

## **VII. APPENDIX**

- A. Densmore Hill Topo Map
- B. Densmore Hill Orthophoto
- C. Chain of Title
- D. Public Input – Response to Comments
- E. Authorization to Plan and Manage
- F. Summary of Some Policies and Guidelines
- G. Glossary
- H. Forest Stand Inventory Data and Forest Stand Map
- I. Ecological Assessment

**APPENDIX A. Densmore More Hill Topo Map.**

**APPENDIX B. Densmore Hill Orthophoto.**

## APPENDIX C. Chain of Title

*An approximate chain of title for Densmore Hill WMA*

<b>Grantee</b>	<b>Year</b>	<b>Book/Page</b>	<b>Grantor</b>
S. Perkins	1816	8/22	Isaac Cobb
I. Kendall	1832	12/53	Isaac Cobb
J. Wilder	1834	12/60	Isaac Cobb
Cobb Estate	1843	15/140	Abigail G. Weed & others
Abigail G. Weed	1849	27/263	Abigail Weed
Heirs of Abigail MacKenzie	1900	35/265	Daniel & Frank Cody
<b><i>above represents 111 acre Cobb Place</i></b>			
Alvin Dutton	1845	14/290	Sullivan Cady (140 acres)
S. Cady Estate	1878	23/25	Daniel & Frank Cady
Cobb Place	1900	35/265	Daniel & Frank Cady
Kendall Farm	1900	35/265	Daniel & Frank Cady (88 acres)
Frank Cady Estate	1936		Merton Lewis
Flora Lewis (widow of Merton Lewis)	1940		A. Robinson & Francis McEwen
Richard & Dorothy Fowler		38/127	A. Robinson & Francis McEwen (64 acres)
McEwen Estate	1957	52/269-275	Margaret Finney & others
McEwen heirs		52/493-501	W. & Elizabeth Peabody
Peabody	1975		The Nature Conservancy
The Nature Conservancy	1977	53/31	State of Vermont Department of Fish & Wildlife (252 acres)

**APPENDIX D. Public Input  
Response to Comments**

# APPENDIX E.

## 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.

**APPENDIX F.**  
**Summary of Some Policies and Guidelines**  
**Used in the Management of**  
**Vermont Agency of Natural Resources Lands**

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 management plan. 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.

WMAs 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, Streamsidings 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 VSA 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, Streambanks 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

## **APPENDIX G.**

### **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 percent 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 (VSA 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.

# APPENDIX H.

## Forest Stand Information Management Unit: Densmore Hill WMA Forex Inventory Summary, 2002

Stand	Acres	MSD	BA/A* Total	Acc. BA/A**	Unacc. / BA/A**	Cull BA/A**	Tim- ber Type	Species % BA	Opera- bility
1	46	10.9	81	71	26	12	25	beech 26 sugar maple 22 hemlock 20	good
2	36	9.4	85	57	15	26	25	sugar maple 42 white ash 20	good
4	19	9.4	76	60	26	8	25	paper birch 51 sugar maple 15 white pine 11	good
5	38	7.2	83	81	25	10	25	sugar maple 76	fair
6	55	11.3	96	79	20	11	25	sugar maple 52 yellow birch/beech 30	fair
7	7	3.4	65	60	5	0	25	white ash 30 pin cherry 15 sugar maple 15	good
9	30	8.6	80	65	43	1	11	sugar maple 30 paper birch 25	non- commercial, steep
10	21	11.0	106	100	37	7	25	white ash 30 sugar maple 20	fair

\* total basal area  
dominant-codominant

\*\* acceptable, unacceptable & cull, all canopy positions

## Densmore Hill WMA Timber Volumes /Acre

Species	Stand								% BA
	1	2	4	5	6	7	9	10	
Eastern Hemlock	943		39	110	148		39	243	6.0
White Pine	312	478	201					48	4.1
Red Spruce	50								0.1
White Ash	105	734	164	216	253	215	273	634	10.2
American Beech	1196	183	121	163	852		429		11.6
White Birch	575	439	970	273	253	53	741	98	13.5
Yellow Birch					852	107	195	147	5.1
Red Maple	50	36					78		0.6
Sugar Maple	993	1504	283	2876	2898	161	888	438	39.4
Elm								48	0.1
Red Oak	211								0.8
Hardhack	156		39	53	253		195	147	3.3
Basswood		111							0.4
Black Cherry		72	53					48	0.6
Pin Cherry		36				23.1			0.09
Aspen		81	53				156	243	2.1
<b>Totals</b>	<b>3,768</b>	<b>1,539</b>	<b>1,516</b>	<b>1,397</b>	<b>3,892</b>	<b>363</b>	<b>1,542</b>	<b>3,521</b>	

## [Forest Stand Map]

# APPENDIX I.

## **ECOLOGICAL ASSESSMENT**

Agency of Natural Resources land managers use the “coarse filter/fine filter” approach to conduct 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 inventory 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 the wintering areas, and rare plants.

The coarse filter assessment begins by describing landscape and climatic factors that characterize Densmore Hill WMA, such as bedrock geology and water resources. It then details the eight 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**

Vermont can be divided into eight biophysical regions that share features of climate, topography, geology, human history, and natural communities. Densmore Hill WMA is located in the Southern Vermont Piedmont biophysical region, which encompasses the eastern margin of the state from Guilford and Vernon on the Massachusetts border as far north as Randolph, Tunbridge, and Strafford (with a narrow extension as far north as Barnet along the Connecticut River). This is an area of relatively low elevations and mild climate. Elevations average about 1000’ above sea level, with much lower elevation along the rivers, and a few spots above 2000’, such as Mount Ascutney. Annual precipitation is about 42”, a good deal more than that received by the Champlain Valley, but much drier than the upper elevations of the Green Mountains. Although many types of bedrock are found here, the majority of the biophysical region (including Densmore Hill WMA) features metamorphosed limestones. Soils are mostly derived from glacial tills, but glacial outwash silts, sands, and clays are abundant in valleys, many of them making prime agricultural soils.

## **Bedrock, Surficial Geology Soils**

Bedrock at Densmore Hill WMA is of the Waits River formation. This formation is characterized by metamorphosed gray quartzose and micaceous crystalline limestone. Limestone is high in calcium carbonate, which weathers and breaks down easily. The addition of calcium and other positively charged ions to the soils and surface water contribute to the creation of 'sweet' or fertile soils. In areas with limy bedrock, groundwater seepage may greatly enrich soils and increase productivity.

At the end of the last ice age, melting glacial ice deposited a blanket of unsorted clay, silt, sand, and gravel over these rocks. This material, known as glacial till, forms the basis of nearly all the soils on the WMA. These soils are primarily of the Vershire, Dummerston, Glover, Teago, and Pomfret complexes. They are mainly sandy and silty loams, and tend to be very stony. Soil depth is usually at least 10", and in many areas, is greater than 60". These soils tend to be sloped, have low water tables, and be moderately well drained. The zone of nutrient-rich organic material near the surface is well developed, particularly at the base of slopes. These are generally productive forest soils. Approximately 20 acres are recognized as outstanding (designated "prime" and "statewide" by the Natural Resources Conservation Service) agricultural soils. These soils of highest productivity are found along Cady Brook and on the plateau near the height of land.

The beaver wetland along Cady Brook is the only area where soils are composed primarily of recently deposited organic material rather than glacial till. This deep, permanently saturated soil is known as Pondicherry and Wonsqueak Muck.

Soils on the WMA have a long history of human use. Much of the upper elevation areas were cleared for sheep pasturing in the 19<sup>th</sup> century. Pastures were cleared of many tons of rocks, which now form walls, sheep paddocks, and foundations in the woods. Some of the land along Cady Brook was probably tilled for row crops, or at least for small scale gardening around the homestead site.

## **Hydrology**

Most of the waters of Densmore Hill WMA leave the parcel in the headwaters of Cady Brook, either through the main stem, which originates near the parking kiosk, or a secondary permanent stream that flows southeast out of the cove at the heart of the property. Cady Brook joins Lull Brook in Hartland, which soon ends at the Connecticut River. A small area of the parcel on the northeast side of Scott Hill sheds its water to Densmore Brook, which also flows into Lull Brook. A small area at the north end of the parcel drains north to Kedron Brook, which joins the Ottauquechee River at Woodstock Village. This water also joins the Connecticut River in Hartland.

At the headwaters of these streams are small springs and seeps. The assemblage of wetland vegetation that inhabits these important wildlife habitats is described below. The parcel features a single wetland, the series of beaver impoundments on the main stem of Cady Brook.

## Natural Communities

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 (2005) 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 is an example of a matrix community found at Densmore Hill WMA. Large patch communities typically occur at scales of 10-100 acres, and are structured by local bedrock, geological, and topographic factors. Rich northern hardwood forest is a characteristic large-patch natural community of the WMA. Small patch communities are usually less than 10 acres in size, and owe their existence to highly localized site and disturbance characteristics. Local hydrology and topography combine to produce seeps, a small patch community found here.

Eight occurrences of eight natural community types were identified and mapped at Densmore Hill WMA. A total of 15 natural community polygons and one open water polygon 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 (GPS) unit, clinometer, compass, binoculars, soil augur, Cornell pH kit, and a variety of reference manuals for identification of plants, animals, fungi, etc. Plant specimens were collected for identification in the lab. A Geographic Information System (GIS) map of natural communities was produced using ArcView software. Because some natural communities occur at very small scales (e.g., less than ¼ 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 Densmore Hill WMA; instead, it should be treated as a first attempt at describing natural communities in this area. Land manager and members of the public should be aware that additional examples of small natural communities (e.g., vernal pools and seeps) probably occur on the WMA. 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 Densmore Hill WMA. A quality rank (A through D) for each natural community occurrence is given. Quality ranks are objectively assigned on the basis of three factors: occurrence size, current condition, and landscape context. The three factors vary in the degree to which they influence overall quality in different communities. For example, size and landscape quality are more important factors than current condition in the quality ranking of northern hardwood forests, while current condition and landscape context receive greater attention in the ranking of rich northern hardwood forests. 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. It is important to recognize that assignment of low quality ranks may be due to small size rather than poor current condition.

When community occurrences are either rare or of high quality (or a combination of these factors), they may be designated as being of statewide significance. This designation is applied according to objective guidelines established by the Vermont Nongame and Natural Heritage Program, which are available upon request. It is recommended that state significant natural communities be afforded a higher level of protection than other areas. No state-significant natural communities were documented in this inventory. Detailed descriptions of Vermont's natural community types may be found in *Wetland, Woodland, Wildland: A Guide to Natural Communities of Vermont* (Thompson and Sorenson 2005). Additional information may also be found in the glossary (Appendix G).

### **Northern Hardwood Forest**

Two polygons totaling 118 acres form a single occurrence of this common forest type on the parcel. Most of this area is found on moderately well-drained hillsides featuring rocky till soils. All of this forest was cleared for agriculture, and there is abundant sign of these activities, including stone walls and corrals. Vegetation in this community varies with aspect, stand age, land use history, and other factors. Typically, a canopy tree height is about 50', and canopy closure averages at 80-85%. Most common canopy trees are white pine, sugar maple, paper birch, and American beech. Less common in the canopy are red oak, white ash, quaking aspen, and big-tooth aspen. (For scientific names of plants, see list below). In some areas, a 35-40' subcanopy of American beech and hophornbeam is present. A moderately well-developed tall (10-20') shrub layer averages 35% cover, and features American beech, hophornbeam, red oak, and occasionally eastern hemlock. The short (3-8') shrub layer features saplings of the same trees, as well as Japanese barberry and striped maple. Characteristic herbs are club mosses, intermediate woodfern, marginal woodfern, early yellow violet, red raspberry, purple-flowering raspberry, bedstraw, Indian pipe, calico aster, blue-stemmed goldenrod, rattlesnake-plantain, Solomon's seal, wild oats, and normal sedge.

The hardwood forest around the unnamed 1,524' peak southwest of Scott Hill is dominated by large diameter sugar maples, some greater than 34" in diameter. Trees with cavities, large diameter snags, and rotting logs are more prevalent here. There is a sparse understory of sugar maple and hophornbeam saplings, and very little beech is present. The site contains more herbs characteristic of rich woods, including white baneberry and plantain-leaved sedge. It resembles an old sugar bush, and may have been managed as such.

The hardwood forest on steep facing slopes above Cady Brook has characteristics of a Dry Oak-Hickory-Hophornbeam Forest (see Thompson and Sorenson 2005), including a short tree canopy dominated by hophornbeam, more light penetration to the dry forest floor, and herbs such as Pennsylvania sedge in the understory. It is likely that in time, this stand will come to more closely resemble the typical northern hardwood forest described above.

The northern hardwood forest occurrence at Densmore Hill WMA has a "C" quality rank (Size=C; landscape condition=B/C; and current condition=B). In an ecological sense, the occurrence extends off of state land and is much larger; the quality rank would be "B" if ranking considered the privately owned portion of the occurrence.

## **Hemlock Forest**

A five-acre Hemlock Forest was mapped near the northwest corner of the parcel. The slope is steep and faces west-northwest. Soils are rocky basal glacial tills of the Teago-Pomfret and Vershire-Dummerston complexes. A largely single-age canopy tree layer is 50-55' tall with more than 95% cover. Eastern hemlock accounts for nearly all of the canopy, although paper birch and American beech are scattered throughout the stand. Very few shrubs are present, and the forest floor is nearly absent of vegetation. Without management, the long-lived and shade tolerant hemlocks will continue to be the dominant plant in the forest, with hardwoods establishing only in treefall gaps. This forest grades into the surrounding Hemlock-Northern Hardwood Forest, where conditions are more favorable to establishment of hardwood trees. At five acres this is a relatively small Hemlock Forest. It has a "C" quality rank.

## **Hemlock-Northern Hardwood Forest**

Eleven acres of this mixed forest type occur on the west- and northwest-facing slopes above Folding Hills Road. The rocky, well-drained soils have a sandy texture, and are derived from glacial tills. Canopy trees are 40-50' tall, with about 85% cover. Like the hemlock forest described above, this is primarily an even-aged forest. Scattered stumps are evidence of past thinning. Eastern hemlock accounts for about 25% of the forest canopy cover. American beech is the most common tree; other trees present include red spruce, white pine, red maple, paper birch, big-toothed aspen, and sugar maple. A sparse layer is occupied primarily by saplings of these tree species. Herbs are more abundant than in the adjacent hemlock forest. The most common species are club mosses, partridge berry, beech drops, common speedwell, and pipsissewa. Mosses are abundant in places. This is a small hemlock-northern hardwood forest relative to others in the area. It has a "C" quality rank.

## **Rich Northern Hardwood Forest**

This 60-acre community accounts for some of the highest quality forest on the parcel. Two polygons of rich hardwood forest were mapped, one on steep northeast-facing slopes south of Cady Brook, the other in and around the cover in the center of the WMA. These two patches of forest are considered one ecological occurrence. Like other rich northern hardwood forests, this one features mineral rich, mesic soils, high levels of plant diversity, and tall, vigorous canopy trees. The layer of organic material in the upper soil horizon is a deep (i.e., 3-5") humus. The soil is enriched by a combination of factors, including weathering of calcium-rich bedrock outcrops, groundwater discharge, and downslope movement and accumulation of organic matter on the forest floor. The tree canopy is about 70' tall, with more than 75% cover. Most common trees are sugar maple, basswood, and white ash. Also present are yellow birch, red oak, and eastern hemlock. In places, a subcanopy of 50-60' tall trees is present; species composition of this vegetation layer is similar to that of the main canopy. The herb layer is well developed and diverse. Among the most common plants here are marginal woodfern, maidenhair fern, blue cohosh, wild ginger, white baneberry, herb robert, blue-stemmed goldenrod, white boneset, and plantain-leaved sedge. Mosses may be abundant, particularly on wet bedrock outcrops.

This community features the best site conditions for tree growth on the WMA. It includes some of the oldest, least disturbed forest. It also includes six acres of young thickets resulting from clearcutting around 1985. While these cuts created ideal habitat for many species of wildlife, they may have been negative impacts on other aspects of forest ecology. The rich northern hardwood forest has a "C" quality rank, but would be ranked "B" without the fragmentation causing by this cutting.

## **Red Oak-Northern Hardwood Forest**

One small (3.5 acre) area of this forest type was identified in the northwest corner of the parcel. Soils are dry, very rocky, and somewhat shallow, with bedrock outcrops common. A 3" organic horizon was observed; it is markedly drier than that sampled in the adjacent rich northern hardwood forest. Tree canopy is about 50' tall, with less cover (no more than 70%) than the other hardwood forest types described here. Red oak is the most common tree; other species noted include sugar maple, white ash, American beech, and eastern hemlock. Hophornbeam is very common, but mostly in a subcanopy layer about 30-40' tall. Red oak was the only tree observed in the very sparse tall (8-15') shrub layer. Herbs observed include marginal woodfern, intermediate woodfern, wild licorice, blue-stemmed goldenrod, white whorled aster, and a sedge (probably Pennsylvania sedge). This forest has a relatively low ("C") quality rank due to its small size.

## **Seep**

Five seeps totaling three acres were mapped. Due to their close proximity and shared hydrology, they are considered a single ecological occurrence. These are small wetlands created by a near continuous influx of groundwater. The soils are mucky and saturated, with as much as 5" of organic material near the surface, and a gravelly silt loam below. Tree canopy cover is sparse, but some of the seeps are shaded by adjacent forest. Scattered trees in the seeps include basswood, white ash, yellow birch, slippery elm, and apple. A tall shrub layer (8-15') is present in some of the seeps, and contains alternate-leaved dogwood, Morrow's honeysuckle, and willow. Herbs may cover nearly 100% of the ground, particularly at the height of the growing season. Most common species include horsetail, rested fern, sensitive fern, ostrich fern, marsh fern, Christmas fern, golden saxifrage, marsh bedstraw, spotted touch-me-not, herb robert, asters, goldenrods, and sedges. Common nightshade, a weed, was present in several areas. These seeps produce green vegetation nearly all year long, and evidence of feeding by animals was observed in a late winter site visit. They may be a critical habitat feature for herbivores, especially near the end of winter.

These seeps appear to have been impacted by the timber harvest activities in the 1980s. Several are close to the truck road and patch cuts. Groundwater discharge appears to have been affected, and weeds were noted. This natural community is ranked "B/C".

## **Beaver Wetland**

A colony of beavers has dammed the main stem of Cady Brook along Folding Hills Road, creating a series of ponds and small wetlands. Like other beaver wetlands, this one contains a number of distinctive and transitional wetland natural community types. Because beavers come and go (e.g., wetlands are not depicted on the most recent United States Geological Survey topographic maps for the area), the wetlands associated with them are usually inventoried and described collectively under the general name "beaver wetland." At Densmore Hill WMA, the beaver wetland most closely resembles shallow emergent marsh, shrub swamp, and cattail marsh (see Thompson and Sorenson 2005 for descriptions). Common shrubs here are red-osier dogwood, steplebush, and willows. Herbs noted include broad-leaved cattail, sensitive fern, joe-pye weed, and sedges. Several non-native weeds were observed in the wetland, including reed canary grass and glossy buckthorn. Adjacent to the wetland is a thicket of hardwood samplings and stump sprouts resulting from the beavers' harvest of trees from that area. Beaver wetlands

provide habitat for a variety of wildlife species, and while small, this one is an important contribution to the WMA in that respect.

## **Literature Cited**

Thompson, E.H. and E.R. Sorenson. 2005. Wetland, Woodland, Wildland. A guide to the natural communities of Vermont. University Press of New England, Hanover, NH.

## 2) **Fine Filter Assessment**

### **Rare, Threatened, and Endangered Species**

There are no known examples of rare, threatened, or endangered species on this parcel.

### **Exotic Species**

Introduced plant species, some of them invasive, are established on the parcel. The most significant threat to native species and communities is posed by exotic shrubs, including glossy buckthorn, Morrow's honeysuckle, and Japanese barberry. The densest thickets of these plants are associated with the old foundation near the beaver wetland. They are also scattered elsewhere on the parcel. These shrubs have the potential to choke out native vegetation, especially after ground disturbance and opening of the forest canopy during timber harvest. For this reason, land managers should consider control measures both before and after timber sales. Another exotic plant of concern is goutweed, which was found in the kiosk parking area and along Cady Brook. This ornamental garden plant occurs in both its green- and variegated-leaf varieties at the WMA. The green variety is a noted invader of forest understories in Vermont, and can completely out-compete other vegetation. Land managers should consider eradicating goutweed during the life of this management plan. A third weed that might warrant eradication efforts is reed canary grass, found in the beaver wetland. This non-native plant can form dense clones and exclude all other wetland vegetation.

Other exotic plants found primarily in association with the old foundation are periwinkle and apple. Dandelions, burdock, and common speedwell are found in relatively undisturbed areas of the WMA, but do not seem to be causing problems for native vegetation. Many weedy plants were observed along the roads in the WMA, including mullein, ox-eye daisy, self-heal, St. John's wort, and smooth brome grass.

## Plants Described in the Text

American beech	<i>Fagus grandifolia</i>	normal sedge	<i>Carex normalis</i>
apple	<i>Pyrus malus</i>	ostrich fern	<i>Matteuccia struthiopteris</i>
aster	<i>Aster</i> species	ox-eye daisy	<i>Chrysanthemum leucanthemum</i>
basswood	<i>Tilia americana</i>	paper birch	<i>Betula papyrifera</i>
bedstraw	<i>Galium</i> species	partridge berry	<i>Mitchella repens</i>
beech drops	<i>Epifagus virginiana</i>	Pennsylvania sedge	<i>Carex pensylvanica</i>
big-toothed aspen	<i>Populus grandidentata</i>	periwinkle	<i>Vinca minor</i>
blue cohosh	<i>Caulophyllum thalictroides</i>	pipsissewa	<i>Chimaphila umbellata</i>
blue-stemmed goldenrod	<i>Solidago caesia</i>	plantain-leaved sedge	<i>Carex plantaginea</i>
broad-leaved cattail	<i>Typha latifolia</i>	purple-flowering raspberry	<i>Rubus odorata</i>
burdock	<i>Arctium</i> species	quaking aspen	<i>Populus tremuloides</i>
calico aster	<i>Aster ptarmicoides</i>	red oak	<i>Quercus rubra</i>
Christmas fern	<i>Polystichum acrostichoides</i>	Red-osier dogwood	<i>Cornus stolonifera</i>
club moss	<i>Lycopodium</i> species	red raspberry	<i>Rubus idaeus</i>
common nightshade	<i>Solanum dulcamara</i>	reed canary grass	<i>Phalaris arundinacea</i>
common speedwell	<i>Veronica officinalis</i>	reed canary grass	<i>Phalaris arundinacea</i>
crested woodfern	<i>Dryopteris cristata</i>	sedge	<i>Carex</i> species
dandelion	<i>Taraxacum officinalis</i>	self-heal	<i>Prunella vulgaris</i>
rattlesnake-plantain	<i>Goodyera pubescens</i>	slippery elm	<i>Ulmus rubra</i>
early yellow violet	<i>Viola rotundifolia</i>	smooth brome	<i>Bromus inermis</i>
Eastern hemlock	<i>Tsuga canadensis</i>	Solomon's seal	<i>Polygonatum pubescens</i>
glossy buckthorn	<i>Rhamnus cathartica</i>	spotted touch-me-not	<i>Impatiens capensis</i>
golden saxifrage	<i>Chrysosplenium americanum</i>	St. John's wort	<i>Hypericum perforatum</i>
goldenrod	<i>Solidago</i> species	steeplebush	<i>Spiraea tomentosa</i>
goutweed	<i>Aegopodium podagraria</i>	striped maple	<i>Acer pensylvanicum</i>
herb robert	<i>Geranium robertianum</i>	sugar maple	<i>Acer saccharum</i>
hophornbeam	<i>Ostrya virginiana</i>	white ash	<i>Fraxinus americana</i>
horsetail	<i>Equisetum</i> species	white baneberry	<i>Actaea alba</i>
Indian pipe	<i>Monotropa uniflora</i>	white boneset	<i>Eupatorium rugosum</i>
intermediate woodfern	<i>Dryopteris intermedia</i>	white pine	<i>Pinus strobus</i>
Japanese barberry	<i>Berberis thunbergii</i>	whorled aster	<i>Aster acuminatus</i>
joe-pye weed	<i>Eupatorium maculatum</i>	wild ginger	<i>Asarum canadense</i>
maidenhair fern	<i>Adiantum pedatum</i>	wild licorice	<i>Galium circaezans</i>
marginal woodfern	<i>Dryopteris marginalis</i>	wild oats	<i>Uvularia sessilifolia</i>
marsh bedstraw	<i>Galium palustre</i>	willow	<i>Salix</i> species
marsh fern	<i>Thelypteris palustris</i>	yellow birch	<i>Betula allegheniensis</i>
Morrow's honeysuckle	<i>Lonicera morrowii</i>		
mullein	<i>Verbascum thlaspi</i>		