, scenic, cultural, or historic significance where those values are preserved and protected. Human activities and uses should be minimal and regulated to protect the exceptional features on the landscape.
- 2) Unique and Special Use Area** – An area with unique or special resources where management objectives consider protection and/or enhancement of those resources. These areas do not need to have the same level of protection given to highly sensitive areas and, in some cases, may be intensively managed for specific purposes. There may be some evidence

Figure 3 – Land Use Classification Map

of timber harvesting, wildlife management, roads, and recreational activities; however, those activities should be compatible with and will not detract from the primary objective of protection and/or enhancement of the unique or special resources.

3) General Use Area – An area where multiple land uses occur but where the dominant uses may be sustainable timber harvesting, wildlife habitat management, dispersed recreation, or other general land uses. Where one use such as recreation dominates, for example, vegetation will be managed as a secondary use so long as it can be conducted in a way that does not conflict with the dominant use or with other lands categorized as more sensitive that may be adjacent to it.

4) Intensive Use Area – An area that is easily accessible and characterized by a high level of human activity and high intensity development on or adjacent to state land. Vegetative management will be directed toward aesthetic and safety considerations. Other resources maybe managed but in a compatible way with the dominant use.

Management Priorities

The two most obvious priorities for the stewardship of Willoughby State Forest are recreational use and natural resource protection. The forest offers spectacular scenery and diversified recreational opportunities. It is important that the scenic value of this forest is maintained and that the unique natural communities associated with the Willoughby Cliffs area is protected. Planning and implementation of all stewardship activities in this forest will recognize these priorities. Management strategies will continue to be adaptive in order to respond to regional forest conditions and implications for natural resource conservation.

Management Prescriptions By Land Classification Category

1) Highly Sensitive Areas (2215 acres)

The land area classified under this category for Willoughby State Forest includes those lands where previous protection measures have been emphasized under state ownership. It does not preclude appropriate public uses of the land where those uses are deemed compatible with protecting the sensitive natural resource(s). These lands have been and will continue to be open to traditional uses such as hunting, fishing and trapping as well as dispersed recreational activities. During the history of state ownership, these lands have not been subject to active timber management because of inoperable terrain, sensitive habitats or legislative mandates in regards to the protection of State Natural Areas.

1.1) Northern White Cedar Swamp (69 acres; map reference 1.1)

General Description: Located along the upper drainage area of Dolloff Pond, this area is dominated by mature stands of northern white cedar. This particular stand of northern white cedar is a high quality example of a community that is uncommon in the state but not rare. There is one Class C forest road that bisects the northerly part of this land area. The Dolloff

Pond Road, a Class IV town highway, bisects the southerly portion. There are no hiking trails. There are no potential historic properties as indicated by archival maps.

Public Use/Conflicts: Public use (fishing) is mostly concentrated around lower Dolloff Pond. No obvious conflicts.

Management Objectives and Strategies:

- Maintain and preserve in its natural state.
- No timber harvesting will occur.

1.8a) Willoughby Cliffs Natural Area (1685 acres; map reference 1.8a)

General Description: The Willoughby Cliffs area was designated a State Fragile Area in 1982 and a State Natural Area in 1984 as allowed under Title 10 V.S.A. Chapter 83 Section 2607. It was also designated a National Natural Landmark by the U.S. Department of Interior in 1967. This area includes 15 different natural communities and a variety of rare and uncommon plants. Natural communities range from the common Northern Hardwoods to the rare Boreal Calcareous Cliffs. The Boreal Calcareous Cliffs of Willoughby are an excellent example of one of Vermont's rarest natural community types; fewer than 10 examples of this limestone cliff community type are known in the state, and none are as large or of as high quality as those found at Willoughby State Forest. A host of rare plants common to the arctic tundra have been documented growing on the rocky faces of these cliffs. These cliffs are also home to the Peregrine Falcon, which is listed as state threatened. Many rare plants originally documented in this area of the forest have not been recently observed. However, a number of rare, threatened, and endangered plant and animal species still persist. There are four potential historic properties in this area as indicated by archival maps.

Public Use/Conflicts: The Willoughby Cliffs area has provided a very unique field study area that has attracted geologists and botanists for many years. However, the most popular uses that occur in this area include hiking and ice climbing. The 3.9 mile long Mount Pisgah trail is one of the most popular hiking trails in the region and receives heavy use. Trail erosion is evident and is a management concern. Also of concern are a growing number of unauthorized side trails being established that overlook the cliffs. Previous management efforts have focused on relocating steep sections of the trail and improving drainage features. The Willoughby Cliffs have provided ice climbing opportunities to the public for many years and has received wide acclaim as one of the premier ice climbing destinations in North America. Most of the ice climbing activity occurs on the cliffs of Mount Pisgah. Ice climbing on the cliffs of Mount Hor occurs to a much lesser extent. Anecdotal information and that which was gathered at the Willoughby Public Informational meeting on June 13, 2001 indicates that rock climbers also use these cliffs, although the level of summer use appears to be low. The potential impact of rock and ice climbing to the fragile vegetation growing in this cliff and talus community is a management concern. There are sporadic occurrences of illegal camping along the western shoreline of Lake Willoughby during the summer.

Management Objectives and Strategies:

Long Term

- Step 1 - Develop a management plan for the Willoughby Cliffs Natural Area. This plan shall become part of the overall long-range management plan for the forest and include but not be limited to:
 - o Objective(s) of the area; i.e., what value(s) the area possesses and what protection should be afforded.
 - o Inventory and description of critical features.
 - o Boundary delineation.
 - o Appropriate uses.
 - o Prohibited uses.
 - o Vegetation/Wildlife Management procedures.
 - o Long-range considerations.
 - o Schedule and responsibility for monitoring.
 - o Evaluate recreational impact(s) to fauna and flora.
- Step 2 - Identify and collaborate with area climbers and Access Fund members to develop an ice/rock-climbing plan for the Willoughby Cliffs. This plan will be guided by resource information, management goals and strategies developed in Step 1 above. (Refer to the publication "Climbing Management: A Guide To Climbing Issues And The Production Of A Climbing Management Plan", compiled and published by The Access Fund and other available references.)

Interim

- Continue to allow ice/rock climbing by individuals in the Willoughby State Forest.
- Guided/group activities will continue to require a license from the Department. Permission will be granted on a case-by-case basis upon review by ANR staff.
- Coordinate enforcement efforts with Vermont State Police Auxiliary workforce that patrols this lake during the summer to curtail illegal camping along the western shoreline of Lake Willoughby.

1.8b) Marl Pond Natural Area (14 acres; map reference 1.8b)

General Description: The Marl Pond area was designated a State Natural Area in 1987 as allowed under Title 10 V.S.A. Chapter 83 Section 2607. The natural community is Northern White Cedar Swamp. Located on the eastern side of Marl Pond, this area is influenced by calcareous bedrock and groundwater. Several rare plant species are present. There are no recreation trail corridors located in this Natural Area. There are no potential historic properties in this area as indicated by archival maps.

Public Use/Conflicts: Public use is minimal. No obvious conflicts.

Management Objectives and Strategies:

- Maintain and preserve in its present natural state.

- Maintain the established buffer zone around the Northern White Cedar natural community.

1.11a) Special Designation (*Moose Mountain-91 acres; map reference 1.11a*)

General Description: This is an area with excessively steep slopes and shallow soils with exposed granitic bedrock. It is located on a southwestern slope near the summit of Moose Mountain.. Montane yellow birch-red spruce forest is the dominant natural community. A short segment of the Moose Mountain hiking trail passes through this area. There are no potential historic properties as indicated by archival maps.

Public Use/Conflicts: Public use is low. No obvious conflicts.

Management Objectives and Strategies:

- Maintain the existing Moose Mountain hiking trail.
- No timber harvesting or vegetation manipulation for wildlife will occur.

1.11b) Special Designation (*Lake Willoughby Shoreline-61 acres; map reference 1.11b*)

General Description: This is a narrow band of land area located along the shoreline of Willoughby Lake in the northwest portion of the forest. It is bordered on the western side by a Class C forest road. Mature hemlock, red spruce, and northern hardwoods are prevalent. There are no potential historic properties as indicated by archival maps.

Public Use/Conflicts: Because of the limited amount of land area and excessively steep terrain, this area experiences little use. There are sporadic occurrences of illegal camping along the western shoreline of Lake Willoughby during the summer.

Management Objectives and Strategies:

- No timber harvesting or vegetation manipulation for wildlife will occur.
- Coordinate enforcement efforts with the Vermont State Police Auxiliary workforce that patrol this lake during the summer to curtail illegal camping along the western shoreline of Lake Willoughby that is within this state forest.

1.11c) Bald Mountain Special Protection Area (295 acres; map reference 1.10)

General Description: Bald Mountain (elev. 3300 ft.) contains the largest high elevation area on the forest. There are approximately 237 acres above 2500 feet elevation. High elevation habitats provide important breeding sites for Bicknell's thrush and the blackpoll warbler, two species of special concern by the State of Vermont and the Partners in Flight Program. The predominant natural communities here are Montane Yellow Birch-Red Spruce and Montane Spruce-Fir. Two hiking trails (Long Pond Trail and Mad Brook Trail) terminate at the summit of this mountain. There are two historic structures—the fire tower and associated ranger's cabin located at the summit.

Public Use/Conflicts: The main feature that draws people to this area is the panoramic view of the Northeast Kingdom as seen from the fire tower. ATV use on the former access road to the summit has become a problem. This former access road is now the Mad Brook hiking trail. This recreation corridor also serves as a public right-of-way passing across three different private landowners before entering the Willoughby State Forest. ATVs are entering onto this trail near the forest boundary and driving to the summit. This illegal activity has been causing erosion to the trail.

Management Objectives and Strategies:

- Maintain/improve the hiking trails with a focus on abating erosion and improving the tread-way.
- Continue efforts to physically restrict ATVs from traveling on the Mad Brook Hiking Trail by maintaining/improving the stone barricade built in 2002.
- Restore, maintain and determine historic significance of the fire tower and associated ranger's cabin. Determine whether these structures are considered historically significant and eligible for listing on historic register(s).

2) Unique or Special Use Areas (2332 acres)

2.1) CCC Camp # 55 (30 acres; map reference 2.1)

Description: This historic district is included in the Vermont Archeological Inventory (Site Number VT-CA-75). It encompasses a large area of land with an associated buffer, starting at the outlet of Dolloff Pond and extending westerly along both sides of the Dolloff Pond Town Road. Remains of a number of historic features that supported the CCC Camp are scattered throughout this area. A segment of a Class C forest road is located in this historic district. This area is best described as being forested now with scattered wild apple trees and small softwood plantations that were established by the CCCs. (See Field Inspection Report prepared by Giovanna Peebles, State Archeologist dated February 26, 2002 in Appendix A.)

Public Use/Conflicts: Illegal dumping and vandalism at this site continues to be a problem.

Management Objectives and Strategies:

Short Term

- Barricade the Class C forest road to help prevent illegal dumping within the interior area of this historic district.
- Continue to prune and release wild apple trees for wildlife habitat enhancement.
- Continue to manage the softwood plantations in a manner that will protect and preserve the integrity of this historical district.
- List this historic district on the National Register of Historic Places in partnership with the Vermont Chapter of the Civil Conservation Corps.

Long-Term

- Have a professional archaeologist compile a more detailed site description, map and site evaluation. From information obtained in this evaluation, develop a management plan specific to this historic district.

2.1) Stone Pile Field (6 acres; map reference 2.1)

Description: This historic site is included in the Vermont Archeological Inventory (Site Number VT-CA-74). Located on the southeast slope of Bartlett Mountain, this area includes over 100 individual small stone piles covering 2.5 acres with an associated buffer. (See Field Inspection Report prepared by Giovanna Peebles, State Archeologist dated February 26, 2002 in Appendix A).

Public Use/Conflicts: A short section of the Bartlett Mountain cross-country ski trail system bisects this area.

Management Objectives and Strategies:**Short-Term**

- Leave “as is” in its present state.
- Maintain gates at the termini of this trail system to prevent vehicular traffic. Gates will be opened on December 1 to allow for winter non-motorized use and will be closed prior to spring thaw.

Long-Term

- Have a site evaluation conducted by a professional archeologist.
- From information obtained in this evaluation, develop a management plan specific to this historic site.

Further evaluation is needed on the location of the cross-country ski trail based on information obtained in the site evaluation.

2.2) Deer Wintering Area (321 acres; map reference 2.2)

General Description: Located in the southern portion of the forest, this area includes the southwesterly slopes along Route 5 and extends northerly to include the upper drainage area of Dolloff Pond. The Portland Pipeline and an electric utility line, both running parallel and close to Route 5, are located within this area. The Dolloff Pond Road (a Class IV town road) bisects this area of land at the outlet of Dolloff Pond. A Class C forest road bisects the lower portion. This land area is comprised of white spruce, red spruce, balsam fir, northern white cedar, and paper birch. Minor components include sugar maple, red maple, and yellow birch. There are no recreation trail corridors. There are no potential historic properties as indicated by archival maps. However, split rail and wire fence can be found along the southern forest boundary in this area pointing to past agricultural use prior to state acquisition.

Public Use/Conflicts: Public use (fishing) is mostly concentrated around lower Dolloff Pond and along Dolloff Brook. No obvious conflicts.

Management Objectives and Strategies: The specific management objective is to continue to provide for the maximum sustained carrying capacity of over-wintering deer. Implicit in this objective is the need to 1) perpetuate winter shelter; 2) maintain deer mobility throughout the deer wintering area; and 3) provide adequate and preferred browse that is accessible to wintering deer. The following strategies will be employed to accomplish this objective and will concur with the *Management Guide for Deer Wintering Areas in Vermont (1990)*, Vermont Departments of Fish and Wildlife and Forests, Parks and Recreation.

- Uneven-age management is the primary silvicultural system that will be used. This type of management provides continuous canopy closure for essential shelter requirements. Both single-tree and group selection methods will be used in combination with each other. Stand entries will be made every 20 years. Five distinct age classes will be created using an 80-year rotation. Twenty percent of any treatment area will be regenerated during each stand entry. Regeneration will be accomplished by the silvicultural method of group selection.
- Steps will be taken to maintain and improve coniferous species diversity. Presently there is a good mixture of balsam fir, red spruce, white spruce, and northern white cedar. No one species is dominant within the deer wintering area. Natural regeneration will be augmented with planting white pine and eastern hemlock seedlings. Northern white cedar will not be harvested. Individual trees may be cut to promote optimum crown development of more vigorous coniferous trees. This particular species provides good winter cover and its foliage offers a food source for wintering deer.
- The perpetuation of coniferous species is extremely important. A primary objective is to increase the softwood component in all stands within the deer wintering area. Management activities will be aimed at converting the present mixed wood timber type to a dominant coniferous type.

2.2) Beech Mast Stands (*172 acres: map reference 2.2*)

General Description: There are 22 identified beech mast stands scattered throughout the forest. These stands range in size from less than an acre to 45 acres. Beech mast stands are areas where there is a significant stocking of beech with evidence of past and/or present bear use (feeding). These areas provide hard mast in the form of beechnuts that black bears and other wildlife depend upon in the fall to build fat reserves going into the winter. Beech mast stands in the forest are all located within the northern hardwood forest type. Recreation corridors and forest roads pass through or in near proximity to some of these areas. There are no potential historic properties as indicated by archival maps. (See Wildlife Assessment in Appendix A for more information on “Key Mast Areas”).

Public Use/Conflicts: Some of the beech mast stands are located in more remote areas of the forest, while some are located in areas of the forest that sometimes experience moderate

levels of recreational use and motorized traffic at certain times of the year. Sections of the CCC Road and the Bartlett Mountain Road east of Bartlett Mountain are in very close proximity to two different beech mast stands. Both of these roads are open to vehicular travel during the summer but are closed to motorized travel during the winter months. These forest roads have been in place and open to vehicular use for many years. Both of these roads are open to pedestrian use throughout the year.

Also on the east side of Bartlett Mountain there is a cross-country ski trail system. This trail system is approximately five miles long and incorporates segments of both the CCC Road and the Bartlett Mountain Road. It was developed in collaboration with area high schools for the purpose of early season training opportunities and for hosting race events. It is also open to general public use. A section of this trail passes through an identified beech mast stand. The trail system was developed using existing infrastructure of Class C forest roads prior to the identification and mapping of the beech mast stands.

Management Objectives and Strategies specific to the Bartlett Mountain Cross-Country Trail System: *In order to minimize impacts of human use to this particular beech mast stand, the following management guidelines will be followed:*

- Strategically place gates, out of sight to the maximum extent possible, at the four-entry/exit points so as not to draw attention to the new trail system. These gates will be closed and locked except during the winter months when there are skiable conditions.
- Determine the design of the gates.
- Develop and place signage at the entry/exit points that addresses the intended use of this trail (winter only). An important element of this message would be educational (important bear foraging area).
- Screen the entry/exit points by re-vegetating.
- Establish a date when practice sessions/races may start (December 1).
- Monitor and document off-season usage by process yet to be determined.

Management Objectives and Strategies (Beech Mast Stands):

- Uneven-aged management will be used as the main silvicultural system using a combination of single-tree and group selection.
- The cutting cycle will be 20 years.
- A long-term objective is to create four to five distinct age classes and to promote the development of a large-crowned beech trees.
- Management efforts will strive to maintain a minimum of 35% to 40 % of the total basal area in beech.
- Post treatment basal area will range from 65 to 80 square feet per acre (total), comprised of 65% to 70% sawtimber size (12+ inches in diameter) and 30% to 35% poletimber size (6 to 10 inches in diameter).
- Silvicultural prescriptions will favor leaving healthy bear-scarred trees. Beech crowns will be released on all four sides to promote maximum crown development.
- Trees infected with nectria fungus will be discriminated against, especially those exhibiting heavy damage from the disease.

- Harvests will be scheduled during winter, preferably on snow. This will minimize residual damage to and root sprouting of beech.
- Any new forest roads and recreation corridors will be located away from beech mast stands.

2.2) Riparian Areas (*761 acres; map reference 2.2*)

General Description: A riparian area is the area of land and water forming a transition from aquatic to terrestrial ecosystems along streams, lakes, ponds, and open water wetlands. These ecosystems serve several functions depending on the size of the water body, including buffering aquatic species from disturbance, preventing wetland and water-quality degradation, and providing important wildlife habitat and movement corridors (Foss et al. 1999). Although riparian ecosystems account for a relatively small percentage of the landscape, they are among the areas of greatest species richness (Odum 1979, Thomas 1979). Riparian areas include the following:

- Headwater Wetlands and Seepages.
- Streamside Riparian Zones.
- Riverine Floodplains (Natural features include wooded swamps, marshes, oxbows, pools of standing water, meandering tributaries, and seepages).
- Large Ponds and Lakes (Associated riparian areas vary in width and character, are commonly terrestrial-like, and can include other aquatic habitats).
- Beaver Ponds and Small Impoundments (Associated riparian areas of various widths and with differing vegetation communities, depending on the nature of the surrounding watershed).
- Bogs and Fens (peatland habitats).
- Ephemeral Pools (vernal pools).

All of the above examples exist in Willoughby State Forest with the exception of riverine floodplains and peatland habitats, which include bogs and fens. There are seven potential historic properties within this zone as indicated by archival maps.

Public Use/Conflicts: Many of these areas on the forest provide angling opportunities to the public. Public access corridors and forest management roads bisect some of these riparian areas. Maintaining forest water quality is a potential conflict in regards to forest roads, recreation trails and timber harvesting operations and is constantly monitored.

Management Objectives and Strategies:

- Follow Riparian Guidelines (see Appendix).

2.2) Edge-of-Range Species (*21 acres; map reference 2.2*)

General Description: Edge-of-range species are defined as those species whose range extends into Vermont but not beyond. Edge-of-range species are important indicators of biological diversity because of their sensitivity to habitat alteration. Breeding bird surveys

performed on the Willoughby State Forest have identified seven edge-of-range species (Table 1). Six of these species are at the southern extent of their range and are more commonly found in the boreal forests of the north, while one species (great-crested flycatcher) is at the northern extent of its range.

Table 1 Edge of Range Species Documented on the Willoughby State Forest

Bay-breasted Warbler	Common Loon	Northern Rave
Bicknell's Thrush	Great-crested Flycatcher	Ruby-crowned Kinglet
Blackpoll Warbler	Northern Parula	Rusty Blackbird

Although this is the only polygon assigned to this land classification category, habitat for the nine documented species occurs across the forest. The majority of the habitat is concentrated in the Dolloff Pond wetland complex, the Big Valley Brook complex, the cliff faces of Mount Pisgah and Mount Hor, as well as the summit of Bald Mountain. Although several of the species habitats occur in other land use categories, it is expected that the management of those lands will include provisions for these species.

Public Use/Conflicts: These areas attract a variety of users from mountain climbers and day hikers to hunters and anglers. This area attracts mountain climbers and day hikers. Disbursed recreational activities such as hunting, fishing, trapping, snowshoeing, bushwhacking, etc., do not possess a threat or conflict with these special habitats. At present levels, hiking and rock climbing are not believed to be having a detrimental effect on the species occurrence.

Management Objectives and Strategies:

- Management activities on the forest will maintain the habitat requirements of all edge-of-range species found on the forest.
- Logging, recreation, and other management activities will strive to avoid disturbance of the species and their associated habitats.
- Monitoring activities conducted by the Agency of Natural Resources and the Vermont Institute of Natural Science will be the basis for evaluating and ensuring the needs of these species.
- Monitor rock climbing activities on Wheeler Mountain and work with the rock climbers to develop a climbing plan for this site.

2.7) Wellhead Protection Area (*113 acres; map reference 2.7*)

General Description: This part of the forest is a noncontiguous parcel of land located in the northern-most corner of Sutton. Access into this parcel is provided by a public right-of-way across private land from Westmore Town Road #23. This area of the forest has been identified as a wellhead protection area by the Vermont Agency of Natural Resources as allowed by Title 10, §1679(d) for the Village of Barton. It encompasses a portion of the May Pond Brook watershed located east of the village. There are no recreation corridors. There are no known potential historic properties as indicated by archival maps.

Public Use/Conflicts: Public use is minimal. No obvious conflicts.

Management Objectives and Strategies:

- Follow timber management strategies as outlined under “General Use Classification Area” on page 19. ***NOTE: The ANR Department of Environmental Conservation Wellhead Protection Program allows for timber management. Timber management objectives and strategies as outlined in this plan includes among other things, the protection of water quality.***
- Follow Riparian Guidelines in the riparian zone associated with the headwaters of May Pond Brook.

2.8) Agricultural Land (2 acres; map reference 2.8)

General Description: This is a small hay field located in the southern part of the forest and is adjacent to the North Ridge Road, a town road in Sutton. This is the only active agricultural area within the forest.

Public Use/Conflicts: No obvious public use or conflicts.

Management Objectives and Strategies:

- Continue license agreement with local farmer to have this field mowed annually.
- Follow the Accepted Agricultural Practices developed by the Vermont Department of Agriculture, Food and Markets.

2.9) Duck Pond/Blake Pond Recreation Area (480 acres; map reference 2.9, Figure 4)

General Description: The area is located south of the summit of Mount Hor and is adjacent to the Willoughby Cliffs State Natural Area. It contains Blake Pond (8 acres) and Duck Pond (8 acres) and borders onto Vail Pond (16 acres). They are predominantly spring-fed ponds with some small seasonal brooks that drain into them. These ponds are managed as cold-water fisheries by the Department of Fish and Wildlife. That Department annually stocks Duck Pond with catchable size brook trout and Vail Pond receives catchable rainbow trout. Prior to 1994 Blake Pond was stocked with brook trout fry annually. All three ponds are being evaluated by the Department of Fish and Wildlife for the presence and potential management of wild brook trout. Wild, self-sustaining populations of brook trout occur in Duck Pond and Vail Pond outlet brooks. A Class C forest road provides access through this area. A mature northern hardwood forest dominates the landscape. There are four potential historic properties as indicated by archival maps.

The public has historically been accessing this area via motor vehicles. The negative environmental impact of the ever-increasing amount of motorized traffic to this area has become obvious in recent years. Although motor vehicles travel this road during the summer,

it was not designed or intended for vehicular use. As a result of this use, environmental degradation is occurring in the form of erosion and water quality impairment.

(1) Because of the environmental degradation occurring here due to motorized vehicles and (2) because remote undeveloped ponds are becoming increasingly scarce and (3) because of the unique recreational, scenic, and ecological significance of these ponds and adjacent public lands, this area has been classified as The Duck Pond/Blake Pond Recreation Area. The opportunity created by this proposal is to “create a non-motorized access option to a remote pond setting.” This proposal is supported and is consistent within the context of the *Vermont Use of Public Waters Rules* adopted February 2, 1999. Within those rules, procedures shall be followed when petitions are filed under 10 V.S.A. §1424. Procedure 2.11 states “Those water bodies which currently provide wilderness-like recreational experiences shall be managed to protect and enhance the continued availability of such experiences.” This proposal is also consistent with a recommendation put forth in the *1990 Vermont Lakes and Ponds Recreation Management Study* that states “Legislation should be immediately enacted to protect the integrity of Vermont’s few remaining wilderness lakes and ponds.” The *1990 Vermont Lakes and Ponds Recreation Management Study* was done as part of the *1993 Vermont Recreation Plan*. Active citizen input and involvement were an integral part to this study.

Congruency of certain issues between the *1988 Lakes and Ponds Task Group Report* and findings of the *1990 Vermont Lakes and Ponds Recreation Management Study* are evident. The *1990 Vermont Lakes and Ponds Recreation Management Study* findings identified many of the same issues reported in the Lakes and Ponds Task Group report for the *1988 Vermont Recreation Plan*. One of the congruent issues identified was the assessment of the magnitude and distribution of “wilderness ponds” and their protection. Managers expressed concern that the state did not have a comprehensive plan for wilderness ponds nor sufficient protection mechanisms.

The *1996 Vermont Lake and Pond Recreation Survey* was conducted to obtain necessary information and opinions from Vermonters to assist with developing parameters and direction for the Use of Public Waters Policy that was promulgated by the Vermont Water Resources Board in 1994. The Executive Summary for this report highlights among other findings, that “Two very desirable characteristics of lakes and ponds for recreational use include (1) The presence of wildlife and birds and (2) Solitude and quietness.” The desire to have “undeveloped shorelines or natural features” closely followed the first two desired lakes and ponds characteristics.

Public Use/Conflicts: This area is a favorite destination spot for a variety of recreational pursuits, including fishing, swimming, camping, hunting, and other activities per a user survey conducted by the Department of Forests, Parks and Recreation District staff in the summer of 2000. A summary of survey results for this area of the forest is in the Appendix under Recreation Assessment.

Figure 4 – Duck Pond/Blake Pond Recreation Area Map

A Class C forest road that provides access into this area currently serves as a Vermont Association of Snow Travelers (VAST) corridor trail during the winter. This trail was authorized under a Special Use Permit for the winter of 1996/’97. Permission has been renewed on an annual basis since then.

The segment of Class C forest road along the westerly shore of Duck Pond is in conflict with the *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs In Vermont (AMPs)*. The AMPs call for a minimum 50-foot wide buffer strip to be maintained between roads and bodies of water. There is an inadequate buffer along the westerly shore of Duck Pond and this road. Discharges of sediment into Duck Pond are occurring when motorized vehicles travel this Class C forest road.

ATV use is evident in this area of the forest as well. ATVs are not allowed on state land by Agency of Natural Resources (ANR) policy and pursuant to 23 V.S.A. §3506 (b) (4). A steady increase in the amount of off-trail use of ATVs and four-wheel drive vehicles has been occurring in this area of the forest and is resulting in environmental damage.

Management Objectives and Strategies:

Forest Roads

- There will be no new roads constructed.
- Existing Class C forest roads in this area will be closed off, using natural barriers or gates at three points. Walk-in access will be approximately one-half mile to Blake Pond and approximately one-third mile to Duck Pond from the proposed parking area (See Figure 4).
- Existing roads will be maintained as non-motorized recreation trails.
- The VAST corridor trail that passes through this area will be re-routed either to another location in Willoughby State Forest or on private land. (The Department will work with VAST to investigate and evaluate options).
- Culverts on existing roads will be removed and the width of the travel surface will be reduced to accommodate foot travel, mountain bikes, etc.
- Stabilize the segment of road adjacent to Duck pond and bring into compliance with the AMPs.

Recreation

- Dispersed pedestrian recreation opportunities will continue to be available in this area.
- Primitive camping within this area is allowed according to the rules and regulations set forth by the Vermont Agency of Natural Resources.
- Allow for the establishment of tent platforms or lean-tos if deemed appropriate by the ANR to better regulate public use of this area and to help protect ecological values associated with the ponds.

Vegetative Management

Trees may be cut to:

- Maintain, improve, or enhance recreational opportunities.
- Maintain habitats for threatened, endangered, or rare plants.

- Maintain or create vistas.
- Reduce fire hazard.

Fish and Wildlife

- The Fish and Wildlife Department will continue to evaluate fish populations and habitat conditions at Blake, Duck and Vail ponds.
- Current fishing regulations and stocking will be reviewed in the context of survey and inventory findings, and will be continued or adjusted in the interest of maintaining and/or enhancing fishing opportunities.
- The Department of Fish and Wildlife intends to continue its evaluation of Blake, Duck, and Vail ponds for the presence and potential management of wild brook trout.
- For the present time the Department of Fish and Wildlife supports the continued management of Duck and Vail ponds as fisheries maintained by the stocking of catchable-size trout.
- Snag and den trees will be maintained unless they pose a safety hazard to the public.
- Identify and protect special plant and animal habitats.
- The Department of Environmental Conservation intends to apply “A Classification of the Aquatic Communities of Vermont” to help describe and characterize the aquatic communities of ponds, streams and other water-bodies located within the state forest.
- The Department of Environmental Conservation intends to sample aquatic macroinvertebrates to further document aquatic resources present.

2.10) Special Viewshed Areas (426 acres; map reference 2.10)

General Description: The slopes of Mount Hor and Mount Pisgah as seen from State Route 5A and Willoughby Lake are considered a scenic and visually unique area. The segment of Route 5A along Willoughby Lake has the distinction of being a National Scenic Highway. Most of this land area is protected, being located within the Willoughby Cliffs State Natural Area. The two remaining and separate areas of this special viewshed are located to the north and south of Mount Hor and are adjacent to Willoughby Lake and Route 5A respectively. The CCC Road bisects the southerly viewshed area and a Class C forest road provides access into the northerly land area. Hiking trails are absent. There are three potential historic properties as indicated by archival maps.

Public Use/Conflicts: Most of the use occurs in the southerly land area and is located on the CCC Road. This Class A forest road is open to motorized vehicles except during the winter and also serves as a year-round recreation corridor through the forest. No obvious conflicts.

Management Objectives and Strategies:

- Follow the “timber management strategies” for the General Use Classification Area as described on page 17. **Exception:** Openings in the forest canopy will not exceed one-fifth acre.

- Follow the Landscape Management Guidelines that pertain to this land classification area.

3) General Use Areas (3536 acres)

3.0) Areas of land that do not meet the other land classification categories. (3395 acres; map reference 3.0)

General Description: These are upland areas dominated by northern hardwoods (beech, birch, maple). Natural communities are predominantly Northern Hardwood and Red Spruce-Northern Hardwood. Soils are generally well drained and productive in terms of timber growth. Recreation corridors within this area include sections of the Moose Mountain, Mount Pisgah East, Wheeler Pond and Mount Hor hiking trails, a VAST corridor trail, and the Bartlett Mountain cross-country ski trail system. Most of the forest roads are located within the General Use area. There are 12 potential historic properties as indicated on archival maps.

Public Use/Conflicts: The primary emphasis within this land classification area has been and will continue to be for the production of high quality sawtimber, maintenance and enhancement of wildlife habitat and dispersed recreational activities. The Landscape Management Guidelines and Riparian Management Guidelines (see Appendix) will be implemented for all timber management activities to minimize potential conflicts with recreational use, visual quality and riparian values.

Timber Management

Goals and Objectives: Timber will be managed to sustain and enhance biodiversity, wildlife habitat, scenery, and recreation; to sustain and improve forest health conditions; to produce high quality forest products; and to demonstrate sound and scientifically proven forest management practices. Measures will be taken to protect water quality, rare and endangered plant and animal species, natural features and historic and pre-historic sites.

Strategies:

Northern Hardwood

- Refer to “Guidelines for Applying Group Selection Harvesting,” USDA Forest Service: Northeastern Area State & Private Forestry. NA-TP-02-00.
- Uneven-aged management using the group selection system will be followed.
- Group/patch size up to five acres will be allowed to maintain shade intolerant and intermediate species. Openings in the forest canopy may exceed this limit in the case of natural disturbances.
- Target stands for treatments that are well stocked (halfway between the A and B lines).
- Thinning of individual trees will occur between the groups/patches, leaving a residual basal area of approximately 70 square feet/acre, excluding the newly established groups.
- Approximately 40 to 50 square feet/acre will be left in sawtimber.

- Individual trees of special wildlife significance will be protected.
- Amount of area to be regenerated by forest stand will be determined by area control:
 - Regenerated Acreage = (forest stand size)x(cutting cycle)/(rotation age)
- Rotation age is 120 years.
- Cutting cycle is 20 years.
- Regenerate 1/6 of the harvest area at each stand entry. (This will provide for six distinct age classes within a management unit when fully regulated).

Hardwood/Softwood

- Refer to "Guidelines for Applying Group Selection Harvesting," USDA Forest Service: Northeastern Area State & Private Forestry. NA-TP-02-00.
- Increase the size of this timber type when and where possible.
- Uneven-aged management using the group selection method will be followed.
- Group size may range up to one acre. Openings in the forest canopy may exceed this limit in the case of natural disaster.
- Target stands for treatments that are well stocked (halfway between the A and B lines).
- Thinning of individual trees will occur between the groups/patches, leaving a residual basal area of approximately 90 square feet/acre, excluding the newly established groups.
- Approximately 60 to 70 square feet/acre will be left in sawtimber.
- Individual trees of special wildlife significance will be protected.
- Amount of area to be regenerated by forest stand ulation will be determined by area control:
 - Regenerated Acreage = (forest stand size)x(cutting cycle)/(rotation age)
- Rotation age will be 100 years.
- Cutting cycle will be 20 years.
- Regenerate 1/5 of the harvest area at each entry. (This will provide for five separate age classes within a management unit when fully regulated).

Management Objective:

Softwood Plantations

These areas will be maintained for their historic and cultural value. Pending any natural events with mortality resulting, these plantations will be allowed to grow to biological maturity.

Strategies:

- Periodic thinnings will be scheduled when needed based upon the appropriate silvicultural guidelines.
- Management techniques will be selected to promote natural regeneration of the plantation species.
- Natural regeneration may be augmented with plantings of other native coniferous species to enhance biodiversity.

Management Objective:

Ruffed Grouse Management Unit

Where feasible, portions of Compartment 9 Stand 2 will be treated to provide optimum ruffed grouse habitat. Even-aged management using patch cuts will be used. The stand will be broken into 40-acre units, with each unit accounting for the home-range of a hen and brood. Units will be divided into a checkerboard pattern of 2.5 to 5 acre patches that will be harvested on a 40 to 60 year rotation to provide the three necessary age classes utilized by grouse.

Strategies:

- One quarter of each unit will be treated every 10 to 15 years.
- Large (>12") drumming logs will be retained in proximity to a screen object (rock, root wad, small softwood tree).
- Black cherry, American beech, and yellow birch trees may be retained as mast sources as long as they do not total more than 25% of the block.
- Summer operations may be used to encourage seeding of aspen on scarified soils. When/if aspen becomes established, winter operations will be utilized to promote root sprouting.
- Small patches of softwood trees will be retained for winter cover.

Timber Sale Schedule

Based on a 20-year cutting cycle, an average of 177 acres per year will be treated in the General Use Area. Of this average annual figure, 30 to 35 acres will be regenerated using small groups and patches not to exceed five acres in size. (See Timber Management Strategies on Pg. 40 – 41.) The following Harvest Summary (Table 2) and map (Figure 5) provides a scheduling guide and shows locations of planned timber harvest areas within Willoughby State Forest. This schedule was derived from the most current stand information available and is projected for a 10-year time span into the future, fiscal years 2005 through 2015. There are 1741 estimated acres to be treated in the General Use Classification Area and 602 estimated acres to be treated in the Unique or Special Use Classification Area. Of the estimated acreage to be treated within the Unique or Special Use Classification Area, 428 acres include enhancement of the Deer Wintering Area and 50 acres of beech mast stands will be treated to enhance mast production. At or near the end of this time frame, another forest inventory will be conducted to update forest stand information. Based on that information, another 10-year harvest plan will be developed for fiscal years 2015 through 2025.

4) Intensive Use Areas (42 acres)

4.3) Day Use Areas: Lake Willoughby-South End (34 acres; map reference 4.3)

Official day use areas are designated and managed by the Parks Division through the Department of Forests, Parks and Recreation. The South End is not an officially designated day use area, but functions as one. It is a unique situation that is uncommon on ANR state land.

Table 2, Harvest Summary**Fiscal Year (FY) 2005-2015**

Sale Number	Comp/Stand	Timber Type	Acreage	Treatment	FY
1	1/2	NH	128	Selection	2005
2	2/4 3/5 3/3 3/4	Norway Spruce Plantation NH NH Red Pine/White Pine Plantation	39 6 17 23 Total: 85	Thinning Selection Selection Thinning	2005
3	9/2 (Ruffed Grouse Unit)	NH	190	Regeneration	2006
4	9/2 9/4	NH NH	88 64 Total: 152	Selection	2007
5	2/1 * 2/5 2/2 3/2 (Deer Wintering Area*)	Mixed Wood NH NH NH	68 4 17 7 Total: 96	Selection	2008
6	12/1 * 12/2 * 12/3 * (Wellhead Protection Area*)	Mixed Wood NH NH	44 34 10 Total: 88	Selection	2008
7	21/1 21/2	NH NH	47 10 Total: 57	Selection	2009
8	8/2 8/4	NH Mixed Wood	161 68 Total: 229	Selection	2009
9	5/5 * 2/3 * (Deer Wintering Area*)	Mixed Wood Mixed Wood	242 118 Total: 360	Selection	2010
10	17/1	NH	163	Selection	2010
11	11/3 11/3 * (Beech Mast Stand*)	NH NH	156 45 Total: 201	Selection	2011
12	10/1 14/1 14/1 * 14/2 (Beech Mast Stands*)	NH NH NH Mixed Wood	56 83 5 19 Total: 163	Selection	2012
13	20/1	NH	256	Selection	2013
14	4/1 4/2 4/3	NH NH NH	32 184 33 Total: 249	Selection	2014
15	5/1 * 5/2 (Special Viewshed Area*)	NH NH	36 101 Total: 137	Selection	2015
16	Newark Block	Norway Spruce Plantation	45	Thinning	2015

Footnote: NH - Northern Hardwood

Figure 5 – Timber Harvesting Schedule Map

General Description: The South End (see Figure 6) includes two natural sandy beaches separated by lakeshore bluffs with spectacular views of the lake and cliffs of Mount Hor and Mount Pisgah. It also includes a parking lot, foot trails, a lake access area, the Cheney House, and remains of the Pisgah Lodge. Both the Cheney House and remains of the Pisgah Lodge are considered historic sites and are included on archival maps. Portable toilets are located and maintained in the parking lot from Memorial Day to Columbus Day. A kiosk is located in this parking lot with signage notifying the public of Department policies and allowed uses as they pertain to the South End as well as general information related to this forest. This parking lot serves people using the South End for swimming and sunbathing and also serves as a trailhead for the South Shore hiking trail, which terminates at the base of the cliffs on Mount Hor. Other foot trails in this vicinity include one from the parking lot to the east beach and another one that connects the east beach with the west cove beach, passing over the lakeshore bluffs. The lake access area is located adjacent to State Route 5A. This unimproved site has been historically used to launch small boats and other watercraft.

Public Use/Conflicts: There is an established history of day-use activities at the South End. Much of that use occurs during the summer months. This area becomes congested during periods of hot weather. A number of conflicts have arisen as the amount and diversity of uses this area receives increases. The following list of items is a summary of conflicts and concerns that have been identified to date.

- Swimming and boat moorings
- Lake access area
- Nude bathing
- Camping and campfires
- Excessive noise levels at night
- Unlawful conduct
- Unleashed pets
- Parking
- Sanitary conditions
- Vandalism
- Littering/trash dumping
- Unauthorized foot trails
- Trail erosion

Figure 6 – South End Intensive Use Map

Management Objectives and Strategies: Since the first public involvement meeting which was held for this forest in 1988, the Department of Forests, Parks and Recreation has been working to provide the most appropriate level of management that will continue to allow for public use while minimizing conflict. These prescriptions have been developed with the input of a wide range of recreational user groups. They reflect broad public support to leave this area in its natural state while making minor improvements. The key objective is to minimize conflicting uses, prevent environmental degradation and maintain an element of safety for the public.

The high level of public use of the “South End” and potential conflicts may require a change in management designation for the area. Possible designation as a State “Day Use Area” is under consideration. A public involvement process will be undertaken to determine public opinion on any proposed change to the management of the area.

General Management Recommendations

- **Camping and Campfires:** The Agency of Natural Resources has the following policy in regards to camping and campfires – “Camping is allowed at developed areas (excluded are areas such as beaches, boat launch sites, picnic areas, and roadside turnouts). In developed areas fires shall be built only in fireplaces or charcoal grills provided on site.” **The South End is not considered a developed area.** V.S.A. 86 of 1971, “An act pertaining to overnight camping on public land” states that “A person shall not use any part of a public highway right-of-way, or any public land not designated by the agency, department, or municipality having control of same as an overnight camping area for the purpose of overnight camping.” This is not a designated area for primitive camping. It does not meet eligibility under “Rules Governing the Activity of Primitive Camping on State Lands” as adopted by the authority under the provision of Title 10, V.S.A., Chapter 83, Section 2605-2609, and Title 3, V.S.A., Chapter 51, Section 2801 (a). Section 7 (g) states “Camping shall be at least one hundred (100) feet from any surface water; two hundred feet from any trail or property line; and at least 1,000 feet from any building, campground, shelter, platform, or roads maintained for public vehicular traffic.”
- **Trash Disposal:** A “Carry-In/ Carry-Out” policy is currently in effect and will continue to be advocated by the Department. (Exception for Cheney House activities).
- **Motorized Vehicles:** Restricted to designated parking lots. Only vehicles authorized by the Department in conjunction with the management of the Willoughby State Forest will be allowed.
- **Pets:** Members of the public that bring pets to this area are encouraged to have them on a leash. (Specific management prescriptions involving pets are outlined below for the East and West beaches).
- **Trails:** Continue stabilization and restoration efforts through work projects funded by the Vermont Recreation Trails Program. The relocation of trails may be needed to reduce user conflicts and protect resources.

- **Enforcement:** During the summer of 2002 the Department began contracting with the Orleans County Sheriffs Department to “ provide police services consisting of a uniformed Deputy Sheriff to provide patrol services, security and crowd control at the South End.” The Department plans to continue contracting with the Orleans Sheriffs Department to provide these services from Memorial Day through Labor Day.
- **Signage:** Signage will continue to be developed and displayed at strategic entry points to notify the public of Department policies and allowed uses as they pertain to the South End.
The “South End” includes the following areas that will have site-specific management actions. These areas are as follows and have been identified on a map included within this plan (Figure 6):
 - East Beach
 - West Cove Beach
 - Bluffs
 - Lake Access Area
 - Trails
 - Parking Lot
 - Cheney House
 - Pisgah Lodge Cultural Site

East Beach

- **Swimming Area:** The Department will continue to prescribe, and delineate if necessary, a designated swimming area. This will be in accordance with VT Statute 23 V.S.A. § 3310 which states that “ The state board of forests, parks and recreation or a municipality in administering a swimming beach or waterfront program may designate a swimming area in front of the beach or land which the state or a municipality owns or controls and may make rules pertaining to the area.” This management activity is consistent with public input requesting an area free from boats and boat moorings to ensure safety for swimmers. During 1995 a swim area was designated with buoys. Buoys have not been put out since that year. Boaters that moor here are making a concerted effort to keep an area free for swimming.
- **Signage:** A kiosk shall be erected in a strategic location (at the East Beach area adjacent to Route 5A) for signage that will address appropriate uses and etiquette guidelines for the South End. Special attention will be made to direct users to the portable toilets, the Department’s trash policy and open hours.
- **Pets:** Pet owners will be encouraged to leash their pets. Pets that are not restricted have been identified as a nuisance to other people using the beach. In considering this prescription, the Department acknowledges the fact that there may be occasions where the only user at the beach has a pet with them. In this circumstance the owner could allow their pet to be unrestrained, up to the time that other members of the public arrive to use this area of state land.
- **Camping and Campfires:** Same applies as under “General Management Guidelines.”

West Cove Beach

- **Swimming Area:** Swimming will continue to be an allowed use. However, there will be no designated swimming area for this beach as allowed under Vermont Statute 23 V.S.A. § 3310. Public concern over nude bathing at this beach is increasing. The conflict created for members of the public who feel excluded from the area by this use needs to be addressed. Public opinion will be measured on possible solutions to this conflict.
- **Pets:** Pet owners will be encouraged to leash their pets. Pets that are not restricted have been identified as a nuisance to other people using the beach. In considering this prescription, the Department acknowledges the fact that there may be occasions where the only user at the beach has a pet with them. In this circumstance the owner could allow their pet to be unrestrained, up to the time that other members of the public arrive to use this area of State land.
- **Camping and Campfires:** Same applies as under “General Management Guidelines.”
- **Signage:** A kiosk located in the South End Parking Lot addresses appropriate uses and etiquette guidelines for the South End that is inclusive of this specific area.

Lake Access Area

- Stabilize above water line with crushed rock and gravel. Seek input and assistance from the Department of Environmental Conservation Facilities Engineering Division.
- Maintain appropriate landscaping.

Parking Lot

- Maintain portable toilets.
- Maintain gravel surface.
- Maintain appropriate landscaping.
- Maintain signage.
- Investigate the feasibility of installing a security light.

Bluff Area

- Continue restoration and erosion control work projects by utilizing the VYCC and VLC.

Foot Trails

- Maintain these trails to prevent soil compaction and minimize erosion.
- Better define trail tread-way to prevent off-trail usage and site degradation.
- Barricade and revegetate unauthorized side trails leading to the shoreline.

Cheney House

Future Use: According to a November 3, 2000 focus group that was organized by the Parks Division to brainstorm future management and operation strategies for the Cheney House, three preferred options were chosen from those considered. The three preferred options include:

- Continue as a State Park, but with renovations and enhanced facilities.
- Lease to the Vermont Leadership Center.
- Lease or sell to a private entity.

The likelihood of capital improvement monies being appropriated by the Legislature or available to Vermont State Parks to renovate the existing facilities and to enhance facilities to increase revenues at the Cheney House State Park is not realistic at this point in time. The facilities need desperate attention, and the other two options open up the greater likelihood of the facilities being renovated and kept up over time. However, there are some drawbacks to these two options as well. If these two options were explored further, more public involvement would be necessary before a final decision is to be made.

Pisgah Lodge Historic Site:

- Have a professional archeologist determine the historic significance of this site and recommend management strategies.

4.4) Mount Pisgah Trailhead Parking Lot (2 acres; map reference 4.4)

General Description: This gravel surfaced parking area is located at the easterly junction of the CCC Road and State Route 5A. Parking is available on both sides of Route 5A. Trailhead signage is maintained and a kiosk with general information about Willoughby State Forest is located on the west side of Route 5A. A picnic table is also located there. This parking area can accommodate approximately up to 25 passenger vehicles.

Public Use/Conflicts: This parking lot serves as the trailhead to the Mount Pisgah hiking trail, as well as an important year-round access point into the forest via the CCC Road. Use is heavy and congested at times. School groups and other outdoor commercial guided ventures are often dropped off here by bus to hike the Mount Pisgah trail or walk up the CCC Road into the forest. The public sometimes will use this area as a picnic site. This parking lot also provides a staging and parking area when high school cross-country ski races are being held on the nearby designated cross-country ski trail system in the vicinity of Bartlett Mountain and the CCC Road. During the winter, the Vermont Agency of Transportation plows this parking lot as a courtesy. Vandalism and garbage dumping/littering are the two major conflicts facing the management and maintenance of this area.

Management Objectives and Strategies:

- Maintain the kiosk and trailhead signage
- Maintain the gravel surface
- Maintain appropriate landscaping
- Replace the picnic table

PUBLIC ACCESS

This section of the plan describes management strategies that will protect, maintain and enhance public access opportunities in Willoughby State Forest.

Background: Access to Vermont Agency of Natural Resources lands, including Willoughby State Forest, is provided through the use of designated roads and trails. These access corridors accommodate both motorized and non-motorized uses where appropriate and are managed with public funds. In some cases a corridor will be restricted to a designated use or uses. Whenever possible, access corridors are developed and maintained for multiple uses.

As public use increases on state lands, the ANR may find it necessary to allocate public access among many user groups. This allocation may involve permitting or restricting various uses during different times of the year on the same corridor. In addition, excessive use of some corridors may result in significant environmental degradation. Public access will be continuously monitored to identify problem areas and to minimize any adverse impacts of use. In some cases it may become necessary to limit or prohibit some forms of public use where adverse impacts reach intolerable levels.

Management Objectives and Strategies:

- Existing Class C forest roads located within the Blake Pond/Duck Pond Recreation Area will be modified to accommodate non-motorized uses.
- The Class C forest road that passes through the Blake Pond/Duck Pond Recreation Area will be made into a non-motorized trail.
- The parking area near the intersection of the Vail Pond Road and the Class C forest road that leads to Duck Pond will be improved to better accommodate users of the Blake Pond/Duck Pond Recreation Area.
- The Bartlett Mountain cross-country ski trail system will be managed for winter pedestrian use only. This trail system will accommodate the general public as well as provide a racecourse for local high schools. Gates will be maintained to prevent vehicular access.
- Primitive camping will continue to be allowed according to the rules and regulations set forth by the Vermont Agency of Natural Resources.
- Dispersed pedestrian access is allowed throughout the forest.
- Hunting, fishing and trapping, consistent with current rules and regulations are allowed throughout the forest.
- Continue to allow for equestrian and mountain biking that is consistent with ANR state land policy.
- Continue to allow for ice/rock climbing.
- Collaborate with the Kingdom Trails Association in determining the feasibility of a proposal to develop a designated mountain bike trail system in the forest that offers both single-track and double-track opportunities.
- Continue to work in conjunction with the Vermont Youth Conservation Corps, Vermont Learning Center, Green Mountain Club, Westmore Association and other trails groups to maintain/improve the existing hiking trails infrastructure on the forest.

Motorized Access: Management Objectives and Strategies

Vermont Association of Snow Travelers (VAST)

- The Department of Forests, Parks and Recreation and VAST will work cooperatively to relocate the existing corridor trail to another location within the forest or on neighboring private land.

All-Terrain Vehicles (ATVs)

- ATVs are not allowed on State land by Agency of Natural Resources (ANR) policy and pursuant to 23 V.S.A. §3506 (b) (4) which states that “motorized all terrain vehicles are prohibited on any public land, body of water or natural area unless the Secretary of the Agency of Natural Resources has designated the area for use by such vehicles.”
- Permits can be issued for handicapped access and management purposes such as maintenance and signage of VAST or other trails.

Motor Vehicles

- Motor vehicles are allowed on Class A and Class B forest roads.
- Class C forest roads are not open to general motor vehicle use.
- The operation of motor vehicles on all ANR state land must be in compliance with 23 V.S.A. Chapter 13 § 1135 (a) (3) (A) (B), Trespass by motor vehicle, which states that “A person commits the offense of trespass by motor vehicle if the person, knowing that he or she is not privileged to do so, operates a motor vehicle on any land which is owned or held by the state; that is not a place or trail specifically designated and marked by the secretary of natural resources for use by motor vehicles; or contrary to any rule governing the use of the place or trail.”

Management of Forest Roads

Access into and through the forest is complete. No new road construction is planned for the next long-range management period. Emphasis will be placed on maintaining and upgrading segments of Class A and Class B roads for management purposes and to meet public use demands. Short segments of road may need to be built for the specific purpose of timber management. These roads will be stabilized to prevent erosion and protect water quality and barricaded to prevent vehicular traffic at the close of the timber harvesting operation. All forest roads are open to foot travel and other non-motorized uses as allowed by Department policy.

Road Construction & Maintenance Strategies: All road construction and maintenance operations will be consistent with ANR state land policies and procedures and the stewardship goals and objectives for this forest. Measures will be taken to protect water quality, wildlife habitat, rare and endangered plant and animal species, natural features and historic and pre-historic sites.

- Continue to follow suggested guidelines and practices for forest management roads. References include federal, state and private publications on file in this office.
- Provisions to protect visual quality will be taken by:
 - Keeping road corridors to a minimum width.

- o Seeding and mulching cut and fill slopes.
- o Designing alignment to avoid parallel orientation to the observer.
- Improve/upgrade the “Bartlett Mountain Road”. Work will include installing culverts and ditches and spot gravel.
- Maintain all Class A and Class B forest roads to support allowed motorized use.
- Maintain forest roads that are rights-of ways across private lands that provide for management and/or public access into the forest. Maintenance and management of these roads will be consistent with Agreements and Warranty Deeds pertaining to the easement.
- Install gates at the two terminuses of the “CCC Road”. Gates to be closed and locked during excessively wet periods (Spring break-up).
- Close off all Class C roads to vehicular traffic where environmental degradation is occurring (erosion, water quality impairment, vandalism, garbage dumping etc.).
- Improve/enlarge parking area leading into Duck Pond.

Overview of Management Prescriptions by Resource Category

Recreation Resource Management

Background: Willoughby State Forest offers spectacular scenery and year-round diversified recreational opportunities. The forest is easily accessible from State Routes 5 and 5A and is in close proximity to three population centers: St. Johnsbury, Lyndonville and Newport. A wide variety of dispersed recreational activities occur on the forest including but not limited to hiking, mountain biking, ice and rock climbing, snowshoeing, dog sledding, primitive camping, and cross-country skiing. Other traditional uses of the forest include hunting, fishing and trapping. Much of the forest area is within one-half mile of maintained roads or trails. Interaction between users is usually low to moderate, but evidence of other users is prevalent. Moderate to large numbers of users can be expected periodically at some of the more popular destination spots in the forest. The popularity of this state forest has brought an observed increase in recreational use over the last several years. It is expected that the recreational demand on this forest will only increase in the near future.

Recreational and traditional use types of opportunities exist within all the four broad land classification categories on the forest – Highly Sensitive, Unique and Special Use, General Use and Intensive Use. These opportunities will continue to be available and managed to protect the biological, geological, scenic and cultural resources of the forest.

Management Objectives and Strategies: *Specific recreation management objectives and strategies were previously addressed in this plan by land classification area and also included under the topic of Public Access/Trails. Please refer to the references provided.*

- Public Access/Trails (page 53)
- Mount Pisgah Trailhead Parking Lot (land classification area 4.4 page 53)
- South End (land classification area 4.3 page 46)
- Duck Pond/Blake Pond Recreation Area (land classification area 2.9 page 33)
- Wheeler Mountain (land classification area 2.2 page 32)
- Willoughby Cliffs (land classification area 1.8a page 20)

Wildlife Management

Background: Consistent with the goal of conserving and enhancing biodiversity values on ANR lands, wildlife management on the forest will focus on sustaining and enhancing populations of naturally occurring wildlife species. This section describes those biodiversity components, their inherent wildlife values and management objectives designed to achieve the above stated goal. It also examines the effects of the vegetation management scheme to be implemented in Willoughby State Forest on wildlife species.

ANR will employ two approaches in order to meet the goal of conserving and enhancing biodiversity values for Willoughby State Forest. They include (1) management for species richness (coarse filter) and (2) featured species management (fine filter). These two approaches look at the forest at a whole, with all its inherent wildlife habitat qualities and not solely from a land classification perspective, recognizing that habitat requirements for individual species often transcend those boundaries. Wildlife management decisions will be

based on proven scientific knowledge and will be adaptive as additional resource and scientific information becomes available.

1. Managing For Species Richness

Each species has adapted to living in a particular natural community or mix of natural communities to meet its life history requirements. The relationship between species and their habitats is complex and dynamic. Species populations fluctuate for many reasons including weather, disease, predation, and food availability; however the long-term survival of wildlife populations depends on the availability of their required habitat.

Management Objectives and Strategies:

- Protect, maintain, and create suitable habitat for all naturally occurring plant and animal communities found to exist on the forest by utilizing a coarse-filter approach. This approach will focus on the conservation of all natural community types occurring on the forest with the underlying assumption that in doing so, most species will be accounted for.

Vegetation Management

Vegetation management in the forest will employ primarily an uneven-aged silvicultural system. This system will focus on producing stands with several different age classes of trees and many vertical layers of vegetation. Future conditions of the forest will be dominated by multi-aged stands with a relatively continuous forest canopy interspersed with openings in the canopy up to five acres in size. Even-aged management will be used where appropriate for wildlife habitat improvement.

Management Objectives and Strategies:

- Encourage mixed hardwood/softwood community types where feasible.
- Avoid thinning operations in single canopy strata to increase vertical stand diversity.
- Maintain and enhance softwood inclusions in hardwood forest types.
- Retain biological legacies such as standing dead trees, fallen logs, large live trees, and species not commonly found in the forest.

Coarse Woody Debris

Coarse woody debris is made up of downed woody material, snags and cavity trees. Downed woody material refers to logs and slash in all stages of decay. Snags are standing dead trees that are relatively stable. Cavity trees are live or dead trees with existing cavities (Foss et al. 1999). Coarse woody debris is important to the biodiversity goals of the Willoughby State Forest because it provides habitat for thirty-two species of birds, twenty-seven species of mammals, eight species of reptiles, and nine species of amphibians. Coarse woody debris is used by wildlife for nesting, denning, cover, thermal and drought refuges, as a source of and place to store food, drumming sites, preening sites, sunning sites, and perching.

Management Objectives and Strategies:

- Overall management activities on the forest will strive to enhance and protect the availability of coarse woody debris.

- Protection and enhancement measures to provide for coarse woody debris will be achieved during timber harvesting operations by incorporating special provisions within the timber sale contract.

Riparian and Stream Ecosystems

Riparian and stream ecosystems refer to the areas adjacent to streams and water bodies. This zone often graduates from the wetland into the adjacent uplands. These ecosystems serve several functions depending on the size of the water body including, buffering aquatic species from disturbance, preventing wetland and water-quality degradation, and providing important wildlife habitat and movement corridors (Foss et al. 1999). Although riparian ecosystems account for a relatively small percentage of the landscape, they are among the areas of greatest species richness (Odum 1979, Thomas 1979).

Management Objectives and Strategies:

- Follow Riparian Management Guidelines
- Apply “A Classification of the Aquatic Communities of Vermont” to help describe and characterize the aquatic communities of ponds, streams and other water-bodies located within the state forest .
- Sample aquatic macroinvertebrates to further document aquatic resources present.

2. Feature Species/Feature Habitat Management

Feature species, or fine filter management, entails maintaining and/or improving habitat for one or a few species. This management strategy ensures provision of habitat for species not covered by the coarse filter approach; species of special concern, rare, threatened and endangered species, species of economic importance such as game species, and edge of range species whose presence hinges on habitat availability.

Management Objectives and Strategies:

- (Deer Wintering Area) Follow management objectives and strategies for “Deer Wintering Area” as outlined on page 26.
- (Vernal Pools and Communal Breeding Sites) Follow Riparian Management Guidelines.
- (Beech Mast Areas) Follow management objectives and strategies for beech mast areas as outlined on page 28.

Rare, Threatened, and Endangered Species (RT&E)

Peregrine falcons, common loons, and Bicknell’s thrush are monitored by the Agency of Natural Resources and the Vermont Institute of Natural Science. These monitoring activities will be the basis for evaluating and ensuring the protection needs of these two species.

Management Objectives and Strategies:

- Management activities on the Willoughby State Forest will maintain the habitat requirements of all RT&E species found on the forest.
- All prescribed uses and management activities will minimize disturbance and/or deterioration of RT&Es and their associated habitats.

Beaver Influenced Ecosystems

Because beaver influenced ecosystems support a great diversity of wildlife species, their presence on the Willoughby State forest will be encouraged.

Management Objectives and Strategies:

- Follow Riparian Management Guidelines.
- Take actions to resolve beaver/human conflicts with water leveling devices rather than destruction of dams or trapping off-season.

Woodland Raptor Nest Sites

Nesting sites for woodland raptors refers to both existing nest sites and trees suitable for supporting large stick nests. In Northeastern Vermont, there are ten species of woodland raptors that utilize stick nests in forest trees. Trees most frequently utilized by nesting raptors include three-pronged main forks of mature hardwoods, closely spaced large branches in mid-canopy whorls of white pines, and large diameter stubs (Foss et al. 1999). Woodland raptors frequently re-use nests or nests in the same stand over a period of many years.

Management Objectives and Strategies:

- Strive to maintain suitable nesting sites across the landscape over time and to avoid disturbing nesting pairs by;
 - o Having field staff personnel watch for and note locations of existing large stick nests.
 - o Retaining trees highly suitable for nest sites.
 - o Not conducting timber harvesting operations within 300 feet of active nests of most raptors from mid-March through July.
 - o Having a 100-foot uncut buffer surrounding large stick nests at all times.
 - o Having a 525-foot undisturbed buffer maintained during the nesting period around nest sites identified as northern goshawk and red-shouldered hawk.

Management of Upland Openings

Very few upland openings exist in the Willoughby State Forest. Most openings in the forest were made for log landings to support timber harvesting operations. These log landings are maintained as grass/forbs openings. There are also two cleared utility rights-of-way that are maintained in grass/forbs cover and a three-acre hayfield that is mowed annually.

Management Objectives and Strategies:

- Where permanent openings are desired, they will be maintained in a mixture of grasses, forbs, and brambles by mowing at three- to five-year intervals.
- Mowing of openings will generally occur after the summer berry-picking season and not before July 15.
- Mowing of the three-acre hay field on the North Ridge Road in Sutton will not occur before July 15 to allow for nesting grassland birds.

- As a provision of timber sale contracts, all log landings will continue to be bulldozed to mineral soil, smoothed, seeded, mulched, limed, and fertilized upon completion of timber harvesting operations.

Management of Wildlife Movement Corridors

A wildlife movement corridor has been identified known to be utilized by wide-ranging species such as the black bear exists along Vermont State Route 5A near the south end of Lake Willoughby. A quarter mile wide by a quarter mile long buffer will be maintained on either side of Vermont State Route 5A. Land use activities within the buffer will not be allowed to adversely impact this travel corridor. This wildlife movement corridor is located within a land classification unit referred to as Special Viewshed Area.

Management Objectives and Strategies:

- Follow the Timber Management Strategies for the General Use Classification Area. **Exception:** Openings in the forest canopy will not exceed one-fifth acre.
- Follow the Landscape Management Guidelines that pertain to this land classification area. (See Appendix.)

Waterfowl Nesting Structures

Tree cavities are superior nesting sites as compared to artificial nesting boxes for waterfowl species that utilize cavities for this purpose. In the absence of adequate cavity trees, artificial nesting boxes can be used as a temporary means to attract waterfowl.

Management Objectives and Strategies

- Until recruitment of larger snag trees increases in riparian areas, artificial wood duck boxes will be placed and maintained at appropriate locations in wetland complexes.

Mast

Mast is the fruit produced by trees, shrubs and vines. Mast includes the hard-shelled seeds of beech, the dry seeds of birches, maple and ash, and the fleshy fruits of apple, mountain ash, and black cherry. Mast is a valuable, high-protein food source for many species of wildlife.

Management Objectives and Strategies:

- Considerations for mast trees will be included in all timber harvesting operations by;
 - Apple trees will be retained, released, and pruned to improve tree vigor and encourage utilization by wildlife.
 - Promoting and insuring a mixture of mast producing-species.
 - Conducting a crown release for healthy individual trees identified as good seed producers to improve mast production.
 - Favoring the retention of groups or clumps of mast producing trees where they occur.

Effects of Proposed Management on Wildlife Species

Avian

Due to the land use history of the forest prior to state acquisition, the current age/size structure of the forest is heavily dominated by pole-timber sized stands. Recent studies in the White Mountain National Forest indicate that pole-timber northern hardwood stands support the lowest breeding bird diversity of all the hardwood age classes. This forest type and age class heavily dominates the landscape of Willoughby State Forest. As a result of this condition, species richness is currently considered to be low. Over time, the uneven-aged silvicultural system and timber management strategies to be implemented for Willoughby State Forest will improve conditions for the majority of avian species (most notably the conservation priority species identified), by creating a mosaic of multi-aged stands throughout the forest.

Research conducted in the White Mountain National Forest suggests that the uneven-aged management strategy may not account for some early succession bird species (Costello et al., 1999). Although forest management may not directly influence habitat availability for these species, it is believed that the management of surrounding lands will. There are currently 12 large landholdings (>500 acres) within proximity to the Willoughby State Forest that are currently enrolled in the Use Value Program. These landholdings total 15,834 acres. Of this acreage, 5218 acres are currently being managed using even-aged management strategies.

Mammals

Most mammal species are expected to respond favorably to the uneven-aged silvicultural system and management strategies to be implemented in Willoughby State Forest. As with birds, mammals benefit greatly from multi-aged stands with high vertical diversity. The uneven-aged forest management strategies coupled with the provisions for coarse woody debris will greatly benefit mammalian species such as the northern flying squirrel, gray fox, raccoon, fisher, and black bear that will utilize mature canopies, large hollow trees, cavities, and fallen logs. Black bears are expected to especially benefit from habitat enhancement of the key mast areas and the protection of identified wetland feeding areas and movement corridors. Management of the deer wintering area is expected to improve the structure of the yard and increase the number of over-wintering deer.

Fish

Fish assemblages in the waters of Willoughby State Forest are relatively simple. There is considerable interest among visitors in angling for trout, where they occur. Willoughby Lake is a major fishing destination in Vermont, and is perhaps the foremost lake trout water in the state. Conscientious application of the Riparian Management Guidelines, selective repair, relocation or discontinuation of problem roads and trails, remediation of erosion and sediment transport problem areas, and general watershed protection sensitivity during other management activities, such as timber harvest, will protect and improve water quality and directly benefit fish populations within and downstream of Willoughby State Forest.

Amphibians

Protection of the vernal pools and communal breeding sites will greatly benefit the amphibian species on the forest. The continuous canopy resulting from the uneven-aged management scheme as well as maintenance of stream buffers will allow for greater mobility between breeding sites. Management provisions for coarse woody debris will greatly enhance the microhabitat structure.

Reptiles

Two of the snake species (northern red-belly snake and smooth green snake) likely to occur on the forest that prefer open/edge habitat will find suitable conditions in the log landings and the few maintained upland openings.

Public Use of Wildlife

The Willoughby State Forest is open to regulated hunting, fishing, and trapping consistent with State Rules and Regulations. Hunting for white-tailed deer, moose, black bear, waterfowl, and small game may occur across the forest. Hunting pressure is unknown but assumed to be relatively low to moderate. Angling is a very popular activity at Willoughby Lake, at the several ponds within and abutting the State Forest and in the larger streams.

Non-consumptive uses of wildlife include wildlife observation and photography. The Pisgah Cliffs are included in the *VT Watchable Wildlife Program* as a viewing site for Vermont. Although these endeavors are generally encouraged, some related uses such as the use of blinds, spotlights, and attractants (such as food or vocalizations), may require a special use permit from the Agency of Natural Resources.

Recreational activities and developments may have significant impacts to wildlife species and habitats. For example, high boating pressure may negatively impact nesting loons, and a snowmobile trail running through a deeryard may adversely impact wintering deer by increasing their energy expenditure and risk of predation. Proposals for new trails and other recreational developments will be reviewed to assure that negative impacts will be avoided. Existing trails and recreational developments will be monitored and evaluated to assure present activities do not negatively affect critical wildlife habitats.

Literature Cited

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Historic Resource Management

The Department of Forests, Parks and Recreation (FP&R) contracted Archaeology Consulting Team, Inc. (ACT) to provide management recommendations to protect and preserve historic resources within Willoughby State Forest. ACT conducted background research and a limited field inventory was conducted by FP&R District V field staff. The results of these efforts are presented in the draft *Historic Properties Management Plan for the Willoughby State Forest*.

The report includes a variety of management goals and recommendations that would protect historic resources. The Department of FP&R will review these recommendations over time to determine what measures are appropriate. On an interim basis and consistent with these recommendations, the Department of FP&R will implement practices to protect historic resources by:

- Recognizing historic resources by conducting a reconnaissance of a proposed treatment area to locate known and potential historic resources and looking at broad or connected areas on the landscape.
- Recognizing that historic resources exist as linear (stone walls), point (cellar hole) and area features (Civilian Conservation Corps historic district) on the landscape and require different types of management strategies.
- Consulting with the Vermont Division for Historic Preservation regarding establishing appropriate buffer zones around known historic sites.
- Conducting periodic monitoring of known archaeological and historic sites.

Water Resource Management

Willoughby State Forest is located within the Passumpsic and Lake Memphremagog river basins. Managers of Willoughby State Forest will cooperate with ANR's Department of Environmental Conservation, Water Quality Division as they conduct watershed planning for the Passumpsic and Lake Memphremagog river basins when they are undertaken.

The watershed basin planning effort includes the determination of the water classification and water management type of all waters located within each watershed basin. Through this process, the assignment of water classification and water management type for all waters will take into consideration the existing water quality, the desired water quality, and whether or not the desired quality is attainable.

The goal for the water management type of waters at Willoughby State Forest, which are all below 2500 feet, is of a high level (potentially B1). B1 waters are managed to maintain an almost natural condition showing minimal changes from reference conditions for aquatic macroinvertebrates and fish assemblages.

The management of Willoughby State Forest by the Department of Forests, Parks, and Recreation will, at minimum, maintain the quality of all surface waters associated with the land. It is understood that agricultural and silvicultural activities, which follow Accepted

Agricultural Practices and Acceptable Management Practices are presumed to conform with the rebuttable presumption of compliance with Vermont's Water Quality Standards.

Timber Resource Management

Goals and Objectives: Timber will be managed to sustain and enhance biodiversity, wildlife habitat, scenery, and recreation; to sustain and improve forest health conditions; to produce high quality forest products; and to demonstrate sound and scientifically proven forest management practices. Measures will be taken to protect water quality, rare and endangered plant and animal species, natural features and historic and pre-historic sites.

Timber sales will be implemented in the General Use Classification Area and within some of the land classification areas designated as Unique or Special Use. There will be no timber harvesting within the Highly Sensitive or Intensive Use areas.

- See timber management objectives and strategies as outlined under land classification areas (2.2) Deer Wintering Area, (2.2) Beech Mast Stands, (2.2) Riparian Areas, (2.7) Wellhead Protection Area and (3.0) General Use.

SECTION V

Monitoring and Evaluation

Monitoring and evaluation are essential to any land management program. They provide the information necessary to track progress in achieving management goals and objectives and to gauge effectiveness of particular approaches to resource management issues. Monitoring and evaluation efforts will include ecological, recreational use, forest roads and trails infrastructure and historic resources.

Monitoring and evaluation will be accomplished via periodic site visits conducted by ANR personnel, management partners, and easement holders. Agency personnel involved with these efforts will include foresters with the Department of Forests, Parks and Recreation; ecologists, wildlife biologists, and game wardens with the Department of Fish and Wildlife; and ANR environmental enforcement officers. Management partners outside of state government include the Vermont Housing and Conservation Board, The Nature Conservancy, Vermont Association of Snow Travelers, Green Mountain Club, Westmore Association, Orleans County Sheriffs Department, Vermont Leadership Center, and Kingdom Trails Association. Examples of resources to be monitored and evaluated include but may not be limited to water quality, recreation trails, wildlife habitat conditions, exotic invasive plant species, tree health, and soil erosion.

It is important to monitor and evaluate recreational use of the forest and outcomes of management prescriptions as part of an adaptive management program. The objective of this effort will be to maintain the nature and quality of resources and ensure that public use experiences are not adversely impacted. The Agency of Natural Resources may suggest recommendations for modifications to the Willoughby State Forest Management Plan to reflect changed conditions or unanticipated results based upon findings. Any major changes would be proposed as amendments to the plan and would be subject to public review and approval by the Agency's State Lands Stewardship Team and the Commissioner of Forests, Parks, and Recreation.

SECTION VI Appendices

- A. Assessments
 - 1. Ecological
 - 2. Timber
 - 3. Recreation
 - 4. Public Access
 - 5. Lakes and Ponds
 - 6. Fisheries and Water Resources
 - 7. Historical
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- B. Public Involvement
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A. Assessments

Ecological Assessment

Agency of Natural Resources staff use the “coarse filter/ fine filter” approach to the ecological inventory and assessment of state lands. Widely recognized as an effective tool for inventorying and managing biological resources, it is an aid to land managers who seek to protect most or all of the species that naturally occur on their lands, but who lack the resources to make exhaustive inventories of all taxonomic groups. Because many groups of organisms are cryptic or poorly understood (for example, fungi and soil invertebrates), it is not practical to make lists of all of them. Even if we could assemble such lists of species, it would be impossible to manage the land with all of them in mind. Instead, natural communities are treated as a proxy for the biological organisms of which they are composed. It is thought that if examples of all of Vermont’s natural communities are conserved at the scale at which they naturally occur, most of the species they contain, from the largest trees and mammals to the smallest insects, will also be conserved. Natural communities are thus a coarse filter for “catching” the majority of an area’s native organisms. Because conservation of habitats (in the form of natural communities) will not protect all species, we also employ a “fine filter” to catch the remaining species that are known to require very specific conditions for their growth, reproduction, wintering, etc. Examples of organisms benefiting from the fine filter inventories described below include breeding birds, deer on their wintering areas, and rare plants.

The coarse filter assessment begins by describing landscape and climatic factors that characterize Willoughby State Forest, such as bedrock geology and water resources. It then details the 32 distinct natural community types documented and mapped during inventories of the state forest. This is followed by a fine filter assessment describing rare species and specialized habitat types found here. Along with other resource assessments, this ecological inventory was used to make many of the land management decisions documented in this plan.

1) Coarse Filter Assessment

Biophysical Region and Climate – The 7784-acre Willoughby State Forest is located in the Northeastern Highlands biophysical region (see map on page 12). This region is characterized by cool summer and extremely cold winter weather. Most of the region is at moderate to high elevation. The metamorphosed limestone bedrock that covers much of the area is interrupted by large granitic plutons. Willoughby State Forest is typical of lands in the northeastern Highlands biophysical region, in that it encompasses a range of elevations, and features large areas of both limestone and granite bedrock. Natural communities here are typical of the cold northeastern corner of the state, with conifer dominated uplands and wetlands a prominent feature on the landscape.

Bedrock and Surficial Geology and Soils – The geologic history of this area has much to do with the current distribution of natural communities at Willoughby State Forest. More than 60% of bedrock here is of the Waits River Formation (see Figure 7), a group of Devonian-aged metamorphosed quartzites and limestones. This relatively soft rock weathers easily and

Figure 7 – Bedrock Geology Map

is responsible for raising the pH and mineral content of many soils in the area. It is at least partly responsible for the many cedar swamps in the area, and forms the majority of the calcareous cliffs here. Metamorphic limestones of the Gile Mountain Formation cover about 10% of the land area here; they extend in a band from the summit of Mount Hor west towards Wheeler Pond. Thirty percent of the state forest is underlain by a younger granitic rock that pushed into these limestones as an igneous intrusion (essentially, a volcanic event that did not reach the surface). This biotite granite is hard and weathers very slowly; it consequently contributes little to the soils that form on top of it. As the softer limestones have eroded over time, areas of granite have become exposed. The cliffs and talus of Wheeler Mountain are good examples of this rock.

Although the soaring cliffs of Mount Pisgah and Mount Hor are primarily Waits River rocks, they contain many granite dikes (linear intrusions). A walk across the base of one of these cliffs, particularly the east facing cliffs of Mount Hor, will reveal strikingly different vegetation communities as one moves from limestone cliffs to granite, and back. Without these lenses of granite, the soft Waits River rock would not be able to form or maintain such large cliffs.

This may help explain why there are relatively few large calcareous cliffs in the expansive Waits River rocks of eastern Vermont, and consequently, why Boreal Calcareous Cliffs and their vegetation are rare here.

In more recent times, glacial ice scoured southeast over this landscape, rounding the north sides of many mountains and shearing off their south faces. May Pond Mountain, Wheeler Mountain, and Mount Hor are characteristic examples of these prominences, sometimes known as “roches moutonneés”. Glacial ice is at least partly responsible for carving out the trough that holds Lake Willoughby, as well as the many smaller kettle hole ponds found on the state forest. When the ice retreated, a variety of sediments were deposited on the scoured bedrock. The most common of these is glacial till, a jumble of unsorted materials that fell out of the ice column as it melted. The Glover-Calais and Paxton-Woodbridge general soil associations dominate the mountainous terrain west of the lake. These well-drained to excessively-well drained silts and loams may be shallow or deep, and have a hardpan within three feet of the surface. Tills of the Lyman-Marlow-Peru general soil association covers most of Mount Pisgah and Bald Mountain; they are similar to those described above, but are often shallower, with bedrock commonly encountered within three feet of the soil surface. The Peru-Marlow and Colrain-Woodstock general soil associations are till-derived soils that are mapped around Dolloff, Marl, and Vail ponds. A loamy organic layer one to six inches deep was observed on top of many of these deposits. Large ‘glacial erratic’ boulders are a common site in the forest.

Several sorted glacial sediments are evident in the valleys. One of these is the excessively well-drained Windsor gravels found at the south end of Lake Willoughby and in the vicinity of Bean Pond. Another is the steep-sided esker that rises out of a beaver wetland near the Pisgah trailhead; its coarse sandy materials are deep and support an excessively well-drained variant of Red Spruce-Northern Hardwood Forest. Much more recently, the waters of Lake Willoughby have deposited sand at the south end of the lake; it is possible that this area

would support a Lake Sand Beach natural community if it were not used for swimming and boat access.

Comprehensive soils mapping for Orleans and Caledonia Counties is incomplete. Future inventories are expected to reveal more information about soils in Willoughby State Forest.

Hydrology/Streams/Rivers/Ponds – Hydrology plays a major role in the composition and maintenance of natural communities at Willoughby State Forest. The parcel is within five watersheds that drain water to both the Connecticut and St. Laurence Rivers. Headwaters of the Passumpsic, Barton, and Willoughby Rivers all begin at the summit of Mount Hor. Bald Mountain's streams are the headwaters of both the Clyde River and the east branch of the Passumpsic. Lake Willoughby is 1653 acres in size, and more than 300 feet deep. The lake impacts cold air drainage in its basin and moderates temperatures somewhat in winter, which impacts tree canopy composition and vegetation on nearby cliffs. The state forest includes 27,000 feet of lake shoreline. A very rare plant, lake quillwort (*Isoetes macrospora*), occurs in the lake (Kennedy 1904; Gilman 1999).

The five major ponds are Blake Pond, Duck Pond, Vail Pond, Marl Pond, and Wheeler Pond. Blake Pond is a 7.7-acre pond with a wooded shoreline and a maximum sounded depth of 26 feet. Duck Pond is a 7.1-acre pond with a wooded/rocky shoreline and a maximum sounded depth of 43 feet. Vail Pond is 19.8 acres with a maximum sounded depth of 43 feet and a wooded shoreline. Marl Pond is 12.4 acres with a wooded shoreline and a maximum depth of 20 feet. Wheeler Pond is 11.4 acres, ringed with emergent vegetation, and has a maximum sounded depth of 30 feet. Natural communities associated with pond edges include Intermediate Fen, Lowland Spruce-Fir Forest, Northern White Cedar Swamps, Seeps, Shallow Emergent Marsh, and Sweetgale Shoreline Swamp. Beavers are common inhabitants of these ponds, and have created some extensive emergent marsh wetlands around them.

Willoughby State Forest encompasses 33 miles of perennial streams, plus many smaller ephemeral water courses. The largest is Big Valley Brook, running 2.7 miles from its headwaters on the flanks of Mount Hor to where it joins Willoughby Brook and flows north to Crystal Lake. Big Valley Brook has a gradient of 8.3% and runs through Northern Hardwood Forest above 1900 feet and through Lowland Spruce-Fir Forest below this elevation. The steep West and Arcadia Brooks drain the south slopes of Mount Pisgah towards the Passumpsic. Gray and Bald Mountain brooks begin in the high country of Bald Mountain. Most other streams are unnamed.

Vernal pools form in depressions where water collects in the wetter months of the year. Water movement may be impeded by either bedrock or a hardpan of aggregated surficial material. Several examples were found on flat ground on Moose Mountain and Mount Pisgah.

One of the most interesting aspects of Willoughby's hydrology is the seepy nature of its cliffs. Perennial water here creates habitat for some of Vermont's rarest plants, as well as spectacular columns of winter ice. The spring melt of this ice contributes to dramatic

wasting of cliff rock, the dominant natural disturbance force structuring Boreal Calcareous Cliffs, Boreal Talus Woodlands, and other natural communities.

Natural Community Types – A natural community is an assemblage of biological organisms, their physical environment (e.g., geology, hydrology, climate, natural disturbance regime, etc.), and the interactions between them. More than a simple collection of species, a natural community is characterized by complex webs of mutualism, predation, and other forms of interaction. The 80 natural community types described in Vermont repeat across the landscape in patches (or “polygons”) of various sizes. These patches (or groups of patches in close proximity to each other) are referred to as natural community *occurrences*, and are to be distinguished from broad descriptions of community types.

Thompson and Sorenson (2000) describe three general size categories for natural communities. Matrix communities occur in broad expanses across the landscape, and form the context in which other, smaller communities are found. They are structured by landscape-level disturbance processes, such as periodic weather events and insect outbreaks. Northern Hardwood Forest and Montane Birch-Red Spruce Forest are two prominent examples of matrix communities found at Willoughby State Forest. Large patch communities typically occur at scales of 10 to 100 acres, and are structured by local bedrock, geological, and topographic factors. Northern White Cedar Swamps are a characteristic large-patch natural community of the state forest. Small patch communities are usually less than 10 acres in size, and owe their existence to highly localized site and disturbance characteristics. Local geology, topography, and hydrology combine to produce Boreal Calcareous Cliffs, a small patch community found here.

Eighty-seven occurrences of 32 natural community types have been identified and mapped at Willoughby State Forest (see Figure 8). A total of 290 natural community and 28 water body polygons (areas of open water, including beaver ponds) were mapped. Natural communities were identified through aerial photograph interpretation, systematic FOREX inventory (see timber assessment section), and field surveys. Field data were collected using a Trimble Geoexplorer II global positioning system (G.P.S.) unit, clinometer, compass, binoculars, soil augur, Cornell pH kit, and a variety of reference manuals for identification of plants, animals, fungi, etc. Many plant specimens were collected for identification in the lab. A Geographic Information System (G.I.S.) map of natural communities was produced using ArcView software. Because some natural communities occur at very small scales (e.g., less than a quarter acre), this mapping effort is probably incomplete. Natural community mapping is an iterative process, and our knowledge improves with each mapping effort. Thus, the map presented here should not be viewed as a final statement on community distribution at Willoughby State Forest; instead, it should be treated as a first attempt at describing natural communities in this area. Land managers should keep in mind that additional examples of small natural communities (e.g., vernal pools and outcrops) probably occur at Willoughby State Forest. As subsequent inventories and site visits are conducted, this map will be improved.

What follows is a description of all natural community types identified at Willoughby State Forest. A quality rank (A through D) for each natural community occurrence is given.

Figure 8 – Natural Communities Map

Quality ranks are objectively assigned on the basis of occurrence size, current condition, and landscape context. An A-ranked occurrence is of high quality in comparison with other occurrences of its natural community in the state, while a D-ranked example is of comparatively low quality. Natural communities differ in the degree to which the three ranking characteristics affect their ecological quality; for example, for Northern Hardwood Forests, size is the most important characteristic, while for small isolated wetland communities, landscape context may be the most important. It is important to recognize that assignment of low quality ranks may be due to small size rather than poor condition. Detailed descriptions of Vermont's natural community types may be found in Thompson and Sorenson (2000). Additional information may also be found in the glossary (Appendix F).

1. Montane Spruce-Fir Forest

A single B-ranked occurrence of this uncommon natural community is found on Bald Mountain. This forest type occupies elevations between 2400 and 3200 feet and is upslope from the related Montane Yellow Birch-Red Spruce Forest. The community covers about 350 acres, but only 178 acres are in state ownership. Little inventory work was done in this community, however it is reasonably similar to other examples in the state. Here, red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*) are the main canopy trees, with red spruce typically growing taller and living longer than balsam fir. Where large openings have been created by natural processes or timber harvest, hardwoods such as heart-leaved paper birch (*Betula papyrifera* var. *cordifolia*) and yellow birch (*Betula allegheniensis*) may be common in the canopy. Common shrubs include mountain maple (*Acer spicatum*), striped maple (*Acer pensylvanicum*), and American mountain ash (*Sorbus americana*). The latter is particularly common on the west side of Bald Mountain, where it has been identified as a significant wildlife food source (see wildlife section below). Sphagnum and other mosses usually dominate the understory of Montane Spruce-Fir Forests; other herbaceous plants commonly found in this community include bluebead lily (*Clintonia borealis*), bunchberry (*Cornus canadensis*), common wood sorrel (*Oxalis acetosella*), and mountain wood fern (*Dryopteris campyloptera*). A rare bird, Bicknell's thrush, breeds in this community near the summit of Bald Mountain (Vermont Institute of Natural Science, 2002; see below). Other wildlife species occurring in montane spruce-fir include red-backed vole, blackpoll warbler, ruby-crowned kinglet, slate-colored junco, white-throated sparrow, and yellow-bellied flycatcher (DeGraaf and Rudis 1987). A variant of this natural community, Montane Spruce Forest, is found at somewhat lower elevation on the east summit of Moose Mountain. Steep, shady slopes littered with very large boulders support a near-pure stand of large red spruce, with occasional heart-leaved paper birch encountered. American mountain ash forms a sparse shrub layer. The rocks are covered with mosses and lichens, but other herbaceous vegetation seems to be absent. This spruce stand is associated with a Boreal Talus Woodland.

2. Lowland Spruce-Fir Forest

The Willoughby Lowland Spruce-Fir Forest occurs on areas of gentle slope and poor drainage at elevations of 1200 to 1800 feet. This uncommon community type totals 329 acres on the state forest. Most is considered to constitute a single B-ranked occurrence, but polygons at May Pond and on the slopes of Mount Pisgah are considered separate occurrences of lower quality. Red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*)

dominate the 35-foot to 45-foot canopy of these forests; paper birch (*Betula papyrifera*), red maple (*Acer rubrum*), and yellow birch (*Betula allegheniensis*) are also present, particularly where larger canopy openings were created by logging or natural disturbance events.

Northern white cedar (*Thuja occidentalis*) and eastern hemlock (*Tsuga canadensis*) are also present in some areas of this community. The shrub layer is usually sparse, and features wild raisin (*Viburnum cassinoides*), mountain holly (*Nemopanthus mucronata*), yew (*Taxus canadensis*), and mountain ash (*Sorbus americana*). The herbaceous layer is dominated by mosses at most sites. Other plants present include dwarf raspberry (*Rubus pubescens*), trout lily (*Erythronium americanum*), blue bead lily (*Clintonia borealis*), wild sarsaparilla (*Aralia nudicaulis*), and sensitive fern (*Onoclea sensibilis*). Where this community occurs along pond shores beavers are a regular source of natural disturbance; examples include spruce-fir around May Pond and in the upper Big Valley Brook drainage. Due to the relatively small acreage of this habitat type, wildlife species characteristic of spruce-fir are limited to those with relatively small home ranges or generalist species, which utilize more than one habitat type to meet its life history requirements. Species utilizing seedling/sapling age classes include snowshoe hare, southern red-backed vole, deer mouse, magnolia warbler, and Nashville warbler. Species utilizing older age classes (poletimber to sawtimber) include olive-sided flycatcher, red-breasted nuthatch, golden-crowned kinglet, northern parula, Swainson's thrush, Blackburnian warbler, red squirrel, northern flying squirrel, white-tailed deer, and porcupine (DeGraaf and Rudis 1987).

3. Montane Yellow Birch-Red Spruce Forest

This hardwood-conifer transition forest is found on the upper slopes of mountains at Willoughby State Forest. Three separate occurrences centered around Mount Hor and Moose Mountain, Mount Pisgah, and Bald Mountain cover a total of 704 acres. The Hor/Moose example has a quality rank of A due to its large size, buffered landscape context, and generally successional stage. The community forms on slopes and benches at moderate to high elevation, where the cold, wet (and sometimes droughty) climate favors red spruce (*Picea rubens*) and some of the more tolerant hardwood species. Where sampled, soils in this community were somewhat acidic (pH=5.6) and featured a 0 to 2 inch organic layer on top of 20 to 40 inches of gritty till materials, including both clay and silt loams. Soil mottling was observed in some samples, and a gray-colored zone of mineral leaching was often present just below the organic layer. Typical examples of this community at Willoughby feature a 45-foot to 50-foot, 75% closed canopy of red spruce, heart-leaved paper birch (*Betula papyrifera* var. *cordifolia*), yellow birch (*Betula allegheniensis*), and balsam fir (*Abies balsamea*). Sugar maple (*Acer saccharum*) is a common canopy species in areas of seepiness and greater mineral enrichment. Pioneer hardwood species such as chokecherry (*Prunus pensylvanicum*) and quaking aspen (*Populus tremuloides*) are sometimes present. Shrub layer cover ranges from 10% to 30%; most common species are mountain maple (*Acer spicatum*), striped maple (*Acer pensylvanicum*), and advanced regeneration of the canopy tree species. Skunk currant (*Ribes lacustre*) and bush honeysuckle (*Diervilla lonicera*) are sometimes present in the short shrub layer. Herb density varies, but is often quite high (70% or more); characteristic species are blue bead lily (*Clintonia borealis*), mountain wood fern (*Dryopteris campyloptera*), Canada mayflower (*Maianthemum canadense*), wood sorrel (*Oxalis montana*), whorled aster (*Aster acuminatus*), large-leaved goldenrod (*Solidago macrophylla*), and drooping woodreed (*Cinna latifolia*). Two plants that are usually

restricted to mountainous, enriched sites, wood millet (*Milium effusum*) and Braun's holly fern (*Polystichum braunii*), are common on Mount Hor. Mosses are locally common in this community; their abundance is likely dependent on degree of canopy closure and stand age. The Mount Hor occurrence features areas with good densities of large-diameter yellow birch, coarse woody debris, dead snags, and cavity trees. The montane yellow birch-red spruce forest type characterizes the transition from northern hardwoods to montane spruce-fir, therefore wildlife species characteristic of both the northern hardwood forest and the montane spruce-fir forest are present. Species include Swainson's thrush, winter wren, solitary vireo, and yellow-bellied flycatcher (DeGraaf and Rudis 1987).

4. Red Spruce-Northern Hardwood Forest

The Red Spruce-Northern Hardwood Forest in the vicinity of Lake Willoughby is some of the most extensive in the state. More than 2600 acres occur on the state forest, and more is found on adjacent private lands. While virtually all of it has been repeatedly logged, a number of stands have characteristics of older or late-successional forests. The community occurs on all three bedrock types at Willoughby and on a variety of soil types; it is most common on flat to moderately sloped, somewhat poorly drained glacial till soils, but may also be found on steep, well drained, acidic esker sediments south of Lake Willoughby. In limited field observations, soils were acidic, and had a 0 to 4-inch organic layer over 12 inches or more of coarse sandy loam. Where slope and drainage increase, Northern Hardwood Forest is usually found; by contrast, Lowland Spruce-Fir Forest often occurs in the wetter hollows adjacent to this community. A wide variety of wetland and other small patch communities are found imbedded in this landscape matrix natural community. Average stands have a 50-foot tall (range 40 to 65 feet), 80% closed (range 70% to 98%) canopy where red spruce (*Picea rubens*) is co-dominant with sugar maple (*Acer saccharum*), yellow birch (*Betula allegheniensis*), balsam fir (*Abies balsamea*), and paper birch (*Betula papyrifera*). Red maple (*Acer rubrum*) and American beech (*Fagus grandifolia*) are found on some sites, but they are generally less common here than in other examples of Red Spruce-Northern Hardwood Forest in Vermont. A variety of other tree species are found at low densities in the canopy of this community. Shrub layer density is variable; it is usually composed of hobblebush (*Viburnum lantanoides*), wild raisin (*Viburnum cassinoides*), Canada honeysuckle (*Lonicera Canadensis*), striped maple (*Acer pensylvanicum*), and mountain maple (*Acer spicatum*), as well as saplings of the canopy tree species (e.g., in some stands, hardwoods dominate the canopy, and spruce and fir form a dense regenerating shrub layer beneath). Herb layer is moderately sparse and commonly includes wild sarsaparilla (*Aralia nudicaulis*), intermediate woodfern (*Dryopteris intermedia*), Canada mayflower (*Maianthemum canadense*), painted trillium (*Trillium undulatum*), and Indian cucumber (*Medeola virginiana*). At least three species of grapefern were noted in this community, including *Botrychium virginianum*, and *Botrychium matricariifolium*. Mosses are common and densely distributed in the wetter expressions of this community, but they may be absent from the drier sites. Examples observed include bazzania (*Bazzania trilobata*) and *Leucobryum glaucum*. Where Red Spruce-Northern Hardwood Forest occurs on dry sites, drought tolerant species such as velvetleaf blueberry (*Vaccinium myrtilloides*), and bracken fern (*Pteridium aquilinum*) are common. The combined factors of size, landscape context, and ecological integrity make this a high quality occurrence relative to others of its type statewide. Wildlife species utilizing red-spruce-northern hardwood habitat types are similar

to those found in the northern hardwood type, however the softwood inclusions provided for by the red spruce presents additional habitat for the northern goshawk, wood thrush, solitary vireo, northern parula, yellow-rumped warbler, Blackburnian warbler, yellow-bellied flycatcher, and red squirrel (DeGraaf and Rudis 1987).

5. Boreal Talus Woodland

Boreal Talus Woodlands form where steep boulder fields at the base of cliffs combine with cold air drainage and exposure to climatic extremes. Their cool, shady nature makes these rather moist places, however water drains away from the surface quickly and soils can be very dry in summer. The four occurrences at Willoughby State Forest are found below east-facing cliffs on Wheeler Mountain and Mount Hor, and below both east and west facing cliffs on Moose Mountain. Although a great deal of rock has wasted from the cliffs of Mount Pisgah, no boulder field or talus woodland is presently established there, possibly because the cliffs are still actively losing large fragments of rock. Most plant growth is on the horizontal faces of boulders. Soil is almost entirely organic, with only slight signs of contribution from the boulders on which it forms. A low (25-foot to 35-foot), 50% to 65% closed canopy is composed almost entirely of heart-leaved paper birch (*Betula papyrifera* var. *cordifolia*); other trees occasionally present are yellow birch (*Betula allegheniensis*), red maple (*Acer rubrum*), and red spruce (*Picea rubens*). Striped maple (*Acer pensylvanicum*), mountain maple (*Acer spicatum*), mountain ash (*Sorbus americana*), and mountain holly (*Nemopanthus mucronata*) form a dense 8-foot to 15-foot tall shrub layer; shorter shrubs such as skunk currant (*Ribes glandulosum*) and bush honeysuckle (*Diervilla lonicera*) are also present. Herb diversity is low. Appalachian polypody (*Polypodium virginianum*) is the most common plant found on boulders, with goldenrods (*Solidago* sp.) and marginal woodfern (*Dryopteris marginalis*) occasionally seen in the crevices between boulders. Lichens and mosses are abundant in this rocky, moist natural community. The deep crevices and small caves characteristic of this community are excellent habitat for a variety of wildlife species.

6. Northern Hardwood Forest

Northern Hardwood Forest is the most abundant and perhaps the most variable natural community found at Willoughby State Forest. Along with Red Spruce-Northern Hardwood Forest, it forms the matrix in which most of the other, smaller natural communities are situated. Northern Hardwood Forest occupies mesic slopes with moderate levels of moisture and mineral enrichment. Soil substrates are extremely variable, but typical soils include a one to five inch organic layer over 3 to 20 inches of glacial tills. Average stands feature a 50-foot to 60-foot, 80% closed canopy of sugar maple (*Acer saccharum*), yellow birch (*Betula allegheniensis*), white ash (*Fraxinus americana*), American beech (*Fagus grandifolia*), paper birch (*Betula papyrifera*), and big-toothed aspen (*Populus grandidentata*). A wide array of other tree species is present in lower densities, including red maple (*Acer rubrum*), eastern hemlock (*Tsuga canadensis*), red spruce (*Picea rubens*), basswood (*Tilia americana*), and black cherry (*Prunus serotina*). Tall shrubs such as striped maple (*Acer pensylvanicum*) are usually present, and shorter shrubs such as hobblebush (*Viburnum lantanoides*), wild raisin (*Viburnum cassinoides*), nannyberry (*Viburnum lentago*), Canada honeysuckle (*Lonicera canadensis*), and mountain maple (*Acer spicatum*) and may form thickets in the understory. A diverse herb flora occurs in this expansive

community occurrence. More commonly encountered species include intermediate trout lily (*Erythronium americanum*), woodfern (*Dryopteris intermedia*), Christmas fern (*Polystichum acrostichoides*), false solomon's seal (*Smilacina racemosa*), whorled aster (*Aster acuminatus*), jack-in-the-pulpit (*Arisaema triphyllum*), swollen sedge (*Carex intumescens*), violets (*Viola* spp.), drooping woodreed (*Cinna latifolia*), and shining clubmoss (*Lycopodium lucidulum*). Sites with greater levels of mineral enrichment are common, and here one finds wood millet (*Milium effusum*; a moderately uncommon species in Vermont), blue-stemmed goldenrod (*Solidago flexicaulis*), leathery grapefern (*Botrychium virginianum*), rough-leaved ricegrass (*Oryzopsis asperifolia*), round-leaved orchis (*Platanthera orbiculata*), and maidenhair fern (*Adiantum pedatum*). Fourteen acres of a variant type, Yellow Birch-Northern Hardwood Forest, were identified on the west shore of Lake Willoughby, where a bouldery substrate allows yellow birch a competitive advantage over many other hardwood species.

The Northern Hardwood Forest supports a wide diversity of wildlife species, including redback salamander, northern two-lined salamander, wood frog, northern redbelly snake, barred owl, northern saw-whet owl, downy and hairy woodpecker, pileated woodpecker, least flycatcher, black-capped chickadee, white-breasted nuthatch, hermit thrush, red-eyed vireo, black-throated green warbler, black-throated blue warbler, scarlet tanager, masked shrew, smokey shrew, northern flying squirrel, deer mouse, white-footed mouse, woodland jumping mouse, porcupine, fisher, and white-tailed deer. The American beech component of this forest type is heavily utilized by the blue jay, eastern chipmunk, black bear, and ruffed grouse. Species utilizing the younger ages classes of this forest type include the chestnut-sided warbler, American redstart, mourning warbler, rose-breasted grosbeak, and white-throated sparrow (DeGraaf and Rudis 1987). Perhaps the most common natural community in Vermont, there are relatively few examples of Northern Hardwood Forest that are currently found in an unfragmented landscape context. The largely unfragmented nature of the occurrence in the vicinity of Lake Willoughby is notable. Northern Hardwood Forests here have been extensively logged, but few areas were probably cleared for agriculture. A resilient natural community, a number of stands on the state forest now have attributes of later succession forests, including multiple tree age classes, heterogeneous canopy structure, presence of large diameter trees, and adequate representation of biological "legacies" such as coarse woody debris and dead snags. The combined factors of size, landscape context, and ecological integrity make this a high quality occurrence relative to others of its type statewide.

7. Northern Hardwood Talus Woodland

This natural community was identified on just three acres of the state forest. There are two occurrences, one downslope from south-facing cliffs on Mount Hor, the other at the base of a steep slope west of Big Valley Brook. The ground in this community is exceedingly rocky or bouldery as a result of cliff or outcrop erosion upslope. Soils are shallow and consist primarily of organic debris deposited on top of rocks. The flora of this natural community shows signs of mineral enrichment, likely due to upslope erosion of calcium rich bedrock. Yellow birch (*Betula allegheniensis*), white ash (*Fraxinus americana*), basswood (*Tilia americana*), and sugar maple (*Acer saccharum*) are the main trees in the open canopy of this forest type. Striped maple (*Acer pensylvanicum*) and mountain maple (*Acer spicatum*) form

a dense shrub canopy. Herb diversity is low; species observed include round-leaved violet (*Viola rotundifolia*) and liverwort (*Hepatica acutiloba*). Mosses and lichens may be abundant on rocks.

An uncommon natural community in Vermont, both occurrences here are of low quality.

8. Rich Northern Hardwood Forest

An abundance of mineral-rich bedrock makes this a favorable spot for the formation of enriched hardwood forests. Seventy-two acres of Rich Northern Hardwood Forest are found on the slopes of Mounts Pisgah and Hor, where both groundwater seepage and upslope cliff erosion have enriched the soils. These forests are among the most productive and biologically diverse on the parcel. A rich organic humus soil layer 0 to 8 inches in depth covers fine loamy till soils, and pH is high (6.4 at one Pisgah site). Forest canopy averages 75% closure, and features tall (60-foot to 80-foot) hardwoods, primarily sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), American basswood (*Tilia americana*), and red oak (*Quercus rubra*). Yellow birch (*Betula allegheniensis*) and American beech (*Fagus grandifolia*) are also present. Hophornbeam (*Ostrya virginiana*) is common in the subcanopy. The shrub layer includes saplings of the canopy trees, plus beaked hazelnut (*Corylus americana*), red-berried elder (*Sambucus racemosa*), leatherwood (*Dirca palustris*), and alternate-leaved dogwood (*Cornus alternifolia*). The herb layer is dense and diverse; selected species occurring here are maidenhair fern (*Adiantum pedatum*), Christmas fern (*Polystichum acrostichoides*), fragile fern (*Cystopteris bulbifera*), blue-stemmed goldenrod (*Solidago flexicaulis*), blue cohosh (*Caulophyllum thalictroides*), plantain-leaved sedge (*Carex plantaginea*), broad-leaved sedge (*Carex platyphylla*), rough-leaved ricegrass (*Oryzopsis asperifolia*), and long-bracted orchis (*Platanthera viridis* var. *bracteata*). A diverse assemblage of mosses grows on rocks.

Most Rich Northern Hardwood Forests in Vermont are not influenced by as much downslope rock movement and talus as those at Willoughby. Areas of this natural community below cliffs receive a fresh influx of calcareous rocks of all sizes each spring, as ice and rock crack off of cliffs upslope. Deformed and even snapped-off trees are a common sight under the cliffs of Mount Pisgah, and there are rockslides here where vegetation is permanently suppressed. Along the margin of these 30-foot wide openings the Rich Northern Hardwood Forest vegetation is accompanied by shrubby red oak, poison ivy (*Toxicodendron radicans*), grape (*Vitis* species), purple-flowered raspberry (*Rubus odoratus*), white boneset (*Eupatorium rugosum*), bulblet fern (*Cystopteris bulbifera*), dandelion (*Taraxacum officinale*), and dogbane (*Apocynum androsaemifolium*). The example along Route 5A, below the Pisgah cliffs shows no evidence of human vegetation management and has a quality rank of B.

9. Hemlock-Northern Hardwood Forest

Hemlock-Northern Hardwood Forest is found along the Big Valley Brook as well as in spots along the west shore of Lake Willoughby. Soils are a one-inch to two-inch organic layer on top of one to four inches or more of rocky glacial till. Rocks and boulders are common on the soil surface. Trees are relatively tall and canopy is well developed (80%+ coverage). Most common canopy trees are eastern hemlock (*Tsuga canadensis*), yellow birch (*Betula*

allegheniensis), red spruce (*Picea rubens*), and red maple (*Acer rubrum*). (In a variant type of the community, also mapped in the Big Valley Brook drainage, yellow birch and eastern hemlock dominate the canopy, and other hardwoods are much less common.) Shrubs include striped maple (*Acer pensylvanicum*), yew (*Taxus canadensis*), hobblebush (*Viburnum lantanoides*), and Canada honeysuckle (*Lonicera canadensis*). Herb layer is moderately sparse and is composed of shining clubmoss (*Lycopodium lucidulum*), Appalachian polypody (*Polypodium virginianum*), oak fern (*Gymnocarpium dryopteris*), bluebead lily (*Clintonia borealis*), Indian cucumber (*Medeola virginiana*), and pipsissewa (*Chimaphila umbellata*). Mosses are common in the understory, especially on boulders. This community occurs as a patch within surrounding Northern Hardwood and Red Spruce-Northern Hardwood Forests. These examples are small in comparison to others statewide and have thus been given a low quality rank.

10. Boreal Outcrop

One and one-half acres of this community occurs in 14 small patches near the summit of Moose Mountain. They are divided into two separate occurrences based on bedrock type, proximity, and aspect. This community was mapped from aerial photos, and no site visit was made. Future surveys should confirm the identification of this community, and characterize them more fully.

11. Boreal Acidic Cliff

Boreal Acidic Cliffs are found on Wheeler and Moose Mountains, where granite rocks are exposed as sheer faces. A total of six acres are under state ownership. Vegetation is very sparse in this community. There are no trees. A shrub layer with less than 5% coverage features red maple (*Acer rubrum*) saplings, wild raisin (*Viburnum cassinoides*), mountain holly (*Nemopanthus mucronata*), black chokeberry (*Aronia melanocarpa*), striped maple (*Acer pensylvanicum*), lowbush blueberry (*Vaccinium* species), and bog laurel (*Kalmia polifolia*). Herbs present are Canada mayflower (*Maianthemum canadense*), pink lady's slipper (*Cypripedium acaule*), bracken fern (*Pteridium aquilinum*), and a sedge (*Carex* species). Cliffs on Moose Mountain are a B-ranked example of the community, while those at Wheeler Mountain are A-ranked, even though most of the occurrence is not under state ownership. This is a popular destination for rock climbing. There is evidence of disturbance at the base of the cliffs (e.g., trampling of vegetation), but overall climbing at the present levels is not significantly affecting the natural community.

12. Boreal Calcareous Cliff

Some of the finest examples of this rare natural community type in Vermont are found on Mounts Pisgah and Hor. A total of 55 acres are divided into three ecological occurrences: one on the cliffs of Mount Pisgah, a second above Lake Willoughby on the east-facing cliffs of Mount Hor, and a third facing south off of Mount Hor. All feature vertical faces of eroding Waits River limestones, with many areas of seepage from above and within the cliffs. A highly distinctive flora grows on shelves, in cracks, and at the base of these drippy cliffs. Trees are not present. Shrubs such as smooth rose (*Rosa blanda*), green alder (*Alnus viridis*, uncommon in Vermont), northern white cedar (*Thuja occidentalis*), and red oak (*Quercus rubra*) are found on a few ledges and at the base of the cliffs. Herbs are absent from much of the rock, but grow in profusion where they may root. Common species on the

cliffs are black-seeded sedge (*Carex eburnea*), harebell (*Campanula rotundifolia*), and pumpkin sedge (*Carex aurea*). Very rare species (ranked S1 by the Vermont Nongame and Natural Heritage Program) found on the cliffs are: Northern rock-cress (*Braya humilis*; state-threatened), lanceolate cress (*Draba cana*; state-threatened), white mountain saxifrage (*Saxifraga paniculata*), yellow mountain saxifrage (*Saxifraga aizoides*), purple mountain saxifrage (*Saxifraga oppositifolia*), bird's eye primrose (*Primula mistassinica*; state-threatened), alpine sweet-broom (*Hedysarum alpina*), green spleenwort (*Asplenium trichomanes-ramosum*; state-threatened), alpine woodsia (*Woodsia alpina*; state-endangered), glaucous bluegrass (*Poa glauca*), bentgrass (*Calamagrostis stricta* ssp. *inexpansa*; state-endangered), blunt sphenopholis (*Sphenopholis obtusata*; state-endangered), capillary beakrush (*Rhynchospora capillacea*; state-threatened), few-flowered spikerush (*Eleocharis pauciflora*; state-threatened), bashful bulrush (*Scirpus verecundus*; seen only once, in 1863, and now state-endangered). Butterwort (*Pinguicula vulgaris*) has been reported from the cliffs of Mount Pisgah (French and Pence 1989), but this record needs verification. Rare plants (ranked S2 by the Vermont Nongame and Natural Heritage Program) of the cliffs include hyssop-leaved fleabane (*Erigeron hyssopifolius*), Blake's milk-vetch (*Astragalus robbinsii* var. *minor*), boreal wormwood (*Artemisia campestris* ssp. *borealis*), smooth woodsia (*Woodsia glabella*), and scirpus-like sedge (*Carex scirpoidea*). Uncommon plants are green alder, greenish sedge (*Carex viridula* var. *viridula*), and Steller's cliffbrake (*Cryptogramma stelleri*). Ground fir (*Diphasiastrum sabinifolium*) and Alaskan clubmoss (*Diphasiastrum sitchense*) were collected from the cliffs of Mount Pisgah in 1911, but have disappeared from the station. The former is rare in the state, and the latter no longer occurs in Vermont. An interesting moss flora is present on the cliffs (McQueen 1991; Allard 2001), including *Sphagnum quinquefarium* (provisionally ranked as rare in the state), *Cyrtomnium* (formerly *Mnium*) *hymenophylloides* (very rare, and, until recently, considered extirpated entirely from the state), *Rhizomnium appalachianum*, *Plagiomnium drummondii* (rare in Vermont), *Myurella julacea* (rare), *Myurella sibirica*, *Plagiopus oederiana* (uncommon), *Bryhnia graminicolor* (rare), and *Buxbaumia minakatae* (considered a globally rare species; Crum and Anderson 1981). Most of these species are restricted to boreal, montane, or cliff habitats, and a number of them prefer limestone-enriched substrates such as those found here. While the rarity rankings for mosses are considered provisional at present, it is clear that these mountain cliffs provide habitat for a specialized and regionally rare moss flora.

Despite more than 150 years of intensive botanizing (Russell 1852; Thompson 1854, Kennedy 1904; Eggleston 1922; Vermont Nongame and Natural Heritage Program 2003), road construction, nearby logging, and ice climbing, the vegetation communities here appear to be in very good condition.

13. Northern Conifer Floodplain Forest

A few small patches of this floodplain forest type were found on tributaries to Big Valley Brook and at an unnamed pond near Vail Pond. This community is a variant of Silver Maple-Ostrich Fern Riverine Floodplain Forest (See Thompson and Sorenson 2000), but includes some characteristically northern species. Soils are more than 3 ½-inches, moderately decomposed peat, and lenses of mineral soil probably occur within this. Canopy trees are red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), yellow birch (*Betula allegheniensis*), and black ash (*Fraxinus nigra*). Shrubs are mountain maple (*Acer*

spicatum), striped maple (*Acer pensylvanicum*), and hobblebush (*Viburnum lantanoides*). Ostrich fern (*Matteuccia struthiopteris*) covers more than 90% of the ground; other herbs present are dwarf raspberry (*Rubus pubescens*), Goldie's fern (*Dryopteris goldiana*), lady fern (*Dryopteris filix-femina*), intermediate woodfern (*Dryopteris intermedia*), marsh fern (*Thelypteris palustris*), wood nettle (*Laportea canadensis*), swollen sedge (*Carex intumescens*), fowl mannagrass (*Glyceria striata*), and spotted touch-me-not (*Impatiens capensis*). This community is poorly understood in Vermont. One of the two examples at Willoughby features large-diameter coarse woody debris and standing trees, and has probably not been cut for some time. Its quality rank is nonetheless low because of its small size.

14. Red Maple-Black Ash Swamp

There are four small occurrences of this community at Willoughby State Forest. One is located north of Mount Pisgah, in an area of acidic granite bedrock, one is on a terrace north of Marl Pond, and the others are in the vicinity of Big Valley Brook. Red Maple-Black Ash Swamps are forested wetlands whose species composition is dependent on presence of acidic ground water for all or part of the year. Acidic conditions slow the decay of organic debris, leading to deep accumulations of peat soil. The Willoughby examples feature a low (25-30'), open (as little as 20% cover) canopy of red spruce (*Picea rubens*), red maple (*Acer rubrum*), yellow birch (*Betula allegheniensis*), black ash (*Fraxinus nigra*), and balsam fir (*Abies balsamea*). The shrub layer is sparse, and includes winterberry (*Ilex verticillata*), striped maple (*Acer pensylvanicum*), mountain maple (*Acer spicatum*), alternate-leaved dogwood (*Cornus alternifolia*), and dwarf raspberry (*Rubus pubescens*). The herbaceous flora is diverse and it covers at least 90% of the ground; some species noted include false hellebore (*Veratrum viride*), drooping woodreed (*Cinna latifolia*), delicate-stemmed sedge (*Carex leptalea*), turtlehead (*Chelone glabra*), marsh marigold (*Caltha palustris*), touch-me-not (*Impatiens* sp.), golden saxifrage (*Chrysosplenium americanum*), wood nettle (*Laportea canadensis*), helleborine (*Epipactis helleborine*), and swamp thistle (*Cirsium muticum*), which is uncommon in Vermont. Bryophytes are common in these swamps. All occurrences at Willoughby are D-ranked due to their small size relative to others in the state.

15. Northern White Cedar Swamp

Northern White Cedar Swamps are some of the biodiversity highlights of this area. This community type covers more than 100 acres of the state forest, and, like the other two cedar swamp types, it is highly diverse and may harbor a number of rare plants. Occurrences are near or adjacent to May, Wheeler, Blake, and Dolloff Ponds, as well as in some topographic depressions on Mounts Hor and Pisgah, where mineral-rich bedrock enriches groundwater. All examples have probably been logged in the past, and while some are currently in an early successional stage, others are mature, with little or no sign of human disturbance. Typical examples have deep (greater than four feet), moderately well decomposed peat soils. Like other cedar swamps, these have alkaline soils (average pH=7.6). The 45-foot to 50-foot canopy of northern white cedar (*Thuja occidentalis*) can be quite dense, reaching 95% closure in places. Other species sometimes present include red spruce (*Picea rubens*), yellow birch (*Betula allegheniensis*), and paper birch (*Betula papyrifera*). The understory of these swamps is a shady place, with widely dispersed shrubs, including striped maple (*Acer pensylvanicum*), mountain maple (*Acer spicatum*), American yew (*Taxus canadensis*),

mountain ash (*Sorbus americana*), and wild raisin (*Viburnum cassinoides*), as well as regenerating canopy trees. Despite the low availability of light, the herb flora is relatively diverse, and covers about 50% of the ground. Common species include wood sorrel (*Oxalis acetosella*), foam flower (*Tiarella cordifolia*), goldthread (*Coptis groenlandica*), three-flowered bedstraw (*Galium triflorum*), dwarf enchanter's nightshade (*Circaeae alpina*), naked miterwort (*Mitella nuda*), creeping snowberry (*Gaultheria hispidula*), bunchberry (*Cornus canadensis*), three-seeded sedge (*Carex trisperma*), crested woodfern (*Dryopteris cristata*), pink ladyslipper (*Cypripedium acaule*), northern green orchis (*Platanthera hyperborea*), and broad-lipped twayblade (*Listera convallarioides*). Bryophytes have at least a 30% cover, and include a peat moss (*Sphagnum squarrosum*) as well as many "brown mosses", among them bazzania (*Bazzania trilobata*) and stair-step moss (*Hylocomnium splendens*). Northern White Cedar Swamps are uncommon in the state, and several A-ranked examples are found at Willoughby State Forest. One swamp (around Dolloff Pond) is mapped as a deer wintering area. Beavers sometimes flood parts of cedar swamps, creating other wetland habitats but severely altering the swamp; the example around May Pond has recently been flooded by beavers, and large-scale vegetation changes are under way. Wildlife species closely associated with this habitat type include masked shrew, deer mouse, short-tailed shrew, northern waterthrush, northern parula, and winter wren (DeGraaf and Rudis 1987).

16. Red Maple-Northern White Cedar Swamp

A single, five-acre example of this community was found in a basin west of Big Valley Brook. Red Maple-Northern White Cedar Swamp is usually thought of as being restricted to the Champlain and Memphremagog Valleys, so its occurrence here is puzzling. Still, vegetation and landscape position closely match the profiles of other examples in warmer, lower parts of the state. Soils are peat to a depth greater than 3 ½ inches. The swamp has a 45-foot tall, 60% to 95% closed canopy. It has some hummocks, but is mostly level. Red maple (*Acer rubrum*) and large diameter northern white cedar (*Thuja occidentalis*) dominate the canopy; also present are black ash (*Fraxinus nigra*), yellow birch (*Betula allegheniensis*), red spruce (*Picea rubens*), and balsam fir (*Abies balsamea*). Tall shrubs are mountain maple (*Acer spicatum*), Canada honeysuckle (*Lonicera canadensis*), and currant (*Ribes* sp.). Herbs are dwarf raspberry (*Rubus pubescens*), ostrich fern (*Matteuccia struthiopteris*), cinnamon fern (*Osmunda cinnamomea*), crested wood fern (*Dryopteris cristata*), oak fern (*Gymnocarpium dryopteris*), three-seeded sedge (*Carex trisperma*), bunchberry (*Cornus canadensis*), goldthread (*Coptis groenlandica*), foam flower (*Tiarella cordifolia*), wood nettle (*Laportea canadensis*), dwarf enchanter's nightshade (*Circaeae alpina*), naked miterwort (*Mitella nuda*), and northern green orchis (*Platanthera hyperborea*). This swamp shows little signs of past human disturbance (e.g., mature northern white cedar are common as coarse woody debris), and may harbor other, more sensitive species. Red Maple-Northern White Cedar Swamps are uncommon in Vermont, and this one is in good ecological condition.

17. Northern White Cedar Sloping Seepage Forest

This variant of Northern White Cedar Swamp is found on sloping, seepy, mineral-rich ground. Soils usually feature only 18 to 30 inches of peat, under which are 2 to 10 inches of clay or sandy loam soils, and bedrock. Flora is similar to other cedar swamps, but may include some upland species that are able to tolerate seasonally wet soils. Tall (50-foot to

55-foot) northern white cedar (*Thuja occidentalis*) dominate the canopy, but balsam fir (*Abies balsamea*), red maple (*Acer rubrum*), yellow birch (*Betula allegheniensis*), white ash (*Fraxinus americana*), and eastern hemlock (*Tsuga canadensis*) are also present. Widely dispersed shrubs are striped maple (*Acer pensylvanicum*), raspberries (*Rubus* sp.), and Canada honeysuckle (*Lonicera canadensis*). Herbs include rough-stemmed sedge (*Carex scabrata*), bunchberry (*Cornus canadensis*), miterwort (*Mitella diphylla*), intermediate woodfern (*Dryopteris intermedia*), goldthread (*Coptis groenlandica*), shining clubmoss (*Lycopodium lucidulum*), and pipsissewa (*Chimaphila umbellata*). A number of mosses are found here, but they are not as densely aggregated as in other cedar swamps. Several herbs protected by Vermont's endangered species statute occur in these swamps.

There are two occurrences, one associated with Dolloff Pond, and the other at Marl Pond. The latter occurrence is at a late successional stage and may represent an old-growth example of the community. It has been recognized as so by state natural area designation.

The Dolloff Pond occurrence is part of a deer wintering area, and as such, provides important browse and winter cover for white tailed deer.

18. Boreal Acidic Northern White Cedar Swamp

This variant cedar swamp type is distinguished from others by its markedly more acidic soils, and slightly different vegetation. Three occurrences are found in the Big Valley drainage. Because these swamps occur in close proximity to other Northern White Cedar Swamps and in similar topographic situations, it is not clear what controls expression of them. It is possible that when deep glacial sediments sit on top of mineral rich bedrock (as they do in parts of this valley), an acidic swamp is more likely to establish than when the bedrock sits directly beneath the ground surface.

19. Spruce-Fir Tamarack Swamp

A single 10-acre Spruce-Fir-Tamarack Swamp was identified during this inventory effort, but little natural community information was recorded. These swamps are typically acidic, with a well developed peat soil, and a dense canopy of red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*). Tamarack (*Larix laricina*) is present in more enriched examples, and other tree species may be present as well. The ground often features a hummock and hollow topography, creating a variety of microhabitats or varying wetness and acidity. This helps account for the moderately high diversity of these swamps. This swamp should be studied in greater detail.

20. Seep

Seeps occur where groundwater comes to the surface of upland forests for at least part of the year, creating saturated soils and a continuously flowing water source. Seepage water often brings plant nutrients to the surface, particularly in areas with mineral rich bedrock, so Seeps support a wide array of plants adapted to both wet conditions and mineral enrichment. Nineteen examples were identified during this inventory, but it is expected that a number of others will be found in future work. Seeps are located in most of the major forest types in the state forest. Where soils were sampled, they averaged 18 inches of either muck (or sometimes woody peat) on top of 18 inches or more of clay or clay loam soils. Bedrock or

hardpan was present below this. Water was present on the surface in spring, but ran 2 to 18 inches below the surface in drier summer conditions, and had a pH of 6.8 in one sample on Mount Pisgah. Canopy tree species are usually those of the surrounding natural community, but seeps often facilitate growth of species more tolerant of saturated soils and highly enriched conditions, such as red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), northern white cedar (*Thuja occidentalis*), black ash (*Fraxinus nigra*), white ash (*Fraxinus americana*), and sugar maple (*Acer saccharum*). Commonly occurring shrubs are striped maple (*Acer pensylvanicum*), mountain maple (*Acer spicatum*), Canada honeysuckle (*Lonicera canadensis*), dwarf raspberry (*Rubus pubescens*), and swamp red currant (*Ribes triste*). In early spring, Willoughby's seeps are dominated by golden saxifrage (*Chrysosplenium americanum*), jack-in-the-pulpit (*Arisaema triphyllum*), spring beauty (*Claytonia caroliniana*), trout lily (*Erythronium americanum*), marsh marigold (*Caltha palustris*), Macloskey's violet (*Viola macloskeyi*), and rough-stemmed sedge (*Carex scabrata*). Later, they develop a dense, 3-foot to 5-foot growth of wood nettle (*Laportea canadensis*), pale touch-me-not (*Impatiens capensis*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), ostrich fern (*Matteuccia struthiopteris*), and goldie's fern (*Dryopteris goldiana*). Other herbs commonly occurring in Seeps are delicate-stemmed sedge (*Carex leptalea*), drooping woodreed (*Cinna latifolia*), and water avens (*Geum rivale*). Mosses may be common, but at this site, species encountered are mostly those that require some mineral enrichment. A few species encountered are stair-step moss (*Hylocomnium splendens*), *Cratoneuron filicinum*, and *Plagiomnium cuspidatum*. Seeps are important wildlife habitat. One of the first areas to support new growth in spring, they are visited by bears and other large mammals for food. And, they are critical breeding habitat for forest amphibians such as northern two-lined salamander.

21. Vernal Pool

Vernal Pools occur in small topographic depressions, where water collects during spring snowmelt and after large rainfalls. They are usually flooded from sometime in March until early June, then dry for the remainder of the year. Amphibians visit the pools each spring to court, mate, and lay eggs, which must hatch and develop before the pools evaporate. There is also a specialized invertebrate fauna that takes advantage of Vernal Pools, overwintering in the dry mud at the base of the pool, then emerging to carry out the rest of their life cycles in just a few short weeks. These include fairy shrimp and fingernail clams. Six Vernal Pools were located at Willoughby State Forest, but it is expected that others will turn up with future inventories. One occurrence consists of ten or more very small depressions in the ground near May Pond; others are single, larger pools. Pools usually have a 50% to 75% canopy cover from the surrounding forest. Most have a floor strewn with decaying leaf litter, under which is found two to five feet of decomposed, mucky organic material. In some cases, this is underlain by impermeable clay soils, while in others, bedrock sits beneath the top soil layer. Vegetation is sparse in the pool; plants encountered here are black-green rush (*Scirpus atrovirens*), swollen sedge (*Carex intumescens*), Dewey's sedge (*Carex deweyana*), and violets (*Viola* sp.). Amphibians observed in the pools are American toad (*Bufo americanus*) and spotted salamander (*Ambystoma maculatum*).

22. Intermediate Fen

A half-acre Intermediate Fen has been documented along the southern margin of Duck Pond, but was not visited during these inventories. Intermediate Fens are seepage wetlands related to bogs. They receive a small amount of mineral enrichment via groundwater seepage. Typical vegetation includes shrubby cinquefoil (*Potentilla fruticosa*), sweet gale (*Myrica gale*), hairy-fruited sedge (*Carex lasiocarpa*), bog-bean (*Menyanthes trifoliata*), and marsh cinquefoil (*Potentilla palustris*). Intermediate Fens are rare in Vermont, and they may support a number of threatened or endangered plants. Consequently this natural community should be inventoried during the next planning effort for Willoughby State Forest.

23. Shallow Emergent Marsh

Shallow Emergent Marsh is a widespread and variable wetland natural community. Eighteen acres are found along the margins of Vail and Dolloff Ponds as well as a number of unnamed bodies of water. Several stages of vegetative growth around beaver ponds are best described as Shallow Emergent Marsh, but they were not mapped as such (see below). Shallow Emergent Marsh has deep, mucky, organic soils. They are saturated most or all of the year. They are open wetlands with less than 5% tree cover; scattered trees present include black ash (*Fraxinus nigra*), yellow birch (*Betula allegheniensis*), red maple (*Acer rubrum*), and red spruce (*Picea rubens*). Shrubs may be sparse or dense, and include sweet gale (*Myrica gale*) and willows (*Salix* sp.). The herb layer is dominated by graminoids, among them gynandrous sedge (*Carex gynandra*), three-way sedge (*Dulichium arundinaceum*), common bluejoint grass (*Calamagrostis canadensis*), Canada mannagrass (*Glyceria canadensis*), and rice cutgrass (*Leersia oryzoides*). Other herbs noted are bull thistle (*Cirsium vulgare*), rough-stemmed goldenrod (*Solidago rugosa*), elliptic St. John's wort (*Hypericum ellipticum*), touch-me-not (*Impatiens* sp.), boneset (*Eupatorium perfoliatum*), and joe-pye weed (*Eupatorium maculatum*). None of the Shallow Emergent Marshes here are large enough to warrant high quality ranks, though all are in natural situations and appear to be undisturbed.

24. Sedge Meadow

Two small Sedge Meadows were mapped, one at Vail Pond, and another on the northern margin of an unnamed pond near the parking area for the Mount Pisgah hiking trail. These are open, treeless places dominated by sedges and a few grasses. Shrubs such as leatherleaf (*Chamaedaphne calyculata*), common pussy willow (*Salix discolor*), slender willow (*Salix petiolaris*), and red-osier dogwood (*Cornus stolonifera*) are sparsely distributed. Herbs have more than 95% cover. Most common species are stipitate sedge (*Carex stipata*), gynandrous sedge (*Carex gynandra*), cyperus-like sedge (*Carex pseudocyperus*), three-way sedge (*Dulichium arundinaceum*), common blue-joint grass (*Calamagrostis canadensis*), Canada mannagrass (*Glyceria canadensis*), broad-leaved cattail (*Typha latifolia*), blue flag iris (*Iris versicolor*), northern bugleweed (*Lycopus uniflora*), joe-pye weed (*Eupatorium maculatum*), rough-stemmed goldenrod (*Solidago rugosa*), and pumice aster (*Aster puniceus*). Hidden-scale sedge (*Carex cryptolepis*), an uncommon species in Vermont, grows in the Sedge Meadow at Vail Pond. Sedge Meadows are often produced by the activities of beavers, and while beavers are active at this pond, the natural community seems to be structured by other natural forces.

25. Cattail Marsh

Two acres of Cattail Marsh are found along the southern shores of Marl Pond. The marsh was not inventoried. Cattail marshes are usually dominated by broad-leaved cattail (*Typha latifolia*), though they may have a number of other plants in them. They are important habitat for a variety of wetland-associated birds, amphibians, and fish.

26. Alluvial Shrub Swamp

Three small examples of this natural community were mapped, one west of Marl Pond, one south of the Mount Hor summit, and another around the inlet of the smaller Dolloff Pond. The community is not well understood at Willoughby, and these sites should probably be resurveyed in the future. These are shrub-dominated wetlands that receive regular deposits of alluvium (mineral and organic debris) during flooding episodes. Species that compose the dense shrub layer are speckled alder (*Alnus incana*), willows (*Salix* sp.), red-osier dogwood (*Cornus stolonifera*), northern white cedar (*Thuja occidentalis*), and balsam fir (*Abies balsamea*). Herbs present include cinnamon fern (*Osmunda cinnamomea*), turtlehead (*Chelone glabra*), marsh fern (*Thelypteris palustris*), northern bugleweed (*Lycopus uniflora*), and nodding beggar's ticks (*Bidens cernua*).

27. Sweet Gale Shoreline Swamp

This community was found along the margins of Duck, Vail, Marl, and Wheeler ponds. Trees are absent, and vegetation is dominated by shrubs, particularly sweet gale (*Myrica gale*), which favors the alkaline waters of these ponds. Other common shrubs are leatherleaf (*Chamaedaphne calyculata*), meadowsweet (*Spiraea latifolia*), mountain holly (*Nemopanthus mucronata*), speckled alder (*Alnus incana*), and northern white cedar (*Thuja occidentalis*). Herbs noted are blue-flag iris (*Iris versicolor*), managrass (*Glyceria* sp.), sedges (*Carex* sp.), and northern bugleweed (*Lycopus uniflora*). Peat moss (*Sphagnum*) is present in some examples. The community is uncommon in Vermont. All occurrences at Willoughby are quite small, making them of low overall ecological quality.

28. Beaver Wetland

Where beavers dam streams, a characteristic assemblage of wetland plants develops around the edge of their ponds. When dams are breached and ponds abandoned, other communities form on the rich alluvium left behind. As these communities can change very quickly (i.e., on the order months or a few years) they are not delineated as part of this mapping effort. However, beaver are abundant at Willoughby now, and have likely played an important role in maintaining wetland systems here for a long time. Forty-five acres have been mapped as Beaver Wetland, and many more acres of beaver ponds (all mapped as "open water") are also present. Natural communities of beaver dominated systems are most similar to Sedge Meadow, Shallow Emergent Marsh, and Cattail Marsh. A number of Beaver Wetlands were formerly conifer swamps, and they still bear many dead cedar snags. Beavers create habitat for a great many species of mammals, birds, fishes, and invertebrates.

2) Fine Filter Assessment

Rare, Threatened, and Endangered Plant Species

Willoughby State Forest is home to many rare, threatened, and endangered species of animals and plants. Some of Vermont's rarest plants are found on the Boreal Calcareous Cliffs of Mounts Pisgah and Hor (see treatment of the natural community above for a list of 20 plants found there). Impacts from ice climbing are expected to be negligible, while summer rock climbing poses a greater threat. Plant collection by botanists over the last 150 years may also have had negative effects on these plants. Other rare plants species are noted in the community treatments above.

Despite Willoughby's reputation as a botanical hotspot, a great number of rare species once collected in the vicinity of Lake Willoughby have now disappeared from the local flora. Many of the extirpated species are orchids of Northern White Cedar Swamps, virgin examples of which Kennedy (1904) remarked were fast disappearing by the turn of the twentieth century. Rare species recorded in Kennedy's flora that are no longer known from the state forest or its immediate surroundings include: adder's tongue (*Ophioglossum pusillum*; probably extirpated from the state), purple-stemmed cliffbrake (*Pellaea atropurpurea*; uncommon), ground fir (*Diphasiastrum sabinifolium*; rare), Alaskan clubmoss (*Diphasiastrum sitchense*; extirpated from the state), alpine sweetgrass (*Hierchloe alpina*; very rare and listed as threatened), slender cottongrass (*Eriophorum gracile*; very rare), bog-rush (*Cladium mariscoides*; rare to uncommon), shore sedge (*Carex lenticularis*; rare to uncommon), alpine rush (*Juncus alpinus*; rare and now restricted in Vermont to Lake Champlain shores), Siberian chives (*Allium schoenoprasum*; very rare), ram's head lady's-slipper (*Cypripedium arietinum*), rose pogonia (*Pogonia ophioglossoides*; uncommon), hooded ladies'-tresses (*Spiranthes romanzoffiana*; uncommon), heart-leaved twayblade (*Listera cordata*; uncommon), trailing stitchwort (*Stellaria alsine*; very rare), trailing stitchwort (*Stellaria alsine*; very rare), white water crowfoot (*Ranunculus longirostris*; rare to uncommon), mare's-tail (*Hippuris vulgaris*; very rare), mountain cranberry (*Vaccinium vitis-idaea*; very rare alpine plant formerly occurring on the summit of Mount Pisgah), hidden-fruited bladderwort (*Utricularia geminiscapa*; uncommon), sweet coltsfoot (*Petasites frigidus* var. *palmatus*; very rare and listed as threatened in Vermont, it formerly occurred in swamps as well as at the south end of Lake Willoughby), and three-leaved rattlesnake root (*Prenanthes trifoliata*; very rare, and formerly occurring on the summit of Mount Pisgah). In addition, Eggleston (1922) lists four-leaved milkweed (*Asclepias quadrifolia*), an uncommon plant usually seen only in the warmer parts of the state, as occurring on Mount Hor (then known as "Annance"). Gilman (1999) lists Mingan moonwort (*Botrychium minganense* [*B. lunaria*]) as having been collected in the town of Westmore at "Willoughby"; it is no longer known from the state. Although we cannot be certain of the identification of all of these plant collections, and for many of them no specific location on the state forest is given in the 1904 publication, it is clear that the parcel has lost some of its biological diversity in the last hundred years.

Non-Native Species

Exotic species can pose a threat to biodiversity and natural community health. They can also affect silviculture and other management considerations. A number of non-native species

were observed in field surveys of Willoughby State Forest, and many have been mentioned above. None of these plants are currently thought to be a problem at the state forest. Given the many wetlands here, it is notable that purple loosestrife (*Lythrum salicaria*) is relatively uncommon in the area. If managers see it in the state forest, they should consider eradicating it while before it becomes established.

3) Wildlife Habitats and Species Assessment

a. Special Wildlife Habitats

Several distinct special wildlife habitats exist on the Willoughby State Forest (see Figure 9). In general, these are habitats limited in distribution, support species of management concern, have a temporal importance to wildlife, or support a highly diverse assemblage of species. Significant habitats occurring on the Willoughby State Forest include white-tailed deer wintering areas, high elevation, cliffs, beaver influenced ecosystems, wildlife movement corridors, and key mast areas.

1) Deer Wintering Areas

In Northern New England, white-tailed deer are at the northern limit of their range. Cold temperatures and high winds increase the energy needs of deer and deep snows limit mobility and access to food resources. These factors coupled, increase the vulnerability of deer to predation and starvation. Functional deer yards contain a high component of softwood cover (>50%), consisting of cedar, hemlock, spruce, and balsam fir, have a greater than 50% conifer crown closure, contain more than 100 square feet of total basal area, and have tree heights greater than 35 feet (Wiley 1988, Stadler et al. 1993). Winter survival of deer depends upon these special habitats to provide both cover for thermoregulation and access to food resources for increased energy demands.

The Willoughby State Forest contains a 321-acre deer yard located in the southeast corner of the Forest. Vegetation in the wintering area includes white spruce, red spruce, balsam fir, northern white cedar, and paper birch with a minor component of sugar maple, red maple, and yellow birch.

During the winter of 1996-67, one-third of the deer yard was treated to regenerate the winter shelter and provide browse. Single-tree and group selection methodologies were utilized to remove 35 square feet per acre, leaving 100 square feet per acre as functional cover. Hardwood species were targeted to convert the present mixed stand to a dominant coniferous canopy.

2) Key Mast Areas

Mast provides critical foods for many different wildlife species. Mast includes nuts, seeds, berries, and fruits. Nuts and seeds are considered hard mast, while fruits and berries are considered soft mast. The value of mast to different wildlife species differs with the size, abundance, production frequency, accessibility, palatability, and nutritional content of the mast (Foss et al. 1999). The Willoughby State Forest contains two mast producing tree species of great value to wildlife, American beech (hard mast) and American mountain ash (soft mast). Mountain ash is an abundant fruit producer, which provides an important

migration food for many species of birds as well as for bears preparing for hibernation. With the American chestnut no longer remaining in the northern forest, the American beech is the only remaining, major hard mast producing tree. Beechnuts have a high fat and protein content that helps birds and mammals build fat reserves for winter migration and hibernation.

The Willoughby State Forest contains two areas containing significant amounts of mountain ash (107 acres). These key mast areas are located along the top and cliff face of Mount Pisgah, and on the top of Bald Mountain. (Figure 9) Inventories conducted by the Department of Forests, Parks, and Recreation and the Fish and Wildlife Department in 2001 identified 22 key mast beech stands totaling 172 acres (Figure9).

3) Wildlife Movement Corridors

The ability of wildlife species to disperse is critical to an individual species use of suitable habitats across the landscape. Habitat connectivity allows for safe movement, daily movements for foraging, seasonal or annual migrations, and dispersal for young (Foss et al. 1999). Movement corridors include riparian zones, softwood and mixed stands along contours, near major slope changes, and along edges between dissimilar forest types and age classes. Figure 9 illustrates riparian zones and black bear movement corridors located on the Willoughby State Forest.

4) Cliffs

The Willoughby State Forest contains three cliff locations, Mount Pisgah, Mount Hor, and Wheeler Mountain. Mount Pisgah and Hor are characterized as boreal calcareous cliff communities. Characteristic tree species of this community type include northern white cedar, balsam fir, and American mountain ash (Thompson and Sorenson, 2000). Wheeler Mountain is a boreal acidic cliff community containing red spruce, balsam fir, and American mountain ash (Thompson and Sorenson, 2000). Cliff communities are rare in distribution and provide important breeding sites for the northern raven, golden eagle, and peregrine falcon.

5) High Elevation

The Willoughby State Forest contains 285 acres of high elevation forest (>2500 feet). Bald Mountain contains the largest high elevation area on the Forest, with a summit elevation of 3300 feet and 236.55 acres above 2500 feet. Mount Pisgah rises to 2751feet and encompasses 33.12 acres above 2500 feet. Mount Hor covers the smallest high elevation area with 15.66 acres above 2500 feet. High elevation habitats provide important breeding sites for the Bicknell's thrush and the blackpoll warbler, two species of special concern.

Figure 9 – Wildlife Habitat Map

6) Core Forest

Willoughby State Forest represents a large area of core forest with continuous canopy cover and a general lack of fragmentation. This type of landscape is important for wide-ranging wildlife species such as black bear, goshawk, and peregrine falcon. There are several major paved roads in the area (e.g., Routes 5 and 5A), as well as development around the lake and ponds. The road system south of Mount Hor is also a fragmenting feature, and negative effects on wildlife and natural communities were not assessed. The most remote areas of core forest habitat (i.e., greater than 2000 feet from roads) are the east face of Mount Hor, areas of the May Pond parcel, and the majority of the Bald Mountain parcel. Significant acreages greater than 1500 feet from any roads exist southeast of the summit of Mount Pisgah, in the Duck Pond, Blake Pond Recreation Area (west of the network of forest roads), and in the area between Big Valley Brook and Wheeler Pond.

b. Other Wildlife Habitats

1) Upland Openings

Upland openings in the Willoughby State Forest include roadsides, logging roads/skid trails, log landings, cleared ROW for the Portland Pipeline, and a small two-acre field leased for agricultural purposes. Eleven openings across the forest total 16.4 acres. These upland openings account for less than one percent of the forest. Vegetation in these openings include grasses, sedges, forbs, and often with low shrubs along the edges. Openings provide habitat for a number of upland species including northern brown snake, eastern garter snake, meadow jumping mouse, woodchuck, eastern bluebird, song sparrow, and American woodcock. Upland openings also provide important foraging sites for the red-tailed hawk, cedar waxwing, northern mockingbird, eastern coyote, red fox, Keens's myotis, big brown bat, and hoary bat (DeGraaf and Rudis 1987).

2) Sand & Gravel Banks

Exposed sand and gravel banks exist in one excavated pit and along scattered road cuts. The exposed vertical banks provide potential breeding habitat for belted kingfishers, bank swallows, and northern rough-winged swallows (DeGraaf and Rudis 1987).

3) Structures

The Cheney House and its associated outbuildings, located near the south end of Lake Willoughby, provide a unique habitat feature not otherwise found on the Forest. Exposed window and door ledges provide the only nesting habitat available for eastern phoebe and barn swallows. Loose boards and attics also provide roosting and brood-rearing sites for bat species such as the little brown bat and the silver-haired bat (DeGraaf and Rudis 1987).

c. Wildlife Species Present

Wildlife inventories conducted by the Department of Forest, Parks and Recreation began in the spring of 2000 on the Willoughby State Forest. Breeding bird surveys were conducted between June 7 and June 29, 2000. Nocturnal owl surveys were completed between March 9 and April 16, 2001. Reptile and amphibian surveys were completed during May and June 2001. All surveys also documented chance encounters with mammals.

1) Breeding Birds

Breeding bird surveys conducted on the Willoughby State Forest have documented seventy-three species of birds potentially breeding on the Forest (Table 3). These include 19 resident species, 23 short-distance migrants, and 31 neotropical migratory species. The most commonly detected species documented during the 2000 point count surveys include: ovenbird (9.6% of total individuals observed), red-eyed vireo (8.9%), black-throated green warbler (6.7%), white-throated sparrow (5.4%), black-throated blue warbler (5.4%), and winter wren (5.2%). Of the 72 species known to occur on the Forest, 20 species (28%) are considered conservation priorities by the State of Vermont and/or the Partners in Flight Working Group, including two state-listed as rare/uncommon species, two state-listed species of special concern, eighteen priority species designated by the Partners in Flight Working Group, and two state-endangered species.

2) Reptiles & Amphibians

Spring call surveys and directed searches have documented six species of reptiles and amphibians on the Willoughby State Forest. Table 4 provides a list of documented and potentially occurring species.

3) Mammals

Field surveys and incidental sightings have documented eleven mammal species on the Willoughby State Forest to date. Table 5 lists mammal species *known* and potentially occurring.

Rare, Threatened and Endangered Species and Species of Special Concern

The Willoughby State Forest is known to harbor two endangered wildlife species, two species of special concern, and one rare/uncommon species. Endangered species include the common loon and the peregrine falcon. Bicknell's thrush and rusty blackbird are species of special concern. Rare/uncommon species include the bay-breasted warbler.

1) Endangered: State Listed

Common Loon

Loons are currently known to be nesting on the May Pond parcel of the State Forest.. Nesting loons are found on several nearby lakes and ponds including Jobs Pond, Bald Hill Pond, and Newark Pond. As the distribution of loons increases, the 27,000 feet of undeveloped shoreline along Lake Willoughby may provide additional nesting sites.

Peregrine Falcon

The peregrine falcon was extirpated from Vermont in the mid to late 1960s due to indiscriminate use of DDT. The last sighting of a wild peregrine falcon occurred at the Willoughby cliffs in 1970. In 1984, after several years of an intensive captive breeding and release program, the first territorial pair of falcons reoccupied the cliffs of Mount Pisgah. In 1985, the peregrines returned to breed successfully. Peregrines have occupied the Mount Pisgah cliffs for 17 years, producing 27 fledglings. Mount Pisgah is one of 24 nesting sites statewide.

Table 3: Birds Documented in the Willoughby State Forest During the Breeding Season

Alder Flycatcher	Cedar Waxwing	Least Flycatcher (P)	Ruby-throated Hummingbird
American Crow	Chestnut-sided Warbler	Magnolia Warbler	Ruffed Grouse (P)
American Goldfinch	Common Grackle	Mourning Dove	Rusty Blackbird
American Redstart	Common Loon (E, P)	Mourning Warbler	Scarlet Tanager
American Robin	Common Merganser	Nashville Warbler (P)	Solitary Vireo
Barred Owl	Common Yellowthroat Warbler	Northern Parula (P)	Song Sparrow
Bay-breasted Warbler (RU, P)	Dark-eyed Junco	Northern Raven	Swainson's Thrush
Belted Kingfisher (P)	Downy Woodpecker	Northern Waterthrush	Tree Swallow
Bicknell's Thrush (P, SC)	Eastern Kingbird	Olive-sided Flycatcher (P)	Veery (P)
Black-and-White Warbler	Eastern Phoebe	Ovenbird	White-breasted Nuthatch
Blackburnian Warbler (P)	Eastern Wood Pewee (P)	Peregrine Falcon (E)	White-throated Sparrow
Black-capped Chickadee	Evening Grosbeak	Piliated Woodpecker	Winter Wren
Blackpoll Warbler (P)	Golden-crowned Kinglet	Purple Finch (P)	Wood Duck
Black-throated Blue Warbler (P)	Gray Catbird	Red-breasted Nuthatch	Wood Thrush
Black-throated Green Warbler (P)	Great-blue Heron (RU)	Red-eyed Vireo	Yellow-bellied Sapsucker (P)
Blue Jay	Great-crested Flycatcher	Red-tailed Hawk	Yellow-rumped Warbler
Broad-winged Hawk	Hairy Woodpecker	Red-winged Blackbird	
Brown Creeper	Hermit Thrush	Rose-breasted Grosbeak	
Canada Warbler (P)	Hooded Merganser	Ruby-crowned Kinglet	
E- State listed as Endangered		SC- State listed as Special Concern	
RU-State listed as Rare/Uncommon		P- Partners in Flight Priority Species	

Table 4: Reptiles & Amphibian species known and potentially occurring on the Willoughby State Forest

American Bullfrog	Common Snapping Turtle	Redback Salamander
Green Frog	Midland Painted Turtle	Eastern Newt
Gray Treefrog	Red-spotted Newt	Northern Redbelly Snake
Northern Spring Peeper	Spotted Salamander	Northern Brown Snake
Mink Frog	Northern Dusky Salamander	Eastern Garter Snake
Pickerel Frog	Northern Spring Salamander	Eastern Smooth Green Snake
Wood Frog	Northern Two-lined Salamander	
American Toad	Jefferson Salamander	

Table 5: Mammal species known and potentially occurring on the Willoughby State Forest

Masked Shrew	White-footed Mouse	Deer Mouse	Red Fox
Water Shrew	Southern Red-backed Vole	Meadow Vole	Marten
Smokey Shrew	Rock Vole	Gray Fox	Fisher
Pygmy Shrew	Red Bat	Black Bear	Ermine
Northern Short-tailed Shrew	Hoary Bat	Raccoon	Long-tailed Weasel
Hairy-tailed Mole	<i>Snowshoe Hare</i>	Muskrat	Mink
Star-nosed Mole	Eastern Chipmunk	Southern Bog Lemming	Striped Skunk
Little Brown Myotis	Woodchuck	Meadow Jumping Mouse	River Otter
Keens Myotis	Red Squirrel	Woodland Jumping Mouse	Bobcat
Small-footed Myotis	Northern Flying Squirrel	Porcupine	White-tailed Deer
Silver-haired Bat	Beaver	Eastern Coyote	Moose
Big Brown Bat			

3) Special Concern

Bicknell's Thrush

The breeding range of the Bicknell's thrush in the United States is limited to the montane zone of stunted balsam fir, red and black spruce, and paper birch just below timberline in New England and New York. The Bicknell's thrush has been ranked by the Partners in Flight Conservation Group as one of the most at-risk passerine species in the Northeast due to its limited distribution, atmospheric pollution, recreational development, communications tower construction, and wind power development (Lambert, unpublished manuscript).

Surveys have documented the Bicknell's thrush on Bald Mountain (Atwood and Rimmer 1994, Lambert, unpublished data) during the breeding season. Bald Mountain is one of 112 sites statewide where Bicknell's thrush has been documented (Atwood and Rimmer 1994). Other potential habitat occurs off of the Forest on Bald Mountain as well as on nearby Job and Goodwin mountains.

Rusty Blackbird

In Vermont, the rusty blackbird is a rare inhabitant of northern wetlands. Rusty blackbirds are invariably found in coniferous forests near bogs, ponds, beaver flowages, and swampy woodlands (Laughlin and Kibbe 1985). Rusty blackbirds are sensitive to habitat alteration and human disturbance and therefore are considered indicator species for healthy wetland systems. The rusty blackbird has been documented near Upper Dolloff Pond during the breeding season.

4) Rare-Uncommon

Bay-breasted Warbler

The bay-breasted warbler is a small neotropical migrant found in mature conifer and mixed forests. Vermont is at the extreme southern limit of the bird's range. The bay-breasted warbler prefers small forest openings, particularly at edges of clearings, ponds, and bogs with large vigorous conifers (Foss 1994). Bay-breasted warblers have highly cyclical populations

dependent on spruce-budworm outbreaks. Laughlin and Kibbe (1985) found only one confirmed nest near Granby/Guildhall for the Vermont Atlas of Breeding Birds. One singing male was observed at the edge of Duck Pond during the 2000 point count survey. The likelihood of bay-breasted warblers nesting in the Willoughby State Forest is low due to the lack of enough suitable habitat. It is hypothesized that the bird observed on Duck Pond was an unpaired male.

Edge-of-Range Species

Edge-of-range species are defined as those species whose range extends into Vermont but not beyond. Edge-of-range species are important indicators of biological diversity because of their sensitivity to habitat alteration. Breeding bird surveys performed on the Willoughby State Forest have identified seven edge-of-range species occurring (Table 6). Six of these species are at the southern extent of their range and are more commonly found in the boreal forests of the north, while one species (great-crested flycatcher) is at the northern extent of its range.

Table 6: Edge of Range Species Documented on the Willoughby State Forest

Bay-breasted Warbler	Common Loon	Rusty Blackbird
Bicknell's Thrush	Great-crested Flycatcher	
Blackpoll Warbler	Ruby-crowned Kinglet	

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Timber Resource Assessment

Background: The database for this portion of the plan was generated by a resource inventory conducted during 1992. The program that our Department uses is called “FOREX”, an abbreviation for forest examination. A complete FOREX examination was done on the forest in 1981. An abbreviated version of FOREX was conducted to gather the data for this plan.

History of Timber Management: The current status of timber resources on Willoughby State Forest are partly the results of past land use management practices that occurred before and during state ownership. Although some of the forest was influenced by past agricultural practices, much of it has always been in a forested condition. Prior to state ownership, much of this property could be categorized as industrial forestland. Portions of the present-day forest were previously owned by U.S. Bobbin and Shuttle Company, Willoughby Lumber Company, and Caledonia Bobbin and Lumber Company. J.C. Wymess owned and actively managed a large part of the forest and had ties to the Groveton Paper Company in Groveton, New Hampshire. The forest was logged heavily under previous ownerships and up to the time the state acquired these lands. These logging practices resulted in the present-day even-aged stand conditions.

The forest continues to be actively and sustainably managed under state ownership. Timber sale records date back from the late 1950s to the present. The focus of timber management under state ownership has been to improve stand conditions by removing the cull component and releasing potential sawlog quality trees.

Economic Benefit: There has been and will continue to be an active timber management program in Willoughby State Forest. Local loggers and sawmills have benefited economically from timber harvesting operations conducted in the state forest. During the last 20 years, ANR has marked and sold sixteen timber sales in Willoughby State Forest. Approximately 1785 acres have been treated yielding 14,782 cords of firewood/pulpwood and 1,927,583 board feet of sawlogs. Receipts for stumpage sold during this period of time totals \$241,678.

Willoughby State Forest has also provided firewood to homeowners through the “Household Fuelwood Program.” The Vermont Legislature initiated and funded this program during the mid-1970s as a result of world oil supply shortages and increased fuel oil prices. The program allowed individuals to purchase and cut five-cord firewood lots on state lands. A minimal fee was charged for stumpage. Demand for firewood in the forest was substantial, selling between 400 to 500 cords each year throughout the late 1970s and early 1980s. It gradually tapered off as oil prices stabilized. The program provided an economic incentive for many homeowners by alleviating heating costs. It has also allowed the Department of Forests, Parks and Recreation the opportunity to improve residual stand quality by thinning young vigorous hardwood stands and removing poor quality trees.

Current Conditions: Timber harvesting will occur throughout the General Use classification area (3536 acres), as well as in the following areas classified under Unique and Special Use; Deer Wintering Area (321 acres), Beech Mast Stands (172 acres), Wellhead

Figure 10 – Timber Assessment Map

Protection Area (113 acres), Riparian Areas (761 acres) and Special Viewshed Areas (426 acres). Altogether timber harvesting will occur at regular intervals on 5329 acres or 69% of this state forest area. Predominant timber types within these classification areas as recognized and described by the Society of National Foresters include Northern Hardwood and Red Spruce/Yellow Birch. A description of these timber types and others that are present in the forest is included in this assessment.

Table 8 (Forest Stand Data) shows that the forest is dominated by well-stocked even-aged stands. The information is displayed in a matrix format that shows timber type by size class and stocking level. The amount of land area is represented as a percentage of the entire land area (5329 acres), where timber harvesting will occur at regular intervals over time.

The general health of the forest is good. There have been no severe insect or disease epidemics. Some crown damage and dieback resulted from heavy infestations of birch leaf minor and birch skeletonizer during 1991. Beech mortality has become more evident during the last few years. This is apparently due to another wave of the Beech Scale Nectria Complex, which is passing through New England. There has been no damage due to Pear Thrips. During 1991, Anthracnose became very noticeable at the higher elevations within the forest. This outbreak was due to cool, damp weather conditions that were prevalent that year. Very little damage occurred from the 1998 ice storm. Light damage was confined to the uppermost easterly slopes of Mount Pisgah.

Stand quality is good overall. This is mainly attributable to the productive soils and past commercial and non-commercial treatments that have focused on improving residual stand quality.

Description of Timber Types: The following is a description of timber types as recognized by the Society of National Foresters that are present in Willoughby State Forest.

Northern Hardwood - This is the predominant timber type in the forest. It includes beech, yellow birch and sugar maple; with a minor component of white ash, paper birch and red maple. Stand size ranges from 11 acres to 300 acres with 93 acres being the average. Sugar maple is the most prevalent species within the northern hardwood timber type. This species represents more than 50% of the stocking in 54% of the northern hardwood stands inventoried in the forest.

Sugar Maple – This timber type is located in small “pockets” in the forest and covers a small land area (176 acres). Sugar maple is the dominant species with a minor component of white ash, basswood, yellow birch and beech. The minor species components make up less than 20% of the total stocking. This timber type can be found on some of the most productive sites within the forest on well-drained, deep loamy soils.

Red Spruce/Yellow Birch – This timber type is a mixed-wood type that has a mix of yellow birch, red maple, red spruce and balsam fir, with a minor component of paper birch, northern white cedar, and white spruce. These stands are typified by a 25 % to 65 % stocking of conifers, predominantly spruce/fir. The softwood component is generally of better quality

than the hardwood. These sites are less productive since they are located on soils that are shallow-to-hardpan and are poorly to moderately well drained. Stand size ranges from 10 acres to 200 acres with 71 acres being the average. In the forest, these stands can be found along the Dolloff Brook and Big Valley Brook drainages and also occur as inclusions within the northern hardwood timber type.

Spruce/Fir – In Willoughby State Forest, this timber type is dominated by balsam fir with red spruce being present. Minor associated species include northern white cedar, tamarack, red maple, paper birch and yellow birch. It can be found at both low and high elevations. Within the forest, this timber type can be found in the lower drainage area surrounding Dolloff Pond and along other smaller brook drainages. Spruce-fir forests can also be found at the uppermost elevations of Bald Mountain. Shallow soils are a characteristic trait for this timber type. Soils are generally poorly drained and shallow-to-hardpan in lowland stands of spruce-fir. Spruce-fir stands located on steep upper mountain slopes have better drained soils that are shallow-to-bedrock.

Northern White Cedar – This timber type comprises a small land area in the forest. Northern white cedar comprises the majority of stocking with this timber type. Other associated species include balsam fir, red spruce and tamarack. Forest stands of northern white cedar in the forest are generally found on wet sites with organic soils and are scattered in small pockets within the forest. Two of the larger stands of northern white cedar are located in the Dolloff Pond drainage and along the eastern shoreline of Marl Pond and is part of the Marl Pond State Natural Area. Many of these stands have been mapped through the U.S. Department of Interior National Wetlands Inventory as forested wetlands.

Plantations - The Civilian Conservation Corps established most of the plantations during the 1930s. In 1960, the Vermont Forest Service established a 22-acre White Pine/Red Pine plantation along town highway #78 (North Ridge Road), in Sutton. The CCCs and the Vermont Forest Service conducted cultural treatments (weeding and thinning) at periodic intervals until the plantations were well established and free to grow from competition. All the plantations have received commercial thinnings at least once. Some crop tree pruning was done in the white pine/red pine plantation during 1995. There are 160 acres of softwood plantations in Willoughby State Forest.

Table 7 – Plantations

PLANTATIONS		
Compartment	Timber Type	Acreage
1	White Spruce	22
1	Red Pine	2
2	Norway Spruce	43
3	Norway Spruce	17
3	White Pine/Red Pine	24
Newark Block	Norway Spruce	52

Table 8 - Forest Stand Data

Timber Type	Size Class			Stocking Level		Percent
	Seedling/ Sapling	Poletimber	Sawtimber	Well Stocked	Over- Stocked	
Northern Hardwood			(*)		(*)	5.3%
Northern Hardwood		(*)		(*)		36.6%
Northern Hardwood	(*)			(*)		11.5%
Northern Hardwood			(*)	(*)		23.4%
Sugar Maple			(*)	(*)		2.1%
Sugar Maple		(*)			(*)	1.0%
Sugar Maple			(*)		(*)	.3%
Red Spruce/ Yellow Birch		(*)		(*)		8.9%
Red Spruce/ Yellow Birch			(*)	(*)		7.6%
Plantations			(*)	(*)		3.3%

Size Class

Seedling/Sapling – Mean Stand Diameter (MSD) 0-4 inches Diameter at Breast Height (DBH)

Poletimber – MSD 6-8 inches DBH

Sawtimber – MSD 10 inches and greater DBH

Stocking Levels

Well Stocked – Between the A and B line in the silvicultural stocking guide for that particular timber type.

Over Stocked – Above the A line in the silvicultural stocking guide for that particular timber type.

Recreation Assessment

General Description: Willoughby State Forest offers spectacular scenery and year-round diversified recreational opportunities, including but not limited to hiking, mountain biking, ice and rock climbing, snowshoeing, dog sledding, primitive camping and cross-country skiing. Traditional uses of the forest include hunting, fishing and trapping. The forest is easily accessible from State Routes 5 and 5A and is in close proximity to three population centers: St. Johnsbury, Lyndonville and Newport. It is less than one day's drive from major population centers including Montreal and Boston.

Willoughby State Forest is located in the northeastern area of the state, referred to as the Northeast Kingdom. The Vermont Fish and Wildlife Department refers to this area as "Vermont's premier wildlife region." The forest is adjacent to Lake Willoughby, which is one of Vermont's largest and deepest lakes. It is arguably one of Vermont's premier cold-water fisheries and produces some of the largest lake trout caught in the state.

With human population expected to double over the next five decades, pressure to use public lands in Vermont is expected to increase. Projections have been estimated by the U.S. Forest Service regarding increases in demand in the northeastern U.S. for many of the activities that occur at Willoughby State Forest.

The popularity of this state forest has brought an observed increase in recreational use over the last several years. It is expected that the recreational demand on this forest will only increase in the near future. Providing for recreational opportunities while protecting the biological, geological and cultural resources, poses one of the greatest challenges in regards to the stewardship of this state forest.

Much of the forest area is within one-half mile of maintained roads or trails. At this time, interaction between users is usually low to moderate, but evidence of other users is prevalent. Moderate to large numbers of users can be expected periodically at some of the more popular destination spots in the forest.

Assessment of Recreational Uses and Experiences Occurring on the Lands and Waters of Willoughby State Forest

An inventory and evaluation of recreational user experiences was conducted for Willoughby State Forest. The Recreation Opportunity Spectrum (ROS) was used so that the character of experience a recreational user can expect to find is described for each of the areas of the forest. Developed by the U.S. Forest Service, this national system allows the public to receive consistent information about recreational experience types regardless of whether they're recreating on state or federal lands.

The six ROS categories include Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Semi-Developed Natural, Developed Natural and Highly Developed. Each of these categories describes experiences that range from highly developed to undeveloped. The characteristics used to develop the categories are 1) the physical setting consisting of feeling of remoteness, size of the area, and evidence of people; 2) the social setting, consisting of the

amount and type of contact between individuals and groups; and 3) the managerial setting, consisting of the amounts and kinds of restrictions placed on people's actions.

Recreational experiences for most of Willoughby State Forest fall into the Semi-Developed Natural ROS category. The exception being at the "South End", where summer recreation use is high. This area of the forest is considered to best fit into the Developed Natural ROS class where the natural setting has been substantially modified, encounters with other individuals are common, and where regimentation and controls are in place and obvious to control human use. The Semi-Developed Natural areas of the forest can generally be described as an area with a natural appearing environment where the natural setting may have obvious modifications ranging from being easily noticed to strongly dominant. Frequency of encountering other people is moderate and on-site regimentation is noticeable but harmonizes with the natural environment. .

Descriptions of the experience types are included for different areas of the forest in this assessment. For a further explanation of the Recreation Opportunity Spectrum, refer to the Implementation Guide "Inventorying, Mapping and Evaluating Recreation Resources On Public Lands Using the Recreation Opportunity Spectrum" located at any ANR district office. Public access opportunities for traditional and recreational uses of Willoughby State Forest are described in the Public Access Assessment.

Bald Mountain

This is a non-contiguous parcel of land acquired by the state in 2000 and is now part of Willoughby State Forest. Two hiking trails lead to the summit of Bald Mountain (3300 feet in elevation). They are the Mad Brook and Long Pond hiking trails. These two trails offer a northerly and southerly approach to the summit. A panoramic view of the Northeast Kingdom from can be seen from the obsolete fire tower at the summit.

The northerly approach (Mad Brook Trail) serves as a public right-of-way to this parcel of land and passes across three different private landowners before entering the state forest. This trail receives a moderate level of use. The lower segment of the trail can be described as being in good condition, but segments on the upper portion of the trail where slopes are steeper, have been eroded severely in places over the years as a result of illegal ATV use. Illegal ATV use remains a problem that the Department of Forests, Parks and Recreation (FPR) is dealing with at this area. During 2002 a natural barricade using large boulders was placed on the trail to prevent ATV's from reaching the summit. The results of this work have proven to be somewhat successful, however there is evidence that some ATVs are still able to pass around the barricade.

The southerly approach (Long Pond Trail) is predominantly located on private land but enters the forest from the south at the upper elevations before ascent is made to the summit. The private landowner allows the public to use this trail. The use and maintenance of this trail is provided through cooperation of the landowner, the Westmore Association and the Vermont Leadership Center. FPR is responsible for trail upkeep on the segment located on state land. An obsolete fire tower and associated ranger's cabin is located at the summit. The obsolete fire tower is now used exclusively for sightseeing purposes. The steps of the tower

were replaced in 2002, and the roof was repaired in 2003. Vandalism at this site occurred prior to state acquisition. Some of the glass windows of the tower have been broken, and another structure built by the previous landowner was burned to the ground. Arson is suspected. The likelihood of vandalism remains a concern for the fire tower and the associated ranger's cabin.

Trailhead parking is very limited for the Mad Brook hiking trail. There is no defined parking area. Only roadside parking is available on privately owned lands at the discretion of the landowner. Adequate trailhead parking is available by permission of the private landowner for the Long Pond hiking trail.

This is a remote, non-contiguous parcel of the forest that can be accessed only by hiking trails. Human development is noticeable with the existence of the hiking trails and the old fire tower and associated Ranger's cabin at the summit. These trails receive low to moderate use during the summer and into the fall, so one can expect to sense a general feeling of remoteness. Occasional dispersed recreationists may venture into this area of the forest during the winter. From spring through the fall, a minimal amount of human contact can be expected during the weekdays and a low to moderate amount on the weekends.

Willoughby Cliffs

The cliffs and summit areas of Mount Pisgah and Mount Hor have been designated as a Vermont State Natural Area as well as a National Natural Landmark by the U.S. Department of Interior. The Willoughby Cliffs area is recognized as one of the premier ice-climbing destinations in North America. Most of this activity occurs on the cliffs of Mount Pisgah. These cliffs have provided ice-climbing opportunities to the public for many years. Anecdotal reports indicate that limited rock climbing also occurs here during the summer. Although the level of rock climbing appears to be low, an assessment of the ecological impacts of this activity is recommended. The cliffs have also been a popular destination site for botanists for more than 100 years due to the unique flora that grows there. The unique geology of this area also makes it a favorite field site for geological interpretation.

Some illegal camping takes place along the western shoreline of Lake Willoughby during the summer. It does not meet the ANR Primitive Camping guidelines that require a 100-foot setback from water bodies and streams. Shoreline erosion and sanitation issues are valid concerns.

Hiking trails within this area of the forest include the Mount Pisgah Trail and the associated East Trail, the Herbert Hawkes Trail and the South Shore Trail. The 3.9-mile long Mount Pisgah trail is one of the most popular hiking trails in the region and receives heavy use. Because of this heavy use, it requires a substantial amount of on-going maintenance to keep erosion in check. Also, a number of unauthorized side-trails overlooking the cliffs on Mount Pisgah are starting to appear. Access to the summit of Mount Pisgah is also provided via private land by landowner permission, from the Long Pond Road (a town highway), to the East Trail located on the state forest. Public use and promotion of this hiking trail is coordinated through the Westmore Association.

The trailhead parking area at the north end of the Mount Pisgah hiking trail is small. This is a factor that may limit the amount of use on this section of trail. It is within the Vermont Agency of Transportation (AOT) right-of-way and no opportunities exist to make it larger due to physical constraints. It cannot be plowed during the winter because of its small size. Trailhead parking at the south end is ample for both summer and winter uses. It is plowed by AOT during the winter as a courtesy. Winter parking for the increasing amount of ice-climbers was a concern voiced at the September 12, 2002 public involvement meeting for Willoughby State Forest. Limited opportunities exist for providing nearby winter parking for ice climbers on the forest. It was suggested that the ice climbers approach AOT and/or the owners of the White Caps Campground to explore options.

Because of the easy accessibility and popularity of this area of the forest, one can expect to encounter other users much of the time. The Mount Pisgah trail is probably the heaviest used hiking trail in this region of Vermont. The heaviest use occurs during the summer and through the fall. A minimal amount of winter hiking also occurs on this trail. Ice climbing becomes the dominant recreational activity in this area during the winter. This activity is usually done in groups or pairs of individuals working together. Human contact between ice climbing groups can usually be expected during the week and on the weekends. The extensive ice sheets that form on the cliffs allow for climbers to disperse, although it is somewhat common for one group to be in visual contact with another. Human development is obvious and blends in to enhance the natural surroundings and the recreation experience of a semi-developed area.

South End of Lake Willoughby

A popular destination spot for summer users is located at the “South End” of Lake Willoughby. The South End includes two natural sandy beaches separated by lakeshore bluffs with spectacular views of the lake and cliffs of Mount Hor and Mount Pisgah. This area is easily accessible via State Route 5A and is characterized by a high level of public use at times during the summer. Although this area is not a designated state park or day-use area, it does function as one and receives heavy use by swimmers and sunbathers during the summer.

A designated but unmarked swimming area exists at the beach area adjacent to State Route 5A. The swim area was marked with buoys in 1995 in an effort to maintain a safe area for swimmers away from the boat moorings and from boats being launched at the South End. The buoys were difficult to maintain and required constant attention since they often were dislodged during periods of high winds. Continuing to delineate the swim area to prevent encroachment of moorings does not appear necessary at this time. Boaters appear to be self-regulating, in that they are allowing an area to be free from boats for bathers.

Although not an official boat access area, small trailered watercraft and car-top boats are launched at the South End adjacent to State Route 5A. Although the Fish and Wildlife Department provides an officially designated fishing access near the northeastern corner of the lake, some fishermen and boaters prefer and continue to launch their boats from the South End. The physical constraints at the South End access site preclude the launching of larger watercraft. Some lakeshore erosion and disturbance is occurring at this site.

Nude bathing became an established use in the west cove during the late 1980s and has been an issue of contention among a segment of the public. In 1991, FPR sought an opinion from the Vermont Attorney General's Office, regarding the legality of this specific activity. It was the Attorney General's opinion that nudity has certain protections afforded under the Vermont Constitution. The nudity at this beach area remains to be a controversial issue that the department will need to continue managing responsibly.

There is a small parking lot at the South End that will accommodate about 10 vehicles. Visitors to this area also park along State Route 5A. An informational kiosk and two portable toilets are located in this parking lot. One is handicapped accessible. Excessive noise from late night parties and vandalism of vehicles has been a perennial problem associated with this parking lot.

The parking lot also serves as the trailhead to the South Shore Trail that leads to the base of the cliffs at Mount Hor. The first part of this trail, to the lakeshore bluffs, can accommodate wheelchairs but is not officially considered "wheelchair accessible" and may not meet ADA requirements. The South Shore Trail (approximately one mile) starts from the South End parking lot and terminates at the Mount Hor cliffs. Use of this trail is relatively low. Bridges on this trail need some repair and/or replacement.

A number of foot trails provide access to the beaches at the South End. Another unofficial trail follows along the western side of the lake. Vegetation has been illegally cut for campfires, and numerous side trails have been established. Soil compaction is evident in certain areas of congested use. Unauthorized trails, which have become established over time and are showing obvious signs of erosion, traverse over steep terrain in the vicinity of the lakeshore bluff area to the lakeshore. Continuous efforts have been made by the department to control this unauthorized establishment of trails and stabilize the exposed mineral soil. Trails projects carried out by the Vermont Youth Conservation Corps (VYCC) and the Vermont Leadership Center (VLC) have focused on erosion control, re-vegetating and closing off unpermitted trails.

The following list of items is a summary of conflicts and concerns that have been identified to date.

- Swimming and boat moorings
- Lake access area
- Nude bathing
- Camping and campfires
- Excessive noise levels at night
- Unlawful conduct
- Unleashed pets
- Parking
- Sanitary conditions
- Vandalism
- Littering/trash dumping
- Unauthorized foot trails
- Trail erosion

In 1991 the Department outlined a draft proposal for the long-term management of this area and presented it at a public meeting. At that meeting, it was contended by a private citizen of the community that the state did not have legal title to a portion of the South End that the state thought it owned. The continued use of this area and comments received by the public led the department to implement portions of the plan on lands owned by the state until the question of ownership was resolved. Management actions taken by the department included (1) establishing a swimming area free of boat moorings, (2) making improvements to the parking area and (3) developing signage. A gate was installed at the parking area and public use hours were posted from 7 am to 9 pm. Management of the gate (opening and closing) was taken on by a previous owner of White Caps Campground as a volunteer effort. During the summer of 2002, FPR contracted with the Orleans County Sheriffs Department to address illegal uses and unlawful conduct occurring at the south end. This effort was considered successful and the recommendation is that it be continued.

Cheney House State Park

History

The (Van Arsdale)-Cheney House is located at the south end of Lake Willoughby. The Parks Division has management responsibility for this state-owned facility as well as all other facilities located on lands held by FPR. The department acquired the Cheney House and 20 acres of land through a trade with Burke Mountain Recreation Inc. in 1970. Previous programs and activities offered at this facility have centered on environmental education. The Federal Youth Conservation Corps Program operated during summers out of this facility from 1975 through 1980. When federal funding for this program stopped, summer crews no longer stayed here nor worked in the forest. In 1991, the newly established Vermont Youth Conservation Corps (VYCC), formed a community-based partnership with Lyndon State College, several State agencies, the town of Westmore, and many local volunteers, to restore, protect, and reoccupy the house. The VYCC used the Cheney House as a summer residential base camp from 1991 to 1999.

Condition and Uses of Facilities

The Cheney House State Park includes the Main House, the Carriage House, the Log Barn, a ropes course, a trail to the South End of Lake Willoughby, and a number of fields. This facility is currently operated and managed by the Parks Division through a contractual agreement with a private individual in the area. It is open year round to public use for meetings and workshops, weddings and family reunions, and for group lodging.

The Cheney House is an historical residential structure currently used as a small-scale residential conference/meeting center that is available to rent by the public for small group use. It provides one of the only group accommodations in the region which complements the other private lodging opportunities in the area. It features a conference space in what was the house's living room and adjacent enclosed porch. On its first and second floors, the building also contains a dorm-style sleeping area and three bedrooms that can accommodate up to 25 overnight guests, men's and women's washrooms with showers and a completely outfitted commercial kitchen for groups to use for preparing and serving meals.

The Carriage House is a small two-story cottage set on a stone foundation on a hillside behind the main house. The building has been used as staff quarters during the summer only when the VYCC was using the facility for a residential camp. The building consists of a covered first floor porch under a second floor sleeping porch, a central room with a cobblestone fireplace, small kitchenette and storage room on the first floor and a single bedroom with a bath on the second floor.

The Log Barn is down-slope from the Carriage House and features vertical logs as exterior walls and a corrugated metal roof. The barn is used for storing equipment and firewood for the facility.

The 1999 Vermont State Parks Infrastructure Survey estimated over \$266,000 in renovations that were needed to all three structures to bring the buildings up to an acceptable standard. Minimal work has been completed over the years to stabilize the building and improve the interior aspects of the main house.

The rustic facilities and furnishings provide for a relaxed and unassuming atmosphere at the park. There is an on-site ropes course open to the public on a request basis. Through an agreement with Lyndon State College, ropes course instructors can be provided to a group requesting use of the ropes course.

Within the regional area of northeastern Vermont, this is the only reasonably priced facility of this nature. The 2002 fees to use the Cheney House for day use, such as for meetings, are \$60 for nonprofit groups and \$125 for private and commercial groups; and for overnight use the fees are \$150 for nonprofit groups and \$225 for private and commercial groups. The main users of the Cheney House are repeat users, and include school groups, state and local governmental agencies, some nonprofit groups, and long-time other groups such as families. The majority of the use is on weekends.

Revenues generated from the Cheney House are increasing slowly each year. The facility became available year round to the public in 2000 when the VYCC decided that they would no longer use the facility as a summer residential camp for their conservation programs. Revenues for previous years are as follows:

Year	Revenues
2002 (thru Aug. 8)	\$11,095.00
2001	\$ 9,686.00
2000	\$ 7,815.00
1999	\$ 7,457.00
1998	\$ 9,066.00
1997	\$ 4,267.00

The current condition of the Cheney House was assessed through a 1999 Statewide Infrastructure Study of Park Structures. Overall, the main house structure is in fairly decent condition.

Moderate to high concentrations of use during the summer months characterizes the overall experience found at the South End. This is generally weather dependent. The highest concentrations of use appear to be on the hottest days of summer as people seek relief from the heat. During the winter there is no use, except for this area providing an access point onto the lake for ice fishermen to put out and take off their ice fishing shanties. Human development is obvious and blends in to enhance the natural surroundings and the recreation experience of this minimally developed area.

Bartlett Mountain Area

The Bartlett Mountain area of the forest has been and continues to be a popular spot for year-round dispersed forms of recreation. The area is well accessed from Route 5A and two forest roads, Bartlett Mountain Road and the CCC Road. They are both open to motorized traffic. The CCC Road is a four-mile long gravel surfaced road that was built in the 1930s by the Civilian Conservation Corps stationed at Camp Number 55. The remains of this camp are located in the forest and are still evident today. The CCC Road is a major artery running through the forest connecting State Routes 5 and 5A. Motorists sometimes use this route as a short-cut connector between Routes 5 and 5A. Rutting usually occurs during the early spring of every year, as frost is coming out of the ground, on some sections of these roads and their associated spur roads that are open to motorized traffic.

There is a parking lot at the easterly terminus of the CCC Road on the west side of State Route 5A. Directly across from this parking lot there is another on the easterly side of State Route 5A. These two lots provide trailhead parking to the Mount Pisgah hiking trail and also serve as a point of access to the Bartlett Mountain area. These parking lots are plowed during the winter as a courtesy by the Vermont Agency of Transportation.

The trailhead for the Mount Hor hiking trail is located about 1.25 miles from State Route 5A heading westerly on the CCC Road. A vista offering spectacular views of Lake Willoughby and the Willoughby Cliffs is located just west of the easterly junction of the CCC Road and the Bartlett Mountain Road. This area of the forest offers opportunities for a casual walk, snow shoeing, cross-country skiing and mountain biking. The roads provide a corridor for the occasional horseback rider and are used by dog-sledders during the early winter months for training.

The Department of Forests, Parks and Recreation has worked cooperatively, since 1998 with area high schools and the New England Nordic Ski Association (NENSA) in accommodating requests to hold cross-country ski races and practice sessions in this area of the forest. The availability of skiable terrain early in the winter attracted these groups to this area. Originally these groups used the existing forest road corridor loop around Bartlett Mountain. This route posed safety concerns because a section of the route serves as a Vermont Association of Snow Travelers (VAST) corridor trail. It also posed undue physical challenges for the younger Junior Varsity racers, according to the high school Nordic ski coaches because of its

length and a couple of steep climbs. In order to relieve these problems and safety concerns area high schools requested the Department to consider alternatives. In June 2001 a new 5.5-kilometer cross-country ski trail system was designed and developed on the east side of Bartlett Mountain. This new trail system utilized existing infrastructure that include portions of the CCC Road and the Bartlett Mountain Road as well as some woods trails. This trail system offers a training and racecourse for local high school cross-country ski teams that now accommodates the needs and abilities of all high school student skiers. NENSA also continues to host an annual race event on this course. These trails are open to the public except during race events. These trails are gated at the four termini points along the CCC Road and the Bartlett Mountain Road to prevent vehicular traffic during the summer months. A segment of one of the trails passes through a "Key Mast Area", being a beech stand. Key mast areas are described and addressed in the appendix section of this plan, (See Ecological Assessment - Wildlife Habitats and Species Assessment). This trail system will be managed to protect the wildlife values associated with this particular beech mast stand.

A section of this trail system also passes through a historic district that was identified after the trail system was constructed. Recreational activities in this area should not impact the historic resource due to restrictions placed on how this trail system will be managed.

The easy access and availability of parking lends this area of the forest to receive low to moderate levels of use year-round. One is most likely to usually encounter motorists and pedestrians at any time from spring through fall. Moderate contact with other users is likely mid-week, with higher concentration expected on weekends during this time of year. Use tapers off during the winter months, as this road is not plowed. High concentrations of use do occur during cross-country ski race events and practice sessions. Human development is obvious and blends in to enhance the natural surroundings and the recreation experience of a semi-developed area.

The Ponds

There are six small ponds within or forming the boundaries of the forest. These ponds include Blake, Duck, Dolloff, Wheeler, Marl and Vail. (Wheeler Pond is partially within the forest). Altogether, they represent 35 acres of surface water. These ponds offer a diversity of recreational opportunities to the public. The Vermont Department of Fish and Wildlife manages these ponds as cold-water fisheries, with the exception of Marl Pond, which is privately owned.

During the summer of 2000, Department staff conducted a public user survey of the ponds. Survey boxes were installed and people were asked how they utilize the ponds. Categories of use included fishing, swimming, remote camping, hunting and "other" uses. A total of 176 responses were collected. (Bean Pond, though it is not within or borders onto the forest, was also surveyed and results included in this total.). The results of the survey showed that most people utilize these ponds for fishing (45%) and remote camping (26%). Highest use occurred at Duck Pond where the Department received 86 responses. Details of the survey results are included in this section of the appendix.

Motorized vehicles via unimproved woods roads in the forest can access Vail Pond, Duck Pond and Blake Pond. Wheeler Pond and Dolloff Pond are accessed from Class III town roads. The Vail Pond Sportsmen hold a legal right-of-way across state land to their private camp located on Vail Pond. Out of all these ponds, Blake Pond is the most remote. A section of the forest road that leads into this pond from Route 5 has washed out making it impossible for vehicular passage beyond that point. Vehicular access from the Duck Pond side is possible only by four-wheel drive vehicles.

The Duck Pond/Blake Pond area has become an area within the forest where illegal ATV activity continues to escalate. This use has caused some environmental degradation in the form of soil erosion and water quality impairment. The Vermont Department of Fish and Wildlife wardens have been working cooperatively with the Department of Forests, Parks and Recreation to enforce the illegal use of ATVs on this forest.

People camping along the shore of Duck Pond are not following the ANR Primitive Camping Guidelines and are sometimes leaving camp litter behind. (Trash dumping remains to be a problem throughout the forest.) Discharges of sediment and shoreline erosion into and along Duck Pond are occurring when motorized vehicles travel the road due to the inadequate natural buffer.

This is a place in the forest where people congregate mostly during the summer. Recreational activities occur mostly on weekends. Access into this area is by unimproved forest roads, which makes it difficult for passenger cars. This situation contributes to making this a more remote area of the forest. Human development is obvious and blends in to enhance the natural surroundings and the recreation experience of a semi-developed area.

Big Valley Brook/Wheeler Mountain Area

This area is located in the northwesterly portion of the forest. Town highways and two forest roads provide access into this area. There are two hiking trails - Wheeler Mountain and Moose Mountain. The trail to the summit of Wheeler Mountain, at 2371 feet in elevation, is mainly on private property, with the summit on public land. Trailhead parking is very limited and is located on private land. The landowner has allowed public use of this trail and has worked collaboratively with the Westmore Association Trails Committee to publicize and maintain this trail. This trail provides a short and relatively easy climb with a panoramic view of Lake Willoughby to the southeast. The granitic cliffs of this mountain are becoming a popular place for rock climbing. Due to increasing numbers of climbers, improved monitoring and management activities are recommended. These would best be developed in a collaborative fashion via a planning process involving interested individuals. The Vermont National Guard has used the cliffs for training purposes in the past with approval of the ANR.

The Moose Mountain Trail begins at the parking area off the Wheeler Mountain Road, a Class III town road located just east of Wheeler Pond. It receives a low level of use and connects in with the Herbert Hawkes Trail that leads to Mount Hor. ATVs are accessing the upper part of this trail via an old woods trail in the Big Valley Brook basin area. Recent field

inspections indicate that they are causing trail erosion and water quality impairment to small mountain streams.

A short hiking trail skirts around Wheeler Pond and goes onto private land to two cabins owned by the Appalachian Mountain Club (AMC). This trail was established by the AMC with approval from ANR. In the past, AMC volunteers have performed general maintenance on both this trail and the Moose Mountain trail.

Overall, human use in this area is relatively low, with the exception of the Wheeler Mountain hiking trail, which can experience short durations of heavy use. Human development is obvious and blends in to enhance the natural surroundings and the recreation experience of a semi-developed area.

Public Access Assessment

Forest Roads

Background and Description: Prior to state acquisition, much of the forest was heavily logged. Elaborate networks of logging roads and woods trails were built and still exist today. These roads were bulldozed to accommodate logging equipment common during that era. They were built specifically for the purpose of extracting timber products.

After state acquisition, the Civilian Conservation Corps built a road connecting Routes 5 and 5A that would accommodate vehicular traffic. Stone and mortar headwalls were built for the culverts that were installed. This road is referred to as the “CCC Road.” It is a graveled road open to vehicular traffic except during the winter when it is not plowed. In 1975, an alternate route to the south of Bartlett Mountain, the “Bartlett Mountain Road” was built. It was constructed to provide a more favorable route for log trucks by eliminating some steep grades on the CCC Road. This road was built under a training program sponsored and administered by the AFL-CIO under supervision of state foresters within this district office. The purpose of the program was to train heavy equipment operators.

The forest road infrastructure has historically been used for a variety of both motorized and non-motorized uses. During the 1970s, many of the old logging roads were brushed-out for snow machine trails. Some new trails were built to link together existing trails to create a network throughout the forest. Willoughby State Forest became a popular destination spot for snowmobiling prior to the formation of VAST. Today, some of these original trails have once again grown in. The original logging roads and woods trails continue to provide forest management access and recreational opportunities for the public. As a result of this use, environmental degradation is occurring in the form of erosion and water quality impairment.

Road Classification: Willoughby State Forest is well accessed by a network of forest roads and woods trails. Several rights-of ways across private lands insure permanent access points into the forest for long-term management and public access. The Public Access Map (Figure 11) shows locations and types of roads encountered in the forest. For management purposes, roads on the Willoughby State Forest are classified into three classes based largely on function and road condition.

Class A-Major Access Road – Roads that have had drainage installed (culverts and ditches) and have received a surface treatment of processed aggregate material. They have been built and are being maintained to a standard to accommodate vehicular traffic including passenger cars. Travel surface is 10 to 12 feet.

Class B-Minor Access Road – Roads that have had some improved drainage installed (culverts and ditches) and may have been spot-graveled using unprocessed aggregate material. They have been built and are being maintained to a standard to accommodate limited vehicular traffic, excluding passenger cars. Travel surface is 10 to 12 feet.

Figure 11 – Public Access Map

Class C-Unimproved Road – Roads that have had only minimal drainage installed (water turn-outs) and no aggregate surface. Travel surface of 8 to 10 feet. They are not designed to accommodate sustained vehicular traffic.

Mileage Summary

Class A Roads: 4.28 Miles

Class B Roads: 3.49 Miles

Class C Roads: 27.67 Miles

Rights-of-Ways: 1.28 Miles

Trails

Hiking

More than 12 miles of hiking trails on the forest offer a variety of day-hiking experiences for novice as well as intermediate hikers. The amount of use these trails receive ranges from low (Moose Mountain Trail) to high (Mount Pisgah Trail). The 3.9-mile long Mount Pisgah trail is one of the most popular hiking trails in the region. The Vermont Youth Conservation Corps, the Vermont Leadership Center and Westmore Association volunteers help to maintain these trails.

Snowmobiling

A 5.8-mile section of Vermont Association of Snow Travelers (VAST) trail traverses through the western portion of the forest. This trail was authorized under a Special Use Permit for the winter of 1996-97. Permission has been renewed on an annual basis since then.

Equestrians

Equestrian use is evident on some of the forest roads, but this activity appears to be low at the present time.

Cross-Country Skiing

Opportunities for back country skiing area available throughout the forest. A 5.5-kilometer cross-country ski trail system was built during 2001 in the vicinity of Bartlett Mountain. Existing forest roads were utilized to create this trail system, with some short connectors built that would provide for loops. It serves as a course for early/late season practices and race events for local high school cross-country ski programs. This trail system is open to the public for winter non-motorized use.

Snowshoeing

Snowshoeing opportunities are available throughout the forest. A low level of this use occurs in this forest and it is mostly located on the CCC Road and Bartlett Mountain Road in the vicinity of Bartlett Mountain and on the Mount Pisgah trail.

Dog-Sledding

Some local dog sledders go to this forest during the early winter months as part of a conditioning regime for their dogs. This activity occurs predominantly around the Bartlett Mountain area on the CCC Road and Bartlett Mountain Road.

Mountain Biking

A local trails group, Kingdom Trails Association, has submitted a proposal to the District Stewardship Team to create a mountain bike trail system in the forest that would be open to public use. The proposal is to incorporate both single-track and double-track opportunities within this trail system. This local non-profit organization proposes to build, maintain and monitor this trail system if approved by the District Stewardship Team.

Rock/Ice Climbing

Cliff communities in the forest are located on Mount Pisgah, Mount Hor and Wheeler Mountain. These cliff communities have provided climbing opportunities to the public for many years. The Willoughby Cliffs area has received wide acclaim and is noted as one of the premier ice-climbing destinations in North America. Most of the ice-climbing activity occurs on the cliffs of Mount Pisgah. Ice climbing on the Mount Hor cliffs occurs to a much lesser extent.

Anecdotal information and that which was gathered at the Willoughby Public Informational meeting on June 13, 2001 indicates that rock-climbers also use these cliffs, although the level of summer use appears to be low. Most of the rock-climbing activity is located on the granitic cliffs of Wheeler Mountain. This type of bedrock is more conducive to rock climbing than that found at the Willoughby Cliffs, and does not support any known populations of rare, threatened and endangered plants.

Primitive Camping

Willoughby State Forest is a popular area for this activity. This district office usually receives a number of inquiries and provides information regarding this activity in the forest each year, mostly during the summer. Primitive camping is allowed in the forest except at the South End of Lake Willoughby. Within designated areas, camping must be at least 100 feet from any stream or body of water, 200 feet from any trail or property line, and 1000 feet from any traveled road. The brochure "Vermont Guide to Primitive Camping on State Lands" is available at Department of Forests, Parks and Recreation district offices. This brochure provides guidelines and practices for primitive camping on ANR lands.

There are areas in the forest where people tend to gather to camp. These areas include the South End, the western shoreline of Lake Willoughby and Duck Pond. Camping activity at these areas do not follow primitive camping practices as outlined in the brochure. As a result of this sustained use, environmental degradation is occurring in the form of shoreline erosion, litter, live vegetation being cut and soil compaction.

Other Activities

Other activities include but may not be limited to sightseeing, picnicking, bird watching, photography and berry picking. No information is available about current levels of these activities.

Traditional Uses

Hunting

Willoughby State Forest is located in the heart of Wildlife Management Unit (WMU) D2, a 681 square mile area that stretches from the Canadian border to U.S. Route 2 in Danville. WMU D2 is 85% forested, and as part of Vermont's famed Northeast Kingdom, is renowned for its high densities of moose, bear, ruffed grouse and snowshoe hare. Although deer densities are relatively low, the heavily forested and less developed nature of this unit leads to a higher percentage of older, and therefore bigger, bucks in the population. Consequently, most large parcels of public land in the Northeast Kingdom are not only of extreme importance to hunters and trappers who choose to live in the region, but are also the favorite destinations for many sportsmen from Vermont's more populated cities and towns.

There is no data available to the specific levels of use by hunters and trappers on the forest. Harvest data for some game species, however, is collected annually on a township basis. Such data for Sutton and Westmore, therefore, can provide insight into what levels of harvest the forest is contributing toward.

For the most recent 10-year period (1993 –2002) an average of 20 and 16 bucks have been taken each year during the November deer hunting season in Sutton and Westmore, respectively. The total deer harvests for this period has averaged 26 (Sutton) and 22 (Westmore) deer annually. The highest historic buck kills for Sutton occurred in 1969 (45 bucks), 1966 (44) and 1970 (40). For Westmore the highs were in 1997 (25 bucks) and 1969 (24). The high buck kills in the mid- to late-sixties were consistent with the statewide trend when a combination of excellent habitat (reverting hill farms) and a bucks-only hunting law led to a statewide deer population of around 250,000 deer. Unfortunately, this high density represented overpopulation of Vermont's deer range, and overbrowsing caused serious damage to the long-term carrying capacity of the winter range. Today's deer herd is 40% smaller, or about 150,000 animals.

Vermont's current Deer Management Plan has a total (from archery, youth, rifle and muzzleloader seasons) buck-harvest objective of 500 for WMU D2. This target was not met in 2002, when a total of 467 bucks were harvested, largely due to excessive winter mortality in the heavy snow year of 2001-02. As a result, no antlerless permits have been issued for WMU D2 in recent years and deer populations are expected to rebound to target levels fairly soon. This population management response coupled with active forest management planned for the majority of the acreage should provide good future deer hunting opportunity on this state forest.

Moose are common inhabitants of Willoughby State Forest. Several of the 23 moose that have died of non-hunting causes (mostly motor vehicle strikes) in Sutton and Westmore since 1990 have died in or near Willoughby State Forest.

Limited moose hunting likely occurs on the forest; however, since WMU D2 was opened to moose hunting in 1995, no moose have been taken here. No moose have been reported anywhere from Sutton, but three of the five moose taken from Westmore were tagged close to forest borders. Permit numbers for WMU D2 have increased in recent years, and

Willoughby State Forest is likely to receive increasing levels of use by moose hunters in the coming years.

Recent black bear harvests in WMU D2 have often been the highest of any WMU in the state. For example, D2 recorded the highest harvests in 2000 (61 bears), 1999 (58), 1998 (52) and 1997 (40). Westmore and Sutton are among the perennial top bear harvest towns in the unit. From 1963 through 2002, 77 females and 132 males have been taken in the two towns, with an annual average of over 9 bears/year over the last 5 years. And in 1989, the 11 bears taken in Sutton represented the highest kill that year for any town in Caledonia County.

Trapping

As with most big game harvests, trapping harvest data are available on a town-by-town or WMU basis, but not specifically for Willoughby State Forest. Harvest records for the past 20 years show 8 otters, 3 bobcats and 55 fishers taken in Sutton and Westmore. Since 1990, harvest records have been kept for coyote, fox and beaver on a WMU basis. In WMU D2 from 1990 through 2002, 90 coyote, 61 red fox, 306 beaver and 103 nuisance beaver have been taken.

Fishing

Lake Willoughby

Adjacent to the forest, Lake Willoughby is one of Vermont's largest and deepest lakes. A coldwater fishery, it is arguably Vermont's premier lake trout lake, producing some of the largest lake trout caught in Vermont. It also supports populations of rainbow trout, landlocked Atlantic salmon, rainbow smelt, burbot, and yellow perch.

There is a Fish and Wildlife Department fishing access on the northeast side of the lake. This is not part of Willoughby State Forest. Some boats are launched from the East Beach site at the South End of the lake. Boaters currently self-regulate and are avoiding the area where people swim.

The Streams

Perennial streams within the forest are very small. Angling opportunity in these streams is expected to be limited. Within the forest, wild self-sustaining populations of brook trout at an abundance level and growth rate high enough to attract angling interest may occur in Big Valley Brook, Dolloff Brook, Vail Pond outlet that drains into Bean Pond and in beaver flowages associated with these and other streams. No information is available about current levels of angling activity in these streams.

The Ponds

There are six small ponds within or forming the boundaries of the forest. These ponds include Blake, Duck, Dolloff, Wheeler, Marl and Vail. (Wheeler Pond is partially within the forest and Marl Pond is privately owned and has been posted by the landowner). Altogether, they represent 35 acres of surface water. The Vermont Department of Fish and Wildlife manages these ponds as cold-water fisheries, with the exception of Marl Pond. A system of public highways and forest roads provide access to these ponds. Duck Pond and Blake Pond

are the most remote ponds within the forest. Although there are unimproved forest roads that lead into these ponds, motorized access is difficult.

Despite findings of undesirable thermal and oxygen levels, ANR receives anecdotal reports of quality trout fishing experiences in some of the ponds. The remoteness of the ponds appears to contribute to angling enjoyment and provides part of the appeal for visitation. Angler impressions about the ponds were gathered during the summer of 2001 via voluntary completion of opinion survey cards located at the pond sites. Roughly 40% to 60% of the respondents reported that their primary purpose for coming to these ponds was for fishing. No information is available about current levels of angling activity in these ponds.

Lakes and Ponds Regional Accessibility Assessment for Willoughby State Forest and Surrounding Area

Introduction

The District V ANR land stewardship team recommends creating a non-motorized recreation area in Willoughby State Forest in the vicinity of Blake and Duck Ponds as described in the draft plan. The major intent of this proposal is to provide for a type of recreational opportunity that is not readily available in the Willoughby State Forest area. That opportunity would be “to create a non-motorized access option to a remote pond setting”. The team advises that this area be named the ***Blake Pond/Duck Pond Recreation Area***. The proposal as put forth in the draft plan released on April 1, 2003 was endorsed at the July 7, 2003 District V ANR land stewardship team meeting. An action item identified at that meeting was: **to develop an assessment and inventory of lakes and ponds in the Willoughby State Forest area that would provide information as to type of access to water bodies within the region.** These are the findings of that effort.

Methods

The Department of Environmental Conservation (DEC), Water Resources Division, maintains a database, which includes a wide array of information relating to lakes and ponds throughout the state. This data is readily available and is able to be combined with a GIS database showing lakes and ponds. Using ARCVIEW, a 10-mile radius was drawn around Duck and Blake ponds in Willoughby State Forest. The area covered the following towns with the approximate percentage in parentheses: Albany (2%), Barton (100%), Brighton (20%), Brownington (60%), Burke (50%), Charleston (50%), Glover (80%), Greensboro (5%), Irasburg (3%), Lyndon (10%), Newark (90%), Sheffield (100%), Sutton (100%), Westmore (100%), and Wheelock (30%). Lakes and ponds within this area were selected from the DEC lakes and ponds database and evaluated for shoreline development, fishery, type of access and ownership. Other information such as the Vermont Dept of F&W Fish *Vermont* map, conserved lands database, E911 road and buildings information, and ANR district staff knowledge and records were used to provide information that was absent in the DEC lakes and ponds database.

The conserved lands GIS database was used to determine which lakes and ponds have public (state, federal and municipal) lands along a shoreline. Lakes and ponds with public land located on the shoreline were considered to have public access. Proximity to the nearest town highway was the protocol used to determine type of access to lakes and ponds enclosed by private property. If town highways were located along or in close proximity to a shoreline, then it was decided that the pond had private car-top access. If the town highway was more than two hundred feet from water, it was determined to have private foot access. Access across public land was determined by personal knowledge of ANR district staff and district records. Shoreline development was evaluated by determining the number of camps along the shore of the particular lake or pond. The number of camps was determined either by the lakes and ponds assessment prepared by DEC or by utilizing the E911 GIS data.

Figure 12 – Lakes and Ponds Access Map

This assessment did not identify access restrictions that may be in place for those lakes and ponds surrounded by private property.

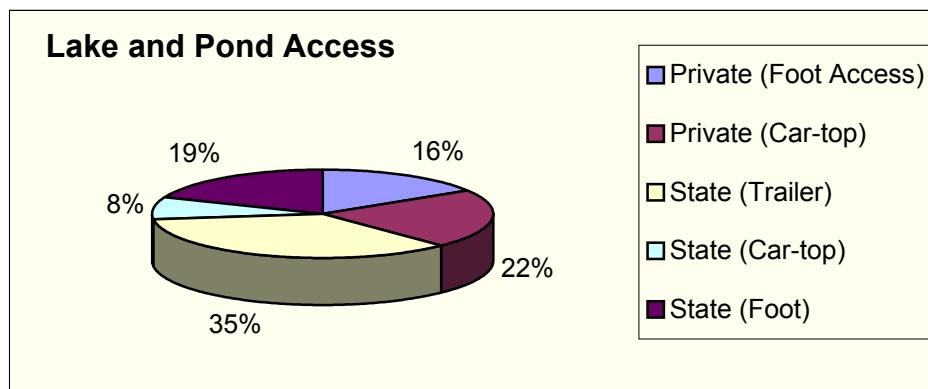
Results

The 10-mile radius, which was used to select lakes and ponds within the Willoughby State Forest area, incorporated 37 lakes and ponds, which are monitored by DEC. There are many other small water bodies, which are not in this database such as beaver ponds, and some private ponds. The waterbodies evaluated are listed below.

Waterbody	Name	Acres	Camp Count
VT17-08L07	BAKER POND	55	5
VT15-08L01	BALD HILL POND	107	12
VT17-08L04	BEAN POND	36	4
VT15-08L06	BECK POND	7	1
VT15-06L02	BLAKE (SHEFLD)	2	0
VT17-08L14	BLAKE POND (SUTTON)	6	0
VT15-08L04	BROWN POND	17	3
VT15-06L01	BRUCE POND	26	0
VT15-08L03	CENTER POND	80	17
VT17-04L03	CHARLESTON	1	1
VT17-08L08	CRYSTAL LAKE	769	125
VT17-08L02	DANIELS POND	59	29
VT15-08L07	DUCK POND (BURKE)	6	0
VT17-08L13	DUCK POND (SHEFLD)	10	1
VT17-08L15	DUCK POND (SUTTON)	6	0
VT17-05L09	HANCOCK (BRIGTN)	7	0
VT07-22L02	HORSE POND	33	3
VT17-05L03	JOBS POND	42	5
VT17-08L06	LAKE PARKER	253	82
VT17-06L02	LAKE WILLOUGHBY	1624	176
VT17-08L09	LONG POND (SHEFLD)	38	0
VT17-06L01	LONG POND (WESTMR)	90	11
VT15-07L02	MARL POND	11	
VT17-08L05	MAY POND	82	3
VT17-08L17	MUD (IRASBG)	20	0
VT17-08L16	MUD (SHEFLD)	5	0
VT15-07L01	NEWARK POND	156	45
VT17-08L10	ROUND POND (SHEFLD)	14	3
VT15-08L02	SAWDUST POND	14	0
VT17-08L03	SHADOW LAKE	210	110
VT15-07L03	SOUTH DOLOFF	2	0
VT17-05L10	SUKES POND	12	1
VT17-08L01	TILDY'S POND (CLARK POND)	23	5
VT17-04L01	TOAD POND (CHARTN)	22	0
VT17-08L12	VAIL POND	19	2
VT15-08L05	WALKER POND (NEWARK)	6	0
VT17-08L11	WHEELER POND (BARTON)	17	2

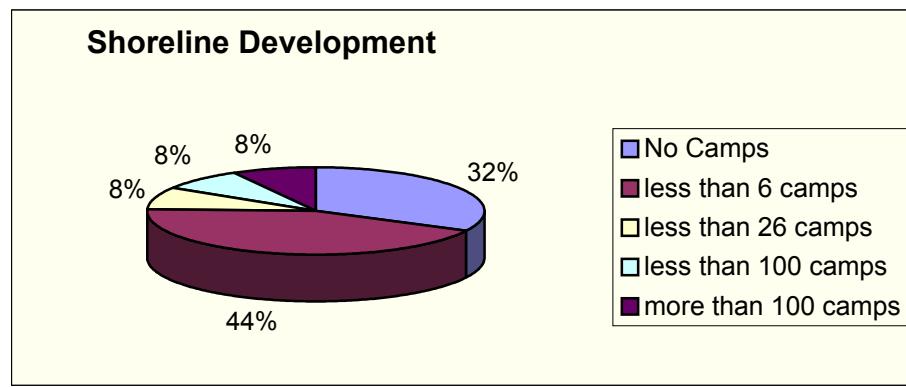
Currently, 13 (35%) of the lakes and ponds in the 10-mile radius assessment area have developed boat launch sites maintained by the Vermont Department of Fish & Wildlife; 14 (38%) have access across private property ranging from boat launches to foot access, which may or may not be available to the general public. On ANR lands, there are three (8%) lakes and ponds that have car top access and another seven (19%) lakes and ponds, including Blake Pond and Duck Pond in Willoughby State Forest, are pedestrian accessible (see Graph 1). The extent to which someone has to walk to get to one of the pedestrian access only ponds was not evaluated in this assessment. They range from a few hundred feet to as much as one half of a mile.

Graph 1.



Shoreline development (the presence of camps) was the second feature that was assessed for lakes and ponds within 10-mile radius region of Duck and Blake Ponds (see Graph 2). There are 12 lakes and ponds that currently have no shoreline structures.

Graph 2.



There are five ponds on public land, accessible by foot, which have undeveloped shorelines (Table 9). This table includes both Blake and Duck ponds in Willoughby State Forest.

Table 9.

Lake or Pond Name	Area (Acres)	Max. Depth	Fishery	Comment
Blake Pond (Sutton)	8	20'	Cold Water	Willoughby State Forest
Duck Pond (Sutton)	8	43.3'	Cold Water	Willoughby State Forest
Long Pond (Sheffield)	38	30	Cold Water	Holbrook State Park
Mud Pond (Sheffield)	5	?	Warm Water	Holbrook State Park
Sawdust Pond	15	?	Warm Water	Bald Hill Wildlife Management Area

There are seven ponds enclosed by private property that are walk-in only (Table 10).

Table 10.

Lake or Pond Name	Area (Acres)	Max. Depth	Fishery	Comment
Blake Pond (Sheffield)	2	?	?	~800 feet from road
Bruce Pond (Sheffield)	26	?	?	~800 feet from road
Duck Pond (Burke)	6	?	Warm Water	~600 feet from road
Mud Pond (Irasburg)	20	?	?	~200 feet from road
Toad Pond	22	?		~400 feet from road
Walker Pond (Newark)	6	?	?	~600 feet from road

Summary

The District V Land Stewardship Team, during the July monthly meeting (7/7/03), discussed the proposal to create the Blake Pond/Duck Pond Recreation Area. The stewardship team endorsed the proposal presented in the Draft Long-Range Management Plan for Willoughby State Forest. It was decided that the stewardship team needed to better articulate the need for the establishment of this recreation area.

After evaluating the lakes and ponds within 10 miles of the Blake Pond/Duck Pond area it is clear that Blake Pond and Duck Pond have the potential to provide a recreational opportunity that is not readily available to the general public. Looking solely at ponds with guaranteed public access it is obvious that the range of access is heavily weighted toward motorized access (car-top and trailer). The Blake Pond/Duck Pond Recreation Area creates a range of opportunities not only in the Willoughby State Forest area but within the forest as well.

There are town highways or forest roads leading to all of the ponds, which include Dolloff, Wheeler, Bean, Vail, Blake and Duck Ponds. By restricting motorized access to Duck and Blake Ponds the entire range of access possibilities can be found within the forest. There is access for launching boat from trailers on Wheeler Pond, and Willoughby Lake. There is car-top access on Vail Pond, Bean Pond and Dolloff Pond and pedestrian access will be provided for by establishing the Blake Pond/Duck Pond Recreation Area.

References

Vermont Lakes and Ponds Database: Department of Environmental Conservation, Water Quality Division.

An Inventory of the Undeveloped Lakeshore of Northern Vermont: Northeastern Vermont Development Association. 1992

Vermont Center for Geographic Information

Fish Vermont – Official Map & Guide: Vermont Department of Fish & Wildlife

Fisheries and Water Resources Assessment

Willoughby State Forest (WSF) represents a headwaters area for several small watersheds that are part of two of Vermont's four major drainage basins. WSF is situated on a major drainage divide, flowing both north to the St. Lawrence River system and south to the Connecticut River system. Almost no land area outside the forest boundary drains onto or through the forest area.

Roughly a third of the WSF land area, nearly all of its northern and eastern portions, empties into Willoughby Lake (also known as Lake Willoughby) via springs and numerous small unnamed, mainly ephemeral streams. The western portion, another third, drains northwesterly toward Crystal Lake via several small watersheds: Wheeler Pond; Big Valley Brook and Vail Pond. The southeast portion drains south into the Acadia Brook and the Passumpsic River West Branch. The southern portion flows south to the Sutton River and then the Passumpsic River West Branch mainly via the Marl Pond and Dolloff Ponds watersheds. The watersheds and their physical attributes are listed in Table 11.

Willoughby Lake (also known as Lake Willoughby)

Willoughby Lake is one of Vermont's largest and deepest lakes. A coldwater fishery, it is arguably Vermont's premier lake trout lake, producing some of the largest lake trout caught in Vermont. It also supports populations of rainbow trout, landlocked Atlantic salmon, rainbow smelt, burbot, yellow perch and round whitefish.

The lake is not enclosed by WSF. A relatively small portion of the lake's drainage area and shoreline are part of WSF. The management of its fishery resources and fishery-related recreation do not fall under the jurisdiction of state forest planning, but are the ongoing responsibility of the Vermont Fish and Wildlife Department (VTFW). For these reasons, the fishery resources of Willoughby Lake are not discussed in detail here. Contact VTFW at the St. Johnsbury Regional Office for more information about fish and fishing at Willoughby Lake. The lake's outlet is located in the town of Westmore. It is a natural lake with artificial control and is a water supply. Jet skis and other motorized personal watercraft and boats are allowed on the lake. VTFW manages a Fishing Access Area that provides opportunity for boat launching.

According to the Water Quality Division of the Department of Environmental Conservation, portions of the near-shore zone of the lake are threatened by an invasive exotic plant, Eurasian watermilfoil. A heavy infestation can affect aesthetics, aquatic life, swimming and secondary contact uses. The plant is scattered along the main, east-central cove of the lake, with small patches of abundant growth. Milfoil will only thrive in localized areas with suitable substrate, like this area. Owing to the highly rocky nature of the substrate and steep dropoffs along much of the lake's southwest perimeter, the threat along Willoughby State Forest shoreline is low. The lake also has one especially dense area of the native plant, *Elodea* species. This growth is attributed to agricultural runoff and may pose a localized threat similar milfoil, if unabated. Like the milfoil distribution, this area is also remote from Willoughby State Forest.

Water resource and land use planning for the portion of WSF that drains into the lake must take into account the tremendous ecological, recreational and aesthetic significance of this crown jewel of Vermont's lakes, and contribute to maintenance of its extraordinary resource value.

The Streams

The largest single stream leaving the forest is Big Valley Brook. Its drainage area is only 1.7 square miles (1053 acres). Based on general watershed yield patterns for small streams in northern New England, instantaneous streamflows from a watershed of this size are likely to range from 0.1 cubic feet second (64 gallons per minute) under drought conditions to perhaps 200 cubic feet per second under the most extreme flood conditions. An average annual range would be on the order of 0.3 cfs to 30 cfs.

The next largest stream is the Dolloff Ponds outlet brook, with a drainage area of less than 1.3 square miles (830 acres). It and the rest of the streams would have proportionately lower discharge characteristics.

There is a relationship between stream size, fish assemblages and fishery resources. For most coldwater streams, the fish assemblages are simple. The smaller the drainage area of a stream, the greater the probability that it will be ephemeral (seasonally ceasing to flow above ground in most years). Seasonal streams may be fishless. Streams that dry out every few years may have simple fish communities that are dependent entirely on re-colonization from permanent waters downstream. Likewise streams that are reduced seasonally to intermittent pools may have fish communities that are simple and numbers that are low. High stream gradient (steep slope) may have major implications for re-colonization following droughts and other events that extirpate fish populations. Many of the streams in WSF may fall into these categories. The presence of the many ponds in WSF will influence re-colonization of stream reaches upstream and downstream, because they provide refugia during the most extreme drought conditions. For all streams, species richness begins with one species, usually brook trout. The further downstream, the more species are added.

No documentation of past fish population sampling has been found for WSF streams. A limited amount of sampling was undertaken in autumn 2001. Results of stream sampling are presented in Table 12. Fish assemblages were very simple, in most cases, consisting of only brook trout. The brook trout populations observed were all of natural origin and assumed to be endemic to WSF. It cannot be readily ascertained whether these populations have been influenced by past stocking. Additional stream-dwelling species occurring in the WSF ponds were present in the immediate vicinity of the ponds.

Angling opportunity in WSF streams is expected to be limited. Within WSF wild, self-sustaining populations of brook trout at an abundance level and growth rate high enough to attract angling interest may occur in Big Valley Brook, the Dolloff Ponds, Duck Pond and Vail Pond outlet brooks and in beaver flowages associated with these and other brooks. No information is available about current levels of angling activity in these streams.

Acadia Brook and the Passumpsic River West Branch begin on the east and south facing slopes of Mount Pisgah. Perennial watercourses within the WSF boundaries are very small.

At the southern toe of Mount Pisgah spring seeps and beaver flowages are crossed by the Pisgah hiking trail boardwalk, which affords observant hikers the opportunity to glimpse spawning activity of small wild brook trout in the fall.

There are numerous waterfalls and cascades that exit the WSF. The water quality of these streams is variable as these streams are mostly ephemeral.

None of the streams that drain WSF are considered to be "large" in size, and most drain less than a square mile. They are not likely to be a significant source of nutrients in the form of nonpoint source pollution, despite the fact that the topography of the forest accounts for the steepest gradient in the Willoughby Lake watershed.

The greatest concern regarding the water quality of these streams is back road runoff and occasional logging. The greatest threats to surface water are the steep back roads that traverse through the southern forestlands, the CCC Road, for example.

The streams of WSF should be accorded the highest level of protection from land use activities in their drainage areas to preserve the viability of their wild, self-sustaining and probably endemic fish populations. Protecting their water quality and habitat structure and integrity will also contribute to water quality protection and enhancement for the WSF ponds and for downstream waters off the forest.

The Ponds

WSF encloses three named ponds (Dolloff, Blake and Duck), three to eight acres in size, and eight smaller ponds that have no generally recognized names. WSF also has frontage on three other named ponds (Marl, Wheeler and Vail), 10 to 16 acres. Marl Pond is privately owned. All of these ponds are potentially threatened due to their proximity to Willoughby Lake, which has acres of Eurasian watermilfoil infestation.

The major ponds and their physical attributes are also included in Table 11.

The WSF major ponds are small, with areas ranging from 3 to 16 acres. They are middle elevation ponds, all falling within a 250-foot range, between 1450 feet and 1700 feet above sea level. All ponds but lower Dolloff are natural, and, for the most part, their outlets have not been modified or raised. The existence of lower Dolloff may be dependent entirely on the presence of a dam constructed during the CCC era. Duck and Vail ponds are very deep for their surface area, with maximum depths in excess of 40 feet. Blake and Marl are moderately deep, with maximum depths approaching 20 feet. The maximum depths of the Dolloff Ponds, the two smallest ponds, are three to four feet or less.

Boat launching sites for carry-in or car-top boats only are provided by the state at Blake, Duck and Vail Ponds. Car-top boats can be launched at Wheeler Pond as well.

Lake assessment visits to Duck and Blake ponds in 2001 noted road and access erosion problems near the water.

Temperature and dissolved oxygen content in the water column were measured at several ponds in summer 2000, at the same time that reconnaissance-level fish community sampling was performed. Oxygen levels were measured again under ice/snow cover conditions in winter 2001. Thermal and chemical information is presented in Table 13. Dates of fish sampling and gear type used are presented in Table 14. A list by pond of fish species collected is presented in Table 15. Additional information gathered on the ponds in summer 2001 by personnel from the Water Quality Division of the Department of Environmental Conservation is contained in Attachment 1.

Individual ponds contain four (Blake) to seven (Vail) species. There is much species overlap among the ponds. The origins of some of these species (endemic versus introduced) can be determined readily, but the origins of others are in question. It is likely that the fish community in each of these ponds is more complex now than it was 300 years ago prior to European colonization of the Americas and subsequent human transfer of fishes from remote waterbodies. The interaction among original and introduced species (predation, competition) may have produced fish communities with a very different structure than existed following the retreat of the glaciers. Such changes may have implications for present day fisheries management, for example our ability to support wild, self-sustaining brook trout populations that withstand angling exploitation.

Deep ponds that may maintain cold water conditions through thermal stratification in the warmest season may have significant potential for trout populations and fisheries. The WSF ponds, as *young* ponds, may have been colonized by brook trout following the retreat of the last glaciation. Brook trout populations were probably maintained at least until European colonization through trout spawning in the ponds and/or in the streams and spring seeps that flow into them. Water chemical conditions, mainly temperature and oxygen, were, in all likelihood, suitable for trout habitation year round.

As the ponds *aged* due to slow replacement of water volume and gradual accumulation of organic material on the pond bottom, oxygen content in the deep strata of the water column was depleted seasonally, making zones of the pond potentially unsuitable for trout for portions of each year. Land use activities (logging, clearing, farming) over the past two centuries may have dramatically accelerated this aging process. In the present time context, the oxygen and temperature profiles of the ponds raise significant concerns and challenges for management of indigenous fishes, and especially brook trout.

Summer 2000 was a moist and cool season. Worst-case oxygen conditions would not be expected to develop under this weather regime. Mid- to late-summer sampling at Duck and Vail, the two deepest ponds, found thermal stratification (thermocline) around 20 feet. The temperature at 10 feet deep was moderately high for trout, but oxygen content and temperature was good for trout at 20 feet. Between 20 and 30 feet, oxygen declined to very low levels (below 1mg/l), lethal for trout. In a hot and dry summer with little wind the zone in these ponds where both water temperature and oxygen are adequate for trout survival could become small to non-existent. Trout survival would depend on well oxygenated springs in the ponds or on cold streams and seeps around the pond shore. Competition, disease and mortality could seriously affect populations.

Blake and Marl ponds, the next two deepest, exhibited even more marginal conditions for survival or trout or other coldwater fish species. At the time of mid-September sampling oxygen approached dangerous levels at 10 feet and 13 feet in the two ponds, respectively. At 13 feet and 16 feet, respectively, conditions were in the lethal range. The thermal profile in mid-September shows no signs of stratification, meaning the temperature difference between the surface and the bottom is small. Although temperatures in the well oxygenated zone in summer 2000 were suitable for trout, marginal thermal conditions are probable under a different weather regime in other years.

The Dolloff ponds are not expected to have favorable conditions for trout during the summer. Springs and seeps are likely to provide the only refuge from lethal oxygen and temperature conditions during warm weather.

The colder the water, the more oxygen that can be dissolved in it. Metabolic processes, like oxygen-demanding decay of organic material, are typically slower in cold water. Theoretically oxygen availability should be less of an issue for fish in winter than in summer. Nevertheless oxygen levels can become limiting for fish in winter under the ice as well, when light intensity is low, oxygen producing photosynthesis is at its minimum and wind has no opportunity to mix air into the water column.

For this reason we measured dissolved oxygen in the WSF ponds in winter 2001 under conditions of deep and protracted snow cover. Measurements were made between February 8 and 13, over a month before ice thickness and snow depth reached their maxima. Readings were taken at only one location, roughly the area of maximum depth, in each pond.

At Blake, Marl and Wheeler ponds, no dissolved oxygen levels higher than 4.5 mg/l were observed. In each case the highest level was found just below the ice. At Duck and Vail, the deepest ponds with the greatest water volume, oxygen levels of 5 mg/l or higher were found in the first 10 feet below the ice. At Duck Pond D.O. was down to 4 mg/l at 20 feet; at Vail it was 3 mg/l at 16 feet.

It is likely that as winter 2001 progressed, oxygen levels declined further throughout the water column of all the ponds. In the cases of Blake, Marl and Wheeler ponds, this almost certainly means that seriously oxygen-deficient conditions prevailed for trout and even more tolerant species. Conditions in Duck and Vail Ponds probably declined to levels marginal for trout by winter's end. These findings are consistent with observations made during summer 2000.

Independent of the potential or limitations for management of these ponds for wild, self-sustaining brook trout populations, VTFW annually stocks Dolloff, Duck and Wheeler ponds with *catchable size* brook trout and Vail receives *catchable size* rainbow trout (Table 16). Marl Pond is no longer stocked as it falls within private land that is posted. Prior to 1994 Blake Pond was stocked with brook trout fry annually. Most of the fish sampling in Summer 2000 did not target trout, either wild or residual from stocking. The only trout that were collected were captured in the gill nets set at Blake and Vail: one adult brook trout from each pond. No rainbow trout, the species stocked at Vail, were captured there. Interestingly, brook trout were captured at the only two ponds not currently stocked with brook trout.

Despite our findings about thermal and oxygen conditions and changes in fish community structure, we receive anecdotal reports of quality trout fishing experiences in some of the WSF ponds. The fact that wild and/or *hold-over* stocked trout are caught at Blake and Vail ponds is evidence that conditions suitable for trout exist in these ponds, at least in limited areas, in most if not all years.

The remoteness of the ponds appears to contribute to angling enjoyment and provides part of the appeal for visitation. Angler impressions about the ponds were gathered in Summer 2001 via voluntary completion of opinion survey cards at several locations by WSF visitors. Roughly 40% to 60% of the respondents reported that their visit involved fishing (Chart 1).

TABLE 11. Morphometric attributes of streams, ponds and their watersheds at Willoughby State Forest

Stream / Pond	Area (acres) ¹	Depth (feet)	Upper Elevation (feet)	Lower Elevation (feet)	Length (miles)	Average slope (%)	Drainage area (mi. ²) ¹
Big Valley Brook			1909	1220	2.12	6.15	-- [1.65]
Dolloff Pond inlet			1886	1443	1.78	4.70	
Dolloff Pond (south)	3	4		1443			1.20 [1.14]
Marl Pond east inlet			1896	1588	.675	13.93	
Marl Pond west inlet			1183	1588	.88	14.98	
Marl Pond	10 [12.42]	20		1588			0.40 [0.37]
Blake Pond inlet			2066	1660	.34	22.75	
Blake Pond	8 [7.74]	17		1660			0.16 [0.21]
Duck Pond inlet			2145	1699	.58	14.62	
Duck Pond	8 [7.07]	46		1699			0.22 [0.21]
Vail Pond inlet from Blake			2066	1509	.93	11.40	-- [0.31]
Vail Pond inlet from Duck			2145	1509	.99	12.23	-- (0.27)
Vail Pond east inlet			1630	1509	.26	8.89	
Vail Pond	16 [19.78]	40		1509			0.22 [0.74]
Wheeler Pond east inlet			1699	1456	.98	4.67	
Wheeler Pond west inlet			1975	1456	.59	16.65	
Wheeler Pond	15 [11.4]	23		1456			1.16 [1.23]

¹ Surface area and drainage basin area numbers outside brackets are from VT Department of Environmental Conservation. Numbers in brackets represent measurements made by St. Johnsbury Regional Office staff using 1999 digital orthophotos and topographic maps, respectively.

Table 12. Fish species found in Willoughby State Forest streams, based on sampling by electrofishing, summer / autumn 2001.

Stream		Big Valley Brook	Dolloff Ponds inlet			Marl Pond			Vail Pond		
			inlet	inlet	outlet	inlet 1	inlet 1	inlet 2	inlet	inlet trib	outlet
Elevation (feet above sea level)		1400	1850	1550	1440	1800	1580	1580	1590	1590	1250
Date		8/14/01	8/14/01	8/14/01	8/14/01	8/14/01	11/6/01	11/6/01	8/14/01	8/14/01	8/14/01
Species											
TROUT											
	brook trout		x	x	x			x	x	x	x
MINNOWS											
	blacknose dace									x	
	creek chub				x		x				
	northern redbelly dace						x		x		
	unidentified minnows				x						
KILLIFISH						x					
	banded killifish					x					

Table 13. Dissolved oxygen levels (mg/l) and water temperatures (° C) observed at WSF ponds in late summer 1997 and dissolved oxygen levels (mg/l) under the ice observed in winter 2001.

Pond	Blake		Dolloff	Duck		Marl		Vail		Wheeler		
Date	9/17/97	2/8/01	2/13/01	8/28/97	2/8/01	9/17/97	2/13/01	9/17/97	2/8/01	8/27/97	02/13/01	
Parameter	D.O.	temp	D.O.	D.O.	temp	D.O.	D.O.	temp	D.O.	D.O.	temp	D.O.
Depth (m)												
surface	7.79	17.8	3.5		8.08	19.1	6	8.75	17.2	2	8.78	17.4
1				7								
2			1.5									
3	5.11	16.3	1		7.8	18.7	6	8.49	17.2	1	8.46	17.3
4	2.48	15.5					5.1	16.6				12.26
5	0.055	14.4					0.31	16	1		3	0.45
6					7.94	11.7	4	0.18	14.4		8.41	11
7										2.25	0.23	7.4
8												
9					0.55	7.5	2.5			0.42	6.2	1.25
10							1.5					
11							1				1.25	
12					0.23	5.8				0.36	5.7	
13												
14					0.18	5.7						

Table 14. Sampling dates and gear used at Willoughby State Forest ponds, 2000 - 2002.

Pond	Blake	Dolloff #1	Duck	Marl	Vail	Wheeler
Gear and use dates						
minnow trap	10/26/00	7/24/00	7/20/00	7/25/00	10/27/00	8/11/00
trap net	10/26/00		7/20/00	7/25/00	10/27/00	8/11/00
gill net	10/26/00		7/31/02		10/27/00	
electrofishing		5/20/02				5/28/02

Table 15. Fish species found in Willoughby State Forest ponds , based on sampling by minnow traps, trap nets, gill nets (Blake, Duck and Vail ponds only) and electrofishing (Dolloff and Wheeler ponds only), 2000-2002.

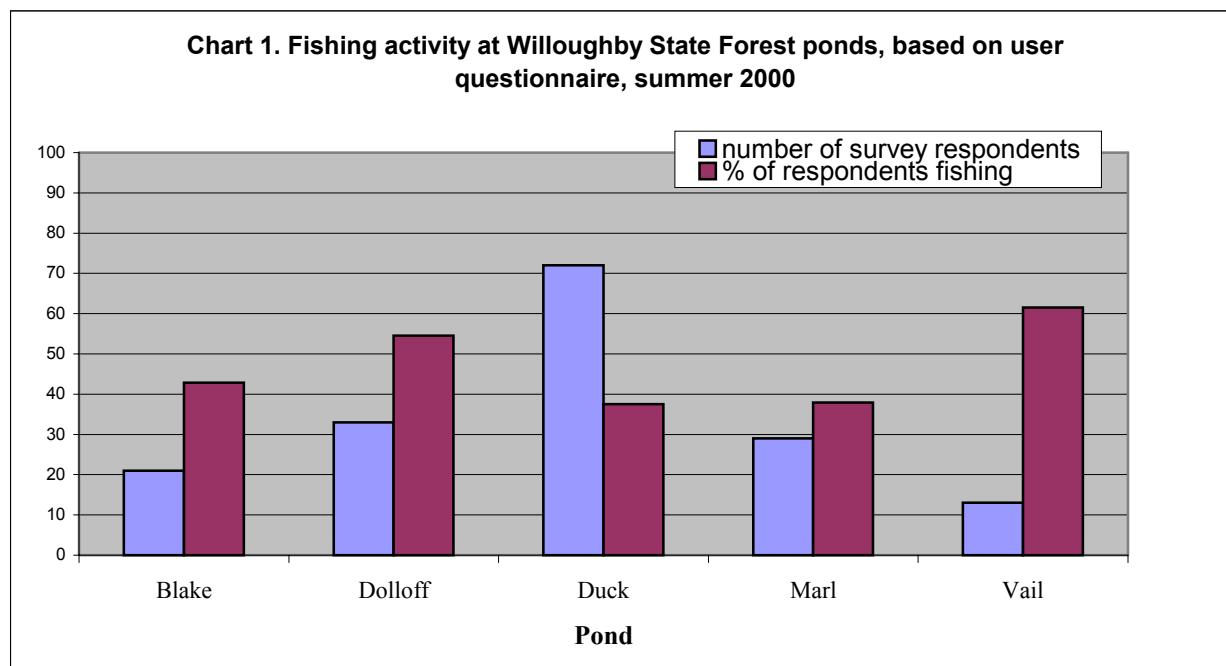
SPECIES GROUPS AND SPECIES ¹	Blake	Dolloff #1	Duck	Marl	Vail	Wheeler
TROUT						
brook trout ²	x	sbno	x	sbno	x	sbno
rainbow trout ²					sbno	
MINNOWS						
golden shiner		x	x			x
bluntnose minnow	x	x	x	x	x	
common (redfin) shiner		x		x		
northern redbelly dace	x	x	x	x	x	
creek chub		x			x	x
blacknose dace			x		x	
SUCKERS						
white sucker	x		x	x	x	x
KILLIFISH						
banded killifish		x				
SUNFISH						
pumpkinseed						x
rockbass						x
CATFISH						
brown bullhead					x	x

¹ Other fish species present may not have been observed. Identification of several minnow specimens is not definitive.

² sbno = stocked, but not observed

Table 16. Fish species and numbers as stocked or currently planned by VT F&W in Willoughby State Forest ponds, from 1999.

Pond	1999	2000	2001	2002	2003	2004
Dolloff #1	100 brook trout @ 9"	100 brook trout @ 10"	100 brook trout @ 8.6"	100 brook trout @ 9.3"	100 brook trout @ ~10"	50 brook trout @ ~10"
	2000 BKT @ 1"					
Duck	250 brook trout @ 4.7"	250 brook trout @ 4"			250 brook trout @ ~10"	100 brook trout @ ~10"
	320 brook trout @ 9.1"					
Vail	200 rainbow trout @ 12"	200 rainbow trout @ 10.9"	210 rainbow trout @ 10.1"	200 rainbow trout @ 11.2"	200 rainbow trout @ ~10"	200 rainbow trout @ ~10"
	300 brook trout @ 9"	300 brook trout @ 10"	300 brook trout @ 8.6 "	300 brook trout @ 9.3"	300 brook trout @ ~10"	120 brook trout @ ~10"



ATTACHMENT 1

**Willoughby State Forest Ponds
Lake Assessment Program findings from Mini Assessments
conducted during the summer of 2001**
Lakes and Ponds Section
VT DEC Water Quality Division

Lakes in the Willoughby State Forest were visited in the summer of 2001 by Kellie Merrell of VTDEC-WQD. The following are a summary of the findings.

Wheeler Pond – Barton (6/15/01)

Tannic, but clear water with no odor. Continuous mixed forest (dominated by deciduous trees) with a 2-5 m wide buffer of shrubs and then another 2 meter wide wetland margin (mostly scirpus) surrounds the lake. There is a freshly maintained beaver dam at the outlet, with fresh chewings on it. There is a large beaver lodge on the NE side of the pond. The bottom type was only noted on the S side of the pond, with sand predominating and rocks at the outlet. There was pollen accumulating along the SE side where the outlet is due to prevailing breeze. No phytoplankton or periphyton blooms observed. There is one camp set back from the water on the NE shore which does not appear to have been built in the last 10 years. There are 2 AMC camp buildings (AMC Wheeler Pond Camp). All three of the buildings on the pond are inconspicuous and do not detract from the pond's character. The N shore camp has 5 m of shore area mowed (it is mostly just a path to the water). The S shore AMC camp has benches and a fire pit. The W shore access from the road can be driven on but looks like it should be a foot path. No potential problems observed. There is public access from the road, with the buffer broken for the width of car access. Unfortunately, the road runs over the major inlet to the pond and there is certainly potential for overflowing the road, especially with help from the beaver. There is a small beach on the S shore by AMC's benches. No negative or unscenic areas at this pond, unless one considered the road along the W side. However, it is well buffered and the traffic is hidden. The road does provide good access for public use. There are beautiful views from the S shore AMC shore of the Wheeler Mountain cliff face. Saw some toads, perch, and lots of large mouth bass by the outlet. It is a very quiet pond in excellent condition. It is very scenic, with no algae blooms, lots of fish, good swimming. There is good shallow submerged macrophyte habitat, which probably becomes denser later in the summer; this visit was during June. The following aquatic plants were noted: *Nymphaea sp.*, *Ceratophyllum sp.*, *Sparganium sp.*, *Char sp.*, *Potamogeton natans*, *Eriocaulon aquaticum*, *Nuphar sp.*, *Scirpus sp.*, *Typha sp.*

Current data:

Date	Depth m	Temp C	DO mg/l	Conductivity uS/cm	pH
6/15/2001	1	22.06	9.14	31	7.38

Neutral pH, plenty of dissolved oxygen. But samples not taken at the deepest hole.

Historical data:

Depth m	Date	Temp C	DO mg/l	pH	Alkalinity mg/l
0	2/1/1972		11.2	7.1	20
7.5	2/1/1972		4	7.1	20
0	7/20/1972	26	7.7	7.34	30
11	7/20/1972	14			30

Given the historical chemical data on the lake as it is presented here, 30 years ago the pond had a neutral pH, and an alkalinity suggesting sufficient acid neutralizing capacity to protect the pond from the effects of acid precipitation. The February dissolved oxygen at 7.5 m was only 4, which is stressful to most fish species.

Vail Pond (7/6/01)

Green water color with no odor. Secchi depth was 3.5 m in the center at 9:23 a.m. A 40% cedar and 60% mixed deciduous forest surrounds the pond, with 20% of the shoreline having a wetland margin between the water and forest. There are 3 inlets with a natural outlet with a beaver dam. The bottom is sandy throughout the lake and there are lots of snags. At station 1 (13.2 m deep), the DO peaked close to 12 mg/L at 4 and 5 m depth, from 8 mg/L at 1, 2 and 3 meters depth. This suggests some phytoplankton bloom may be occurring at that depth. No periphyton was noticed. Submersed aquatic macrophytes seem to be limited to the nearshore, since the depth drops off dramatically. There are lots of snags on the bottom as already noted. The plant cover along the shoreline is about 20%, with *Equisetum sp.*, *Potamogeton natans*, *Potamogeton gramineus*, *Eriocaulon aquaticum*, *Sparganium sp.*, *Iris versicolor*, *Sagittaria sp.*, *Dulichium sp.*, and *Potamogeton amplifolius*. Could be considered a wilderness lake if 2 camps weren't present. Both have good buffers, although both have made access by vehicle possible to the lake shore. Access is limited to hiking in or 4WD. Evidence of ATV use of the 4WD road in boggy areas on the way to the pond as well as down into the marsh by the public access. Land use is predominantly forested. Buildings are limited to the 2 camps. Surrounding land use is predominantly mixed deciduous. The public access is a footpath down from the 4WD road. There is a sandy beach by the eastern most camp and the bottom is sandy throughout the lake. There is a floating/swimming platform and dock off of the western camp. The western camp is very visible from the lake and access. Owing to the difficulty of access, Vail Pond is very secluded and quiet, and use by people appears to be limited. Observed 5 juvenile minks frolicking along the shore, spooked a deer and saw a wood duck. There were 3 rowboats along the shore and 2 canoes at the eastern camp. The lake is wilderness to wilderness-like, with a diversity of aquatic and emergent plants and minimal shoreline alterations. Lots of snags for fish habitat and marsh for bird nesting areas.

Date	Time	Depth m	Temp C	DO mg/l	pH	Alkalinity mg/l	Conductivity uS/cm
2/17/1972	NONE	0		11.5	8.2	40	
2/17/1972	NONE	13.5		0.02	8	50	
8/22/1972	NONE	0		8.5		55	
7/6/2001	0922	1	19.28	8.13	7.87		126
7/6/2001	0922	2	19.3	8.03	7.87		126
7/6/2001	0923	3	18.68	8.61	7.87		126
7/6/2001	0924	4	12.85	11.67	7.92		134
7/6/2001	0925	5	9.3	11.81	7.93		134
7/6/2001	0926	6	6.98	8.32	7.59		135
7/6/2001	0928	7	5.67	1.39	7.28		136
7/6/2001	0929	10	4.8	0.08	7.11		145
7/6/2001	0930	12	4.57	0.02	6.98		153

The pH of this pond is neutral. The moderate alkalinity indicates sufficient acid neutralizing capacity to protect the pond from the effects of acid precipitation. The Dissolved oxygen was depleted at the bottom, both during the February 1972 visit and during this July 2001 visit.

Marl Pond (7/6/01)

Posted as a private pond, although abuts state forest land. Currently FPR and landowner are in dispute. FPR attorney currently interprets the landowner's claim as correct. The lake is a quiet and secluded wilderness to wilderness-like lake. Was unable to access the pond since it is posted by Roger and Evelyn Lussier of Lyndonville. Observations here are from a footpath that leads down from the 4WD road to the pond. *Nuphar sp.* and *Potamogeton natans* were viewed from the footpath.

The pond was not posted when Jim Kellogg (VTDEC-WQD) visited the pond on August 19, 1998. The temp was 19 C, pH was 7.72, alkalinity was 80.9 mg/L and the calcium level was 30.2 mg/L. There were three species of snail from the same family (Planorbidae), two species of dragonflies, and a single species of Pea Clam (*Sphaerium simile*).

Duck Pond (6/15/01)

The water color was greenish with no odor and the clarity was 4.2 m in the center of the pond. The pH was neutral to slightly basic. The bottom dissolved oxygen dropped below 5 mg/l both during the 1972 February visit and the June 2001 visit. The alkalinity reading from 30 years ago, showed that the pond has a high acid neutralizing capacity, protecting it from the effects of acid rain.

Date	Depth m	Temp C	DO mg/L	Conductivity uS/cm	pH	Alkalinity mg/L
2/17/72	0		10.65		8.02	40
2/17/72	10.5		3.65		8.3	40
6/15/01	1	21.61	9.18	124	8.19	
6/15/01	2	18.77	9.91	122	8.36	
6/15/01	3	15.16	11.05	128	8.34	
6/15/01	4	12.03	11.65	138	8.27	
6/15/01	5	9.49	12.82	136	8.59	
6/15/01	6	7.62	8.4	137	7.74	
6/15/01	7	6.32	4.94	138	7.48	
6/15/01	8	5.5	1.48	140	7.35	
6/15/01	9	5.09	0.09	146	7.21	
6/15/01	10	4.89	0.03	154	7.15	
6/15/01	11	4.92	0	155	7.18	
6/15/01	1	21.67	9.01	124	8.46	

The E shore is lined with cedars and the S and N shores are bushy. The 4WD to Blake Pond runs along the W shore with little buffer. There are two inlets and the outlet shows evidence of old beaver activity, although no active beaver signs now. The bottom drops off steeply within 5 to 10 meters of the shore, with the depth in the middle maxing out at station 1 with a depth of 12 m. There was some noticeable phytoplankton on the surface. There was some periphyton on the *Chara sp.* at the N end of the pond, although it could be a dusting of sediment. There wasn't much submerged macrophyte growth.

Potamogeton natans, *Chara sp.*, *Elodea sp.* (fragment), *Potamogeton gramineus*, *Typha sp.*, and *Scirpus sp.* were observed. Behind the *Scirpus* marsh at the NE corner of the pond, there might be some *Phragmites australis* mixed in with the *Typha sp.* Lots of bait fish were observed.

There are no camps near the pond. The public access area is the worst feature of the pond. It just sprawls too much, especially after coming so far into the woods to get to this pond. The access detracts from the scenic character of the pond because it is torn up from 4WD. This area should be improved to decrease its potential impacts on the lake and to increase the wilderness feel and character. The 4WD road to Blake Pond from Duck Pond is in poor condition and presents water quality problems. The road runs through the pond's outlet, then right along the edge of the pond. The Water Quality Division recommendation is that this road be diverted from the pond, and the brook crossing remediated. Except for the road and access, there are no signs of human alterations and the pond is surrounded by deciduous forest on all sides.

Blake Pond (7/6/01)

The surrounding shoreline is dominated by cedars, with some fringing marshes. There are lots of snags along most of the shoreline. Observations were made from the access area. *Sagittaria* sp., *Equisetum* sp., *Scirpus* sp., *Typha* sp., *Nuphar* sp. and potentially *Phragmites australis* (an invasive, non-native species of rush) were observed from the shore. The 4WD road into the pond is difficult and limits access. There is a rough downhill to the pond with campfire rings. There are no camps on the shore as viewed from the access and NE shore. The only shoreline alteration is the access, which has some erosion. The access road should be improved to prevent people from driving down the steep slope to the water's edge. Canoe, kayak, row boat or inflatable boats are all that could be launched here. Access is just a few feet from the 4WD road. The 4WD road runs along the NE portion of the pond about 15' up from the shoreline. The lake is very quiet and remote, a wilderness lake.

Historic Resources Assessment

Introduction

This assessment consists of a summary of the preliminary information gathered so far about historic resources of Willoughby State Forest.

Willoughby State Forest contains some examples of historic resources that are sometimes referred to as historic properties. These include standing buildings and remnants of buildings, campsites, stone walls, multiple resources constituting historic "districts," agricultural and planted forest lands (plantations), natural features, and archeological resources. Many of these resources have not yet been identified or documented.

At this time, two historic districts have been preliminarily defined in the forest. Both districts have been determined to be of statewide significance and eligible for inclusion in the National Register of Historic Places.

It is possible that other unidentified historic resources could be present in the forest. Archaeology Consulting Team, Inc. (ACT) has preliminarily identified potential sites of historic significance from archival maps. These represent a variety of historic periods from Vermont's history. These include the following: (1) tourism, as related to spas and hotels, seasonal residents, and the outdoor recreation industry; (2) transportation; (3) cultural and government, especially with respect to a 1930s Civilian Conservation Corps (CCC) camp that was located in the forest; (4) historic architecture and patterns of town development; (5) agriculture; and (6) industry and commerce. Historic period Native American sites also linked to some of these historic contexts may exist within the forest.

A more detailed discussion of the historic contexts represented by resources likely or already found in the forest can be found in the ACT Draft Historic Properties Management Plan for the Willoughby State Forest, May 2002.

Pre-contact Native American archeological resources probably exist at Willoughby. ACT conducted a preliminary analysis of archeological sensitivity in 2001-2002. This analysis was based on a methodology developed by D. Frink using forest community types. A brief description of this archeological sensitivity model is found at the end of this assessment. The ACT preliminary analysis will be used in conjunction with the model used by the Vermont Division for Historic Preservation.

Besides the work completed by ACT and staff members from the Division for Historic Preservation, staff members from the Vermont Department of Forests, Parks and Recreation have recorded information about many of the known historic sites.

The primary components of this summary of historic resources are a map of known and potential historic sites and a table, which briefly describes them. More detailed descriptions of the known resources are found on forms written by either the State Archeologist Giovanna Peebles or by staff members from the Department of Forests, Parks and Recreation. These forms include some specific suggestions regarding how these resources should be managed.

The potential historic sites, in particular, will need field investigation. However, more detailed information about these resources as shown on archival maps may be gleaned from the ACT Draft Historic Properties Management Plan for the Willoughby State Forest, May 2002.

Considerable additional work remains to determine the significance and value of each of these resources. Assistance from professional archeologists and architectural historians will be needed. However, ANR staff members should use the preliminary information found in this assessment to assist in managing these resources throughout the forest.

Summary of Historic Period Resources Identified to Date

Table 17 briefly describes the historic period resources shown in Figure 13. These include sites where physical evidence is present as well as potential sites where historic resources might be found.

For most of the sites where physical evidence is already known to be there, either a Vermont Archeological Inventory site form or a Preliminary Description of Historic Resources form has been prepared. This information is on file at the St. Johnsbury District Office. These sites correspond to numbers 2, 3, 14, 25, 26, 37, 38, 39, 40 and 41 on the map in Figure 13. In addition, a preliminary description form is available for a plantation created by the CCC in the area of points 32 and 33. This area needs to be delineated in the field as an historic district.

Archival maps and other sources of information indicate that many historic resources have yet to be field verified by an archeologist. In many of those cases, there is no obvious evidence that can readily be observed. Table 17 indicates many of the references for these potential sites that are shown on archival maps. Although there is indication from the draft report by Archaeology Consulting Team (ACT) that physical evidence is present at some of these potential sites, this has not been confirmed. Therefore site forms have not been filled out for most of these resources.

Assistance from professional archeologists and architectural historians will be needed to determine how to identify these sites and how to determine their significance and value. Until more funds and personnel become available to do this, ANR staff members will try to locate these resources and fill out a Preliminary Description of Historic Resources form as they are located.

The management of these resources, once they've been located, may involve additional consultation with the Division for Historic Preservation and/or archeological professionals.

Figure 13 – Historic Period Resources Map

**Table 17 - Summary of Recorded or Potential Historic Period Resources Identified to Date
on Willoughby State Forest**
Page 1

None = no structure shown on an archival map

Each "X" indicates a structure shown on an archival map

Shaded text indicates known sites for which documentation has been prepared

Map ID No.	Walling Map Description (1858 and 1859)	Beers Map Description (1875 and 1878)	USGS Maps (1920s or 1930s)	USGS Maps (1950s)	USGS Maps (1980s)	Comments
1	L. Davis	None	None	None	None	
2	Summer Houses	W. Van Ansdale	X	X	X	Existing structure now known as the Cheney House
3	A. Bemis	Willoughby Lake House	XX	XXX	none	Existing cellar hole known as Pisgah Lodge
4	A. Chamberlain Bowling Alley	None	None	None	None	Area excavated for fill by AOT
5	Lake House	Summer Hotel C.C. Thurber	XX	XXX	None	Area excavated for fill by AOT
6	A. Cummings	None	X	X	X	Not sure if located in the forest
7	J. Fogg	Farm of J. Fogg & Son, 100 a	X	X	None	
8	W. Daniels	Farm of A. Ball, 100a.	None	None	None	
9	None	M. Smith	None	None	None	
10	J. Bishop	A. Allen	None	None	None	
11	None	None	X	XXXXX	None	
12	None	E.K. Chappell	None	None	None	Site of a former camp
13	None	W.E. Ross	None	None	None	Site of a former camp
14	None	None	Fire tower	Fire tower	Look out tower	Structure has an associated ranger's cabin
15	P. Hovey	R.&G. Johnson	X	X	None	
16	None	H. Brainard	None	None	None	
17	None	O.&C. Steam Mill Co.	XX	XX	X	Associated company structures south of Bean Pond outside SF
18	None	None	X	X	X	
19	None	None	X	X	X	Site of a former camp
20	X	None	None	None	None	
21	None	None	X	X	None	
22	None	None	None	X	None	Site of a former camp
23	None	X	X	X	None	Site of a former camp

**Table 17 - Summary of Recorded or Potential Historic Period Resources Identified to Date
on Willoughby State Forest**
Page 2

None = no structure shown on an archival map

Each "X" indicates a structure shown on an archival map

Shaded text indicates known sites for which documentation has been prepared

Map ID No.	Walling Map Description (1858 and 1859)	Beers Map Description (1875 and 1878)	USGS Maps (1920s or 1930s)	USGS Maps (1950s)	USGS Maps (1980s)	Comments
24	None	Large Sugar Grove	None	None	None	There is evidence of old agricultural land between Marl and Vail Ponds
25	E. Rice	J.M. Rice	CCC Camp [10 structures total]	XX [total]	None	See 1930s CCC plans; area now part of historic district
26	J. Pittsbury	O. Rice [2 structures]	CCC Camp [10 structures total]	XX [total]	None	See 1930s CCC plans; area now part of historic district
27	J. Dolloff	T.C. Dolloff	X	X	X	Not sure if located in the forest
28	W. Powers	None	None	None	None	Near the stone pile district, see #39
29	J. Bartlett	None	None	None	None	
30	None	None	None	None	X	Not sure if located in the forest
31	None	None	None	None	X	Not sure if located in the forest
32	A.B. Curtis	A.B. Curtiss	X	X	X	Not sure if located in the forest
33	J. Rice	None	None	None	None	There's a cellar hole in Norway spruce plantation
34	T. Curtis	Mrs. T. Curtis	X	XX	None	Currently cellar holes called "North Ridge Road" cellar holes are at this site; not sure if related to archival information
35	None	J. Curliss Store	None	Pipe Line	Pipe Line	On private land
36						Boiling Spring
37						Moonshiner's Cave
38						Vail Pond cellar hole site
39						Stone piles district
40						Includes area where #25 and 26 were located; CCC district
41						CCC Road

Summary of Areas Sensitive for Precontact Native American Resources

Archaeology Consulting Team (ACT) conducted a preliminary analysis of Native American archeological sensitivity in 2001-2002. Based on a model developed by Douglas Frink¹, three primary forest community types are considered to be represented in the forest: Northern Hardwoods-Hemlock-Spruce; Northern Hardwoods-White Pine (Maple-Ash-Beech dominant); and Lake and Freshwater Marsh.

Early Native American hunting activities are unlikely to be found in the Northern Hardwoods-Hemlock-Spruce forest community due to its relatively low faunal carrying capacity. Native Americans are more likely to have used this area to procure medicinal floral resources, but this activity leaves little evidence in the archeological record.

Small and moderately-sized game processing camps and kill-spots are expected in the Northern Hardwoods-White Pine (Maple, Ash and Beech Dominant) forest community type. The density of such sites is likely to be moderate to sparse.

Few identifiable archeological sites are expected in the Freshwater Marsh communities. However, dry, flat, or gently sloping areas next to marshes within the ecotone of adjoining forest communities are likely to contain Native American habitation sites and food processing camps. Site density is expected to be high in these areas.

For more detailed information about this preliminary Native American site sensitivity analysis, refer to the ACT Draft Historic Properties Management Plan for the Willoughby State Forest, May 2002. This preliminary analysis will be used in conjunction with the Precontact Environmental Predictive Model of the Vermont Division for Historic Preservation, which has not yet been applied to the forest.

There may be sensitive micro-environments in the forest having a high potential for precontact Native American sites that are yet to be identified. This will require field assessment by an archeologist.

The information from these models can be used by staff members of the Agency of Natural Resources (ANR) for determining the appropriateness of sites and/or areas where a variety of land uses and projects with development may be proposed. Additional consultation with the Division for Historic Preservation and archeological professionals may be warranted on a case-by-case basis.

¹ Frink, D.S., Asking More Than Where: Developing a Site Contextual Model Based on Reconstructing Past Environments, *North American Archaeologist*, 17(4):307-336, 1996.

Legal Constraints

Licenses

- Verizon Telephone: A 50-foot right-of-way for the sole purpose of constructing, maintaining and operating a phone line. Also the permission to bury and maintain a phone cable across a portion and under the lands of Willoughby State Forest located on the North Ridge Road in Sutton.

Rights-of-Way

- Robert D. Delaney to State of Vermont by Warranty Deed dated September 11, 1980.
- Robert D. Delaney to State of Vermont by Warranty Deed dated February 9, 1988.
- State of Vermont to Portland Pipeline Corporation by Easement Deed dated June 8, 1965.
- State of Vermont to Vail Pond Sportsmen, Inc. by signed agreement dated April 22, 1975.
- State of Vermont to Peter T. Liberty by Quit Claim Deed dated May 9, 1984.
- John M. and Julia Bugge to State of Vermont by Quit Claim Deed dated March 7, 1973.
- Ken Davis to State of Vermont by Agreement To Acquire Easement dated November 10, 1983.
- J.C. Wemyss to State of Vermont by Warranty Deed dated November 26, 1968. (An associated right-of-way to lands acquired by the State of Vermont.)
- Anne L. Jackson to State of Vermont by Warranty Deed dated August 31, 2000. (An associated right-of-way to lands acquired by the State of Vermont-Bald Mountain Parcel.)

Special Designations

- Willoughby Cliffs State Natural Area (1984): Botanically and geologically significant.
- Marl Pond State Natural Area (1987) - Botanically significant Northern White Cedar Swamp (1987).
- National Natural Landmark (1967) - Willoughby Cliffs. (3744 acres of land and 922 acres of water).
- National Scenic Landmark (1967) - Three miles of lakeshore along State Route 5A.
- Wellhead Protection Area - Town of Barton. (Triangle lot-Town of Sutton-Compartment 12)

LWCF Projects

- Wemyss Acquisition - (Project #50-00071) 5,000 acres purchased by the Department of Forests Parks and Recreation, and the Department of Fish and Wildlife.
- Duck Pond Acquisition - (Project #50-00103) 13 acres acquired to enhance the "primitive wilderness qualities" of the state forest.

- Harry Zabarsky Shoreline Acquisition - (Project #50-00083) 10 +/- acres including 1500' of lakeshore
- John and Louise Swainbank (Blake Pond watershed) Acquisition - (Project #50-00079) - 130 acres.

Conservation Easements

- Bald Mountain Parcel - (292 acres) granting of development rights, conservation restrictions and public access easement to the Vermont Housing and Conservation Board. July 2000.
- Hoagland Property - (90 acres) restrictions placed upon this property by The Nature Conservancy.

Other Deed Restrictions

- Lena D. Cheney – spring rights for house on Willoughby Lake.
- J. C. Wemyss – reserved spring rights to “Boiling Spring”.
- University of Vermont reserved oil, gas and mineral rights on 305-acre parcel.
- Skinner/Soucier Parcel (South End-Lake Willoughby): Deed restrictions ensure public access to the lake.

Figure 14 – Legal Constraints Map

B. Public Involvement

Willoughby State Forest Public Involvement Meeting

Wednesday, June 13, 2001

Fellowship Hall, Westmore, Vermont

1. What is the single-most important value or public benefit that you place on the Willoughby State Forest?	2. How do you use this forest?
Recreation-non-motorized	Climbing winter & summer; hiking; skiing
Recreation	Have not an occasion to use lately
Its preservation as a relatively wild, undeveloped area for wildlife habitat and non destructive human recreation.	Rock climbing
The absence of "NO Trespassing" signs and the distinct geologic formations.	Hiking
Open wilderness and lake available to the PUBLIC	Swim, sail, fish, hike, snowmobile, dirt bike.
To keep this tract of state land open to various use that do not have an adverse affect on the forest.	Hunting, fishing, and dog sledding
Ice climbing	Ice climbing
The Willoughby State Forest cross-country ski trails are a unique resource region-wide in Northeast US. The trails are the best accessible trails in terms of snow retention.	I cross-country ski there when there is no skiable snow anywhere else in New England. I also enjoy hiking and mountain biking in the forest in the summer. I canoe on Lake Willoughby and swim too.
Free public use of public lands for recreation	Rock and ice climbing
Wildlife habitat and walking	Walking
Ice/rock climbing - premiere ice climbing in New England and perhaps the country.	Ice/rock climbing Hiking
Preserving natural features	Hike
Climbing (rock/ice) World-class ice climbing since 1970s	I have been using the forest for 20 years; fishing; hiking; swimming; climbing.
Watershed protection	Hiking
Its beauty!	Walking, swimming, sunbathing, ice climbing, soul refreshment every day!

1. What is the single-most important value or public benefit that you place on the Willoughby State Forest?	2. How do you use this forest?
The natural beauty (undeveloped) for day hiking.	Summer resident - hiking Winter visitor- snowshoeing (Tubbs)
A place to go to experience the woods in peace, which is nearby impossible considering the amount of motor vehicle use.	Mountain biking on gravel roads and trails. Hiking; Cross Country Skiing; snowshoeing; swimming. Observing nature. Please prohibit motor vehicles. Snowmobiles, OK
The serenity of the area, very picturesque.	Recreation, swimming, hiking, boating.
The water is clean and free of pollutants and a place where people can go enjoy the beauty of the lake and all it has to offer.	Swimming, snorkeling, hiking and sitting on the beach listening to the loons and watching people have fun and also listening to their comments about how beautiful the lake is and there is no other place like it on this earth! Try not to destroy it!
Natural surroundings untouched - undisturbed- unblemished- unbelievable beautiful - nature as God intended.	Hiking - canoeing - swimming - climbing. Fishing summer and winter. Sailing. Have spent many, many enjoyable days on this lake since the age of 16. I am now 37 and love it still - but for how long?
The natural unspoiled beauty is spiritual. It is whole and complete. It cures the soul.	Hiking, walking, looking, absorbing the beauty, and swimming, also canoeing, I use it to rejuvenate my soul. It is a special place. Thanks for caring.
Nudist beach, which VT. US Senator Leahy strongly endorses.	Foot hiking, south beach/west side approached by boat, most times.
Nudist beach which Vermont U.S. Senator Leahy strongly endorses and has so relayed to Vermont State Officials	Foot hiking, boating, swimming.
Natural beauty that has been only minimally spoiled by humans.	Hiking, Photography.
Preserves and protects natural (geologic, plant like, animal habitat) and cultural (past residential, agricultural, logging, tourism) landscape and history of the area.	Forest: hiking, aesthetic, natural and cultural history Lake: swimming; non-motorized boating; aesthetics, family camp on east side.

1. What is the single-most important value or public benefit that you place on the Willoughby State Forest?	2. How do you use this forest?
For us, the beach at the southern end of the Lake Willoughby is interesting because of its pristine state.	Once again, for the beach. As said above, we spend two weeks every summer in the region <u>solely</u> for the beach. We would certainly not incur the expenses to see the beach bulldozed and the lake subject to more boat traffic. We would go elsewhere. I do not now much about the Willoughby State Forest as a whole. But keep the southern beach just as it is now. More boats would add nothing to it, and would just detract it. I certainly do not come to Vermont to hear motor noises.
Quietness and happiness to be there with my family.	For the south-end beach only and I hope forever. I want my children to bring theirs in the future.
Preserve it as one of Vermont's most undeveloped natural resources.	Hiking, swimming, enjoying the beauty in its natural state.

undated version: July 24, 2001

Willoughby State Forest
Public Informational Meeting-June 13, 2001
Record of Comments Received

How can we better accommodate your interests/needs in our long-range planning efforts for this forest?

Non-Motorized	Limit boat access so petroleum pollutants are kept to a minimum
	Preserve the resources we share while ensuring continued, and appropriate, recreational use. (Ice climber)
	We would like to ask to preserve this unique climbing place and do not restrict usage of this area for ice climbing.
	Well maintained hiking trails with restricted use (i.e., NO motorized or mountain bike use), especially fragile areas.
	Keeping trails well marked and clear of debris and fallen trees. i.e., mile markers and elevation
	Insure continued access to the cliffs on Wheeler Mountain and elsewhere for rock climbing
	I would like to continue to be able to climb on Wheeler Mountain, but I would like to see a more systematic situation, in terms of where routes are going to be established and some guidelines as to who, what, where.
	Rock and ice climbing allow the personal freedom necessary to gain self knowledge as well as physical prowess in a setting that forces the person to also focus on her/his own safety. This personal responsibility sets climbers apart from many other sports enthusiasts. While a rescue of a climber always gets press coverage, the truth is that, on the whole, climbers need less rescue and first aid assistance than other sports enthusiasts. Most climbers know the risks and plan accordingly. These activities have little impact on the forest.
	Please involve climbers in the decision-making process. We care about the forest and cliffs at Lake Willoughby.
	Establish trail network in area of Willoughby Cliffs. Excellent hiking trails to Pisgah in place.
	Allow access to Pisgah to ice climbers to continue and educate to minimize vegetative impact.
	Control the A.T.V. use
	Incorporate trail maintenance plans that include all available groups: Westmore Trails; Vt. Leadership/NED Youth Corps, Green Mtn Club; also Scouts, 4-H, other civic groups willing to help.
	Develop additional recreation areas of all kinds that are environmentally sound. Reduce use of motorized recreation.
	Insure access for climbing, hiking, skiing, separate motorized and non-motorized uses.

	Continue to allow ice climbing [Also receive a letter of request originating from New Paltz, New York and signed by 13 individuals asking for the Department to continue to allow ice climbing]
	Please allow mountain biking on state land in W.S.F.
	Be considerate of the human-powered recreational activities that take place in Willoughby State Forest.
	Continue to provide road-side parking along route 5A for ice climbers.
(June 13 Meeting)	Ice climbing; rock climbing; provide for cross-country skiing; provide for sled dogs; provide for snowshoers; provide communication among different users; snowmobiles allowed for grooming trails/cross-country, sled dogs, snowshoe; work with Westmore Assoc. to develop a "common use map" for public. Issue to respect public and private property.
South End	Limit boat access so petroleum pollutants are kept to a minimum.
	Leave the south end as it is. There is already a small boat launch and two beaches on it.
	We love the beach at the southern end of the lake, from the cleanliness of the sand, the quality of the water, and the quietness of the place. It is a pristine area that should be preserved as such.
	I use the south-end beach only. Keep it the way it is. We do not need more boats.
	Maintain the South End of Lake Willoughby "as is". Creating a boat launch at South Beach would increase several forms of pollution - noise, petroleum products, trash, Eurasian milfoil.
	Establish a system for a bi-annual, clean-up of the "beach" areas. There is debris from the winter, refuse from visitors, excrement from dogs, decaying animals and oil spills from boats.
	Please do not put a boat ramp at the south end of the Lake.
	Signs on taking rubbish out with you. Possibility of Rubbish barrels?
	Eliminating the nudes at the South end of the lake, As an out-of-state visitor, what would happen if we sat on the capitol steps in the nude? We would be locked up! Why should we have to put up with it here? They are exhibitionists!
	Improving the boat launching area at the south end of the lake.
	Ban nude bathing at the south beach. Eliminate late night rousers parties in this area. Stop unlawful camping on the shore of the beach.
	Stop camping and fires on all beaches. The cove is the nicest beach of all and yet cannot be used for family swimming.

	I think that since the State owns the beach, they could put out trash barrels or else signs that read "Take In/Take Out".
	Leave things as they have been for many, many years - wild - untamed - natural and beautiful. Don't change a thing.
	By limiting the use. Not allowing noisy jet skis and by not developing the south end into another boat launch, which will only help spread milfoil.
	Do not destroy the environment, water quality, water pollution, noise pollution. Keep it free and open to everyone. Add a reasonably size boat launch at the south end so we do not destroy the current beach accommodations and still maintain the present boat launch.
	Do not allow motorized boats-limit access. As more boats are introduced, more environmental problems are inevitable. Maintain trails for safety. Remove fallen trees or initiate volunteer permission for removal.
	By keeping the public informed.
	Signs on taking rubbish out with you. Possibility of Rubbish barrels?
	I feel that you have done a great job at Lake Willoughby and do not see anything particular that is needed to better accommodate my interests. If you do not have enough bathrooms, that would be a good addition and perhaps put in established trails to the climbing areas to minimize use. Beyond that I feel that Lake Willoughby remains a very beautiful and pristine place.
	New and larger fishing access on South End. Plan developed in 1995(?) by Westmore Assoc.
	Ensure the South End remains undeveloped and accessible - Limit motorized access
	Maintain south end better - new parcel
	Leave south end natural and beautiful like it is now.
	I am in favor of a boat launch at the North West Corner of Public Beach, where space is ample. No to South End of Lake
	Current use and service is fine, but we do not wish for this to change.
	Do not convert the nude beach into a fishing area.
(June 13 Meeting)	Multiple use access - ADA for all recreational users; Safety! boats vs swimmers. Need to separate uses; More parking - Sunday afternoon; Add fishing access - boat launch - washing station; Purchase in-holding on SW side. Maintain south end better - new parcel; Safety-improve parking at trailhead and bottom of CCC Road; Better clean up effort of beach and parking area by State! They own it! ; Ice fishing debris, shanties, trash, equip. Clean-up???: Better signage; Add rustic campground; Purchase White Caps Campground.

Motorized Use (June 13 Meeting)	Regulations on ATV's should be enforced aggressively - be serious. A.T.V.s inappropriate. If it could be controlled, it might be appropriate. ADA should be accommodated. 4-W vehicles! Can they be ticketed on public land? State needs a recreation and environmental law enforcement division. Planning process: Motorized User's need to be involved.
Consumptive Use:	Limit logging to a small amount of selective cutting per year which has been approved by permanent and part-time Westmore residents.
	Limit all logging to only selective cutting, only a small segment per year. Cutting should be approved by Westmore residents/part-time and full-time
	Keep state forests working. Department obligations to manage for multiple use, including timber production
	Please continue to manage this state forest for multiple use and make sure that includes timber management.
	Take a more active role in promoting the benefits to state land from timber management.
	The timber industry is an important industry in the state and the logging community is especially in need of a reliable source for quality logging jobs. Please keep timer production as a top goal on state land management plans.
	Managing state forests for timber is important to me. I believe multiple-use management is important and that much of what logging creates, enhances the other uses. I think we should actively manage Willoughby State Forest for timber.
	I would like to see the Willoughby State Forest managed for timber, as I believe that logging helps to create the multitude of benefits on state lands that most of the public seeks.
	We believe that the state should continue to manage for multiple uses, as all users benefit from timber management. We support having the state promote and educate, the benefits to the public from timber management. To avoid what has happened on our National Forests, we hope that the State will take a more aggressive role, and a more positive tone, about multiple use management that includes timber as a key component.
(June 13 Meeting)	Like it the way it currently is. Variety of uses is a benefit to the forest, Including logging. Clear-cutting should not occur on forest. Fewer roads on forest. Improve hazard at boat launch (F&G). There is a difference between ATV's and snowmobiles. ATV's tend to be used more irresponsibly.
	I hope the Department will take an active role in working with loggers to make sure that multiple use management is always a prime goal of land owned by the State.
	Would like to see the Department continue to manage for timber, as dictated in State Statute, and to work with loggers and truckers to carry out those management objectives

Willoughby Lake Issues	Keep the lake healthy in terms of biological threats (e.g., immediate threat of milfoil and potential zebra mussel threat)
(June 13 Meeting)	Water quality-algae on rocks, increase in boat use, health issues, red eyes etc.; Policing of refueling in lake; Lake appreciation day with State involved.
General Questions and Comments	Recovery plans for T & E species in plans.
	Has human waste or parking become an issue? Both human waste and parking have been problems at the south end of Lake Willoughby. The Department addressed the human waste problem a number of years ago by installing two port-a-lets in the parking lot located at the south end. Parking is still chaotic on heavy-use days during the summer. This issue will be addressed in the upcoming draft plan.
	Horses, Lamas - What is policy on allowed use on W.S.F.? Are mountain bikes allowed on the forest? The Department has one formal state-wide policy that addresses Mountain Bicycles, Horseback Riding and Pack Animals. In Willoughby State Forest, they are currently allowed on any gravel surfaced road.
	Bald Mountain R.O.W. status - what is the State's R.O.W.? The State right-of-way, as stated in the deed, is obtained by way of Westmore Town Highway 9 (a Class IV road) and crosses over two different private parcels before entering state lands. A clear chain of title has not yet been established on one of these parcels. A more comprehensive title search will be forthcoming.
	Expand present natural areas.
	State lands policies and appropriate uses of state lands should be posted on our website.
	How many acres in Westmore that are in the Willoughby State Forest? The present amount of acreage by town in this forest is: Westmore-2472 acres; Sutton-5158 acres; Newark-52 acres.
	Is motorized use in the forest allowed? Motor vehicles are allowed to travel roads in the forest. Motor vehicle corridors will be identified in the upcoming draft plan.
	Are motor boats allowed on the small ponds within the forest? According to the "Vermont Use of Public Waters Rules" adopted by the Vermont Water Resource Board February 2, 1999 and as currently written, motor boats are allowed on the small ponds within the forest. These ponds include Blake, Duck and Dolloff. Maximum speed limit as allowed by State Statute is 5 MPH.

	<p>Is the State going to purchase the “Hatch Property” (small private inholding located near the south end of Lake Willoughby)?</p> <p>“Acquiring additional parcels that are adjacent or within existing Agency holdings and contain important public values or serve a specific purpose beyond just adding acreage is prudent policy and remains a high priority for the Agency”. {Vermont Agency of Natural Resources. Lands Conservation Plan-A Land Acquisition Strategy for the Agency of Natural Resources. October, 1999.}</p>
	<p>ATV usage-why is it not allowed?</p> <p>“Pursuant to 23 V.S.A. 3506(b) (4), motorized all terrain vehicles are prohibited on any public land, body of public water or natural area unless the Secretary [Agency of Natural Resources] has designated the area for use by such vehicles.” No areas have been designated in Willoughby State Forest.</p>
	<p>Will logging continue on the forest?</p> <p>The Department will be developing a <u>draft</u> timber management plan that will sustain and enhance species diversity, wildlife habitat, scenery, and recreation; to sustain and improve forest health conditions; to produce high quality forest products; and to demonstrate sound and scientifically proven forest management practices. Measures will be taken to protect water quality, rare and endangered species, natural features and historic and pre-historic sites.</p>
	<p>Will ice climbing continued to be allowed?</p> <p>This will be determined through the Department’s long-range planning process for the forest. The Department will evaluate this activity’s overall impact on the resource to determine compatibility.</p>

What do you see as existing or potential conflicts of use in Willoughby State Forest?

What are your ideas on how to resolve or prevent these conflicts?

Non-Motorized	<p>Relatively undisturbed cultural and natural areas vs. logging, motorized and mountain bikes.</p> <p>Log in winter only when ground is frozen. Well informed public (e.g. meetings, signs, brochures as appropriate). Barriers in restricted areas to prevent motorized and mountain bike use. Use previously disturbed and established roads (maybe CCC road) for motorized/mountain bikes. Avoid fragile cultural and natural areas for all uses, including hiking to preserve them.</p>
	<p>Snowmobiles may disrupt the tranquility and peace of ice climbing. (No answer) Do not ban roadside during the winter along Route 5A.</p>
	<p>Motorized recreation and logging vs. habitat and quiet recreation. Prevent conflicts if possible by insisting on sound logging practices resulting in minimal habitat degradation and keeping motorized use to a minimum.</p>

	<p>Rock climbing vs. Protection of the Peregrine Falcons.</p> <p>No rock climbing on face of Mount Pisgah from May-August. Education and information via signage and website. Keep communication open and informal. Find a “middle ground” where most people are satisfied with outcome.</p>
	<p>Possible negative impact on vegetation from ice and rock climbing.</p> <p>Sensitivity to <u>specific</u> sites, with posted signs explaining what is off limits, and why. Positive and instructive contact with the climbing community.</p>
	<p>Overuse vs. resource protection. Access vs. natural communities.</p> <p>Motorized vs. non-motorized use.</p> <p>Education. Voluntary use restriction. Reduce “promotion” of recreation among out-of-state users (i.e., non-committed to area health.)</p>
	<p>Local schools closing down some of the trails for racing purposes on weekends without any notice to anyone.</p> <p>Improve communications between user groups.</p>
	<p>ATV's are unsupervised. Trailhead signs are stolen regularly.</p> <p>Install gates at trailheads and patrol.</p>
	<p>Climbing vs. sensitive areas.</p> <p>Establish a plan with assistance from the climbers, that would both help protect sensitive environs and still allow enjoyment of them.</p>
	<p>Some people are not considerate of other state forest users. Motorized users can damage trails.</p> <p>Make effort to <u>educate</u> the public on the many uses of the area. <u>Explain</u> ways to share the resources. Create <u>special areas</u> for each recreation and post signs explaining intended uses.</p>
	<p>Extractive uses/aesthetic issues. Noise, exhaust, impact/non-mechanized uses.</p> <p>Separate uses whenever possible. Have logging etc. exemplify best management practices and thus illustrate that forestry is compatible with other uses. Limit vehicles to roads that are maintained.</p>
	<p>Development of and kind except for hiking, snowmobiling and ATV's.</p> <p>Do not sell any acreage. Post land for the above only. State restrictions.</p>
	<p>Motorized vs. Non-motorized use; consumptive use vs. conservation, and of course the usual lake issues that occur throughout Vermont.</p> <p>Designate use areas. Education. Parking area for Wheeler Mountain rock climbers.</p>
(June 13 Meeting)	<p>Erosion potential-no set trail; ATV damage to trails; Conflict with snowmobiles; Wheeled vehicles on trails during winter; Too many maps/too many people; issue of over use on the Mount Pisgah trail.</p> <p>Look at seasonality of rock climbing; More communication with Westmore Association, GMC, Leadership Center; Provide communication among different users; ATV use on state land-need more enforcement;</p> <p>Possible closure of south end of Pisgah trail-look at traffic flows; Long-term education about sensitive sites; Use simple signs/blaze trails; Balance resources for uses; Maps to delineate the uses; Group uses of</p>

South End Lake Willoughby	<p>Impact of Closing of existing fishing access area which is located where most of the Westmore population resides and is therefore easily accessible. Potential traffic accidents due to bad location on route 5A related to hikers from Pisgah. (Pedestrians from campground and high speed on hill just before entrance to town). Impact of new access on both south beaches. Cutting of forest to make way for new access and its parking.</p> <p>Do not close existing boat/fishing access for Lake Willoughby. Investigate purchasing adjoining parcel of land to enlarge/improve existing access area. Open fishing access at south end of the lake as secondary limited location. Remove moored boats at south end if new boat access is opened-they pose a safety hazard. Remove moored boats at south end if new fishing access is opened as they are a hazard to entering and leaving the area safely.</p>
	<p>Introducing a new boating access will encourage more boats and environmental issues as well as it will limit or may destroy the purity of the lake and enjoyment of the beach areas.</p> <p>Do not allow motorized boats other than non-petro engines. Limit the size of the boating access to a minimal size as not to destroy the current beach accommodations and still allow for parking and easy access for boaters as well as people enjoying the beach areas. Ask for volunteers to help maintain the beach and trails. No bottled beverages (glass) allowed.</p>
	<p>Water, air and noise pollution and destruction of the current beaches. The economic value at present vs. future projects eliminating present uses.</p> <p>Look at a playable solution that allows everyone to enjoy. Down-size plan for new boat launch without destroying the beach areas.</p>
	<p>Preserving the natural character of this area vs. development.</p> <p>Leave as is.</p>
	<p>Disturbing nesting site of Loons with development of this area.</p> <p>Leave as is.</p>
	<p>My family and I want to keep this place unchanged for swimming (naked if we choose to).</p> <p><u>Do not increase access to motor boats on the lake.</u></p>
	<p>The beautiful cove at the south end has been taken over by so-called "nudists". This discourages family use of this beach.</p> <p>Post this area prohibiting nude bathing.</p>
	<p>Obviously there is potential conflict between clothed and nude use of the immediate area. Establishing more commercial use in this immediate area would create conflict.</p> <p>By designating the area now currently used for unclothed recreation-perhaps on a more formal basis-conflicts could be prevented. As long as everyone is aware of this use, it should not be offensive.</p>
	<p>Keeping the forest clean, while attempting to provide multiple use.</p> <p>Limit boat access to those boats that pass strict pollution standards. Limit boat access to certain portions of lake, so not to disturb loons.</p>

	Proposed development of the south end. It is very naturally preserved for hiking, swimming, boating and picnicking. Keep it as it is! It is developed enough as it is.
	Converting this area of the forest into a state park would be detrimental to the environment. Maintain the forest in its present condition. Do not build a boat launch near the south end of the lake.
	If an additional boat ramp is built, it will further pollute the area and interfere with the safe environment of small children using the shallow waters. Look into funding from the State for clean-up, the placement and maintenance of trash barrels, signs, and periodic evaluation of the health and safety of the area.
	Lack of trash barrels and beach clean-up. Propose the State designate the south beach as a swim area to secure State funding.
	Use of the cove for campground with no bathroom facilities. Use of the parking lot for teenage alcohol and drug parties. Close and lock the gate to the parking lot in the evening. Post rules for all to see.
	The nude beach. Police and patrol the cove as much, or more than you do the fishermen.
	The nude beach. Pass a town ordinance banning nude bathing. Lock the gate at the south end parking lot to discourage late night parties. Patrol the area occasionally to discourage non-permitted uses.
	Illegal camping, fires and trash. Post rules and enforce them. Put out garbage containers.
(June 13 Meeting)	Boats vs Swimmers; fishing access vs nude beach; parking vs safety; restricting size of motors vs boaters, fishermen; fishing access vs overuse; campground RV access vs tenting; fishing vs recreational boaters; snowmobile use of trails vs other winter uses-skiing; more lookouts on hiking trails vs use-places to stop out of the way; trash-over use; pets off leash vs other users; more primitive camping in forest. More signs with rules. More police enforcement of rules and use. Carry In/Carry Out!! User groups made to clean up area before use. Trade clean up time for use-School groups, climbers. Designate part of south end as a State Park vs State Forest. Year-round use of Cheney House.
Motorized	Concern for VAST use, lake access for boats, and impact of surrounding development. Open communication, frequent evaluation of issues and community involvement/awareness.

(June 13 Meeting)	(Only comments recorded).
Consumptive	Logging vs. protection of hiking trails. (No answer)
	Potential conflict between recreation and consumptive users (hunters, loggers). (No answer).
(June 13 Meeting)	The “Hatch Property” could become a conflict if it remains in private ownership. Purchase the “Hatch Property” and improve parking situation at the south end.
Lake Issues	Jet skis and large motor boats vs. canoes, sailboats, kayaks and swimmers. (No solution put forth).
	Boat traffic, although not heavy, is still disturbing at the southern end of the lake: noise, gasoline fumes and slicks. Building a boat launch area at the south end would have a negative impact, by increasing the amount of traffic in this area. Make the southern end of the lake a preservation area for light use (non-motorized), and set up measures that keep this sector in its state of intactness.
	Crayfish are dying, slime on the rocks, milfoil now introduced into the lake. Test water quality regularly.

RESPONSIVENESS SUMMARY TO PUBLIC COMMENTS
WILLOUGHBY STATE FOREST
PROPOSED DRAFT PLAN

The Vermont Agency of Natural Resources hosted a public involvement meeting on Tuesday, September 12, 2002 in the Burke Mountain Room at Lyndon State College. The purpose of the meeting was to present the proposed draft management plan for Willoughby State Forest and solicit public comments. A thirty-day comment period was also provided subsequent to the meeting for people to comment.

Ninety-five comments were received, categorized and recorded. Forty-six comments were recorded at the meeting and another forty-nine comments were received, categorized and recorded from seventeen individuals and organizations during the thirty-day comment period. Those comments were received in the form of letters, e-mails, and the **Written Comment Form** provided at the meeting. All comments were grouped into the following sections: Land Use Classification, Public Access, Proposed Remote Recreation Area, South End-Lake Willoughby, Cliff Areas, Willoughby Lake Issues, and General.

Land Use Classification

1. What percentage of the “Unique or Special Use” area will be managed for timber?

The lands that are classified as “Unique or Special Use” will not be managed solely for timber but a majority (79%) of the land classified as “Unique or Special Use” may receive some level of vegetation management. These lands include deer wintering areas, mast stands, stream buffers and other wildlife habitat of edge of range species, sensitive viewsheds, wellhead protection area and historically significant areas. The only area that will not be managed for timber is the special recreation area, which makes up approximately 6% (480 acres) of Willoughby State Forest.

2. No justification for changing land use classification of area.

The Agency of Natural Resources has adopted this land classification system to establish a consistent vocabulary for internal discussion and for presenting information to the public. This classification system is based on resource information, legal constraints, existing uses and public desires. This is the first time that Willoughby State Forest has been examined using this new system. Most of the areas that we have identified were established based on information that was collected before this new classification system was established so the management of these areas will not change drastically.

3. Not sure setting aside 55% of land as “Sensitive” would address people with limitations.

The designation of “Highly Sensitive” or “Unique or Special Use” in the case of Willoughby State forest has not resulted in any changes in public access, except for restricting motorized access to the Special Recreation Area. The road that leads to the Special Recreation Area is currently classified as a road that is not open to vehicular traffic and efforts have been made to close this road to vehicles in the past. The special recreation area represents 6% of the forest.

4. **Concern that timber harvesting will be too limited.**

The sustainable harvesting of forest products from the state forest is a major part of our management plan for Willoughby State Forest. Over 65% of the forest is in a land use classification that allows for timber harvesting. Many of the areas that are closed to timber harvesting are in portions of the forest that were designated as such in previous plans. The one exception is the Special Recreation Area (480 acres) where no timber harvesting will occur.

5. **Although not mentioned in the plan, Agency staff did refer to clear-cut size on the WSF as “not exceeding 10 acres”. Given the re-growth condition of most of the WSF, and the generally early successional condition of the surrounding landscape, as well as the lack of exemplary natural communities on the forest that exhibit old growth characteristics, silvicultural treatment should focus on the improvement of stand structure rather than its elimination. Middle-aged forest, such as the WSF, should be allowed to attain greater complexity, even and especially where managed. Early successional forest species do take their place in forests that attain old growth character, and as a public forest, it is important that the WSF demonstrates that this can be so.**

Willoughby State Forest is situated in a landscape where timber harvesting is very common and that is something that we evaluated when looking at our timber and habitat management goals and strategies. Working with the Non-game and Natural Heritage staff, and district biologists we have identified areas within the forest where natural communities will be allowed to develop without vegetation manipulation. This area includes the Willoughby Cliffs Natural Area (1700 acres), the special recreation area (480 acres), and state significant natural communities (69 acres). The remainder of the forest will be managed to provide fish and wildlife habitat, recreational opportunities, protect water quality and scenic resources and to provide a sustainable level of forest products. The “not to exceed 10 acres” patch size we discussed at the September Public Meeting has been changed to 5 acres following additional internal discussion and further research. The maximum patch size was chosen to allow for the creation of early successional habitat on the forest if for some reason it is no longer being provided on the surrounding private property. It is our intention to manage the forest uneven-aged by harvesting single trees and small groups.

6. **The Agency has not shown any form of proof that there is a level of deterioration of any of the endangered or sensitive species that occupy areas of the forest currently classified as “Sensitive or Unique”.**

During this planning process we found very little evidence of negative impacts resulting from the current uses of the forest. Things we did take note of include erosion on some of the hiking trails, damage resulting from illegal ATV and off-road vehicular use, illegal dumping of trash, unauthorized trail development at the South End of Lake Willoughby and along the Mount Pisgah Trail and some erosion along the Class A and B roads which needs to be addressed. The designation of “highly sensitive” or “unique or special areas” does not indicate that there been any deterioration but it does indicate how we will attempt to manage them during the life of this plan.

7. **Concerned that very limited timber management is going to occur. No information provided in the plan as to how much timber will be harvested per year. There is very little information regarding the economic impact of the loss of timber management on this land.**

The only acreage that has been removed from the harvestable acreage is the 480 acres Special Recreation Area and 69 acres of Rare or Exemplary Natural Communities. The economic impact of removing this acreage from timber production is unknown as well is the impact from establishing the remote recreation area. The implementation schedule included in this plan includes 16 different timber harvests, which will treat 2639 acres or 33% of the forest.

8. **Support timber removal only for very limited, specific purposes: visitor safety and habitat for rare, threatened and endangered species.**

(See above)

9. **Curious as to whether the “Remote Recreation Area” is a new land use category, or if it is a subset category within a “Unique and Special Use Area”? Would enjoy seeing a definition for this type of management area and any written criteria that pertains to management guidelines for the “Remote Recreation Area”.**

The remote recreation area is a district designation that is being established to provide a recreational opportunity that is very limited in Vermont. Under our current land classification system there is a “special recreation area” designation under the broad category of “Unique or Special Use Areas.” This is where we placed the Duck Pond and Blake Pond area. We have developed management guidelines for this area which are outlined in the plan.

10. **There is no justification for changing the levels from present day uses, (referring to proposed land use classification for the forest); by implementing restrictions and requiring that the public stay out of the areas.**

(See above)

Public Access

1. **Are there any plans for additional parking? (The Boulders parking area will not be available.) Concern about parking during ice climbing months.**

Parking for winter use has not been an issue in past years therefore it was not initially considered during our planning process. The Vermont Agency of Transportation keeps the parking areas at the trailhead to the Pisgah Trail and the CCC Road on Route 5A open during winter months. The South End Parking lot is enclosed with a cedar fence, which will make plowing difficult. We will check with AOT to see if parking along Route 5A can be accommodated for climbers and lake users during the winter months.

2. **How many miles of roads are designated Class C?**

The roads on Willoughby State Forest fall into one of three categories. Class A and Class B roads are open to and suitable for vehicular traffic. There are roughly 4 miles of class A road and about 3.5 miles of class B roads. Class C roads are closed to vehicular travel and are in many different conditions. Many of the older class C roads are growing in and are not easily recognizable as roads and many of the newer roads are still passable with vehicles during drier times of the year. These roads were built for timber management activities and were not designed or constructed to support general public traffic. We have identified about 28 miles of class C roads which are in a wide range of conditions. Many of which were built prior to state acquisition.

3. **Are there plans to address illegal ATV use?**

Currently the Vermont Fish and Wildlife Game Wardens enforce illegal use of ATVs on state land and have been successful in issuing citations on the state forest. Unfortunately the warden force has also seen cuts in their budget and are operating with vacant positions in their staff.

4. **Will South Beach parking area be maintained during the winter?**

(See above)

5. **Change “car-top access” to “launch area” or “lake access” so it does not cause conflict between users in the future.**

It is not our intention to limit use at the south end to watercraft that are transported on the roof of a car or in the bed of a truck but we were trying to point out that the launch is not suitable for larger boats. This is a historical access for small watercraft and we intend to allow this use to continue. We agree that the name “car-top access” is misleading and have changed the designation to “lake access site.” There are no plans to make improvements to this access to facilitate larger boats.

6. **Maintenance of the proposed public access as outlined in the plan is the only modification that should be undertaken.**

(What does this mean?)

7. **Have a clear understanding that users trailering boats with motors will be allowed at this access.**

(See above)

8. **The plan appears to restrict (or prepare to restrict) access to over half the land. This is the public's land. The plan presented no scientific evidence to support the restrictions.**

The access that is changing on the forest is the road to Duck and Blake Pond. This road is being closed for two purposes. The first reason for closing this road is because of its location and condition. According to the Acceptable Management Practices, “log transport machinery must remain outside a 25-foot margin along the stream or body of water” and a protective strip of 50 feet should be maintained along bodies of water. The second reason is to provide a recreational opportunity that is in short supply on public lands in Vermont. Most of the ponds and recreation areas on public land are easily accessible by motor vehicle and it is our intent to provide a diversity of recreational uses on lands managed by the Vermont Agency of Natural Resources.

9. **Regarding the movement of the VAST trail and the statement that it be relocated to private property, I am very much against that statement/plan. The public is being served well by having the VAST trail on public property. It is the public that is using this trail and that should be protected not jeopardized by relocating to private property. It should not be the plan of public officials to move usage off public property and onto private property.**

The reason for relocating the trail is to maintain the remote character of the Duck Pond and Blake Pond area. It is not certain where the new VAST trail location will be at this point. We are exploring alternative routes, which may or may not be on public land. Historically this trail was located east of Lake Willoughby on an old county road and this is one option that we are looking into. The trail on Willoughby State Forest was authorized under a special use permit for the snowmobile season which ran from December 1996 to the spring of 1997. A permanent trail was not

discussed at that point or any point since. It is our intent to work with VAST, the town of Westmore and if necessary private landowners to find an alternative route that meets all of our needs.

10. **Regarding the removal of existing logging roads and trails. I am against this proposal. These create access to the property that the public currently uses. Is it the goal to remove/restrict public access to public property?**

It is our goal to provide a diversity of recreational opportunities on public land to meet the demands of various user groups. It is not our intent to remove any trails or logging roads but corridors that are not suitable for vehicular traffic will be made impassable to protect the resource for any damaging effects of inappropriate use. The entire property is open to pedestrian travel and we highly encourage and facilitate this type of use by maintaining class A and class B roads, establishing parking areas, and maintaining other recreation corridors on the property.

11. **Regarding the ATV “problem”. As I have chosen to register my ATV with the state, I cannot understand the state providing no public land to ride on.**

Current Agency of Natural Resource policy and state law [23 V.S.A. section 3506(b)(4)] prohibit the use of ATVs on property owned by the state.

12. **My only concern is parking during the ice climbing months. At times the area at the South Lake has been plowed, but as the Boulders site has been sold the parking issue may become an important concern for climbers and ice fisher folk.**

(See above)

13. **Trash begets trash, and it should be a priority to not only deal with existing trash but to limit casual access and provide for quality of experience.**

This is an issue that is not unique to Willoughby State Forest. We deal with illegal dumping and littering on many of the state forests and wildlife management areas around the state. We work with the ANR Enforcement Division to enforce state laws pertaining to illegal dumping and littering on public lands.

14. **Opposed to any possible use restrictions now or in the future on the Mount Pisgah and Mount Hor hiking trails.**

Access to the Pisgah and Hor trails will remain at its current level for the life of this plan. We are planning to employ either a Kingdom Corps crew or a Vermont Youth Conservation Corp crew each summer to conduct routine maintenance on the trail system if our budget permits. We have no intention to restrict pedestrian access to the forest.

15. What is proposed for the Class C roads? (What are the Class C roads?)

Class C roads are not open to vehicular traffic and in cases where this use is occurring we will attempt to block access to these corridors. Many of these roads were constructed for the purpose of forest management prior to state acquisition. The condition of these roads varies greatly and they will not be maintained in a condition that will support sustained vehicular traffic.

16. Will Class C roads be opened to motor vehicles for future timber harvest if needed?

Class C roads are mainly forest management roads and will continue to be used as such. Class C roads will be used during timber harvesting operations and in some cases additional Class C roads may need to be constructed to support harvesting operations. Class C roads will not be open to general vehicular traffic following timber harvests since they will not be built to a standard that will facilitate that type of use. Upon completion of any timber harvesting operations, they will be stabilized to prevent erosion and barricaded.

17. Is the South End parking lot a feasible option for winter parking to accommodate ice climbers?

(See above)

18. Ice fishermen will benefit from winter parking at the South End parking lot as well as ice climbers.

(See above)

Proposed Remote Recreation Area

1. Will there be designated tent sites; has ANR evaluated the impacts of dispersed use vs. concentrated use?

We are not planning to designate any specific sites for camping at this time but we have made minor modifications to our management guidelines (as proposed on September 12, 2002) for the “Special Recreation Area” to keep this open as an option pending further evaluation.

2. Wouldn’t road closure to Duck Pond limit access for canoes, small boats, and fishing?

It is obvious that restricting motor vehicles from driving to Duck Pond and Blake Pond will make access more difficult for boats and canoes more difficult, but we will be maintaining a trail to the ponds for pedestrian access. The goal of the “Special

Recreation Area” is to provide a recreational opportunity that is not readily available in Vermont. Remote ponds are rare throughout the area and this is an opportunity to provide a destination for those outdoor enthusiasts looking for remote ponds and areas where motor vehicles will not be encountered.

3. How will people with disabilities be accommodated in the remote recreation area?

The Agency of Natural Resources would be receptive to working with a representative to explore options that may accommodate this interest group and still be consistent with the proposed vision for this area.

4. What can ANR do about the road around Duck Pond?

It is our intent to discontinue vehicular use of this road for all uses in its current location and to stabilize it to prevent erosion and water quality impairment. These actions will be implemented after we find an alternative route for the VAST trail and establish pedestrian access through the Special Recreation Area.

5. Concern about access for “older” fisherman to the ponds.

It is not the intent of this proposal to discriminate against anyone based on age or any other factor. We realize that restricting vehicular access through this area may pose difficulty or inconvenience to some. However there are other areas within the forest and other public lands that provide for vehicle based recreational opportunities.

6. If roads to ponds are closed off, will there be adequate parking for the number of people expected to use the area?

We are planning to establish parking to accommodate the anticipated level of use. Future monitoring will provide information that will help the ANR determine if adequate parking is available or if changes need to be made.

7. Will the road leading into Blake Pond from Route 5 be closed off?

We know that this road receives some level of vehicular use and some limited vehicular access will be provided from this point. The proposal restricts vehicular access to the “Special Recreation Area” from all access points. It might be appropriate to establish a second parking facility there if needed. This road will be closed about half a mile from Blake Pond.

8. It is shortsighted to close the road without more review.

Restricting vehicular access into the special recreation area is a critical component that is essential to meet the management objectives for this area. The segment that

will be closed off is a class C road. This action is consistent with our plans to restrict vehicular access on all class C roads on the forest.

9. Keep the proposed remote area as part of the plan. Build a lean-to to concentrate camping in the area and keep away from the water.

At this time we are planning to allow camping in accordance with the primitive camping guidelines. We have made minor modifications to our management guidelines for the “Special Recreation Area” to allow for the construction of tent platforms or lean-tos if our current policy on primitive camping fails to protect the ecological integrity of this area.

10. As far as enhancing forest health or ecological integrity of the Willoughby State Forest, the primitive area proposal is modest, but a good idea. The proposal’s emphasis is on the use aspect, rather than the contribution that an uncut and unroaded area makes to remoteness, wildness and the health of natural communities. These are important values in the management of forests and the achievement of stated ANR goals.

The characteristics listed, “remoteness, and wildness”, are what we are striving to protect in designating this area a “Special Recreation Area.” These characteristics not only describe ecological values but also describe unique recreational opportunities that we can provide on the forest. We recognize the ecological values that are associated with this management decision.

11. Extending special use protection to the area now in general use that abuts the proposed primitive area, on out to the Wheeler Mountain Road, should be looked at in future plans.

It is our goal to provide a diverse array of recreational opportunities while protecting the ecological integrity of Willoughby State Forest. The “Unique or Special Use” areas are use or resource driven determinations that we can re-evaluate at any time during the life of this plan and during future planning efforts.

12. Limiting access may have important ecological benefits such as reducing the threat of milfoil from casual boating.

This is certainly one benefit of limiting vehicular access to Duck and Blake Ponds. Milfoil can still make its way to these ponds with canoes, kayaks, or in bait buckets so care still needs to be taken to stop the threat from this invasive plant.

13. Keep the proposed remote recreation area as part of the plan. There are not many ponds in our area that are closed to motor vehicles. The sensitive communities around these ponds deserve some conservation measures. The issues of camping next to the ponds will not change, people like to camp near

water. The best alternative is to build a lean-to in an area that is close but not too close. I think that concentrating the use is better than spreading it out.

(See above)

14. **If you find that restricting this area has no implication with ADA or causes any backlash from any other Federal or State requirements, than I would recommend that you proceed with the plan as drafted.**
15. **Strong support for the 481 acre Remote Recreation Area.**
16. **Strongly support the Department's concept of creating a "Remote Recreation Area" in the area located south of the summit of Mount Hor. Encourage the Department to maintain habitats for threatened, endangered or rare plants and to identify and protect special plant and animal habitats within the proposed Remote Recreation Area.**

Even though the area around Duck and Blake Ponds has been designated a "Special Recreation Area" we are still responsible for insuring that the ecological impacts of recreational uses are kept to a minimum. We are responsible for providing compatible recreational uses while protecting the ecological values of the property.

South End-Lake Willoughby

1. **Anglers use the South End for boat launch and this should continue as it has in the past.**

It is not our intention to limit use at the south end to watercraft that are transported on the roof of a car or in the bed of a truck but we were trying to point out that the launch is not suitable for larger boats. This is a historical access for small watercraft and we intend to allow this use to continue. We agree that the name "car-top access" is misleading and have changed the designation to "lake access site." There are no plans to make improvements to this access to facilitate larger boats.

2. **Strongly believe that closing the boat launch at the south end would be totally counterproductive. If anything, the boat launch should be improved.**

(See above)

3. **Fishing boats should not be deferred from using the South End beach.**

(See above)

4. **Motorboats should be deferred from using the South End beach.**

This site has historically been used to launch smaller watercraft and it our intention to allow this use to continue. However, there are no plans to make improvements to this access to facilitate larger boats.

5. **Close the South End of the lake to motorized boats with the exception of waterfront owners boating to and from open motor areas, preferably utilizing a no-wake policy. Do not open another boat launch in that vicinity.**

The use of motorboats on Lake Willoughby is not within the scope of the management plan for Willoughby State Forest. The informal boat launching area is a historical use that we intend to allow to continue. If at some point the level of user conflicts becomes a problem we will further evaluate the situation and make additional management recommendations for the area.

6. **Regulate or eliminate the mooring of boats in the area by limiting the number of moorings and designating locations.**

We have designated a swimming area in years when mooring of boats began interfering with the beach users and launching of boats. This approach has proven successful in consolidating the mooring area without us having to designate a specific site.

7. **Parking should be marked clearly and be easily accessible. The Pisgah trailhead is not properly signed and people are using the South End parking area.**

Signage is an issue that we will be addressing once this plan is adopted by the ANR and received adequate public input. It is our plan to install signage to direct visitors to the appropriate trails, parking areas and to provide information that is relevant to Willoughby State Forest and other state owned property. It is also our intent to not erect signs that will detract from the character that the public expects when visiting the forest.

8. **Encourage the Department to provide for adequate signage and mitigate for unregulated foot trail use, especially in the Bluff Area.**

(See above)

9. **Suggest using steel signs to prevent vandalism.**

(See above)

10. **Invest in metal welded signs that will last longer and be more effective against vandalism.**

(See above)

11. Construct sturdy welded signs and place in conspicuous spots.

(See above)

12. Regulate camping.

The Vermont Agency of Natural Resources has established guidelines for camping on state owned lands, which apply to Willoughby State Forest. These guidelines address appropriate distances from water bodies, trails and roads, fires, length of stay, group sizes and waste disposal. These guidelines are posted on kiosks and are available at district offices.

13. Camping occurs too close to lake.

(See above)

14. Signage to address camping and pets.

(See above)

15. Pets have become a problem.

Pets themselves are not usually the problem. It usually starts with irresponsible pet owners. We will place signage at the South End Parking area requesting that pets be kept under control and continue to evaluate this issue. If necessary, further measures may need to be taken.

16. Build a stone fireplace at the West Beach. Permit the fire ring that is presently being used until a permanent structure is built.

We do not wish to encourage open fires on the West Beach. We are aware this activity is taking place on a regular basis and efforts have been made to discourage it. We will be contracting with the county sheriff to conduct regular patrols in the South End area.

17. Thankful for the vigilant police patrols initiated this past summer and hopeful that they will be continued and possibly expanded a bit.

We will be initiating a new contract with the county sheriff for this coming summer and in subsequent years if the need continues and funding is available.

18. Due to harassment of camp people, maybe the local sheriff might control the locking of the parking lot gate.

In order to be more cost effective, the sheriff patrols only for several hours on Friday and Saturday evening. In the past the gate has been opened and closed by a local volunteer and that individual is no longer available for this task. It would be cost prohibitive for us to hire the sheriff or anyone for that matter to take on this responsibility.

19. **Unruliness at the South End including ATV's running over hiking trails where barriers have been placed, cars racing and screeching tires, loud parties at night on the beaches and portable toilets being pushed over.**

(See above)

20. **Support Department efforts to provide County Sheriff patrols at the South End and urge the Department to continue this effort next year.**

(See above)

21. **A Park Ranger is desperately needed to educate and enforce laws and policies that pertain to use at the South End. Special concern about the potential danger of forest fires occurring as a result of campfires.**

We will be initiating a new contract with the county sheriff for this coming summer and in subsequent years if the need continues. It will be the responsibility of the sheriff to enforce existing laws and policies that pertain to the state forest.

22. **Do a better job in enforcing laws in regards to lewd and lascivious activities that are occurring at the South End.**

(See above)

23. **Concerned that the presence of nude bathers at the West Beach is preventing other people from using this beach.**

Currently nude bathing is not an illegal activity in the State of Vermont or against any Agency of Natural Resources policy.

24. **State should be more active regarding the nude beach. Nude bathing forces out other users.**

(See above)

25. **Install security lights in the South End parking lot.**

Security lights at the South End parking area would detract from the character of the forest. Currently there are very few places that are free from artificial light and at this point we are not advocating for the addition of lights to this parking area.

26. Why can't garbage cans be placed out-of-site from the road and be used only by those frequenting the beach?

The beaches at the South End of Lake Willoughby are managed as a carry in, carry out area. Additional signage may be needed to make sure this is clear to all beach users.

Cliff Areas

1. What is the percentage of state ownership at Wheeler Mountain?

A short section of the trail that accesses the summit of Wheeler Mountain is located on public land but a majority of it is located on private property.

2. Are the rare plants on the cliffs a new find?

The rare plants that are found in the cliffs area are not new findings. This area has been a favorite spot for botanists for decades. Most of the rare plant records are from historical records and we have not made a significant effort to locate them during this planning process.

3. Why is the use classification in this area being changed?

The Agency of Natural Resources has recently adopted a new land use classification system that is used for planning efforts across the state. The category that the cliffs on Mount Pisgah and Mount Hor fall into is based solely on the fact that it has been designated a Natural Area. So in reality nothing has changed for this area. It is still a state natural.

4. Strongly encourage the Department to develop a management plan for the Willoughby Cliffs Natural Area. It is unclear whether the continuation of ice and rock climbing as an interim regulation will have any negative impacts to the unique biological and geological attributes of this area. Evaluating the recreational impact(s) to fauna and flora in the Natural Area should be a management priority in order to comply with 10 V.S.A. § 2607, which requires land uses and practices in natural areas to be subject to regulations of the Department to manage or maintain natural areas "for the preservation of their natural condition". In sum, the management plan for the Willoughby Cliffs Natural Area should be completed as soon as possible to preserve the ecological significance of this area.

We certainly are not advocating for the continuation of any activity that would degrade the condition of the natural area. Having discussed use with both ice and rock climbers it seems the conditions for climbing regulate the use levels. The cliffs

at Mount Pisgah and Mount Hor lend themselves more toward ice climbing and Wheeler Mountain is better suited for rock climbing. The rare plants tend to be located on rock faces of Pisgah and Hor that are covered with ice during the season which sees the highest level of use. The impacts of both ice and rock climbing need to be evaluated more and a specific climbing and management plan needs to be developed for the cliffs area.

5. Is Mount Hor open/available for rock climbing?

No change in use has been recommended but a climbing plan needs to be developed for the cliffs on Willoughby State Forest in the near future.

6. Should climbers be directed to Wheeler Mountain due to the rock quality at Pisgah?

We are not going to direct climbers to any specific site on the forest. Climbers familiar with the conditions that exist on Willoughby State Forest are going to be the best resource for this activity.

7. Rock quality at Pisgah not a problem and closure for summer rock climbing should not be necessary.

(See above)

Willoughby Lake Issues

Willoughby Lake is not within the boundaries of Willoughby State Forest and is managed by the Water Resources Board. Uses that take place on the water are outside of our jurisdiction and therefore are not addressed in this management plan.

1. The jet-skiers frequented the lake and come very close to the swimmers at the South End.

There are regulations that relate to speed limits near designated swimming areas, other boats and shoreline, which apply to all lakes and ponds in Vermont. If you witness reckless operation of a watercraft contact the state police.

2. There are existing conflicts with personal watercraft on the lake.

(See above)

3. Question of milfoil being introduced to the lake at the South End access.

Milfoil is a concern at the South End of Lake Willoughby and informational signs have been placed near the lake access area to inform boaters. The Department of

Environmental Conservation has been active on Lake Willoughby to control the spread of this invasive exotic species. To volunteer with this effort or to report suspected invasions contact the DEC at (802) 241-3777.

4. Any milfoil harvesting activity should have a containment area.

(See above)

General

1. How often are management plans subject to revision?

This plan for Willoughby State Forest does not have an expiration date. We will be reviewing the management goals and strategies periodically and developing new implementation schedules following the completion of scheduled projects. The initial implementation schedule for this plan will list activities, which we hope to complete within the next ten years.

2. All signage should be in French as well as English.

3. Why hasn't ANR developed an enforcement arm to deal with all of the regulations imposed?

We currently have an Enforcement Division, which is responsible for enforcing the rules and regulations that apply to Agency Lands and other environmental regulations. Fish and Wildlife Wardens also enforce regulations on public lands.

4. Will any existing statutes or regulations be changed to implement this management plan?

All of the planned activities discussed in this management plan fit into existing rules and regulations.

5. Draft plan is well done.

6. Maps have Nygrens Road misspelled and shown as a through road. It is a dead end Class 3 road that turns into a trail and is gated in several places. Maps encourage traffic on this road, which would be impossible.

7. Very little, if any thought has been given to recreational/sporting values on the state land.

The recreational/sporting values of public land are issue that we deal with on a daily basis. This plan is written to provide for a diverse array of recreational opportunities and attempts to limit conflicts between users. One of the primary purposes of the state owning land is to provide opportunities for environmentally compatible recreational pursuits.

8. **Further action will be needed to address the ATV problem on the forest and to protect the diverse array of natural communities on the forest from excessive recreational use.**

All recreational uses are monitored for environmental impacts and where necessary corrective actions are taken. The issue with ATVs is an enforcement issue that will continue to be a challenge with current staffing levels.

9. **Education, regulation and law enforcement should all be considered and applied where they will be the most effective in safeguarding the natural values of the forest.**

(See above)

10. **Build stone fireplaces throughout the forest where there are existing fire rings and allow use of existing fire rings until they are built.**

(See above)

11. **Assign responsibility to or eliminate the commercial business adjacent to the South End.**

Management of the public land at the South End is the responsibility of the Agency of Natural Resources. The private property adjacent to the state forest is outside of our jurisdiction.

12. **It is not only our responsibility, it is our right to make Willoughby a safe environment for everyone visiting or living here.**

(See above)

13. **Thanks for trail maps.**

C. Management Guidelines

Landscape Management Guidelines Controlling Visual Quality

In order to help protect and maintain the scenic values of Willoughby State Forest, landscape management guidelines have been developed. The potential impact to maintaining visual quality is a valid concern when conducting any forest management activity. The public has identified this concern as a potential conflict in Willoughby State Forest. This landscape plan has been specifically designed to minimize any potential impacts to visual quality from timber harvesting and road construction activities. In the context of this plan, the following guidelines will provide Department land managers a valuable tool that will enable them to meet the stewardship priorities for this state forest.

Management Actions Affecting Visual Quality:

1. Timber harvesting
2. Road construction (truck roads and skid trails)
3. Log landings

The observer position is critical when designing low visual impact disturbance. An observer traveling at 40 MPH in a vehicle is generally impacted less than a foot observer on an overlook, especially at long range.

Willoughby State Forest has been divided into five Visual Sensitivity Zones with each zone having its own criteria by management activity and observer position.

Sensitivity Zone T-1:

All land within a three hundred (300) foot corridor through which a designated trail passes.

Sensitivity Zone T-2:

All land visible from designated vistas.

Sensitivity Zone W-1:

Refer to Riparian Guidelines (See Appendix)

Sensitivity Zone H-1:

All land within three hundred (300) feet of designated public roads.

Sensitivity Zone H-2:

All land visible from Route 5A along Lake Willoughby.

Sensitivity Zone T-1:

This zone encompasses a three hundred (300) foot corridor through which the following designated hiking trails pass:

1. Mount Pisgah East Trail
2. Herbert Hawks Trail
3. Moose Mountain Trail
4. Wheeler Pond Trail

Timber Sales

- Follow timber management strategies as outlined under “General Use Areas” outlined in Section IV of this plan “Management Strategies and Actions”. Only light harvests

- using the single-tree selection method will be used in this zone. The residual basal area goal for this zone is 80 square feet per acre.
- Tops will not be left within 50 feet of designated recreation trails.
 - Tops will be lopped within 100 feet of designated recreation trails.

Landings

- Landings will be located outside of this zone.

Skid Trails

- Skid trails will cross recreation trails only at designated locations and be kept to a minimum.
- Skid trail crossings will be smoothed and all debris removed 50 feet either side of the recreation trail upon completion of sale.

Forest Roads

- Roads will cross trails only where necessary.
- Cleared road width will be kept to a minimum.
- All debris from construction and management activities will be removed or buried 50 feet either side of the trail crossing.
- Ditches and shoulders will be stabilized within 50 feet either side of the trail crossing.
- Where possible roads will curve at trail crossings to reduce sight distance.

NOTE: Many of the recreation trails in Willoughby State Forest are located within land classification areas where timber harvesting and road building will not occur. However, where this is not the case, all roads and skid trails will remain outside of this 300-foot zone except where trail crossings are absolutely necessary. The above conditions apply to this exception. All trail crossings will be temporary and will be closed out upon completion of management activities.

Sensitivity Zone T-2:

This zone encompasses all State Forest Land where timber-harvesting activity would be visible from the following vistas:

1. Mount Pisgah Trail Vistas
2. Herbert Hawkes Trail Vistas
3. Wheeler Mountain Trail Vista
4. Moose Mountain Trail Vistas
5. CCC Road Vista

Timber Sales

- Follow timber management strategies as outlined in Section IV of this plan "Management Strategies and Actions".

Road Construction

- Large road cuts will be avoided.
- Where unavoidable, cut and fill slopes will be seeded and mulched.
- Alignment will avoid a parallel orientation to the observer.

NOTE: Present forest management strategies will not have a negative visual impact in regards to this Sensitivity Zone. However, the ANR District Stewardship Team has deemed that it is warranted to include this zone in the Landscape Management Guidelines for Willoughby State Forest.

Sensitivity Zone W-1:

This zone includes lands adjacent to water bodies (ponds and streams).

- Follow “Riparian Management Guidelines” (See Appendix). **Exception:** No timber harvesting will take place within 200 feet from the shoreline of Lake Willoughby.

Sensitivity Zone H-1:

This zone includes a four hundred (400) foot corridor along all public highways and Class A and Class B Forest Roads.

Timber Sales

- Follow timber management strategies as outlined in Section IV of this plan “Management Strategies and Actions”. **Exception:** Single-tree selection will be employed in this zone with a residual basal area goal of 80 square feet per acre. Openings in the forest canopy will not exceed 1/50 acre.
- No tops of felled trees will be left within 100 feet of public highways or Class A and Class B Forest Roads.
- Tops of felled trees will be topped to within two feet of the ground within 200 feet of public highways and Class A and Class B Forest Roads.

Landings

- Landings will be excluded from this zone.

Forest Roads

- Entry/exit points will be visually screened and kept to a minimal width.
- The number of entry/exit points will be kept to a minimum.
- Road layout and design will minimize site distance.
- Entry/exit points may be barricaded using natural materials on site after the management activity has been completed.
- All areas of exposed soil within 100 feet of entry/exit points will be seeded and mulched upon completion of the management activity.

Sensitivity Zone H-2:

This zone includes all lands of Willoughby State Forest visible from Route 5A.

Timber Sales

- Follow timber management strategies as outlined under “General Use Areas” in Section IV of this plan “Management Strategies and Actions”. **Exception:** Openings in the forest canopy shall not exceed one-fifth acre.

Landings

- Landings will be located at least 200 feet away from Route 5A and/or Lake Willoughby.

Forest Roads

- Alignment will avoid a parallel orientation to the observer.

Riparian Management Guidelines

Riparian Habitat Types

- Headwater Wetlands and Seepages
- Streamside Riparian Zones
- Riverine Floodplains (Natural features include wooded swamps, marshes, oxbows, pools of standing water, meandering tributaries, and seepages).
- Large Ponds and Lakes (Associated riparian areas vary in width and character, are commonly terrestrial-like, and can include other aquatic habitats).
- Beaver Ponds and Small Impoundments (Associated riparian areas of various widths and with differing vegetation communities, depending on the nature of the surrounding watershed).
- Bogs and Fens (Peatland habitats)
- Ephemeral Pools (Vernal pools).

Management Goals

- Maintain and enhance riparian health.
- Protect water quality.
- Maintain and enhance biodiversity.

Management Guidelines: Silviculture

- Employ uneven-aged management using the single-tree selection method for Northern Hardwoods and group/single tree selection for Mixed Wood and Spruce/Fir in the secondary zone.
- Maintain minimum residual basal area of 80 square feet per acre in Northern Hardwoods, 90 for Mixed Wood and 100 for Spruce/Fir.
- Maximum group size: 1/10 acre in the secondary zone.
- Grow trees to early maturity (80 to 125 years old).
- Provide for coarse woody debris.
- Leave trees along stream banks for stabilization.
- Keep logging equipment 100 feet away from edge of stream channels and open water.
- Locate log landings outside of the riparian management zone.
- Consider sensitive soils and soil conditions during logging operations.

Riparian Habitat Type	Buffer Width/Prescribed Treatment
Intermittent Streams	Primary Zone: 50 Feet; Light Selection Harvest
Permanent Streams < 10 Feet Scrub Shrub and Forested Wetlands (Includes Beaver-Influenced Wetland Complexes)	Primary Zone: 50 Feet: No Harvest Secondary Zone; 100 Feet: Light Selection Harvest
Permanent Streams > 10 Feet Ponds/Lakes Open Wetlands Vernal Pools Communal Breeding Pools	Primary Zone: 100 Feet: No Harvest Secondary Zone: 300 Feet; Light Selection Harvest

Stream width is estimated at the bankfull elevation at the narrowest portion of a straight channel segment within the management area.

D. Authorization to Plan and Manage

Statutory Authority

The Vermont General Assembly has authorized the Agency of Natural Resources and its Departments to acquire lands, hold interests in lands, and conduct land management activities. Authority is vested in several statutes that collectively empower the Agency, upon approval of the Governor or General Assembly, to acquire lands, accept donations of lands or interests in lands, exchange or sell lands or interests in lands for public benefit, and to manage those lands for a variety of public purposes.

Specific authorizing statutes are:

Title 3, Chapter 51, Section 2825: The primary duties of the secretary are to coordinate the activities of the various departments and divisions of the agency for the proper development, management and preservation of Vermont's natural resources, to develop policies for the proper and beneficial development, management, and preservation of resources in harmony with the state comprehensive planning program and to promote the effective application of these policies by the departments and divisions affected.

Title 10, Chapter 83, Section 2601: Establishes the general purposes and policies to acquire and manage state lands and authorizes the Department of Forests, Parks & Recreation to undertake such activities.

Title 10, Chapter 83, Section 2603: Establishes the general powers and duties of the commissioner of the Department of Forests, Parks & Recreation to manage state lands.

Title 10, Chapter 103, Section 4144: Authorizes the Department of Fish & Wildlife to acquire state lands.

Title 10, Chapter 103, Section 4147: Authorizes the Department of Fish & Wildlife to exchange, sell, or lease lands.

Title 10, Chapter 37, Section 905b: Authorizes the Department of Environmental Conservation to acquire and manage lands and the rights to protect the state's water resources.

Title 10, Chapter 155, Section 6301-5: Authorizes acquisition of rights less than fee of real property.

E. Summary of Policies and Guidelines

Some of the highlights of the many policies and guidelines used in managing Vermont Agency of Natural Resources lands are listed below. In general, these were in effect at the start of this long range planning process. If more information is needed, refer to current policies and guidelines which can be made available upon request. The information is grouped into some general categories to make this document easier to use.

Acquisition of Land

Lands Conservation Plan: A Land Acquisition Strategy for the Agency of Natural Resources, October, 1999 - Standards and procedures for the Agency of Natural Resources to acquire lands.

Fish and Wildlife

Vermont hunting, fishing, and trapping regulations.

Wildlife Management Areas Operational Procedures Manual, Vermont Department of Fish and Wildlife - Standards for management of wildlife management areas.

Management Guide for Deer Wintering Areas in Vermont, Fish and Wildlife, 1990 - Standards for managing for deer.

Landowner's Guide to Wildlife Habitat Management, Fish and Wildlife, Fish and Wildlife, 1995 - Standards for managing for a variety of wildlife species on state and private land.

Native Vegetation for Lakeshores, Streamsides and Wetland Buffers, Environmental Conservation, 1994, Standards for buffer strips along lakes, streams and wetlands in Vermont.

Rare and Endangered Species - Listing of species protected under state regulations.

Gravel Pits

Forests, Parks and Recreation Policy #3, 1991 - Standards for use of gravel pits on Forests, Parks and Recreation lands.

Historic and Archaeological Resources

State of Vermont laws, rules, and guidelines applicable to historic and archeological resources, especially 22 V.S.A. 14 and Division for Historic Preservation's *Guidelines for Conducting Archeology in Vermont*, as well as federal laws that apply.

Land Use and Development

Act 250 - Law governing plans for land use and development in Vermont.

Mountain Top Communications Facilities

Siting, Use and Management of Electronic Communication Facilities on Properties Owned by the State of Vermont, Agency of Administration, 1998.

Natural Area Designation

Natural Areas Law and Forests, Parks and Recreation Policy #7 - Standards and guidelines for designation of Natural Areas on state forest and parks lands.

Pesticides Use

Forests, Parks and Recreation Policy #9 - Regulations on the use of pesticides on state forest and parks lands.

Prescribed Fire

Prescribed Burn Directive, Vermont Department of Forests, Parks and Recreation, 1989 - Procedures for planning and execution of prescribed burns.

Recreation

Uses of State Lands, Agency of Natural Resources Policy, 1999 - Criteria for appropriate uses and when permits and licenses are and are not required.

Forests, Parks and Recreation Policies and Procedures Manual, 1990-1999 - Procedures and standards for administering recreational activities on state forests and parks lands.

State Park Ranger's Manual, Forests, Parks and Recreation, 1999 - Operating procedures, rules, regulations, and standards for recreational activity on state forests and parks land.

Scientific Research

Forests, Parks and Recreation policy # 8 - Standards and guidelines for research on state lands.

Silviculture

Silvicultural References Manual, Forests, Parks and Recreation, 1997 - Guidelines for the Intent to Heavy Cut notification process.

Acceptable Management Practices (AMP) Guidelines, 1987 - Practices for maintaining water quality on logging jobs.

Wetlands Regulations, 1990 - Regulations which outline practices for logging around wetlands in Vermont.

Native Vegetation for Lakeshores, Streamsides and Wetland Buffers, Environmental Conservation, 1994 - Standards for buffer strips along lakes, streams and wetlands in Vermont.

Vermont Handbook for Soil Erosion and Sediment Control on Construction Sites, Vermont Department of Environmental Conservation, revised September, 1983.

Vermont Streambank Conservation Manual, Agency of Natural Resources, 1982 - Guidelines for construction around streams.

Water Resources

Acceptable Management Practices (AMP) Guidelines, 1987 - Practices for maintaining water quality on logging jobs in Vermont.

Long Trail Construction and Maintenance Standards, Green Mountain Club, 1995 - Trail construction standards for public and private land.

Native Vegetation for Lakeshores, Streamsides and Wetland Buffers, Environmental Conservation, 1994 - Standards for buffer strips along lakes, streams and wetlands

Vermont Streambank Conservation Manual, Agency of Natural Resources, 1982 - Guidelines for construction around streams.

Vermont Water Quality Standards, Vermont Water Resources Board, 7/2/00.

Vermont Wetland Rules, Vermont Water Resources Board, 1/1/02

F. Glossary

The following is a series of key words and their definitions used in the development of long-range management plans for Vermont Agency of Natural Resource lands.

Acceptable management practices (AMPs). In this plan, a series of erosion control measures for timber harvesting operations, as identified in state statutes. The AMPs are the proper method for the control and dispersal of water collecting on logging roads, skid trails, and log landings to minimize erosion and reduce sediment and temperature changes in streams.

All-aged (Uneven-aged) system. Timber management which produces a stand or forest composed of a variety of ages and sizes. Regeneration cutting methods in this system include single tree selection and group selection.

Basal area. A measure of the density of trees on an area. It is determined by estimating the total cross-sectional area of all trees measured at breast height (4.5 feet) expressed in square feet per acre.

Best management practices. A practice or combination of practices determined to be the most effective and practicable means of preventing negative impacts of silvicultural activities.

Biodiversity. The variety of plants and animals, their genetic variability, their interrelationships, and the biological and physical systems, communities, and landscapes in which they exist.

Biophysical region. A region with shared characteristics of climate, geology, soils, and natural vegetation. There are currently eight biophysical regions recognized in Vermont.

Block. A land management planning unit.

Browse. The part of leaf and twig growth of shrubs, vines, and trees available for animal consumption.

Buffer (Riparian Buffer Zone). The width of land adjacent to streams or lakes between the top of the bank or top of slope or mean water level and the edge of other land uses. Riparian buffer zones are typically undisturbed areas, consisting of trees, shrubs, groundcover plants, duff layer, and a naturally vegetated uneven ground surface, that protect the water body and the adjacent riparian corridor ecosystem from the impact of these land uses.

Canopy. The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth.

Capability. The potential of an area to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity. Capability depends on current conditions and site conditions such as

climate, slope, landform, soils, and geology as well as the application of management practices such as silvicultural protection from fire, insects, and disease.

Cleaning (Weeding). Regulating the composition of a young stand by eliminating some trees and encouraging others, and also freeing seedlings or saplings from competition with ground vegetation, vines, and shrubs.

Clearcutting. A cut which removes all trees from a designated area at one time, for the purpose of creating a new, even-aged stand.

Commercial forest land. Land declared suitable for producing timber crops and not withdrawn from timber production by statute or administrative regulation.

Conservation. The careful protection, planned management, and use of natural resources to prevent their depletion, destruction, or waste.

Conservation easement. Acquisition of some rights on a parcel of land designed to keep the property undeveloped in perpetuity.

Cover. Vegetation which provides concealment and protection to wild animals.

Cultural operation. The manipulation of vegetation to control stand composition or structure, such as site improvement, forest tree improvement, increased regeneration, increased growth, or measures to control insects or disease. Examples of methods used are timber stand improvement, cleaning or weeding, release, and site preparation.

DBH (diameter at breast height). The diameter of the stem of the tree measured at breast height (4.5 feet or 1.37 meters) from the ground.

Deer wintering area. Forest area with at least 70 % conifer that provides suitable, stable habitat to meet deer needs during the winter.

Den tree. A live tree at least 15 inches DBH (diameter at breast height) containing a natural cavity used by wildlife for nesting, brood rearing, hibernating, daily or seasonal shelter, and escape from predators.

Developed (or intensive) recreation. Activities associated with man-made structures and facilities that result in concentrated use of an area. Examples are campgrounds and ski areas.

Diameter at breast height (DBH). The diameter of the stem of the tree measured at breast height (4.5 feet or 1.37 meters) from the ground.

Dispersed recreation. Outdoor recreation activities requiring few, if any, support facilities.

Ecological processes. The relationships between living organisms and their environment. Among these processes are natural disturbances such as periodic fire, flooding, or beaver activity; natural stresses such as disease or insects; catastrophic weather-related events such

as severe storms or lightning strikes; or more subtle ongoing processes such as succession, hydrology, and nutrient cycling.

Ecological reserve. An area of land managed primarily for long-term conservation of biodiversity.

Ecosystem. A complex array of organisms, their natural environment, the interactions between them, the home of all living things, including humans, and the ecological processes that sustain the system.

Ecosystem management. The careful and skillful use of ecological, economic, social, and managerial principles in managing ecosystems to produce, restore, or sustain ecosystem integrity, uses, products, and services over the long-term.

Endangered species. A species listed on the current state or Federal endangered species list (V.S.A. Title 10, chapter 123). Endangered species are those which are in danger of becoming extinct within the foreseeable future throughout all or a significant portion of their range.

Even-aged system. Timber management that produces a forest or stand composed of trees having relatively small differences in age. Regeneration cutting methods in this system include clearcutting, seed tree (seed cut) method, and shelterwood method.

Forest health. Condition in which forest ecosystems sustain their complexity, diversity, resiliency, and productivity.

Forest type. A natural group or association of different species of trees which commonly occur together over a large area. Forest types are defined and named after the one or more dominant species of trees, such as the spruce-fir and the birch-beech-maple types.

Forestry. The art and science of growing and managing forests and forest lands for the continuing use of their resources.

Fragmentation. Division of a large forested area into smaller patches separated by areas converted to a different land use.

Game species. Animals habitually hunted for food, particular products, sport, or trophies.

Geographic Information Systems. A computer-based means of mapping lands and resources and communicating values associated with them (GIS).

Green certification. A process, sponsored by several international organizations, that promotes sustainable forest management practices, providing a marketplace identify for forest products certified to have been grown and manufactured in a sustainable manner.

Group Selection. The removal of small groups of trees to meet a predetermined goal of size, distribution, and species.

Habitat. A place that provides seasonal or year round food, water, shelter, or other environmental conditions for an organism, community, or population of plants or animals.

Hardwood. A broad leaved, flowering tree, as distinguished from a conifer. Trees belonging to the botanical group of angiospermae.

Healthy ecosystem. An ecosystem in which structure and functions allow the maintenance of the desired conditions of biological diversity, biotic integrity, and ecological processes over time.

Heritage Sites. Sites identified by the Vermont Nongame and Natural Heritage Program of the Department of Fish and Wildlife, which have rare, threatened, or endangered species of plants or animals. Heritage sites are identified using a common standards-based methodology, which provides a scientific and universally applicable set of procedures for identifying, inventorying, and mapping these species.

Intensive (or developed) recreation. Outdoor recreation activities requiring major structures and facilities.

Interior dependent species. Those wildlife species that depend on large unbroken tracts of forest land for breeding and long term survival. The term is also often used in conjunction with neotropical migratory bird species requiring large patches of fairly homogeneous habitat for population viability.

Intermediate treatment. Any treatment or tending designed to enhance growth, quality vigor, and composition of the stand after its establishment or regeneration and prior to the final harvest.

Land conservation. The acquisition or protection through easements of land for wildlife habitat, developed state parks, and working forests.

Landscape. A heterogeneous area of land containing groups of natural communities and clusters of interacting ecosystems. These can be of widely varying scales but normally include a range of elevations, bedrock, and soils.

Mast. The fruit (including nuts) of such plants as oaks, beech, hickories, dogwood, blueberry, and grape, used for food by certain wildlife species.

Motorized use. Land uses requiring or largely dependent on motor vehicles and roads.

Multiple-use forestry. Any practice of forestry fulfilling two or more objectives of management, more particularly in forest utilization (e.g. production of both wood products and deer browse).

Multiple-use management. An onsite management strategy that encourages a complementary mix of several uses on a parcel of land or water within a larger geographic area.

Native (species). A plant or animal indigenous to a particular locality.

Natural Area. Limited areas of land, designated by Vermont statute, which have retained their wilderness character, although not necessarily completely natural and undisturbed, or have rare or vanishing species of plant or animal life or similar features of interest which are worthy of preservation for the use of present and future residents of the state. They may include unique ecological, geological, scenic, and contemplative recreational areas on state lands.

Natural community. An assemblage of plants and animals that is found recurring across the landscape under similar environmental conditions, where natural processes, rather than human disturbances, prevail.

Nongame species. Animal species that are not hunted, fished, or trapped in this state. This classification is determined by the state legislature.

Northern hardwood. Primarily sugar maple, yellow birch, and beech. May include red maple, white ash, white birch, black cherry, red spruce, and hemlock.

Old growth forest. A forest stand in which natural processes and succession have occurred over a long period of time relatively undisturbed by human intervention.

Outdoor recreation. Leisure time activities that occur outdoors or utilize an outdoor area or facility.

Overstory. That portion of the trees, in a forest of more than one story, forming the upper or upper-most canopy layer.

Pole. A tree of a size between a sapling and a mature tree.

Pole timber. As used in timber survey, a size class definition; trees 5.0 to 8.9 inches (varies by species) at DBH. As used in logging operations, trees from which pole products are produced, such as telephone poles, pilings, etc.

Regeneration treatment (harvest cut). Trees are removed from the stand to create conditions that will allow the forest to renew or reproduce itself. This is accomplished under either an even-aged management system or an uneven-aged management system.

The four basic methods used to regenerate a forest are clearcutting, seed-tree, shelterwood, and selection (group selection or single tree selection).

Regeneration methods. Timber management practices employed to either regenerate a new stand (regeneration cutting) or to improve the composition and increase the growth of the existing forest (intermediate treatment).

Regulated Hunting/Fishing/Trapping. The harvest of wildlife under regulations stipulating setting of seasons, time frame of lawful harvest, open and closed zones, methods of take, bag limits, possession limits, and reporting or tagging of species.

Release (release operation). The freeing of well-established cover trees, usually large seedlings or saplings, from closely surrounding growth.

Removal cut. The final cut of the shelterwood system that removes the remaining mature trees, completely releasing the young stand. An even-aged stand results.

Salvage Cutting. The removal of dead, dying, and damaged trees after a natural disaster such as fire, insect or disease attack, or wind or ice storm to utilize the wood before it rots.

Sanitation cutting. The removal of dead, damaged, or susceptible trees to improve stand health by stopping or reducing the spread of insects or disease.

Sapling. As used in timber surveys, a size class definition. A usually young tree larger than seedling but smaller than pole, often 1.0 to 4.9 inches at DBH.

Seedling. A very young plant that grew from a seed.

Seed-Tree (Seed Cut) method. The removal of most of the trees in one cut, leaving a few scattered trees of desired species to serve as a seed source to reforest the area.

Shelterwood method. A series of two or three cuttings which open the stand and stimulate natural reproduction. A two cutting series has a seed cut and a removal cut, while a three cutting series has a preparatory cut, a seed cut, and a removal cut.

Silvicultural systems. A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the fellings that remove the mature crop and provide for regeneration and according to the type of forest thereby produced.

Single tree selection method. Individual trees of all size classes are removed more or less uniformly throughout the stand to promote growth of remaining trees and to provide space for regeneration.

Site Preparation. Hand or mechanical manipulation of a site, designed to enhance the success of regeneration.

Snag. Includes standing dead or partially dead trees that are at least 6 inches in diameter at breast height (DBH) and 20 feet tall.

Softwood. A coniferous tree. Softwood trees belong to the botanical group *gymnospermae*, including balsam fir, red spruce, and hemlock.

Stand improvement. An intermediate treatment made to improve the composition, structure, condition, health, and growth of even or uneven-aged stands.

Stewardship. Caring for land and associated resources with consideration to future generations.

Sustainability. The production and use of resources to meet the needs of present generations without compromising the ability of future generations to meet their needs.

Sustained yield. The yield that a forest can produce continuously at a given intensity of management.

Thinning. Removing some of the trees in a dense immature stand primarily to improve the growth rate and form of the remaining trees and enhance forest health.

Threatened species. A species listed on the state or Federal threatened species list. Threatened species are those likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Timber lands. Properties that are managed primarily for the maximum production of forest products.

Timber Stand Improvement. Activities conducted in young stands of timber to improve growth rate and form of the remaining trees.

Traditional uses. Those uses of the forest that have characterized the general area in the recent past and present, including an integrated mix of timber and forest products harvesting, outdoor recreation, and recreation camps or residences.

Uneven-aged (All-aged) system. Timber management which produces a stand or forest composed of a variety of ages and sizes. Regeneration cutting methods in this system include single tree selection and group selection.

Watershed. The geographic area within which water drains into a particular river, stream, or body of water. A watershed includes both the land and the body of water into which the land drains.

Weeding (cleaning). Regulating the composition of a young stand by eliminating some trees and encouraging others, and also freeing seedlings or saplings from competition with ground vegetation, vines, and shrubs.

Wilderness. Areas having pristine and natural characteristics, typically roadless and often with some limits on uses. (This is not the federal definition of wilderness.)

Wildlife habitat. Lands supplying a critical habitat need for any species of wildlife, especially that which requires specific treatment and is of limited acreage.

Working forest. Land primarily used for forestry purposes but also available for recreation, usually where both managed land and land not presently being managed is present.

Working landscape. A landscape dominated by land used for agricultural and/or forestry purposes.