



# FOREST MANAGEMENT PLAN

*for the*

## ***NorthWoods Stewardship Center***

*P.O. Box 220, East Charleston VT 05833*

*(802)723-6551*



*and its 1,475.5-acre property located at 154 Leadership Drive*

## **Charleston/Morgan Orleans County, Vermont**

*Prepared by*

Jayson Benoit & Sam Perron  
NorthWoods Stewardship Center  
P.O. Box 220, East Charleston Vermont 05833  
802-723-6551 x113

**Plan Start / End Dates**

**4/1/2015- 4/1/2025**

\_\_\_\_\_  
Jayson Benoit, Forest Manager/ Operations Director      Date

*Approved for Use Value Appraisal by:*

*Approved for EQIP program by:*

\_\_\_\_\_  
Jared Nunery (*County Forester*)      Date

\_\_\_\_\_  
David Birdsall (*NRCS- TSP*)      Date



## INTRODUCTION

This document summarizes the natural and cultural features of land owned by the NorthWoods Stewardship Center and serves as a guide for the sustainable management and protection of this land over the coming decade (2015-2025). The plan addresses enrollment requirements for Vermont's Use Value Appraisal program, and for the USDA Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP), which has provided funds for its completion. The plan also serves as a required ten-year plan update for the Vermont Land Trust, which holds a conservation easement over much of the acreage.

The current ownership of the NorthWoods Stewardship Center includes two non-adjacent parcels located in the town of Charleston, Vermont and a 1,423.2 acre property (known as the "Tripp Hill Parcel") that straddles the Charleston /Morgan town line. The most easterly of the two smaller parcels (also known as the "Main Campus") is 40.6 acres and includes the Center's main public facility, as well as staff cabins, a woodshop, and a ropes course. A second, 11.8-acre parcel (the "Clyde River parcel") is located approximately 1.4 miles west of the main campus, at the intersection of VT-105 and the Clyde River, and is primarily shrubby riparian land. This property was donated to NorthWoods in 2014 by Jonathan Larsen, Susan Larsen, Kenneth Wyman, and Calvin Preston. Most of the large parcel was donated to NorthWoods by board member Lydia Spitzer in 2008. In honor of this donation, the entire ownership was named the Spitzer Demonstration Forest in 2012, reflecting the goal and intention of NorthWoods to model and teach sustainable forestry here as part of its overall mission of *connecting people and place through science, education, and action*.

As a non-profit organization dedicated to teaching and conservation work, the NorthWoods Stewardship Center brings a diverse and somewhat unique set of management goals as a landowner. Most unique among these is the desire to utilize the site as a powerful educational tool, incorporating hands-on activities such as forest research, demonstration of sustainable forest management, school outings, and recreational opportunities.

Above all, the NorthWoods Stewardship Center intends to improve the health, resilience and productivity of the parcel's forests during its ownership tenure. The primary goal of this plan is to assist in that effort through specific short (ten year) and longer-term management recommendations that draw upon current conditions on the ground, the histories of these parcels, and the needs and priorities of NorthWoods.

With enrollment in UVA come several ongoing responsibilities:

- 1) Completing management activities as outlined in this plan and summarized in the management schedule, within three years of the scheduled date.
- 2) Adhering to the standards outlined in the booklet "*Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont*", which were created to control stream siltation and soil erosion. A link to this guide is provided on page 10 and foresters and loggers should also be familiar with its content.
- 3) Submitting a *Forest Management Activity Report* to the county forester by February 1<sup>st</sup> to report forest management activities completed within the preceding 12 months.

- 4) If ownership of the parcel changes (acreage, those holding title, etc), notifying UVA **within 30 days of the transfer** by submitting a *new UVA application* form.
- 5) And submitting, in the case of parcel subdivision or development within the enrolled area, a *Notice of Development or Discontinuance From Land Use Value Appraisal Program*. Note that development or subdivision may result in an obligation to remove impacted acreage from the program and pay a land use change tax.

Guidance is available from the Orleans County Forester Jared Nunery (802) 751-0119, or the Use Value Appraisal office (802) 828-5860. Questions about federal conservation programs such as EQIP should be directed to the Newport NRCS office (802) 334-8325. Questions about the Vermont Land Trust and issues regarding forestry and the NorthWoods conservation easement can be directed to VLT Stewardship Forester Dan Kilborn at (802) 745-6303.

# TABLE OF CONTENTS

<b>Management Goals and Objectives.....</b>	<b>5</b>
<b>I. Property Summary.....</b>	<b>9</b>
<b>II. Parcel Resource Information</b>	
Overview.....	9
Geology and Soils.....	10
Hydrology.....	12
Recreation/ Aesthetics.....	13
History and Cultural Resources.....	13
Important Natural Features and Rare Species/ Natural Communities.....	15
Current Condition and Management Priorities.....	18
<b>Management Schedule (2015-2025).....</b>	<b>19</b>
<b>Recommended NRCS Practices Summary.....</b>	<b>20</b>
<b>III. Stand Description and Treatment Plan</b>	
<b>Stand 1 – <i>Excluded</i> Pine/ Norway Spruce Plantation.....</b>	<b>21</b>
<b>Stand 2 – <i>Excluded</i> Mixed Forest.....</b>	<b>29</b>
<b>Stand 3 – Mixed Forest.....</b>	<b>35</b>
<b>Stand 4 – Northern Hardwood Forest.....</b>	<b>41</b>
<b>Stand 5 – Mixed Forest.....</b>	<b>49</b>
<b>Stand 6 - Forested Wetland ESTA.....</b>	<b>55</b>
<b>Stand 7 – Northern Hardwood Forest.....</b>	<b>59</b>
<b>Stand 8 – Mixed Forest.....</b>	<b>65</b>
<b>Stand 9 – Northern Hardwood.....</b>	<b>73</b>
<b>Stand 10 – Forested Wetland ESTA.....</b>	<b>79</b>
<b>Stand 11 – Pine/ Norway Spruce.....</b>	<b>81</b>
<b>Stand 12 – Norway Spruce.....</b>	<b>89</b>
<b>Stand 13 – Young Northern Hardwood Forest.....</b>	<b>95</b>
<b>Stand 14 – Northern Hardwood Forest.....</b>	<b>101</b>
<b>Stand 15 – Mixed Forest.....</b>	<b>107</b>
<b>Stand 16– Mixed Forest.....</b>	<b>113</b>
<b>Stand 17 – Forested Wetland ESTA.....</b>	<b>121</b>
<b>Stand 18 – Northern Hardwood Forest.....</b>	<b>123</b>
<b>Stand 19 – Mixed Forest.....</b>	<b>129</b>
<b>Stand 20 – Young Northern Hardwood Forest.....</b>	<b>137</b>
<b>Stand 21 – Young Mixed Forest.....</b>	<b>143</b>
<b>Stand 22 – Mixed Forest.....</b>	<b>149</b>
<b>Stand 23 – Young Mixed Forest.....</b>	<b>155</b>
<b>Stand 24 – Vernal Pool ESTA.....</b>	<b>161</b>
<b>Stand 25 – Riparian Area ESTA.....</b>	<b>163</b>
<b>Stand 26 – Non-Productive (wetland).....</b>	<b>165</b>
<b>Stand 27 - Riparian Area ESTA.....</b>	<b>167</b>
<b>Stand 28 – <i>Excluded</i> Open and Forested Wetland.....</b>	<b>169</b>
<b>Appendix A: Methods.....</b>	<b>170</b>
<b>Appendix B: Notes on Stand Description Categories.....</b>	<b>171</b>
<b>Appendix C: Sources Used.....</b>	<b>172</b>
<b>Appendix D: Vermont Land Trust Surface Water Buffer Zones.....</b>	<b>173</b>
<b>UVA Data Entry Forms.....</b>	<b>175</b>
<b>UVA Forest Management Stand Map.....</b>	<b>179</b>
<b>EQIP Resources Inventory Map.....</b>	<b>180</b>
<b>NRCS Recommended Practice Locations Map.....</b>	<b>181</b>



## MANAGEMENT GOALS AND OBJECTIVES

Management of the NorthWoods Stewardship Center parcels will be guided by the following goals:

- Goal 1:** To promote *forest health*, including intact natural communities and *wildlife habitat* values that support a diverse native flora and fauna.
- Goal 2:** To cultivate a variety of forest products while improving long term timber value and forest productivity and modeling *sustainable forestry* practices.
- Goal 3:** To create and maintain *outdoor education* and *recreation values* that serve as a community resource and best support delivery of the NorthWoods mission.

Specific objectives for achieving these goals may include:

### *Forest Health and Wildlife Habitat-*

- ◆ Improving wildlife habitat and protect against potential damage from insects or disease by maintaining 10-25% of stocking in minor species. Also removing trees that are infected with beech bark disease or other infectious pathogens, when appropriate.
- ◆ Identifying and protecting unique or sensitive natural communities and wildlife habitat features.
- ◆ Promoting a diversity of tree and shrub species, including species that provide high value food for wildlife (beech, yellow birch, black cherry, eastern hophornbeam, serviceberry, basswood, butternut, and mountain ash).
- ◆ Maintaining multi-aged softwood components for wildlife cover and nesting habitat.
- ◆ Monitoring for invasive exotic species and controlling these when they occur.
- ◆ Re-developing old forest structure, including multiple age classes, “legacy” trees >20”dbh (diameter at breast height), and habitat features such as cavity trees, large diameter snags, and large diameter downed logs.
- ◆ During future timber harvests, leaving tops and branches <4”diameter in the woods to serve as cover for wildlife and to return nutrients to the soil.
- ◆ Anticipating future climate change impacts and managing for a resilient forest and species mix that is well adapted to future conditions.
- ◆ Evaluating landscape context (management and composition of adjacent lands) and integrating this with planning and management of the NorthWoods property, including cross-boundary management with adjacent landowners.

### *Sustainable Forestry-*

- ◆ Using natural disturbance regimes as a model for silvicultural practices and maintaining no more than 5% of the forest acreage as young forest (<15 years) at any one time.
- ◆ Providing a continuous source of firewood and lumber for NorthWoods needs.
- ◆ Gradually improving stand quality by promoting higher value species and individual trees.
- ◆ Transitioning to uneven-aged forest management across all or most of the site.
- ◆ Promoting tree species that are best suited to the site's growing conditions – including micro-climate and soil types – as these are most likely to achieve high vigor, rapid growth rates, and/or maximum mast production.
- ◆ Enhancing stand quality and health through appropriate thinning and cleaning activities and through other long-term investments, such as road and trail improvements.
- ◆ Promoting tree species with high value and/or special non-timber forest product values, including; black ash, yellow birch, northern white cedar, sugar maple, black cherry, basswood, and white ash.
- ◆ Improving the quality of growing stock with each entry, including cultivation of veneer-quality hardwood sawlogs. Maintaining residual stocking at or above the B-line in all thinning operations and uneven-age harvests.
- ◆ Protecting soils through the use of appropriate equipment, careful skid trail layout and harvest timing to avoid rutting, the use of buffers around sensitive areas, and adherence to *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont*.
- ◆ Limiting residual stand damage, including basal wounds, broken and/or scraped tops, and exposed roots to 5% or fewer of the dominant trees.
- ◆ Identifying cultural features, such as stone walls, spring boxes, and foundations, and protecting these through clear flagging and protective buffers of at least 25 feet during future forest management operations.

### *Education and Recreation Values-*

- ◆ Coordinating management activities with other NorthWoods programs to maximize opportunities for research, education, and recreation, and to minimize conflicts
- ◆ Improving and maintaining forest access roads and bridges (for recreational, educational, and management access), and collaborating with neighboring landowners to maintain cross-boundary trails.
- ◆ Promoting educational values through signage, careful management accounting, and enhancement of special features located along access corridors
- ◆ Protecting historic sites while also promoting appreciation and understanding of these features.
- ◆ Incrementally establishing a permanent small road system and well-spaced side trails that support both frequent light forest management work and multi-use recreation such as Nordic skiing and hiking (in coordination with the NorthWoods Recreation Plan).
- ◆ Stabilizing currently eroding trail sections and improving stream/ wet area crossings

through the use of appropriate structures (e.g. water bars, broad-based dips, ditches, bridges, culverts, stream fords, and/or corduroy).

- ◆ Considering alternate trail routes where current trails cross unsuitable terrain or are too badly rutted or damaged to easily restore.
- ◆ Serving as a regionally recognized model forest, demonstrating a variety of sustainable forest management techniques and leveraging the educational value of these practices through signage, public access, guided tours, partnerships with other forestry/ educational organizations, workshops, and website content.



# I. PROPERTY SUMMARY

**Landowner Name:**

NorthWoods Stewardship Center

**Mailing Address:**

P.O. Box 220  
East Charleston, VT 05833

**Telephone:** 802-723-6551 (x113)

**Grand List Acreages:**

*(as of November 2014)*

**Charleston -**

Main Campus parcel: 40.6 acres

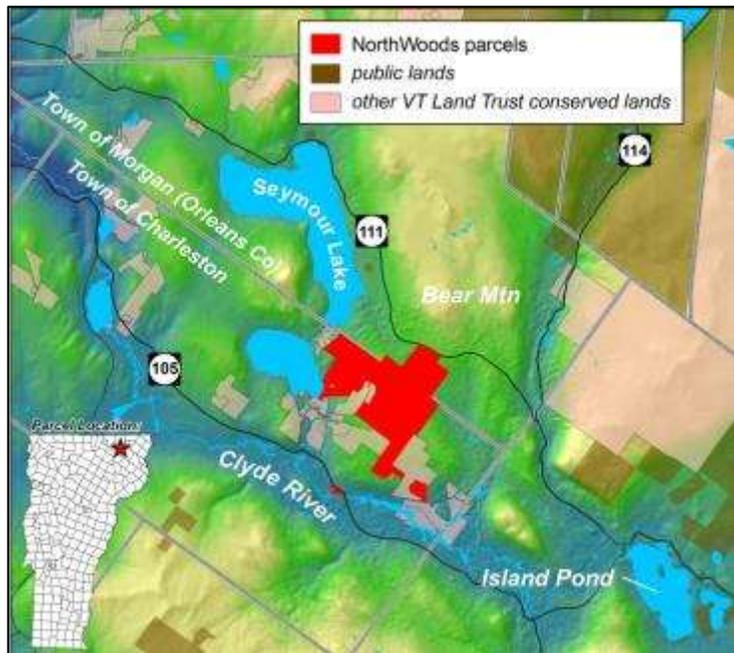
*\*Not enrolled in UVA\**

Clyde River parcel: 11.8 acres

*\*Not enrolled in UVA\**

Tripp Hill parcel: 1,124.7 acres

**Total Charleston:** 1,177.1 acres



**Morgan-**

Tripp Hill parcel: 298.4 acres

**Total Acreage:** 1,475.5 acres

**Total Enrolled in UVA:** 1,423.1 acres

Charleston Tripp Hill parcel: ID # 4350300, SPAN # 135-042-10800

Charleston Main Campus parcel: ID # 4350154, SPAN # 135-042-10799

Charleston Clyde River parcel: ID # 8008020, SPAN # 135-042-10408

Morgan Tripp Hill parcel: ID # 0VT111E112, SPAN # 411-128-10740

**Base Orthophotos:** 2014 Series NAD83 #192256, #192260, #196256, #196260

**Biophysical Region:** Northeastern Highlands

# II. PARCEL RESOURCE INFORMATION

**Overview**

The three non-contiguous parcels owned by the NorthWoods Stewardship Center are located within 1.3 miles of each other in northeastern Vermont, in the headwaters of the upper Clyde River watershed. They lie in the east corner of the town of Charleston (Orleans County), near the Brighton town line, and the south corner of the town of Morgan. These parcels fall within the Northeastern Highlands Biophysical Region - an area known for its cool climate, short growing season, annual precipitation >40", granitic mountains, abundant lakes and wetlands, and expansive undeveloped forest containing a mix of northern hardwood and boreal conifer tree species.

At the landscape level, most of the property occupies a broad mid-elevation dome of land lying between the Lake Memphremagog lowlands to the west (at 900 feet) and the roughly 2500-3000 foot highlands of Bald, Bluff, and Middle Mountains to the east and south. The surrounding countryside is rural, with a blend of dairy farms, extensive mixed forests, and a low density of seasonal and year-round residences.

The east parcel (40.6 acres), also referred to as the Main Campus parcel, occupies a gentle south-aspect slope from 1210-1360 feet in elevation and is bounded to the south by the gravel Ten Mile Square Road. It is 83% forested, with the remaining land containing open fields, the NorthWoods main facility, and staff cabins. Access roads and multi-season public trails also cross this parcel, and it receives the highest annual visitation of the three properties

The large Tripp Hill Parcel (1423.2 acres) is entirely forested, with the exception of several log landings, a small gravel pit, and beaver ponds. It is bordered by route 111 in the north, Echo Lake in the west, the Lang Brook headwaters to the south and nearly reaches Calhoun road in the east. Elevations range from 1250 feet along the southeast shore of Echo Lake to 1731 feet on the broad dome of Tripp Hill, falling again to 1540 feet along route 111. The gradual topography of much of the site is broken by two drainages. In the northeast, the property is bisected by an unnamed tributary of Webster Brook, which flows to the southeast from headwaters near the Morgan town gravel pit. This permanent flowage is punctuated by a series of active beaver ponds, with minor tributaries leading to additional forested wetlands and beaver ponds. A smaller drainage crosses the southwestern part of the site, with its stream draining southward into Echo Lake.

The 11.8 acre Clyde River Parcel lies on the north shore of the Clyde River at 1150 feet elevation and is mostly within the river floodplain, with a small area of upland field bordering VT-105. It includes a mix of shrub and forested wetland and sedge meadow, as well as a small tributary stream.

### ***Geology and Soils***

Bedrock affects forest management through its influence on access, topography, water movement, and the forest nutrient budget. Gradual weathering of bedrock supplies nutrients critical to tree growth and health – and the rate and quality of nutrients supplied are affected by bedrock type. Underlying the NorthWoods parcels is entirely granitic bedrock of the larger Echo Lake pluton, and contains mostly quartz and feldspar. This rock yields little calcium, magnesium or other minerals important for plant growth, due to the nutrient composition of its minerals and their resistance to weathering. A consequence of the low calcium content is a reduced ability to buffer the acids that are created by decomposition and rainfall, resulting in somewhat acidic soils.<sup>1</sup>

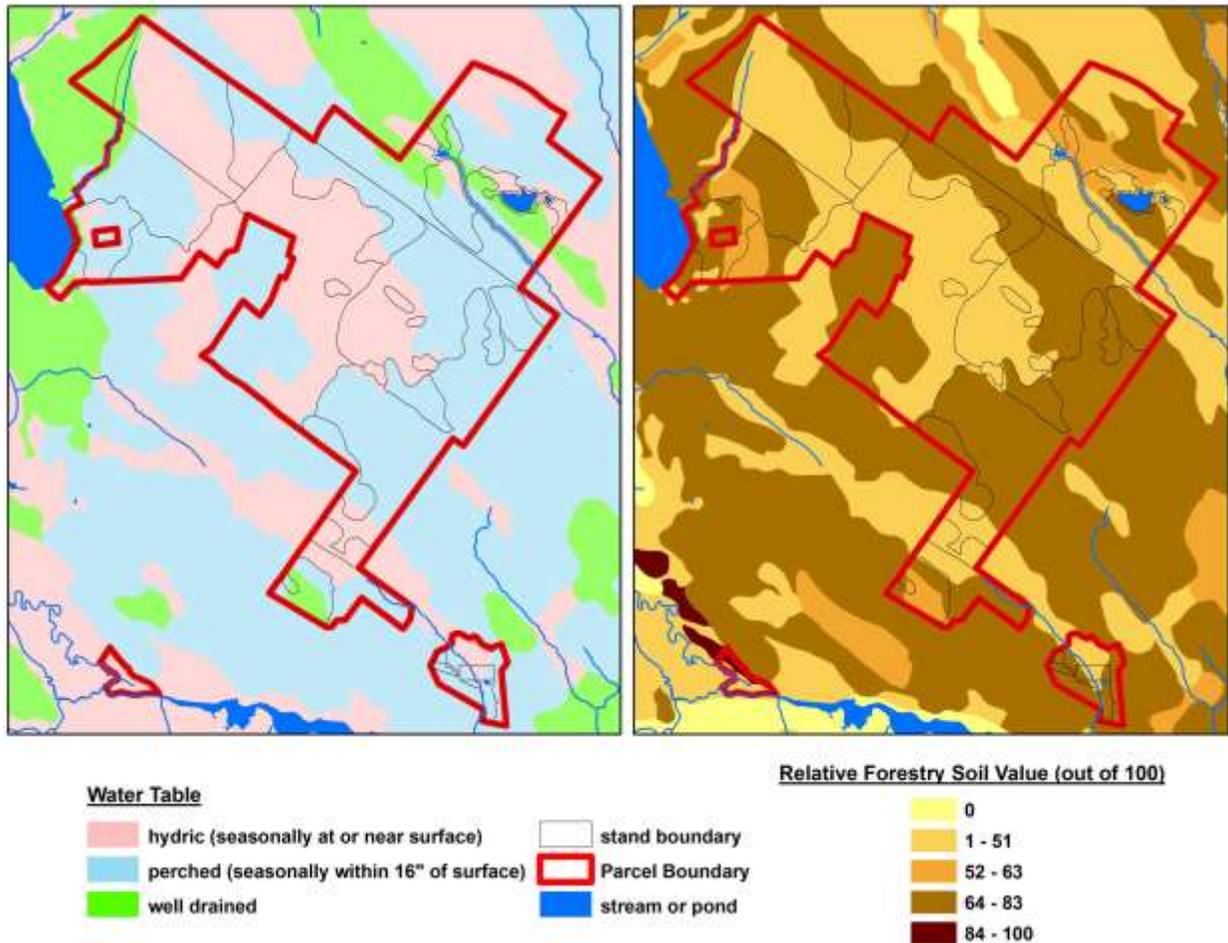
Though some areas are slightly enriched through seepage of groundwater, the combined effects of granitic bedrock and acid precipitation could increasingly limit macronutrient availability to trees in many parts of the site. Whole tree harvesting, which removes all of the nutrients contained within the above-ground portions of a tree, should be avoided on the site, with tree tops and branches under 4" diameter instead left in the woods during forest management operations to aid in nutrient retention and cycling.

Parent material for the site's soils originates from a combination of the bedrock and of the

---

<sup>1</sup> Average pH of rainfall at the nearby NorthWoods Stewardship Center is 4.9 (with a low measurement in July 2005 of 3.9). Soil pH averages 5.3, with a range of 4.7 to 6.4 (NorthWoods 2006).

surficial (glacial) deposits. Across most of the site, these deposits are glacial till – unsorted materials dropped directly out of the ice as it melted – but in the valley areas are some deposits that were carried in water before being sorted by relative texture and then deposited. For example, small areas along the Echo Lake shore feature moraine deposits, while swamp/peak/muck deposits occur in the northeastern valley and southwest softwood swamp. The small Clyde River parcel overlies valley alluvium.



Based on NRCS mapping, most of the site’s soils are relatively deep to bedrock (>60”). Exceptions are found in the southern half of the Tripp Hill parcel, where bedrock appears within 10-20” of the surface, and in the beech ridge area at the south end of this main parcel, where bedrock outcrops can be seen. Soil depth does not necessarily reflect drainage capacity, however. In many upland parts of the site, a seasonably high water table occurs as a result of hardpan (a nearly impenetrable boundary layer near the soil surface created by the compressive force of the glacier). High water tables can also be found in the lowlands as a result of fine, slow-draining soil textures and/or ponding. In general, the least well drained (hydric) soils on the site are found in a band extending from the Jordan Road in the northwest over Tripp Hill and in other smaller areas around the site – mostly in the drainages. These are generally Cabot silt loams in the wetter areas and Colonel-Cabot complex in the more variable ones, and they support a mix of spruce-fir, red spruce-northern hardwood, and northern white cedar natural community types. Soils across much of the remainder of the site are somewhat poorly to moderately well drained and experience seasonal water tables within 16” of the ground surface. These are primarily Dixfield sandy loams

and Tunbridge - Dixfield Complex. They support northern hardwood and red spruce-northern hardwood forests. Only a few locations (shown in green in the map above left) are well drained year round, and these are Tunbridge-Lyman Complex soils or Monadnock fine sandy loams, supporting northern hardwood forest with a higher component of beech.

In the poorly drained soil areas, tree growth rates are slower and shallow root systems increase the potential for windthrow, and for root damage and soil compaction from heavy equipment use. Equipment should be operated in these areas only in frozen ground conditions.

### ***Hydrology***

The property lies within the headwaters region of the Clyde River, a waterway that drains northwest to Lake Memphremagog and then on via Quebec's Magog and St. Francis Rivers to the St. Lawrence River and the Atlantic Ocean.

Despite widespread hydric soils, surface waters are relatively uncommon across the site, with only a few "blue-line" streams appearing on 7.5 minute USGS maps, and few smaller streams encountered. The most notable drainage appears in the northeast part of the Tripp Hill parcel, where an unnamed tributary of Webster Brook drains to the southeast through a series of existing and historical (drained) beaver ponds. A smaller stream valley occurs at the west edge of the Tripp Hill parcel and drains south to Echo Lake. In the southeast part of the site is the small Lang Brook, with headwaters lying in a forested wetland of the Tripp Hill parcel and a lower reach of the brook crossing the Main Campus parcel on its way to the Clyde River. The small Clyde River parcel includes roughly 1200 feet of frontage on the Clyde River and another 800+ feet along a small tributary stream.

Several areas across the site are mapped by the Vermont Significant Wetland Inventory (VSWI) as Class II wetlands. These include a small area in the northeast Webster Brook tributary drainage, five softwood swamps around Tripp Hill, a cedar swamp at the Echo Lake shore, an area of mixed forest at the south end of the Tripp Hill parcel, and much of the Clyde River parcel. Vermont law allows for forest management in wetlands, but requires special guidelines and practices to be followed during logging operations within these areas and within a 50-foot buffer surrounding them. These rules include the following:

- 1) water flow in and out of the wetland cannot be impeded
- 2) logging activities must follow the Vermont AMPs (more on this below).
- 3) equipment maintenance and storing of vehicles is restricted to log landings, and
- 4) log landings must be located in adjacent upland areas or, if located in the wetland area, must not involve fill and must be used only in frozen ground conditions.

More detailed information about the Vermont wetland rules can be found online at:

<http://www.state.vt.us/nrb/wrp/publications/VWR%207-16-10.pdf>.

The management recommendations given in this plan prioritize the protection of the wetland values and many of these areas are being enrolled under the Ecologically Sensitive Treatment Area (ESTA) category to recognize this sensitivity and prioritize non-timber goals.

Many small seeps and springs and one vernal pool are also found on the site. These and the wetlands described above offer important habitat values and are particularly sensitive to damage from heavy forest management equipment. In general, seeps, springs, and streams are best

protected by maintaining an intact forest canopy 25-100+ feet back on all sides (depending on slope and sensitivity) and by keeping logging-related slash and equipment out of the most sensitive areas. Moist soil areas should only be logged in frozen ground conditions and skid trails should be frozen in to avoid rutting, soil compaction, root damage, and erosion. Specific management recommendations for wetland areas are provided in the stand descriptions that follow.

In the interest of protecting soils and water quality, all landowners enrolled in the UVA program are required to adhere to the standards and practices outlined in the booklet "*Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont*". This booklet can be found online at <http://www.vtfpr.org/watershed/documents/Amp2009pdf>.

### ***Recreation/ Aesthetics***

Access for public non-motorized recreation and education is a primary goal for the site, and aesthetics are an important consideration where trails, town or state roads, or well-traveled viewsheds occur.

An extensive trail system is currently maintained by NorthWoods and several adjacent landowners, serving Nordic skiers, snowshoers, hunters, and hikers. School and adult groups participating in NorthWoods education programs utilize trails mainly on the Main Campus and southern Tripp Hill parcels. The trail network includes main trails roughly 15 feet in width that are groomed in the winter and are occasionally used for forest management access using a 4x4 tractor and log forwarding trailer owned by the Center. Smaller footpaths are also maintained in several locations- most notably along Lang Brook, at Echo Lake, and at the Wolcott foundation site. Trail surfaces are generally soil, but improved gravel road sections are found near the route 111 access in the northeast and along the Hopkins Hill road in the west. Several miles of trails, three access areas with informational kiosks, and educational signage explaining the goals of forestry activities have all been added over the past decade, and goals for the coming decade include continued expansion and refinement of this infrastructure – both for recreational and forest management access purposes. Specific recreational assets and plans for the site are described in more detail in the NorthWoods Recreation Plan.

To preserve the recreational and aesthetic values of the site, future harvest planning and layout should consider trail use and include specific plans for road/trail drainage and close out measures, and appropriate adjustments to the cutting plan. In general this will include retention of large well-formed trees and lopping of slash close to the trails, appropriate siting and cleanup of log landings to minimize user conflicts, and matching of equipment and harvest timing to minimize damage to trails. The forest management systems prescribed in this plan are generally very compatible with recreational trails and maintaining aesthetic values of the forest.

### ***History and Cultural Resources***

Within the history of the NorthWoods site is a reflection of the same general patterns that have affected and shaped much of the Vermont landscape; a long period of light subsistence use by Native Americans, settlement and clearing by Euro-Americans in the 19<sup>th</sup> century, intensive land use in the form of agriculture and logging, re-growth of the forest/ subdivision of farms, and second and third waves of logging. The specific ownership patterns of the NorthWoods site from 1792-2003 were researched intensively and summarized in a 2003 report entitled *A Land Transfer History of the Ecosystem Management Project Site (Benoit and Marvin)*, and additional land-use history research was completed and summarized in an unpublished land-use history report for the

period up to 1900, both of which are archived at the NorthWoods Stewardship Center. The land-use history report includes photographs and excerpts from oral history interviews, diaries, and census documents about families that made their livings on and from the sites fields and forests during this period.

Below is a brief summary of known benchmark events in the history of the ownership.

***Pre-European settlement:*** The nearby Clyde River valley was long used as a major east-west travel route for groups of Western Abenaki, moving between Lake Memphremagog and the Connecticut River valley. A seasonal settlement existed at the present site of East Charleston village, less than one mile southwest of the property, and was utilized as late as the 1760's by St. Francis Abenakis. Groups of Abenaki from Cowass (present day Wells River) also used the area for winter moose hunts and as a refuge from white attacks on their Connecticut River village. Lake Seymour is said to have been a preferred beaver trapping area for the Abenakis and possibly the location of a seasonal encampment. While surveying Charleston in 1794, James Whitelaw named a pond bordering the property "Echo" for its unique acoustic properties and reportedly noted, "...the surrounding terra firma was covered with an unbroken forest".

***ca. 1800:*** The early "Magog Road" connecting Newbury, Vermont with Stanstead, Quebec was built within 0.6 miles northeast of the parcel, passing north of Bear Hill.

***1802:*** First Morgan settler Nathaniel Wilcox established a homestead north of Lake Seymour along the Magog road. In Charleston, Abner Allyn cleared land for what would become the first permanent homestead in Charleston the following year.

***1816:*** The infamous "year without a summer". Snow was reported every month and the settlers that remained in Charleston depended heavily upon the forest and lakes (including Echo) for their sustenance. The first road around the east side of Echo Lake was also constructed this year, providing access to the property and surrounding area for the first time. The nearest settlement was at Morgan four corners (four miles northwest of the property).

***1823:*** The construction of the first road connecting East and West Charleston led to the beginnings of a settlement in the East Village. In 1824 a water-powered sawmill was constructed in the town and the population grew quickly.

***1820-1830:*** Numerous homesteads were started on the west side of the site up to Tripp Hill and clearing of the forest began in earnest. By 1850 these farms had a combined total of 60 cattle and 71 sheep.

***1838:*** A wolf hunt on Elan Mountain (less than 1 mile NW of the parcel) involved 200 hunters - half of the town's population at the time.

***1850-1890:*** At least eight sawmills operated within 2 miles of the site (sawing largely spruce) including one at Webster Brook, one at the Echo Lake outlet, and several in Morgan.

***ca. 1880:*** The acreage of cleared land on the site peaked, with roughly 55% in fields.

***ca. 1959:*** Red pine, white pine, and Norway spruce were planted under the federal soil bank program at three locations in the west, south, and east parts of the site.

**1966-1977:** After long tenures by farmers and other individuals, a number of timberlands were consolidated into a single ownership by the Vermont Land Corporation, who then conducted liquidation cuts over much of this acreage in 1984-1985.

**1986:** Management plan for the Main Campus parcel prepared by forester Ross Morgan for then-landowner Bill Manning.

**1992:** Much of the current Tripp Hill parcel purchased by Lydia Spitzer. Management plan prepared by Round Top Woodlot Management forester Richard Carbonetti.

**1996:** Baseline biological inventories begun on several parts of the current site in association with the Ecosystem Management project at the NorthWoods Stewardship Center (at that time the Vermont Leadership Center).

**1999-2000:** Large-scale harvesting administered by forester Richard Carbonetti in central areas of the Tripp Hill parcel.

**2001:** Liquidation cutting on adjacent (roughly 183-acre) Moffat parcel along the Jordan Road.

**2002:** Adjacent parcel purchased from Moffat – forming one contiguous Spitzer parcel.

**2004:** Development rights on the Spitzer parcel donated to the Vermont Land Trust (VLT). Lydia Spitzer announces plans to donate the majority of the property to the NorthWoods Stewardship Center (scheduled for 2007). NorthWoods purchases 100 acres from founder Bill Manning in two non-contiguous parcels (the Main Campus parcel and a portion of the Tripp Hill parcel).

**2005-2012:** Third thinning of the red pine/white pine plantation near the NorthWoods main facility, incorporating coarse woody material retention and small group selection to release northern hardwood advanced regeneration. Also softwood thinning in the west part of the Tripp Hill parcel.

**2008:** Spitzer parcel donated to NorthWoods.

**2012:** NorthWoods ownership designated as Lydia Spitzer Demonstration Forest. Work begun through funding from the Canaday Family Charitable Trust on a variety of demonstration forestry, road and trail improvement, access improvement, and educational signage projects.

**2014:** NorthWoods forest certified under the American Tree Farm System. Clyde River parcel donated by Larsen et al. Fieldwork completed for forest management plan update.

### ***Important Natural Features and Rare Species/ Natural Communities***

No rare, threatened, or endangered (RT&E) species or natural communities are known to occur on the site and none are on record by the Vermont Department of Fish and Wildlife (VCGI, 2013). Occurrences of an uncommon (S3-ranked) Silver Maple-Sensitive Fern-Riverine Floodplain Forest natural community and the uncommon breeding rusty blackbird breeding birds are on record for the site, with the former occurring on the Clyde River parcel and the latter in the large beaver pond at the northeast part of the Tripp Hill parcel. The uncommon (S3-ranked) Northern White Cedar Swamp and Lowland Spruce-Fir Forest natural communities are also known to occur on the site, and several examples have been recognized in this plan with Forested Wetland ESTA designations. These have not yet been mapped by the Vermont Nongame and Natural Heritage

Program, but will be better documented and mapped in the coming year by NorthWoods staff.

***Landscape Context*** – To understand the contributions of a single parcel to wildlife habitat, one must first consider the habitat conditions of the broader region for context. Surrounding the NorthWoods parcel is a mostly forested landscape, with some small dairy farms, gravel pits, and low density rural development. Development and farmland are concentrated to the west – from Echo and Seymour lakes on to Lake Memphremagog – and to the south along the Clyde River floodplain and route 105 corridor. In contrast, to the east and north lies one of the largest undeveloped areas in Vermont, stretching from the Canadian border to St. Johnsbury. Encompassing over 600 square miles, this region contains only small villages and is otherwise mostly forested. Extensive wetlands also are found just south of the site along the Clyde River, with many acres of uncommon or rare natural communities and plants. Over 75% of the area is protected from development, either as state or federal lands or through conservation easements held by the Vermont Land Trust or other similar organizations. This habitat connectivity accommodates the seasonal movement patterns and large home ranges of mammals such as black bear, bobcat, moose, mink, and fisher, as well as rebounding populations of the rare Canadian lynx and American marten. Many other species with smaller territories also benefit from this large habitat block, including some boreal species like gray jay and spruce grouse that are at the southern edge of their range here.

Due to a history of intensive logging and farming, forests in the areas surrounding the NorthWoods parcel are mostly even-aged and <100 years old, with older trees found mainly in small patches in inaccessible areas like swamps or steep slopes. Within this context, the site contributes mainly a large undeveloped forest block, protected in perpetuity through conservation easements and managed with forest health, diversity, and older forest characteristics as long term goals. Some parts of the site- particularly a hardwood slope in the north part of the Tripp Hill parcel and small softwood patches in several areas – do contribute an older age class and structure that is beginning to develop old forest characteristics.

Other important natural or habitat features found on the property are summarized below and are more specifically addressed in the stand descriptions that follow.

❖ ***Lake shore-*** The Tripp Hill parcel includes 1800 feet of undeveloped shoreline on Echo Lake, one of only several frontages on this 530-acre lake that remain in a natural condition. Undeveloped shorelines offer important wildlife habitat and water quality benefits, and are increasingly rare and threatened by development pressure.

❖ ***Surface Waters and Wetlands***–Wetlands and waterways are biodiversity hotspots and the combination on the site of streams, seeps (described below), vernal pools, beaver ponds, river frontage, and forested wetlands adds to this natural species richness. Wetlands also provide important seasonal or year-round habitat for species like moose, black bear, snowshoe hare, various reptiles and amphibians, and migratory birds - alder flycatcher, Canada warbler, American woodcock, yellow warbler, swamp sparrow, northern parula warbler, northern waterthrush, olive-sided flycatcher, and rusty blackbird (to name a few), and all of these species have been observed on the site over the past decade.

❖ ***Seeps***– A small wetland type found among upland forests, small seeps occur in various parts of the site. Seeps serve as specialized habitats with distinct plant communities and offer critical seasonal wildlife values. During the depths of winter and early spring when food resources are at

their lowest point, the constant groundwater temperature of 47° F at seeps often maintains an opening in the snow and a patch of live vegetation. These are important sources of food for black bear and wild turkey and are also home to amphibians like northern dusky and northern two-lined salamanders.

❖ ***Open Habitats***- Uncommon across the site, upland openings occur only in relatively small acreages at the Main Campus and Clyde River sites. These habitats can support an abundance of herbaceous flowering plants and shrubs that are beneficial to wildlife, including butterflies, other invertebrates, and the many species that feed upon them. Efforts to maximize these benefits can include periodic mowing to prevent forest regrowth, seeding of preferred forage plants, and monitoring to prevent the establishment of aggressive invasive exotic plants like the bush honeysuckles or goutweed.

❖ ***Mast Producing Trees and Shrubs*** - “Mast” refers collectively to the nuts, seeds, buds, or fruits of woody plants that are consumed by wildlife. Certain trees and shrubs are considered high value mast producers due to the volume or quality of mast produced, and/or the number of wildlife species known to benefit from them. The most widespread high value mast producing species found on the site are beech, black cherry, yellow birch, mountain ash, and serviceberry.

Beech is not abundant across the entire site, but some patches of bear-scarred mature trees can be found – most notably in stand 4 at the south end of the Tripp Hill parcel. Beech nuts are a critical fall food source for black bears preparing for winter denning and bears will travel many miles to a preferred beech stand. Beech has also become much less common across the landscape due to beech bark disease. General management practices to promote this resource include culling trees that are notably weakened by the beech bark disease (>50% canopy dieback), retaining and releasing healthy beeches with evidence of use by bears (scarring and bunched canopy branches), and uneven-age management that encourages beech over shade-intolerant species.

Yellow birch is the most abundant and widespread mast producing species and is well-suited to the growing conditions that the site has to offer. Butternut is a much less common – but equally valuable - mast producer found only in stand 18 to date. An effort was made in the 2012 timber harvest in that stand to release the highest vigor individuals found.

❖ ***Legacy Trees***- Very large trees (>20” dbh) with extensive canopies offer unique values, such as vertical structure, abundant nesting and foraging sites, prodigious mast (and seed source), cavities, and future large coarse woody debris. Some species are particularly favorable - for example sow black bears prefer the rough bark of large diameter white pine and hemlock as “babysitter trees” – places to send their cubs to escape danger, and large aspen/paper birch are preferred by woodpeckers for nest cavities because they are easier to excavate. Legacy trees are currently uncommon on the site due to the land use history. It is important to recognize the non-timber value of these large trees and to retain, or recruit, them in future management operations.

❖ ***Snags and Cavity Trees***- As a result of past land use, large diameter living cavity trees and snags continue to be underrepresented across the property. The 2005 inventory for the Tripp Hill parcel recorded 2.1 snags 12-18” dbh and 0.2 snags >18” dbh per acre, while the goal is at least 2 snags 12-18” and two >18” dbh per acre. These features are important as forage sites for woodpeckers; shelter for bats, cavity nesting birds, porcupine, and fisher; and open perches for raptors. When large snags fall, they continue to benefit the forest for many years by contributing organic matter to soils, carbon storage, sites for nitrogen-fixing bacteria and mycorrhizal fungi,

nurse logs for tree seedlings, and water storage. As the forest grows, existing snags and downed logs should be retained, and new ones recruited – particularly in the larger size classes. To improve eventual snag and cavity tree density, future management should focus on retaining existing cavity trees, while recruiting additional large diameter trees of mixed species distributed across the site to serve as future cavity trees, snags, and large logs.

### ***Current Condition and Management Priorities***

Most productive forest areas within the NorthWoods ownership are in a mid-successional stage of growth and transition, following a land use history of agriculture and heavy logging. The forest structure is even-aged, with the pole (4-10" dbh) size class dominating, and species composition nearly evenly split between mixed softwoods and hardwoods. Twenty six tree species were recorded in the 2014 forest inventory, with balsam fir and sugar maple being most abundant and collectively accounting for 30% of total stocking. Other significant species (making up at least 4% of total stocking) include yellow birch, red maple, northern white cedar, Norway spruce, red spruce, white ash, gray birch, and paper birch.

Forest management work on the site over the past decade focused mainly upon pre-commercial and commercial improvement efforts (Crop Tree Release, area-wide thinning, thinning from below), a few applications of small group selection to initiate a new age class in older forest areas, and forest access and education/recreation improvements. Exotic invasive plant control (Phragmites) was also initiated at one location on the Tripp Hill parcel, and riparian area along the Clyde River was restored through tree planting (prior to the donation of this parcel to NorthWoods). Roughly 100 acres (7%) of the site was treated over the course of these various activities.

Priorities and opportunities over the coming decade will be largely a continuation of these improvement practices, many of them pre-commercial and dependent upon supplementary funding sources such as EQIP or grants/donations. Some income will be generated through commercial work on a very limited acreage where sawtimber stocking is sufficiently high to warrant thinning/ small group selection harvests. All of this work will be planned and implemented with the following goals in mind; improved forest health and quality, diversified wildlife habitat and forest structure, enhanced education and recreation opportunities, and financial responsibility (break even or income/firewood generating). Specific scheduled and recommended activities over this period are summarized in the tables below and detailed in the stand descriptions. We will also continue to explore new and more effective ways to model and promote sustainable forest management, including through increased visitation to the Spitzer Demonstration Forest, better communication of the efforts underway on the site and their results, and through strengthened collaborations with a variety of individuals and organizations (including adjacent landowners). Our hope and intent is that the efforts to improve and sustain our own land base at NorthWoods will contribute in significant ways to a growing movement in and beyond Vermont that seeks to restore and better steward the landscape that we have inherited.

## MANAGEMENT SCHEDULE (2015-2025)

*Where practices may be eligible for funding assistance through NRCS –the relevant practice numbers are indicated, with practice names listed below.*

Year	Stand	UVA- Scheduled Management Activity	Acres	Other Optional Work
<b>2015</b>	2, 11	--	0.01	- apple release/ pruning (NRCS 660)
	2,5,11,13, 16,19,20	--	0.25	- invasive plant control (NRCS 314-315)
	2, 8, 12, 28	--	4.5	- bush hog meadows/landings (NRCS 647)
	10,14,17,26	--	-	- re-evaluate/ map boundaries
	12	Thinning/ Small Group Selection/ Irr Shelterwood	18	- Install signage/ gate
	18	--	40	- Remove flagging, post-harvest surveys
<b>2016</b>	2,5,11,13, 16,19,20	--	0.25	- invasive plant control (NRCS 314-315)
	4	Crop Tree Release/ Small Group Selection	9	- install deer exclosures
<b>2017</b>	2,5,11,13, 16,19,20	--	0.25	- invasive plant control (NRCS 314-315)
<b>2018</b>	1	Variable Density Thinning	4.5	
	2, 8, 12, 28	--	4.5	- bush hog meadows/landings (NRCS 647)
	8	Crown Thinning	10	-up to ~40 acres could be thinned if commercially viable
	11	Thinning/CTR/Small Group Selection	15	
	23	TSI/Small Group Selection	10	-up to ~32 acres could be treated as funding is available
	2, 11	--	0.01	- apple release/ pruning (NRCS 660)
<b>2019</b>	13	Small Group Selection	20	
<b>2020</b>	9	Small Group Selection	10	
<b>2021</b>	2, 8, 12, 28	--	4.5	- bush hog meadows/landings (NRCS 647)
	2, 11	--	0.01	- apple release/ pruning (NRCS 660)
<b>2024</b>	2, 11	--	0.01	- apple release/ pruning (NRCS 660)
	2, 8, 12, 28	--	3	- bush hog meadows/landings (NRCS 647)
	19	Small Grp Selection/ CTR	12	
	All	--	1476	- forest inventory for plan update (NRCS 106)
<b>All Years</b>	2,3,5,13,15, 16,19	--	30	- light TSI/ CTR (NRCS 666)
	9, 22	--	10	- hayscented fern control
	8, 9, 12, 19	--	15	- balsam brush collection/ cleaning
	All	--	1476	- invasive plant monitoring and control as needed (NRCS Practice 314,315) - road/trail construction or improvements - repaint boundary lines

**Note:** UVA- scheduled activities above must be completed within 3 years of the scheduled date to remain in compliance with the program. A management plan update is due before April 1, 2025.

## Recommended NRCS Practices Summary

*Note: This table is provided for reference and to address EQIP forest management plan requirements. The use of NRCS practices is optional, requires a separate application process, and is contingent upon NRCS review and program funding. NRCS contact information is listed in the plan introduction.*

<b>Practice Name/ #</b>	<b>Implementation Schedule</b>	<b>Location and Amount Recommended</b> <i>(for detailed locations refer to the NRCS practices map at the end of this plan)</i>
#106- Forest Management Plan	April 2024	New inventory of property for forest management plan 10-year update (1476 acres)
#647- Early Successional Habitat Mgmt	Sept 2015, 2018 2021, 2024	Stand 2 fields (2 ac), Stand 8 landing (0.25 ac), Stand 12 landing (0.25 ac), Stand 28 field (2 ac) = 4.5 acres
#660- Apple Tree Release and Pruning	March 2015, 2018, 2021, 2024	Stand 2 (2 trees), Stand 11 (3 trees) = 5 trees
#314/ 315- Herbaceous Weed Control	July 2015, 2016, 2017	Stand 2 (0.01 ac), Stand 5 (0.01 ac), Stand 11 (0.1 ac), Stand 13 (0.05 ac), Stand 16 (0.05 ac), Stand 19 (0.01 ac), Stand 20 (0.05 ac) = 0.28 acres
#666- Forest Stand Improvement (Crop/Mast Tree Release)	November 2016	Stand 4 (9 ac)
#666- Forest Stand Improvement (TSI)	November 2018, 2021, 2024	Stand 23 (20 ac), Stand 16 (10 ac), Stand 13 (20 ac), Stand 5 (2 ac)
#560 – Access Road	August 2018	Hopkins Hill Road (0.5 miles)

### III. STAND DESCRIPTIONS AND TREATMENT PLANS

#### STAND 1

*NOT ENROLLED IN UVA*

#### STAND DESCRIPTION

*Acres:* 8.4

*NED Cover Type(s):* Red pine, white pine and Norway spruce plantation

*Natural Communities:* Northern Hardwood Forest

#### *Stand History and Overview:*

Stand 1 occupies a moderate south-facing slope on the east parcel and is dominated by red and white pine plantation, with a small area of Norway and white spruce.

Located at mid slope on the north side of the Clyde River valley, this stand has a long history of use by human inhabitants. Less than 400 ft. south of the stand are the remains of a homestead first settled by Jacob Lang in 1828. By 1850, forty acres (including all of stand 1) had been cleared and were being farmed by Jacob's son Andrew. The farm at that time included 12 sheep, 2 swine, 9 cattle and 2 horses and was producing wheat, oats, corn, potatoes and maple sugar (U.S. Agricultural Census).

Over the latter half of the 19<sup>th</sup> century, Andrew Lang worked this land to become one of the most successful farmers and entrepreneurs in Charleston, eventually co-owning several nearby starch factories and sawmills. By 1870 his farm was among the most productive in the town, producing most notably 1,800 lbs of butter and 5,600 bushels of potatoes. This potato production alone represented more than a third of the amount grown in Charleston that year and probably utilized ~18 acres of land.

In 1908, only six years after Andrew Lang's death, his son Adelbert ("Bert") Lang built a 100-foot diameter round barn built at the homestead site along Ten Mile Square Road, very similar in construction to the still-standing Robillard barn in Irasburg. Although the property left the Lang family a year later and the round barn burned in 1918, the land continued to be farmed off and on and was acquired by Bert Lang's stepson Will Gardner in 1920. Following in the spirit of his step-grandfather, Will successfully raised a large family through the depression by working the land for timber and crops and succeeding at various entrepreneurial ventures.

Between 1959 and 1961 Will (then in his mid 70s) had most of his fields planted in red pine, white pine, and Norway spruce, including what is now stand 1. Brendan Whittaker, who assisted in this planting as County Forester, remembers that some red pine nursery stock in Vermont was grown from native red pines in Island Pond, but that the stock planted here was most likely non-native.

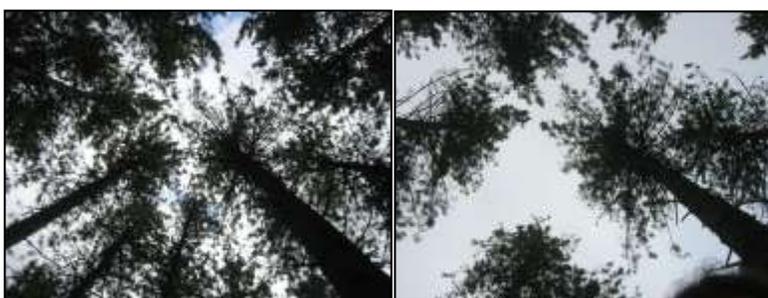
In 1984 Bill Manning and Pat Moyer, founders of what is now the NorthWoods Stewardship Center,



purchased the property from the late Will Gardner estate. In 1986 the site's first management plan was completed by forester Ross Morgan, the property was enrolled in the Current Use program, and the plantation north of the Ten Mile Square Road (including this stand) was row thinned, with every third row removed. Agricultural Stabilization and Conservation Service (now NRCS) cost share funds were received for this thinning, which treated all 25 acres of the original plantation. Several years later Manning began developing the site for educational programming, building a ropes course and several cabins. A second row thinning took place in 1994. The goal of the row thinnings was to bring the stand from 210 sq ft of basal area in 1986 to 110 sq ft through 2 thinnings. The 1994 thinning removed roughly 9,000 bd ft and 30 cords of red pine and more thinning in 1995 removed roughly 3500 bd ft and 14 cords of red pine (per UVA conformance reports).

Since this time, as NorthWoods has grown and broadened its programming, the stand has been visited by hundreds of people annually as they participated in educational programs or visited the interpretive Gardner History Trail on their own.

By 2003, canopies in the stand were closing again due to a good growth response from the 1994 thinning. To optimize the educational opportunity and best achieve the Center's management goals, several demonstration treatments were planned. These included (1) thinning from below with large diameter cull logs retained as coarse woody material, (2) a quarter-acre pine overstory removal to release a patch of advanced hardwood regeneration, and (3) a traditional thinning from below where all merchantable material was removed.



**Left:** Pre-thinning (2006) **Right:** Same location post-thinning

In the winter of 2005 roughly a third of the stand was treated using the Center's 4WD tractor and winch. Another third was treated the following winter and the final third was completed in 2008/2009. Thinned areas were reduced from roughly 190 sq.ft. of basal area to 133 sq. ft., with 120 sq. ft. of the residual stocking being acceptable.

By 2014, much of the canopy has closed following the 2006-09 thinning. Regeneration response to the treatment is also evident, with increased shrub/seedling density in thinned areas, and vigorous 15-

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
<b>Hardwood</b>	<i>paper birch</i>	1.1	0	0.2	0.2
	<i>quaking aspen</i>	1.1	0	0.2	0.2
	<i>black cherry</i>	0.5	0	0.1	0.1
	<i>yellow birch</i>	0.5	0	0.2	0.2
	<b>Hardwood Total</b>	<b>3.2</b>	<b>0</b>	<b>0.7</b>	<b>0.7</b>
<b>Softwood</b>	<i>red pine</i>	53.4	10,307	9.0	33.3
	<i>Norway spruce</i>	21.2	2,070	6.7	10.9
	<i>eastern white pine</i>	16.9	2,425	4.6	9.4
	<i>northern white cedi</i>	2.1	169	0.0	0.4
	<i>white spruce</i>	1.6	60	0.5	0.7
	<i>balsam fir</i>	1.1	77	0.2	0.4
	<i>red spruce</i>	0.5	60	0.1	0.2
<b>Softwood Total</b>	<b>96.8</b>	<b>15,167</b>	<b>21.2</b>	<b>55.3</b>	
<b>Grand Total</b>	<b>100.0</b>	<b>15,167</b>	<b>21.9</b>	<b>56.0</b>	

20' tall advance hardwood regeneration in the overstory removal area.

Understory shrub and herb species in the stand include various *Rubus* species, meadowsweet, wild raisin, alternate-leaf dogwood, pipsissewa, common speedwell, intermediate wood fern, wild sarsaparilla, and Canada mayflower. No state rare, threatened, endangered, or exotic invasive plant species were found in the stand.

### **WILDLIFE STRUCTURAL ATTRIBUTES**

**Canopy (>30 feet):** Closed canopy with one 0.25 acre canopy gap (harvested 2006)

**Midstory (5-30 feet):** 0-33% cover, patchy, with nearly 100% cover in group selection. Primary species: red maple, sugar maple, black cherry, balsam fir and white spruce

**Understory (1-5 feet):** 0-33% cover, scattered dense seedling patches. Primary species: white pine, balsam fir, red spruce, black cherry

**Snags:** Very low density; 16.6 snags/acre, all smaller than 15" DBH

**Coarse Woody Material (>10" dbh):** Low density overall, with greater abundance in thinned area. Decay condition ranges from soft/decaying to new/solid.

**Fine Woody Material (<3" dbh):** Medium density, altered by NorthWoods program activity (primitive shelter building).

**Leaf Litter:** Thin layer of needles; thick moss in Norway spruce plantation

**Wildlife Attribute Summary:** As is typical of softwood plantations, this stand has little diversity in canopy height, overstory tree species and tree diameter. However, many habitat features have been enhanced by silvicultural treatments over the past decade; understory (herbaceous and woody) species are much more abundant, coarse woody debris has increased, and the group selection has established an area of midstory canopy and regeneration of more diverse, site-appropriate hardwood species.

The most notable vertebrate in stand 1 is clearly the red squirrel, which makes good use of the concentration of pine and spruce seeds. Small mammal surveys observed just two species prior to 2006 (red squirrel, deer mouse), and seven species in post-harvest monitoring (red squirrel, deer mouse, short tailed shrew, masked shrew, meadow vole, red backed vole and southern bog lemming). Deer also commonly traverse the stand, though understory cover is limited.

Bird surveys conducted since 1998 in the stand have identified black-capped chickadee, American robin, yellow-rumped warbler, golden-crowned kinglet, red-breasted nuthatch, and blue-headed vireo as the most abundant species. A wild turkey nest was also encountered in logging slash following the 2005 thinning.

Wildlife observations during the 2014 forest inventory (late summer) included deer scat, blue-headed vireo, myrtle warbler, white throated sparrow and ruby-crowned kinglet.

### **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following area is ecologically valuable and fragile, warranting special

management consideration:

- Lang Brook is known to support a diverse aquatic community, including brook trout, mink, northern two-lined and spring salamanders, and many aquatic invertebrates. A 50-foot forested buffer will be maintained (where it currently exists) to provide shade and to limit runoff. Operation of equipment within this zone will be discouraged, and minimal A-line stocking will be maintained.

## **STAND HEALTH**

The following health-related issues were observed, none of which require special action at this time.

### ***Human Impacts:***

- Uses related to NorthWoods programs and ropes course facilitation, including trails and paths throughout the stand, construction of primitive shelters (piling of coarse woody debris) and minor trampling of understory vegetation

### ***Climate Change Considerations:***

- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species diversity. Current species diversity is low but increasing as the stand is converted to uneven-aged northern hardwoods, which should improve future stand resilience.
- Variability in stream flows and greater chance for heavy rains could alter the size and course of Lang Brook. In combination with hardened gravel surfaces and buildings nearby, stand 1 could become susceptible to flood impact, erosion and/or sedimentation in areas near Lang Brook. Maintaining a 50' forested buffer will help prevent erosion during high water events.
- Boreal species such as balsam fir are predicted to decline in response to climate change. Current regeneration is a mix of northern hardwoods and softwood species, primarily balsam fir; management should promote regeneration of species such as black cherry, white ash, red maple and white pine that are predicted to adapt well to future climate conditions.

### ***Other Pathogens and Health Concerns:***

- Some evidence of blister rust
- Minimal stem damage from past thinnings.
- Girdling and physical damage to trees from ropes course elements
- Minor wind and ice damage to white pines

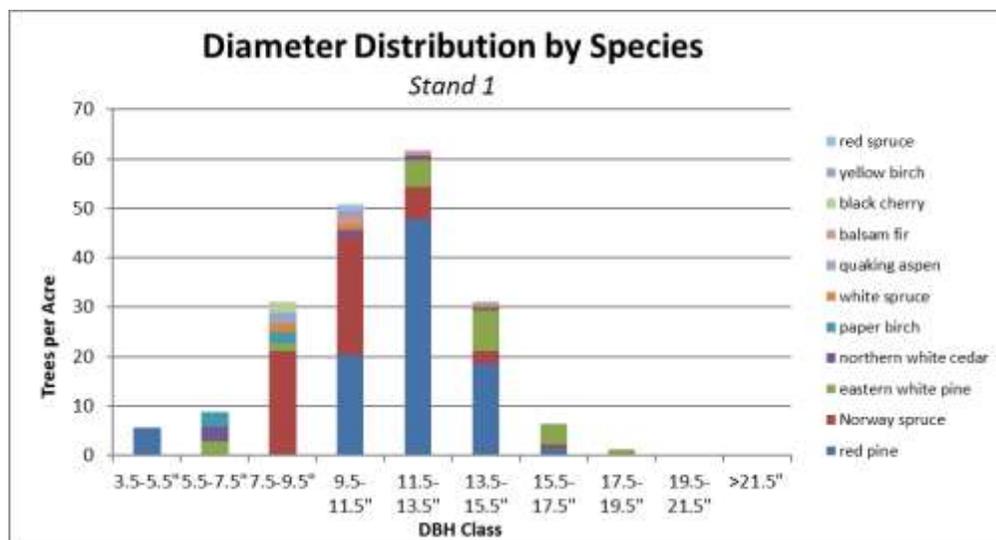
## **RECREATION/ EDUCATION**

Cross-country ski trails are maintained through the stand, as is a high/low ropes course and several group initiative events. The NorthWoods Adirondack style lean-to, used by visiting groups for camping, is located at the upper edge of the stand. This forest is also frequently used by NorthWoods education staff for teaching. Current and future management will seek to balance these goals mainly

by using management as a vehicle for teaching about forest stewardship, and by prioritizing aesthetical and access values in the ropes course area.

The 2006-09 group selection and thinned area is designated as a demonstration site in the Lydia Spitzer Demonstration Forest, with informational signage describing the sustainable forestry practices implemented. Students and groups regularly visit this site as part of NorthWoods education and outreach programming.

Additional signage was installed in 2013 to establish the Gardner Living History Trail, highlighting the history and evidence of past land use found along the hiking trail. This trail passes through Stand 1 and onto adjacent property to the southwest.



## SILVICULTURAL DATA AND GROWING SITE CONDITIONS

**Age Class Structure:** Even-aged (55 years old) transitioning to uneven-aged; advance regeneration in group selection and patchy throughout

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 14 (1 per 0.6 acres)

**Sampling Date:** May 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 145      **AGS BA:** 131 (90%)      **BA 95% CI:** 129-162 (ft<sup>2</sup>/acre)**Total**

**TPA:** 197      **AGS TPA:** 161 (82%)      **QMSD:** 11.6"

**Stocking Level:** Adequate. A-B line on red pine stocking chart (US Forest Service 2008 Timber Management Field Book)

### **Regeneration:**

0-1" DBH – 3,000 stems per acre

1-3" DBH – 40 stems per acre

Number of Plots – 25 (0.3% of stand)

Species composition and density are patchy throughout the stand, largely influenced by recent silvicultural treatments. In the 2006 group selection area, advance hardwood regeneration has reached a height of 15-20 feet with good vigor and a site-appropriate mix of mostly commercial hardwoods

(black cherry, red maple, sugar maple, with some balsam fir and red/white spruce). Where the overstory is dominated by pines, regeneration is patchy and includes a mix of hardwoods (primarily red maple and black cherry) and softwoods (primarily balsam fir and white pine), with heavy competition from *Rubus* species in some areas. Understory in the Norway spruce is dominated by mosses, and regeneration is almost nonexistent except for a small canopy gap with sparse black cherry regeneration (under 5 foot height). Over half of sampled regeneration stand-wide is hardwood, making this stand well suited for conversion to a more natural northern hardwood natural community.

**Site Class:** I (based on soil types and tree growth characteristics).

**Soils:** Fine sandy loams and sandy loams of the Tunbridge-Dixfield complex (100C, Tunbridge-Dixfield Complex, 8-15% slope, rocky). These soils are moderately well drained and moderately deep (16-72” to bedrock or dense basal till). Seasonal high water tables in some areas reach to within 18” of the surface. Somewhat vulnerable to erosion in areas with greater slope. Ranked as a “Statewide” agricultural soil, and well suited to forestry access.

**Access:** A network of trails and driveways allow excellent access in stand 1. Soils are well suited to summer access under normal or dry conditions. Established multi-use recreational trails are often wet and should be accessed primarily in frozen ground conditions. Due to close proximity to the NorthWoods lodge, care should be taken to maintain the aesthetic and recreational values of trails in the stand by minimizing soil damage, keeping a narrow treadway and removing slash.

## **DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 10 years

**Diameter Objectives for Principle Species:**

18-22” dbh- red pine, white pine

14-18” dbh- Norway spruce

Intensive use of the stand for NorthWoods programs requires several overlapping long-range goals, with distinct management approaches. In the ropes course area (east end of the stand) management will prioritize tree health, aesthetics, and safe and easy access for groups. This will be achieved by frequent light thinnings to maintain large canopies on the crop trees, which will be retained as long as their health permits (possibly another 150+ years). Depending upon the goals of a future NorthWoods forest manager, this area may then be regenerated back to pine, or allowed to return to a more natural mixed hardwood forest.

The remainder of the stand will be managed as a demonstration forest, illustrating the process of gradually transitioning a softwood plantation back to an uneven-aged northern hardwood forest. This process will require multiple entries to complete, though each entry will seek to re-introduce missing elements of natural forest structure.

The current forest has only recently reached commercial size, so the emphasis will remain on crop tree canopy release for at least 2 more entries, with a target diameter of 18-24 inches. During each thinning entry, ecological goals will be met by recruiting large-diameter future wildlife snag trees and by increasing downed woody debris – particularly in the larger (>12”) diameter classes. This process was initiated in the most recent thinnings. In addition, shade tolerant northern hardwood tree species

will be gradually re-established to the stand by creating a small (1/10th-1/4 acre) opening during every other entry to promote regeneration of these species. This process was begun in the 2006 entry with a ¼ acre overstory removal in an area of advanced mixed hardwood regeneration. The resulting uneven-aged forest will be managed for high-quality sawlogs and species diversity for educational purposes, using the single-tree selection method with target diameters of 18-22”dbh.

### **PLANNED TREATMENTS:**



*Closed-canopy pine, to be thinned in 2018.  
Photos at permanent plot NWE001- Mav*

#### *Variable Density Thinning (2018)*

This 10-year entry will continue thinning of canopy trees while gradually releasing advance regeneration.

In the plantation matrix, crown thinning (2-4 sided release) will focus on releasing residual trees with vigorous live crowns and minimal timber or health defect. Residual basal area (B-line) will be 90-100ft<sup>2</sup> in Norway spruce and 100-110ft<sup>2</sup> in red/white pines. Understory response to thinning should be anticipated, and areas with desirable advance regeneration may be thinned more heavily to function as single-tree selection harvests.

Existing canopy gaps will be expanded to release advance regeneration, with 0.1-0.3 acres removed. Harvesting activities should use care to prevent damage to advance regeneration, especially in canopy gaps. Gaps will be positioned to favor site-appropriate hardwood species including sugar maple, red maple and black cherry.

Areas used for ropes course elements will be left untreated (see “Other Work” for optional activities). A 50’ buffer along Lang Brook should retain at least 85% canopy cover, with optional removal of high-risk fir to release yellow birch, red spruce and northern white cedar.

### **OTHER WORK**

Other optional work suggested for stand 1 over the coming decade includes:

- Trail maintenance for recreational use and access for uneven-aged management (small tractor/forwarder or draft animals)
- Ropes course maintenance to promote safety, forest health and aesthetics
- Survey and mark property boundaries



## STAND 2

*NOT ENROLLED IN UVA*

### STAND DESCRIPTION

*Acres:* 21.5

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Red Spruce-Northern Hardwood Forest



#### *Stand History and Overview:*

Stand 2 includes all areas of the Main Campus parcel that fall outside of the plantation and the 5-acre building exclusion area. A quarter of the stand area is made up of the lower and upper meadows, which are managed as grassland and orchard for wildlife, education, and recreational purposes. The forested portion of the stand can be summarized broadly by two conditions, influenced largely by soil types and land use history.

*Condition 1:* The area west of Lang Brook (lying mainly on either side of the upper meadow), is mixed forest with a combination of age classes and a canopy with a high proportion of red and white spruce, balsam fir and white pine. Until the 1960s, this area experienced the same land use as described for stand 1 (namely agricultural use beginning around 1840). In 1961, when stand 1 was planted in pine, this part of stand 2 likely continued to be used as pasture. Later, it was gradually recolonized by a variety of pioneer species, including the many conifers that have now reached pole to small-sawtimber size classes. Subsequent patchy logging, most likely in the early 1980s, created a younger age class of mixed species scattered among the older trees. This area also contains a variety of trails and campsites, used by visitors to NorthWoods and for educational programs. Areas with dense regeneration would benefit from pre-commercial cleaning to release the more desirable stems, especially if volunteer or low-cost labor could be used to complete this work.

*Condition 2:* Forested areas east of Lang Brook show more of an influence from past logging than from agriculture. Although probably used at one time for pasture, the majority of this area had returned to mixed forest by 1940. About 1985 the area was heavily high-graded, reducing stocking to well below the C-line. The resulting regeneration is a mix of conifers and broad-leaved hardwoods in the Cabot soils (west of Leadership Trail) and slightly more developed northern hardwoods in the better-drained eastern area. Several recreational paths also cross this area. The forest in condition 2 areas is in the early stage of transitioning from sapling to pole size-class and is overstocked in some areas, with many stems that are poorly formed (especially stump sprouts) or of non-commercial species. With assistance from NRCS cost-share programs, approximately 9.3 acres in this area was thinned pre-commercially in 2010 with the goal of releasing the highest quality stems of commercial species, though more of this improvement work is needed as the basal area increases.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	black cherry	17.0	0	1.2	1.2
	red maple	15.9	71	0.4	0.6
	yellow birch	12.5	0	0.7	0.7
	paper birch	8.0	0	0.3	0.3
	white ash	5.7	69	0.5	0.6
	sugar maple	2.3	0	0.3	0.3
	gray birch	1.1	0	0.0	0.0
	quaking aspen	1.1	0	0.0	0.0
<b>Hardwood Total</b>		<b>63.6</b>	<b>140</b>	<b>3.5</b>	<b>3.7</b>
Softwood	balsam fir	14.8	0	1.0	1.0
	white spruce	10.2	81	1.8	1.9
	northern white cedi	4.5	0	0.5	0.5
	tamarack	4.5	0	0.6	0.6
	eastern white pine	1.1	84	0.1	0.2
	red spruce	1.1	0	0.1	0.1
	<b>Softwood Total</b>		<b>36.2</b>	<b>165</b>	<b>4.1</b>
<b>Grand Total</b>		<b>99.8</b>	<b>305</b>	<b>7.5</b>	<b>8.1</b>

## WILDLIFE STRUCTURAL ATTRIBUTES

**Canopy (>30 feet):** Estimated 85% canopy closure; variable density and small gaps throughout

**Midstory (5-30 feet):** 34-66% cover, patchy. Primary species: serviceberry, white spruce, red maple, yellow birch, beaked hazelnut, alternate leafed dogwood, chokecherry, balsam fir and red spruce. A single highbush cranberry was found in the north.

**Understory (1-5 feet):** 34-66% cover, patchy. Primary herbaceous species: New York or hayscented ferns, sensitive fern, trout lily, intermediate wood fern, Christmas fern, goldthread, stiff clubmoss, foamflower and wild strawberry. Primary woody species: black cherry, white ash, white spruce, balsam fir, northern white cedar, red maple and red spruce.

**Snags:** Medium density of small diameter snags; 30.0 snags/acre, 90% smaller than 15" DBH

**Coarse Woody Material (>10" diameter):** Low density overall. Decay condition ranges from soft/decaying to new/solid.

**Fine Woody Material (<3" diameter):** Medium density, with more material in thinned areas.

**Leaf Litter:** Moderate depth, thicker in hardwood-dominated areas

**Wildlife Attribute Summary:** Much of stand 2 is young, even aged forest that lacks large snags, cavity trees and large woody debris. However, cover type and structure is variable across the stand with areas of dense young hardwood, shrubby field edges and patchy to dense softwood. Edge habitat is a prominent feature of this stand, being bordered by open areas around the NorthWoods Center. Future wildlife management should promote a soft edge along these forest margins, creating a structural transition from grass to forest that includes mast-producing shrubs such as serviceberry and raspberry.

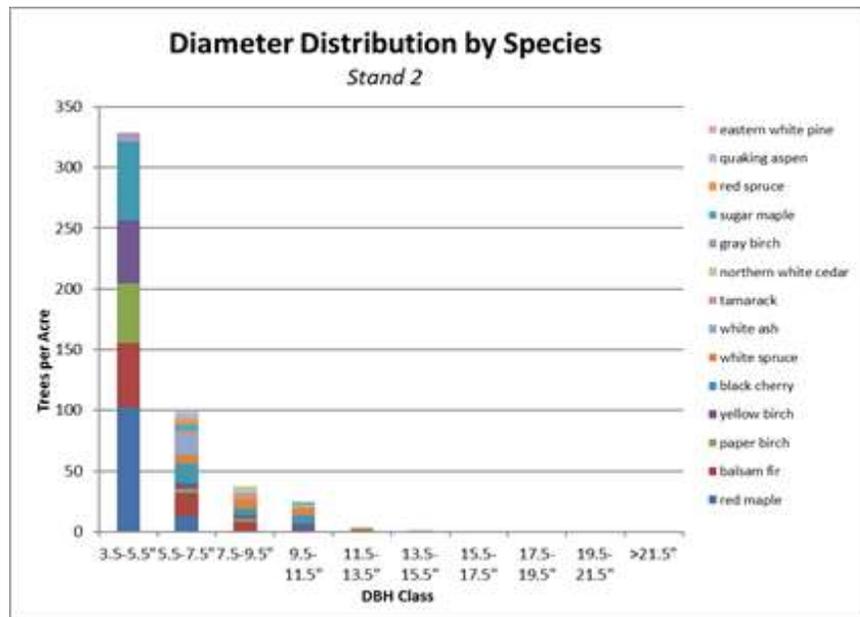
Hydrology in stand 2 includes several areas of importance for wildlife. Lang Brook bisects the stand, creating a wildlife corridor and riparian habitat. Several old excavated holes dating back to the early

1990s have partially filled in and contain standing water for much of the spring and summer; spotted salamander egg masses were found in one of these pools during May 2014.

The patchy, moist, mixed conifer/deciduous forest that characterizes the western half of the stand provides the unique combination of cover and food resources that attract a suite of species including American woodcock, snowshoe hare, bobcat, white-throated sparrow, veery, hermit thrush, Nashville warbler, and Canada warbler. Several of the bird species listed here are experiencing region-wide declines, most notably Canada warbler. This species benefits from moist forest with a well-developed shrub layer and abundant woody material.



Other wildlife observations during 2014 forest inventory included a probable nesting winter wren, porcupine (with associated scat and barking of trees), white throated sparrow, ruffed grouse drumming, and hare/deer browse.



**SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Lang Brook is known to support a diverse aquatic community, including brook trout, mink, northern two-lined and spring salamanders, and many aquatic invertebrates. A 50-foot forested buffer will be maintained to provide shade and to limit runoff. Operation of

equipment within this zone will be discouraged, and a minimum of A-line stocking will be maintained.

- A long pool in the northeast corner, deepened with equipment around 1992, serves as an amphibian breeding pool each spring and a concentrated food source for other wildlife. Egg masses and/or vocalizing males of spring peeper, green frog, American toad, spotted salamander, and wood frog have been observed here annually for the past decade.

## **STAND HEALTH**

A number of health-related issues were observed (below). The remedial action needed at this time is removal/control of the invasive honeysuckle.

### ***Human Impacts:***

- Uses related to NorthWoods programs, including trails throughout the stand and program activities in fields.

### ***Climate Change Considerations:***

- Variability in stream flows and greater chance for heavy rains could alter the size and course of Lang Brook. Maintaining a 50' forested buffer will help prevent erosion during high water events.
- Non-native plant prevalence is predicted to increase, and stand 2 will be especially susceptible due to trails, proximity to roads/open land and movement of animals in the Lang Brook stream corridor.
- Decline of boreal species (such as balsam fir) and potential loss of species (such as white ash) due to pests/disease will likely alter species composition. Species diversity should be maintained or increased to build resilience to species loss.

### ***Invasive Species:***

- One large invasive shrub honeysuckle was found in 2014 along the Lang Brook Trail. This should be cut or pulled and monitored for regrowth.

### ***Other Pathogens and Health Concerns:***

- Browning of needles on balsam fir regeneration (cause unknown).
- Decline of tamarack, especially near southern field edge.

## **RECREATION/ EDUCATION**

Several NorthWoods trails pass through stand 2, and areas near the field edges are frequently used for program activities. A lean-to and several informal campsites are located near the upper field.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

***Age Class Structure:*** Even-aged (~34 years old) with reserves

***Sampling Method:*** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 10 (1 per 2.2 acres)

**Sampling Date:** May 2014

*For all live intermediate-dominant trees >3.5" dbh:*

**Total BA (ft<sup>2</sup>/acre):** 88      **AGS BA:** 27 (31%)      **BA 95% CI:** 62-114 ft<sup>2</sup>/acre

**Total TPA:** 494      **AGS TPA:** 131 (27%)      **QMSD (inches):** 5.7

**Stocking Level:** Understocked. B-C line on mixedwood stocking chart (US Forest Service 2008 Timber Management Field Book)

**Regeneration:**

0-1" DBH – 722 stems per acre

1-3" DBH – 333 stems per acre

Number of Plots – 18 (0.3% of stand)

Although even-aged, stand 2 includes varying stages and species of regeneration. As a young (~34 year old) stand, many canopy trees are over 30' tall but only 3 to 4" DBH, and were sampled as regeneration. Below this canopy, advance regeneration is patchy with prominent areas of dense balsam fir and more scattered hardwoods, including black cherry, white ash and red maple. White spruce, red spruce and northern white cedar are also present. Stand wide regeneration cover was estimated at 34-66%, with 67% of plots containing at least one merchantable/desirable species.

**Site Class:** II (based on soil types and tree growth characteristics)

**Soils:** Two broad soil types dominate. In the northwest corner of the stand and along the east side soils are moderately well drained Tunbridge-Dixfield fine sandy loams. These soils are well suited to forestry, and support a Northern Hardwood Forest community type. The central part of the stand (along and northeast of Lang Brook) is characterized by poorly drained Cabot silt loam soils, which are less well suited to forestry. The seasonal high water table in these hydric soils often reaches the surface and common natural communities are Lowland Spruce-Fir Forest, Northern White Cedar Swamp, Alder Swamp, and Spruce-Fir-Tamarack Swamp. Both soil types are very stony.

**Access:** A network of trails and driveways allow good to excellent access in most of Stand 2, although timber harvests would be best conducted in winter until trails are hardened/improved for equipment use. Areas with hydric soils, especially near the northern and north-eastern stand margin, should be accessed with equipment only when ground is solidly frozen (mid-late winter). Established multi-use recreational trails are often wet and should be accessed primarily in frozen ground conditions. Due to close proximity to the NorthWoods lodge, care should be taken to maintain the aesthetic and recreational values of trails in the stand by minimizing soil damage, keeping a narrow treadway and removing slash.

**DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 15 years

**Diameter Objectives for Principle Species:**

18- 20" dbh - sugar maple, yellow birch, and red spruce;

14-16" dbh - white ash and other hardwoods;

12-15" dbh - balsam fir

The primary goal for this stand is the production of high quality sawlogs in a manner that maintains long-term forest health and is sensitive to educational and recreational uses. Cull materials removed in each entry can also provide firewood for NorthWoods. The existing patchy but moderately well-stocked status of the stand support a gradual shift to uneven-aged management, though adequate stocking in the larger diameter classes will require multiple cutting cycles to achieve.

The current focus should be on pre-commercial stand improvement in the existing overstocked sapling areas, with the goal of improving stem quality and promoting existing well-formed commercial species, especially shade-tolerant and mid-tolerant types. The cost of these operations can be off-set by utilizing volunteer labor or by enrollment in cost share programs, and other benefits can be gained by integrating them with NorthWoods educational programs and helping to meet the annual NorthWoods firewood demand. After one more cutting cycle, new age classes can be introduced during each entry using the single tree and small group selection systems. Marking should promote red spruce, yellow birch and white ash as primary crop trees, with a minor component of other on-site species (northern white cedar, balsam fir, red maple in wetter areas; sugar maple and black cherry in drier ones). Location of groups will be governed in part by variations in topography and soil moisture, to mitigate the threat of wind throw, and in part by the distribution of desirable stems. The overall structural goal will be  $q=1.5$ , with a maximum diameter of 22".

### **PLANNED TREATMENTS:**

*Leave to grow and reevaluate in 2025*

Stand 2 is partially still regenerating from past logging while also responding to the 2010 thinning, and should mostly be left to grow for the next 10 years.

### **OTHER WORK**

Optional work suggested for Stand 2 over the coming decade includes:

- Trail maintenance for recreational use and access for uneven-aged management (small tractor/forwarder or draft animals).
- Light thinning near lean-to and trails to promote safety, individual tree health and aesthetics. Very small gaps (1/20<sup>th</sup> acre) may be created where overstory tree health/quality is declining and desirable advance regeneration is present.
- Continued pre-commercial thinning as described above, retaining at least 350 trees per acre. Thinned trees may be removed for firewood where access allows.
- Invasive honeysuckle control- see Stand Health section, above.
- Harvest Christmas trees in upper field.
- Establish 3 to 5 year mowing interval within 20 feet of field edges, with annual (or more frequent) mowing in fields. Plant clover and other beneficial wildlife plants.
- Mark property boundaries

## STAND 3

### STAND DESCRIPTION

*Acres (pro-rated):* 35.3

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Red Spruce-Northern Hardwood Forest, Northern White Cedar Swamp, Lowland Spruce-Fir Forest



#### *Stand History and Overview:*

Stand 3 occupies the Lang Brook headwater region and is typified by gradual slopes, moist soils, and a cover type of balsam fir and red spruce with a mixed hardwood component. The northwest area is a broad flat, perched valley, with forest along the property line grading into a northern white cedar type that is more extensive over the line. Much of the rest of the stand is dense pole-sized spruce-fir or mixed forest, with a closed canopy interrupted by scattered open sedge-dominated seepages. In the southeast area, slopes increase and Lang Brook flows through a beaver flowage and mixed hardwoods, dominated by yellow birch/ red maple with red spruce and balsam fir.

Little is known about the early history of the stand, though evidence suggests that it was never used for agriculture. Aerial photographs from 1941 show an unfragmented forest with a major softwood component and fairly large canopies. The most recent commercial logging of the stand was a heavy cut that took place between 1966 and 1969, when the property was owned by Poulin Pulpwood. Old stumps, skidder ruts, and metal gas cans are still visible from this entry. This logging appears to have targeted the softwood component leaving a very scattered overstory of residual hardwoods- most concentrated in the eastern corner of the stand. In a 1985 management plan, forester Richard Carbonetti reported a residual overstory basal area of 48 sq ft and a mean stand diameter of 7.6" dbh, though these data encompassed a much larger area than the current stand. A single northern white cedar near Lang Brook, cored in the 2014 forest inventory, was 105 years old and showed rapid growth early in its life with a canopy release around 1960.

The heavy cutting of the late 1960s resulted in aggressive regeneration, most notably of balsam fir. No additional timber harvests have taken place since that time, though the property has changed ownerships four times since 1968. In 2004 NorthWoods acquired the parcel from board member Lydia Spitzer and NorthWoods founder Bill Manning. Ecological monitoring through fixed transects and point plots (of birds, large mammals, and forest vegetation) were initiated by NorthWoods beginning in 1999 and have been surveyed intermittently since.

In 2013, pre-commercial thinning was completed on 15.3 acres, focusing on areas of dense softwood (primarily balsam fir and red spruce) with high quality growing stock. Funding for this work was provided through an NRCS cost-share program.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	red maple	12.9	29	4.0	4.1
	yellow birch	5.5	29	1.0	1.0
	black cherry	3.7	0	0.5	0.5
	paper birch	1.4	0	0.2	0.2
	sugar maple	1.4	0	0.4	0.4
	black ash	0.5	0	0.0	0.0
	quaking aspen	0.5	0	0.3	0.3
	white ash	0.5	0	0.0	0.0
<b>Hardwood Total</b>		<b>26.4</b>	<b>58</b>	<b>6.4</b>	<b>6.5</b>
Softwood	balsam fir	47.0	1,654	12.5	16.7
	red spruce	21.2	225	4.8	5.6
	northern white cedi	3.2	172	0.5	0.8
	eastern hemlock	0.9	0	0.0	0.0
	tamarack	0.9	46	0.2	0.5
	white spruce	0.5	106	0.1	0.3
	<b>Softwood Total</b>		<b>73.7</b>	<b>2,203</b>	<b>18.0</b>
<b>Grand Total</b>		<b>100.1</b>	<b>2,260</b>	<b>24.4</b>	<b>30.3</b>

## WILDLIFE STRUCTURAL ATTRIBUTES

**Canopy (>30 feet):** Estimated 90% canopy closure; uniform, softwood.

**Midstory (5-30 feet):** 0-33% cover, patchy. Primary species: balsam fir, red spruce, yellow birch and paper birch.

**Understory (1-5 feet):** 0-33% cover, patchy. Primary herbaceous species (in mixed forest): painted trillium, goldthread, trout lily, Canada mayflower and starflower. Primary herbaceous species (in spruce-fir forest): sphagnum moss, dwarf ginseng, bluebead lily, Shreber's moss, stairstep moss, Canada mayflower, mountain wood sorrel, intermediate wood fern, painted trillium, starflower, and goldthread. Primary woody species: dwarf raspberry, hobblebush, American fly honeysuckle, creeping snowberry, mountain holly, and balsam fir.

**Snags:** High density of small snags; 63.6 snags/acre, 98% smaller than 15" DBH

**Coarse Woody Material (>10" diameter):** Low density of large material, despite abundant 3-6" woody debris from pre-commercial thinning. Decay condition ranges from soft/decaying to new/solid.

**Fine Woody Material (<3" diameter):** High density, with most material in thinned areas.

**Leaf Litter:** Not sampled

**Wildlife Attribute Summary:** Mammal surveys conducted across the stand since 1999 have recorded a notable lack of activity through the regenerating balsam fir- red spruce forest. Greater species diversity has been noted along the ski trail, which is used as a wildlife travel corridor, and especially around the beaver pond along Lang Brook. Species using the trail include moose, coyote, bobcat, and black bear. Diversity is especially high at the beaver pond, where bird and small mammal monitoring has documented both high species richness and a high incidence of use for rearing young. Species confirmed to breed here include hermit thrush, rose-breasted grosbeak, three woodpecker species,

wood frog, and spotted salamander. Other commonly observed species are golden-crowned kinglet, blackburnian warbler, black-throated green warbler, yellow-rumped warbler, red-backed vole, meadow vole, meadow and woodland jumping mice, and short-tailed shrew. Little brown bats utilize the pond area during the summer months.

### **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites.

However, the following areas offer unique, ecologically valuable and/or fragile features:



*Lang Brook beaver pond - May 2014*

- Almost all of Stand 3 is influenced in some way by special hydrologic features, with a number of management implications. All but the eastern end of the stand is mapped as a Class II significant wetland, bringing the regulations described in the property summary (hydrology section) into play regarding logging.
- Lang Brook also originates in and crosses the stand. During future management activities a riparian buffer of at least 50 feet on either side of the stream will be retained to minimize erosion and preserve water quality. Minimal tree removal will occur within this zone, maintaining stocking at or above the A-line. Stream crossings and other activities will conform to Vermont's Acceptable Management Practices for Water Quality.
- Beaver activity on Lang Brook has created a 0.25 acre pond. Bird and small mammal monitoring has documented both high species richness and a high incidence of use for rearing young in or around this beaver pond. Species confirmed to breed here include hermit thrush, rose-breasted grosbeak, three woodpecker species, wood frog, and spotted salamander. Other commonly observed species are golden-crowned kinglet, blackburnian warbler, black-throated green warbler, yellow-rumped warbler, red-backed vole, meadow vole, meadow and woodland jumping mice, and short-tailed shrew. Little brown bats also utilize the pond area during the summer months.

### **STAND HEALTH**

Though a number of forest health issues were observed (below), none require special action at this time.

#### ***Human Impacts:***

- Trail corridors are maintained through the stand for forestry access and non-motorized recreation.

- Ruts and pools created by past logging (not likely to erode).

***Wildlife Impacts:***

- Some deer browse on regeneration.
- Porcupine barking found on red spruce

***Invasive Species:***

- None observed

***Climate Change Considerations:***

- Variability in stream flows and greater chance for heavy rains could alter the size and course of Lang Brook. Maintaining a 50' forested buffer will help prevent erosion during high water events.
- Decline of boreal species (such as balsam fir) will likely alter long-term species composition. Species diversity should be increased to build resilience to species loss, with increased proportions of northern white cedar, eastern hemlock, tamarack and black cherry.

***Other Pathogens and Health Concerns:***

- None observed

**RECREATION/ EDUCATION**

The south and eastern parts of the stand are crossed by public recreation trails maintained by NorthWoods and used mainly during the winter. These include the Echo Lake Connector trail (a 5-mile loop ski trail) and the beaver pond walking path.

Timber stand improvement areas, completed in 2013, are designated as a demonstration site in the Lydia Spitzer Demonstration Forest. Informational signage will be installed describing the sustainable forestry practices implemented, and groups regularly visit this site as part of NorthWoods education and outreach programming.

**SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

***Age Class Structure:*** Even-aged (~45 years old) with reserves

***Sampling Method:*** Variable radius plots (BAF 10, all stems  $\geq 4''$  dbh)

***Number of Plots:*** 16 (1 per 2.2 acres)

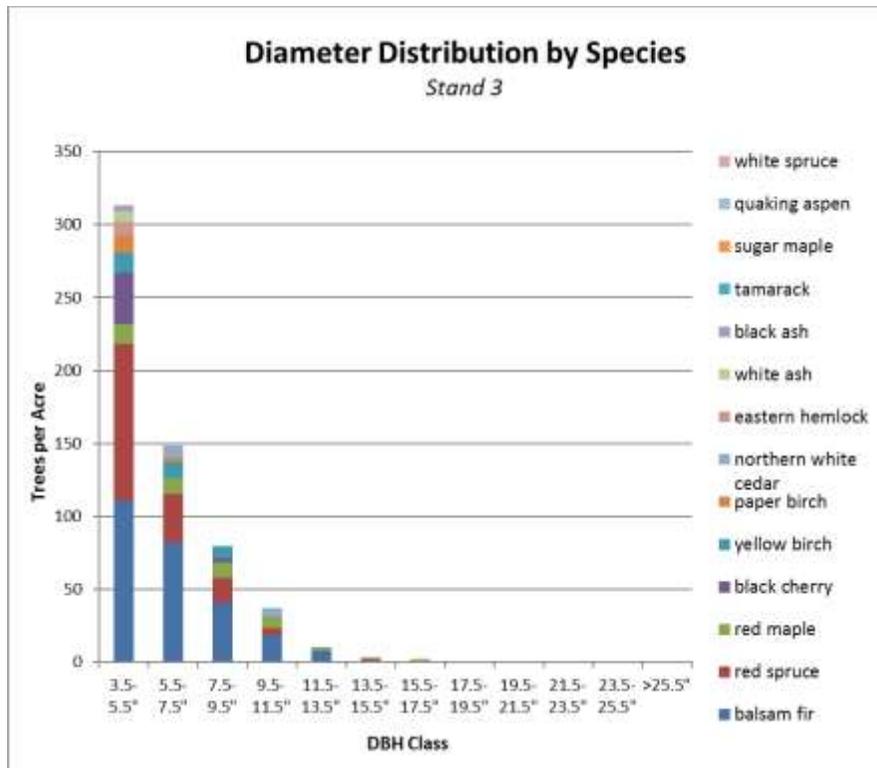
***Sampling Date:*** May 2014

*For all live intermediate-dominant trees  $>3.5''$  dbh:*

***Total BA (ft<sup>2</sup>/acre):*** 136      ***AGS BA:*** 102 (75%)      ***BA 95% CI:*** 123-149 ft<sup>2</sup>/acre

***Total TPA:*** 595      ***AGS TPA:*** 425 (71%)      ***QMSD (inches):*** 6.5

***Stocking Level:*** Fully stocked. A-line on mixedwood stocking chart (US Forest Service 2008 Timber Management Field Book)



**Regeneration:**

0-1" DBH – 233 stems per acre

1-3" DBH – 300 stems per acre

Number of Plots – 32 (0.1% of stand)

With an even-aged structure and closed canopy, regeneration is relatively sparse in stand 3. The primary species is balsam fir. Hardwood regeneration is likely reduced by deer browse.

**Site Class:** II, some I (based on soil types and tree growth characteristics)

**Soils:** Cabot silt loams dominate the northern part of the stand and field evidence suggests that these hydric soils also extend well into the central part of the stand (contrary to NRCS mapping). Dense basal till is close to the surface, resulting in a seasonal high water table at or within 16" of the surface. Textures are silt loams near the surface and fine sandy loams below.

Southern and eastern parts of the stand overlie Tunbridge- Dixfield complex soils. These are moderately deep and moderately well drained. They are generally well suited to forestry, though seasonal high water tables in Dixfield soils can reach within 16" of the surface. Textures are fine sandy loams and sandy loams.

**Access:** Access to Stand 3 is fair, with an established trail reaching much of the area but hydric soils creating limitations for equipment. Distance to the nearest landing is 0.2 miles at the closest point, 0.5 miles at the farthest point on current trails, and 0.7 miles to the farthest stand boundary. Most of the main trail, also the Echo Lake Connector multi-use recreational trail, can sustain moderate summer use for small equipment (up to ~5 tons and ~6 foot width) in dry conditions, but is only suitable for skidding when covered with snowpack. Care should be taken to maintain the aesthetic and recreational values of trails in the stand by minimizing rutting, keeping a narrow trail treadway and removing slash.

## **DESIRED FUTURE STAND CONDITION**

*Long Range Silvicultural Objectives:* Uneven-aged Management

*Cutting Cycle:* 15 years

*Diameter Objectives for Principle Species:*

12-16" dbh - balsam fir

14-18" dbh - red maple, and red spruce

16-18" dbh - beech

18-20" dbh - sugar maple, white ash, yellow birch, hemlock

20-22" dbh - white pine

The primary goal for this stand is the production of high quality sawlogs in a manner that maintains long-term forest health and that is sensitive to recreational values along the existing trail system. The main objective, which will require multiple cutting cycles to achieve, will be to transition to an uneven-aged structure and a species composition with a lesser proportion of balsam fir and red maple and a higher proportion of red spruce, yellow birch, and other commercial species. Minor species well suited to the site and of special wildlife or NorthWoods facility use will also be promoted as up to 15% of the total stocking. Examples include tamarack, hemlock, northern white cedar, and black ash. Pulpwood is a low priority for this stand, as the difficult access will likely make it uneconomical to extract. Low-grade hardwood will be extracted for use as firewood at the NorthWoods facilities. The long-term structural goal is  $q=1.4$ .

## **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

Stand 3 is still too young to support a commercial harvest, but could benefit from continued light pre-commercial thinning. This is not critical in the next 10 years for timber stand development, and may be undertaken as staff time and/or funding allow. Areas of focus should have good growing stock of desirable species, and a dense canopy (high competition). Minimum of B-line stocking should be maintained using appropriate mixedwood or spruce-fir stocking charts. Thinning should focus on retaining and releasing well-formed crop trees, prioritizing red spruce, yellow birch, northern white cedar, and to a lesser extent balsam fir. Where encountered, high quality black ash, tamarack, and other minor species should also be retained as up to 15% of total stocking. Thinned trees may be removed for firewood or NorthWoods projects (tent poles, etc.), using established trails for access.

## **OTHER WORK**

Optional work suggested for Stand 3 over the coming decade includes:

- Trail maintenance for recreational use and access for uneven-aged management (small tractor/forwarder or draft animals)
- Ongoing pre-commercial thinning as described above
- Survey and mark property boundaries

## STAND 4

### STAND DESCRIPTION

*Acres (pro-rated):* 23.6

*NED Cover Type(s):* Northern Hardwoods

*Natural Communities:* Northern Hardwood Forest (including Beech-Red Maple- Hemlock Northern Hardwood Forest variant), Red Spruce- Northern Hardwood Forest



***Stand History and Overview:*** Stand 4 encompasses the ridge and side slopes of an unnamed prominence lying between the Clyde River and Tripp Hill, reaching an elevation of 1,520 feet.

The Echo Lake Connector multi-use trail bisects the stand east to west. The forest south of this trail is nearly pure northern hardwoods, with a major component of bear-scarred beech on the dry ridge area and a sugar maple- beech- yellow birch- white ash mix in the adjacent gradual slopes. Descending north from the trail on east-facing slopes the hardwoods grade increasingly into a mixed forest, with red maple, yellow birch, balsam fir, and paper birch among the more common species.

For the first half of the 20<sup>th</sup> century, Stands 3 and 4 were at the northeast extreme of a large (multiple town lot) ownership held by a sequence of farming families and were probably used as distant woodlots for the farm. The forest south of the ridge in stand 4 may have at one time been the upper part of a sugarbush operated by a farmer living along the Ten Mile Square road. No evidence of agricultural use has been found. A growth spurt recorded in the rings of a number of current canopy hardwoods suggests a possible thinning or natural disturbance around 1930. In 1941 most of the stand was forested in large-canopied hardwoods, with a conifer-dominated north corner being the exception.

In 1966 Poulin Pulpwood acquired the property and during its three year ownership conducted a nearly property-wide liquidation cut. A patchy hardwood overstory (including beech, sugar maple and white ash) was left in much of stand 4, though the eastern part of the stand was clearcut. In a 1985 management plan, forester Richard Carbonetti reported 54 square feet of basal area (43 of this acceptable) and a mean stand diameter of 10.6” for the stand.

The property has changed ownerships four more times since being logged in the late 1960s. In the most recent transfer, NorthWoods acquired the property in 2004 from board member Lydia Spitzer and NorthWoods founder Bill Manning. Ecological monitoring through fixed transects and point plots (of birds, large mammals, and forest vegetation) were initiated by NorthWoods beginning in 1999. Between 2012 and 2015, crop tree release was implemented in approximately 10 acres; 4 acres were funded through NRCS cost-share programs for wildlife habitat enhancement, with all felled trees left in place. In the other 6 acres that have been treated, a 4-wheel-drive tractor and forwarding trailer were used to extract approximately 25 cords of firewood for NorthWoods facility use.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	sugar maple	24.2	859	5.4	7.2
	red maple	19.2	713	5.7	7.1
	yellow birch	19.2	314	3.1	3.8
	American beech	4.2	193	0.7	1.0
	pin cherry	4.2	0	0.1	0.1
	paper birch	3.3	0	0.8	0.8
	white ash	3.3	323	0.5	1.1
	black cherry	1.7	0	0.3	0.3
	striped maple	1.7	0	0.1	0.1
	gray birch	0.8	0	0.3	0.3
	hophornbeam	0.8	0	0.0	0.0
<b>Hardwood Total</b>		<b>82.6</b>	<b>2,401</b>	<b>17.2</b>	<b>22.0</b>
Softwood	balsam fir	15.0	573	3.2	4.7
	red spruce	1.7	52	0.4	0.5
	eastern hemlock	0.8	0	0.1	0.1
	<b>Softwood Total</b>		<b>17.5</b>	<b>625</b>	<b>3.6</b>
<b>Grand Total</b>		<b>100.1</b>	<b>3,027</b>	<b>20.8</b>	<b>27.2</b>

## WILDLIFE STRUCTURAL ATTRIBUTES

**Canopy (>30 feet):** Estimated 95% canopy closure; uniform; hardwood.

**Midstory (5-30 feet):** 0-33% cover, patchy. Primary species: American beech, balsam fir, red spruce, sugar maple and striped maple

**Understory (1-5 feet):** 0-33% cover, patchy. Primary herbaceous species: trout lily (most common), ferns (scattered), Canada mayflower, starflower, spring beauty, painted trillium and oak fern. Primary woody species: hobblebush, sugar maple, yellow birch, balsam fir and American beech.

**Snags:** Medium density, with large snags uncommon; 24.7 snags/acre, 98% smaller than 15" DBH

**Coarse Woody Material (>10" diameter):** Medium density. Decay condition ranges from soft/decaying to new/solid. Wildlife mast tree release treatment areas (southwest of Echo Connector Trail) have all felled trees left in place, creating a much higher density of large, solid hardwood logs.

**Fine Woody Material (<3" diameter):** High density, with most material in thinned areas. Where firewood was harvested, tops were left in place to create piles of fine woody material.

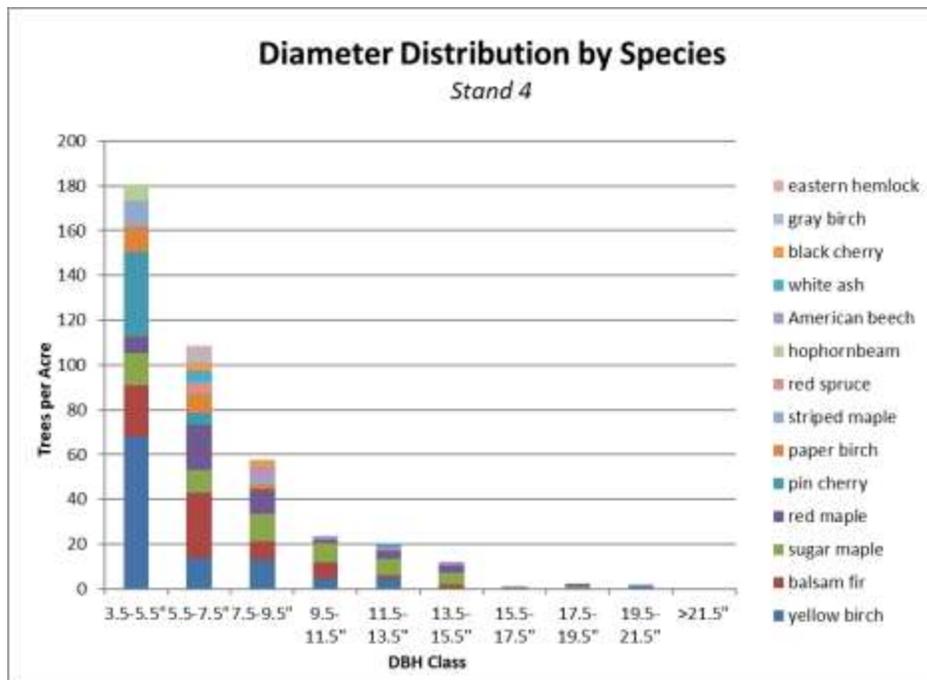
**Leaf Litter:** medium to high density (broad-leaved).

**Wildlife Attribute Summary:** This well-developed hardwood forest offers habitat most beneficial to interior forest species, including far-ranging mammals such as black bear. Bird species associated with mixed interior forest and/or snags are among the ten most abundant recorded here (ovenbird, black-throated green warbler, hermit thrush, red-eyed vireo, black-throated blue warbler, and hairy and downy woodpeckers). Other species noted in the stand are barred owl, scarlet tanager, wild turkey, and Swainson's thrush.

## SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES

No areas within the stand are being enrolled as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- At least two seeps are found in this stand, one crossing the Echo Connector Trail near the southeast corner of the stand, and another in the north part of the stand. Logging around these seeps should follow Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont. New trails should be routed to avoid wet soils wherever possible, and existing trails should be maintained/improved to prevent rutting and erosion.
- In the west central part of the stand, less than 200 feet north of the ski trail is a large vernal pool, impounded by two parallel bedrock outcrops. Based on surveys conducted by NorthWoods staff, this is the largest and most productive natural breeding pool for amphibians on the 3000 forested acres surrounding the NorthWoods facility. Wood frogs and spotted salamanders breed here in large numbers each spring, with 300 spotted salamander egg masses not uncommon. To protect the breeding pool and maintain intact adjacent upland habitat, a no-cut buffer of 100 feet from the vernal pool will be maintained in future management entries (this area is designated as a separate stand and an Ecologically Sensitive Treatment Area in this plan). In a second band extending 100 to 300 feet from the pool, no more than 25% of basal area will be removed in each entry, downed woody debris will be retained intact, and equipment will be used with caution to avoid rutting and compaction.
- Located southeast of the vernal pool and south of the ski trail is a hardwood ridge well stocked with bear-scarred American beech, including several over 12” dbh. Seasonal mammal surveys since 1999 have recorded regular fall use of this area by black bear. Although small in size, it is one of the few remaining concentrated sources of beech mast in the surrounding 3,000 acres and should be managed in part to promote this mast species.



## **STAND HEALTH**

Though a number of forest health issues were observed (below), none require special action at this time.

### ***Human Impacts:***

- Trail corridors are maintained through the stand for forestry access and non-motorized recreation.

### ***Wildlife Impacts:***

- Some deer browse on regeneration.

### ***Invasive Species:***

- None observed

### ***Climate Change Considerations:***

- Increased storm intensity could alter the disturbance regimes, with the ridge top being an area more vulnerable to tree damage and single/multiple tree blowdowns. Management activities should promote a structurally resilient forest by retaining healthy trees, maintaining a low density of species prone to damage (balsam fir, gray birch and paper birch), regenerating the stand in small increments and anticipating natural disturbances.

### ***Other Pathogens and Health Concerns:***

- Beech bark disease is found on some American beech. The disease is caused by an insect-fungus complex, starting with a non-native scale insect introduced from Europe that creates an opening in the bark, which is then invaded by native fungi - most often *Nectria coccinea* var. *faginata*. Infected trees can be identified by the waxy white “wool” covering over the tiny scale insects, by sunken or raised bark lesions, canopy dieback, or the reddish/purple fruiting bodies of the fungal component. The disease attacks the inner bark and sapwood, eventually killing many infected trees. Fungal spores that spread the disease are airborne, therefore the best strategy for combating the disease is to maintain overall forest health, and to promote existing beech that have survived and may harbor a natural resistance to the disease. See the Vermont Agency of Natural Resources (ANR) “Management Guidelines for Optimizing Mast Yields in Beech Mast Production Areas” (available online).
- Emerald ash borer (EAB), an invasive insect that can cause nearly complete mortality in ash tree populations, will likely reach northern Vermont in the next 10 years. The larval stage of EAB tunnels through cambium of white, green and black ash trees, thereby girdling the tree and killing it. Ash trees that are under stress from other factors are more susceptible to EAB infestation. White ash is a dominant canopy species in some areas of this stand; future management activities should retain healthy ash trees while monitoring for EAB damage.

## **RECREATION/ EDUCATION**

The stand is crossed by the Echo Lake Connector Trail, a public multi-use trail maintained by NorthWoods and used mainly during the winter for skiing, snowshoeing and forestry access. Part of

Stand 4 is a featured area in the Lydia Spitzer Demonstration Forest, modeling mast/crop tree release and low-impact timber harvesting. Informational signage describes the sustainable forestry practices implemented, and groups regularly visit this site as part of NorthWoods education and outreach programming.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

**Age Class Structure:** Even-aged (~45 years old) with reserves (~83 years old)

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 10 (1 per 2.4 acres)

**Sampling Date:** May 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 120      **AGS BA:** 78 (65%)      **BA 95% CI:** 96-144 ft<sup>2</sup>/acre

**Total TPA:** 408      **AGS TPA:** 246 (60%)      **QMSD (inches):** 7.3

**Stocking Level:** Slightly overstocked. Above A-line on hardwood stocking chart (US Forest Service 2008 Timber Management Field Book)

### **Regeneration:**

*0-1" DBH* – 316 stems per acre

*1-3" DBH* – 263 stems per acre

*Number of Plots* – 19 (0.1% of stand / 1 plot per 1.2 acres)

With an even-aged structure and closed canopy, regeneration is relatively sparse in stand 4. Primary species include American beech, balsam fir, sugar maple, white ash and yellow birch. Striped maple and hobblebush compete with other regeneration in some areas of the stand.

**Site Class:** II (based on soil types and tree growth characteristics)

**Soils:** Higher elevation, ridge areas of the stand are characterized by Tunbridge-Lyman fine sandy loams. These soils range from shallow (10") to moderately deep (40") to bedrock, though surface stone and even bedrock outcrops are common. They are well drained to excessively drained and are well-suited to equipment use, though tree growth can be inhibited by moisture limitations and thin soils.

Side slopes in west and northeast parts of the stand overlie Tunbridge- Dixfield fine sandy loams and sandy loams. These are moderately deep (20-40") and well drained, with some surface stone and bedrock outcrops. They are well-suited to forestry equipment use, but slope and erodibility can be limiting factors.

**Access:** Fair. Although the stand's soils are well-suited to equipment access in dry or frozen ground conditions, the distance to the nearest possible landing (NorthWoods upper meadow) is at minimum a half mile – and over  $\frac{3}{4}$  mile from the farthest corner of the stand. Ongoing improvements to the Echo Lake Connector Trail, including replacement of two bridges, drainage improvement and surface hardening (using wood corduroy, cobble, gravel and/or geotextile fabric in different locations), have made the stand more accessible but equipment use should still be limited to dry/frozen conditions. Establishment of rough, permanent harvest trails was started in 2014 to the north of the Echo Lake Connector Trail; future work on this trail network should continue a system of looped trails spaced approximately 200' apart, and junctions with the Echo Connector Trail should have signage to

minimize confusion for recreation trail users. Only high value or much needed timber will be economical to remove from the stand and a forwarder system would help to address these difficulties.

## **DESIRED FUTURE STAND CONDITION**

*Long Range Silvicultural Objectives:* Uneven-aged Management

*Cutting Cycle:* 15 years

*Diameter Objectives for Principle Species:*

- 12-16" dbh ----- balsam fir
- 14-18" dbh ----- red maple, and red spruce
- 16-18" dbh ----- beech, white ash
- 18-20" dbh ----- sugar maple, yellow birch, hemlock

The primary goal for this stand is the sustained production of high quality sawlogs in a manner that maintains long-term forest health. Other specific goals include protecting and preserving wildlife habitat values of the vernal pool and beech ridge, supporting recreational trail values, and supporting educational activities. This will be achieved by gradually converting the stand to an uneven-aged structure while simultaneously improving stem quality and species composition. Management will employ single tree and small group selection systems, with group sizes of up to one quarter acre. To maintain canopy cover within the vernal pool 300' buffer, this area will be regenerated using single tree selection and/or a continuous cover shelterwood technique (retaining shelterwood trees until regeneration is close to canopy height), with some reserve trees maintained through natural senescence. Marking will promote well-formed commercial shade tolerant/ mid-tolerant species such as sugar maple, yellow birch and white ash, as well as healthy American beech. Red spruce in all age classes will be promoted over balsam fir in an effort to reverse the relative proportions of these two species. The structural goal is  $q=1.4$ , though several cutting cycles will be needed to reach this.

## **PLANNED TREATMENTS**

*Mast/Crop Tree Release with Small Group Selection (2016)*

Mast/Crop Tree Release, scheduled for 2012/2014 in amendments to the previous UVA plan, will be continued in parts of the stand not already treated. Treatment will be focused on areas where pole-sized hardwoods dominate the canopy and where stocking is high (B-line stocking of at least 60ft<sup>2</sup>/ac will be retained in all areas). Approximately 30 crop trees per acre will be released on 3-4 sides of the canopy, with species with high likelihood of epicormic branching (e.g. yellow birch) released on only 2 sides. Up to 30 cords (10 cords/year) of firewood will be removed for use in NorthWoods facilities. Approximately 4 logs per acre will be left on the ground in areas surrounding the vernal pool buffer to enhance salamander habitat, and any nest or cavity trees will be retained.

Target species for release are disease resistant bear-scarred American beech, yellow birch, black cherry, paper birch, and sugar maple. Other high value mast trees or shrubs, such as eastern hophornbeam or serviceberry may also be released, if encountered. This treatment will improve the mast resource for bears and other wildlife, as well as increasing the proportion of acceptable growing stock. By following the VT ANR beech management guidelines we will also select for the best genetic stock of beech bark disease resistance and nut-producing beech.

Transition to uneven-aged structure will also be initiated with small group selections (up to 1/4<sup>th</sup> acre), with a total area of 1 to 2 acres harvested in 2016. Group selections will be located where overstory trees are of low quality or undesirable species and preferably where advance regeneration of desirable species (sugar maple, yellow birch, American beech, red spruce, black cherry) is present.

### **OTHER WORK**

Optional work suggested for Stand 4 over the coming decade includes:

- Trail maintenance for recreational use and new trail construction/improvement for uneven-aged management access (for use by small tractor/forwarder or similar equipment on dry/frozen ground)
- Due to regeneration pressure from deer browse and the stand's value as an educational area, experimental deer exclosures could be used in group selections while regeneration is establishing



## STAND 5

### STAND DESCRIPTION

*Acres (pro-rated):* 48.4

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Northern Hardwood Forest (with possible Yellow Birch variant in more moist, stony areas)/ Red Spruce-Northern Hardwood Forest



#### *Stand History and Overview:*

This stand extends north from the property line, descending east to west from the top of the Tripp Hill fields almost to the East Echo Lake road. Species mix is variable, with softwood species contributing nearly half of the basal area, although most land area is dominated by less dense hardwoods. Patches with higher densities of old-field conifer species, including white pine, white spruce, and northern white cedar, remain scattered throughout the stand and provide the few current income-producing management opportunities. A small patch of nearly pure hemlock located near the center of the stand is an uncommon occurrence in the NorthWoods forest, and provides winter cover as well as potential future refugia of eastern hemlock if the hemlock woolly adelgid reaches northeastern Vermont. Some yellow birch on the lower slopes also have current and/or future veneer potential. Regeneration ranges from relatively dense to sparse in different parts of the stand. Hardwoods (mostly white ash and sugar maple) comprise most of the regeneration, and although only 13% of these are above deer browse range, this is an increase from the 6% above deer browse observed in 2006. Balsam fir, which represents most of the softwood saplings, ranges more evenly between 1" and 4" diameter, though the species has suffered from some moose browse.

Most of this stand was likely either open pasture or pastured forest during the 19<sup>th</sup> century, and possibly into the early 20<sup>th</sup> century. By 1940 the cover was variable, with active farmland in the lower (west) corner, old fields beginning to reforest in the northeast, and well established conifers through most of the stand. Open areas were soon abandoned and growth continued stand-wide until the early 1970s, when a small cut in the lower west corner again removed most of the tree cover in that area. The stand appears to have been lightly thinned more recently, based upon some stumps observed at the plots.

### WILDLIFE STRUCTURAL ATTRIBUTES

*Canopy (>30 feet):* Estimated 98% canopy closure; uniform with mix of hardwood and softwood species (see diameter distribution chart below).

*Midstory (5-30 feet):* 67-100% cover, uniform. Primary species: sugar maple, white ash, balsam fir, striped maple and yellow birch.

*Understory (1-5 feet):* 0-33% cover, patchy. Primary herbaceous species: sensitive fern, New York

fern, intermediate wood fern, Christmas fern, oak fern, trillium, wild strawberry, sedges, rough-stemmed goldenrod and helleborine. Primary woody species: sugar maple, white ash, balsam fir, striped maple, beaked hazelnut, red-berried elder, creeping dwarf-raspberry and mountain maple.

**Snags:** High density of small snags; 87 snags/acre, 98% smaller than 15” DBH

**Coarse Woody Material (>10” diameter):** Low density throughout. Occasional blowdowns contribute most large downed wood, and most are moderately decayed.

**Fine Woody Material (<3” diameter):** Moderate to high density, uniformly distributed.

**Leaf Litter:** Not sampled

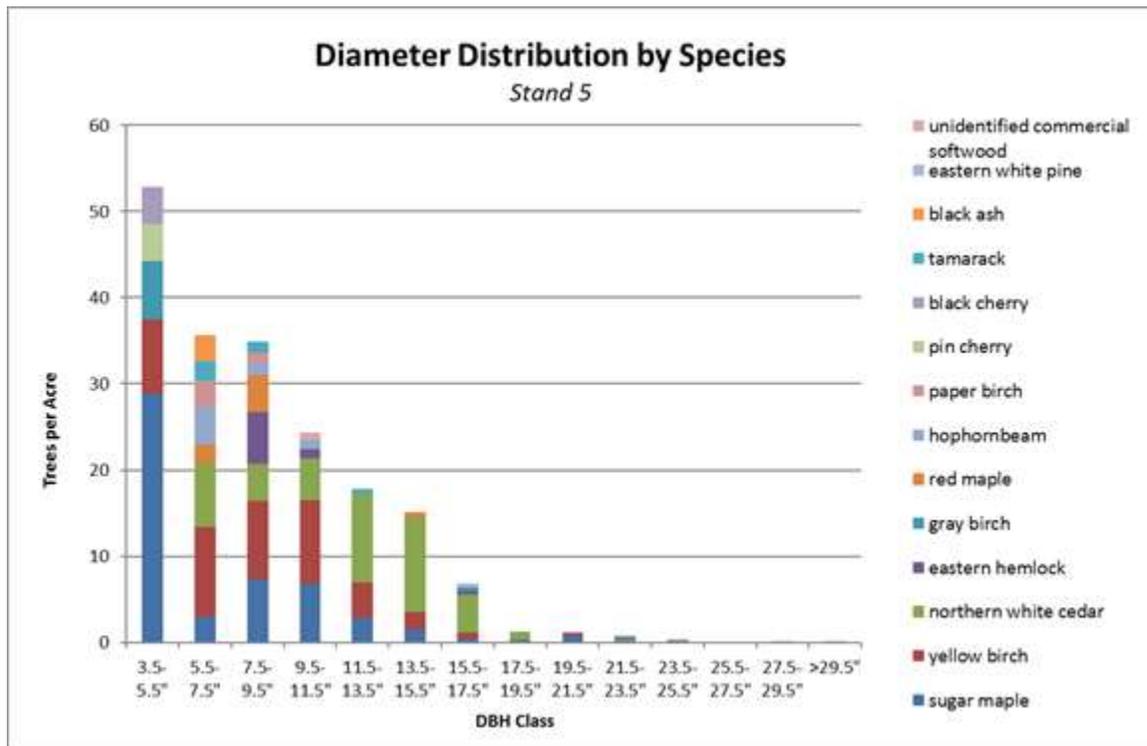
**Wildlife Attribute Summary:** Deer frequently feed and bed in the lower parts of the stand and moose sign is common in the moist upper areas among the fir saplings. While other species use the forest, no special habitat features were noted.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
<b>Hardwood</b>	yellow birch	15.7	580	4.5	5.7
	sugar maple	13.6	588	3.6	4.9
	white ash	8.5	504	2.6	3.5
	quaking aspen	6.8	185	2.5	2.8
	red maple	2.1	45	1.0	1.1
	hophornbeam	1.7	0	0.7	0.7
	bigtooth aspen	1.3	0	0.3	0.3
	gray birch	0.9	0	0.2	0.2
	paper birch	0.9	0	0.3	0.3
	striped maple	0.9	0	0.0	0.0
	American basswood	0.4	0	0.2	0.2
	black ash	0.4	0	0.2	0.2
	black cherry	0.4	0	0.0	0.0
	pin cherry	0.4	0	0.0	0.0
	<b>Hardwood Total</b>		<b>54.0</b>	<b>1,901</b>	<b>15.9</b>
<b>Softwood</b>	northern white cedar	26.4	3,403	5.4	11.8
	balsam fir	5.1	133	1.2	1.6
	red spruce	4.7	721	1.1	2.6
	eastern hemlock	3.0	172	0.7	1.1
	eastern white pine	2.6	684	0.5	1.7
	white spruce	2.6	246	0.7	1.2
	tamarack	1.3	78	0.5	0.7
	unidentified comm	0.4	0	0.0	0.0
	<b>Softwood Total</b>		<b>46.1</b>	<b>5,437</b>	<b>10.0</b>
<b>Grand Total</b>		<b>100.1</b>	<b>7,338</b>	<b>25.9</b>	<b>40.4</b>

### SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. Though no major streams are found here, several large stream gullies remain from earlier agricultural-related erosion in the lower slopes, and a number of small seeps and flowages are present. Seeps should be flagged before any logging operations occur and protected with a 50-foot

equipment-free buffer (and retention of at least 70% of canopy over the seep). AMPs will be followed in setting up and removing stream crossings.



## STAND HEALTH

A number of forest health issues were observed (below). The only one requiring special action at this time is control of the invasive barberry.

### *Human Impacts:*

- None observed

### *Wildlife Impacts:*

- Very minor browse on yellow birch, striped maple and balsam fir (deer and moose).

### *Invasive Species:*

- One non-native barberry plant was found. While this is not a current threat to stand health, it should be removed before becoming more widespread.

### *Climate Change Considerations:*

- Greater chance for heavy rains could increase erosion in gullied drainages on steeper slopes. Future management should minimize soil disturbance in these areas to allow native vegetation to stabilize soils, and monitor erosion to determine whether intervention measures such as drainage ditches or diversions would be beneficial

- Increased storm intensity could alter the disturbance regimes, with the slopes facing Echo Lake being an area more vulnerable to tree damage and single/multiple tree blowdowns. Management activities should promote a structurally resilient forest by retaining healthy trees, maintaining a low density of species prone to damage (balsam fir, gray birch and paper birch), regenerating the stand in small increments and anticipating natural disturbances.

***Other Pathogens and Health Concerns:***

- Some windthrow suggests a potential chronic concern in this stand, due to the prevalent northwesterly winds that blow off of Echo Lake into the steep lower slopes of the stand.
- Some damage from beech bark disease was noted, though beech is a minor component.

**RECREATION/ EDUCATION**

Hunters use the area seasonally and at least one deer stand was noted here.

**SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

**Age Class Structure:** Even-aged (~80 years old) with reserve/legacy trees and advance regeneration

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 17 (1 per 2.8 acres)

**Sampling Date:** July 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 138      **AGS BA:** 102 (74%)      **BA 95% CI:** 110-167 ft<sup>2</sup>/acre

**Total TPA:** 322      **AGS TPA:** 215 (67%)      **QMSD (inches):** 8.9

**Stocking Level:** Fully stocked. A-B line on mixedwood stocking chart (US Forest Service 2008 Timber Management Field Book)

***Regeneration:***

0-1" DBH – 2,313 stems per acre

1-3" DBH – 344 stems per acre

Number of Plots – 32 (0.1% of stand / 1 plot per 1.5 acres)

Regeneration is patchy and sparse in much of the stand, with very little regeneration under areas of closed softwood canopy. Primary species include sugar maple, white ash, yellow birch and balsam fir. Striped maple and various ferns are common (though patchy) throughout the stand and may be suppressing regeneration of more desirable species.

**Site Class:** I

**Site Index:** 47 (white ash), 80 (quaking aspen)

**Soils:** Two general types. In the lower half of the stand are moderately well drained and very stony Dixfield sandy loams, on slopes of up to 15%. The upper half is dominated by more level topography and moderately to poorly drained silt loams or fine sandy loams, with a fairly shallow hardpan. The presence of enrichment indicator herbs like blue cohosh and silvery glade fern suggest that groundwater movement over the hardpan may be contributing added nutrients.

**Access:** Fair to poor due to slopes and wet soils. The best options would be through stand 11 to the East Echo Lake road for the lower areas of the stand, and - with neighboring landowner permission - to the Tripp Hill road for the upper sections.

## **DESIRED FUTURE STAND CONDITION**

*Long Range Silvicultural Objectives:* Uneven-aged Management

*Cutting Cycle:* 20 years

*Diameter Objectives for Principle Species:*

18-20" dbh ----- sugar maple, yellow birch

14-18" dbh ----- northern white cedar

Gradually convert the stand to all-aged using single tree and small group selection, with openings of 1/20<sup>th</sup> to 1/2 acre. Target residual basal area will be 100-110 sq ft/acre, with a structural goal of  $q=1.3$ . Sugar maple, yellow birch, white ash, black cherry and red spruce will be favored for retention and minor species will be included as up to 20% of total stocking. The stand is currently weighted toward the pole size class. Future entries should focus upon removing unacceptable growing stock in the pole and small sawtimber size classes, removing dense/mature old field softwoods, and improving stand structure.

## **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

Stand-wide stocking is not yet high enough to justify an entry in the next 10 years; difficulty of access would make it beneficial to wait for stocking to reach A-line before initiating the conversion to uneven-aged structure.

## **OTHER WORK**

Optional work suggested for Stand 5 over the coming decade includes:

- Precommercial thinning in the southwestern corner of the stand could be undertaken to promote species such as sugar maple, yellow birch and white ash. Areas suitable for stand improvement (moderate-high density with mix of desirable species and good quality) are scattered and small, and of lower priority than other more accessible young stands.
- Invasive barberry control- see Stand Health section, above.



## STAND 6

### SPECIAL UVA CATEGORY

Ecologically Sensitive Treatment Area (ESTA) - Forested Wetland

### STAND DESCRIPTION

*Acres (pro-rated):* 13.3

*Stand Cover Type(s):* Northern White Cedar



*Natural Communities:* Northern White Cedar Swamp/ Northern White Cedar Sloping Cedar Forest

#### *Stand History and Overview:*

This stand lies in a gently southwest-sloping lowland that forms the headwaters of Lang brook (a small stream that drains southward into the Clyde River). This interesting forest is characterized by old cedars (over 115 years), but includes an increasing component of hardwoods (especially yellow birch) to the northeast, as it transitions into the mixed and hardwood types of adjacent stands 7 and 8. Relatively low-productivity soils contribute to the appearance of an even-aged stand, as the oldest trees are only 11-16" in diameter. Canopy height is 55-75 feet.

Stand 6 may have escaped the clearing and heavy cutting of the 19<sup>th</sup> century that affected most of the parcel. Aerial photography from the 1940s shows no evidence of previous land-use in the stand. By 1962, logging over at least 75% of the stand resulted in a patchy residual canopy. A liquidation cut on the adjacent property in the mid to late 1980s spilled into the southeast corner of the stand, removing all the trees in a roughly half-acre area.

The most widespread herb species are northern wood-sorrel, foam-flower, goldthread, intermediate wood fern, shining clubmoss, blue-bead lily, long beech fern, and wild sarsaparilla. Other herbs found here, but uncommon parcel-wide, were twinflower, creeping snowberry, common poison-ivy, crested wood fern, partridge-berry, golden saxifrage, and dewdrop. Somewhat surprising, considering the stand's forested history, was the presence of four exotic herb species (helleborine, self-heal, dandelion, and common speedwell) at multiple plots. Common shrub species include mountain maple, American fly-honeysuckle, dwarf raspberry, red raspberry, hobble-bush, beaked hazelnut, and American mountain ash. Less common shrubs that add to the stand's diversity are spiny swamp currant, bush honeysuckle, American yew, and mountain holly.

Although the cedar canopy and adjacent areas of mixed forbs and regeneration should provide good deer wintering habitat, moose sign has been more commonly observed in the stand (including scat, beds, feeding sign, and cows with calves). Ongoing mammal surveys conducted by NorthWoods have also recorded regular utilization by bobcat and fisher, underscoring the value of the stand as part of the undeveloped core of the parcel. Several rock voles (listed as species of special concern in Vermont) have been captured in the extension of this forest to the northwest, on a neighboring parcel.

## **ECOLOGICALLY SIGNIFICANT FEATURE(S) TO BE PROTECTED**

Northern White Cedar Swamp is an uncommon (S3 ranked) natural community statewide. Although several logging entries have altered the composition of this stand (probably removing the largest trees), a component of old trees remains, and offers a good starting point for rebuilding the community.

*Age Class Structure:* Uneven-aged

*Site Class:* II

*Soils:* Poorly drained Cabot silt loams, shallow to dense basal till and with seasonal high water table at or near the surface. Localized hummocks and hollows provide some variation, creating both more moderately drained and very poorly drained micro-site conditions.

## **JUSTIFICATION FOR ESTA ENROLLMENT**

Several attributes of this site justify its recognition and protection as a Forested Wetland ESTA.

- 1) *Sensitivity:* Soil textures are silt loams over hardpan, with the water table at or near the surface for much of the year. The soil conditions, hydrology, and micro-topography that have produced this forested wetland natural community type could be easily altered through the use of heavy equipment associated with timber harvesting. Disturbances associated with logging could facilitate the establishment of invasive plants at the expense of native plants and tree saplings.
- 2) *Natural Community:* Northern White Cedar Swamp is an uncommon (S3-ranked) natural community type statewide and the examples found in Stand 6 have potential to become high quality, intact examples, especially in combination with cedar swamps on adjacent properties. Parts of the swamps that have been impacted by logging are regenerating well, and overall plant diversity is high.
- 3) *Species and Structure:* The hummock and hollow ground surface is well-developed and downed logs are common features, due to many years of blowdowns (a natural disturbance that defines northern white cedar swamps). The stand also contains a high diversity of native plant species. Though no rare plants were found here, a number of rare species are associated with cedar swamps and could occur in the future.
- 4) *Landowner Goals:* Promoting diverse wildlife habitat is a primary goal and Stand 6 contributes significantly to these values as a result of the species and forest conditions described above. This natural community is known to provide habitat for at least 84 species of wildlife (Miller 1990).

## **STAND HEALTH (INCLUDE THREATS TO THE ECOLOGICALLY SIGNIFICANT FEATURE)**

No threats were noted, though invasive plants are a potential threat, particularly considering the increased light exposure associated with past logging entries.

## **DESIRED FUTURE STAND CONDITION**

The primary goal with this ESTA enrollment is to protect and enhance the natural characteristics of the forested wetland and its values to wildlife and overall ecological processes. The stand already

features natural forest elements that are less common across the uplands (pit/mound topography, old trees, plant diversity, multiple vegetative layers, and coarse woody material). These values can best be further enhanced by allowing the forest to continue to develop naturally, with many trees growing to large diameters (>20" dbh) and others dying and contributing new snags and woody debris to the forest floor. The tree species found here can achieve lifespans over 300 years, and several of the cedars are 115 years old. Conservation of these sensitive wetlands will require ongoing vigilance against invasive plants, and care when operating in adjacent upland areas to avoid impeding water flow into the wetlands or causing erosion or chemical pollution (oil spills, etc) that might affect water quality.

### **PLANNED TREATMENTS**

*None*

The stand should be monitored regularly for invasive exotic plants, and control measures should be applied if these species appear.



## STAND 7

### STAND DESCRIPTION

*Acres (pro-rated):* 23.3

*NED Cover Type(s):* Northern Hardwood Forest

*Natural Communities:* Northern Hardwood Forest

#### *Stand History and Overview:*

Part of a larger midslope hardwood natural community type, this stand is nearly split by a property boundary to the west (Cass parcel).

The resulting variations in land use history have led to a complex and transitioning stand dynamic. This is most true in the northern section, where dominant sugar maples (canopy at 70-90 feet) are senescing, giving rise to a mixed understory with a higher fir and beech component. One theory is that this area was historically a sugarbush and was pastured sufficiently to alter the soils and regeneration through compaction and preferential browsing of hardwoods, thereby promoting the softwoods on this otherwise hardwood soil type and site. Regeneration throughout the stand is well-stocked and should respond well to recent thinning (see below).

The stand provides a number of unique recreational, aesthetic, and wildlife-related values. The long-term management will strive to further enhance these values by gradually transitioning to an all-aged forest, actively promoting high value trees, ecological elements such as snags, and some diversity of tree species that respond well to site conditions. Well-formed beech will be retained in the northern section as future crop trees and a mast source for black bear and other wildlife.

The now-abandoned road that forms part of the stand's north boundary existed as early as 1843, when John Beebe first settled nearby Hopkins Hill and established a small farm in the forest. By 1850 Beebe had cleared 100 acres around this farm, and was keeping cows, oxen, and sheep, and producing 500 bushels of potatoes and 400 lbs of maple sugar per year. Farming continued in this area until at least the 1870s and some level of pasturing may have extended beyond the turn of the century. At one time the cleared farmland extended as far southwest as the current NorthWoods-Cass property line and into the upper slopes in the southern part of the stand. Evidence of this former land use is clearest in 1940s aerial photos, which show old-field softwoods separating the hardwoods in the northern part of the stand from those in the south. A clearcut early in the 1940s removed much of this softwood, including a 2-acre swath in the upslope portion of the southern part of the stand. During this period of early agriculture and in later years, the northern portion of the stand was likely managed as a sugarbush (based upon ag records, proximity to the road, and nearby remains of a sugaring arch), and could very well have been pastured as well (a common practice). Later stand-wide thinning may have taken place in the early 1960s, though evidence for this is spotty. The next known active management was a single-tree/ group selection thinning in 2000 in the southern part of the stand, overseen by forester Richard Carbonetti. The goal of this cutting was to favor the sugar maple- yellow birch- beech component by reducing red maple, with the long-term goal of an all-aged stand of higher stem quality. The goal was reached in that red maple was largely



removed, and desirable saplings (sugar maple, yellow birch, white ash) are responding well. Still, unacceptable growing stock accounts for >60% of the stocking and could be further reduced.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
<b>Hardwood</b>	sugar maple	50.0	1,896	14.0	17.7
	yellow birch	16.7	787	4.8	6.4
	American beech	9.7	0	1.2	1.2
	white ash	9.7	86	4.1	4.2
	bigtooth aspen	1.4	0	0.8	0.8
	quaking aspen	1.4	196	0.4	0.7
	<b>Hardwood Total</b>	<b>88.9</b>	<b>2,964</b>	<b>25.2</b>	<b>31.0</b>
<b>Softwood</b>	red spruce	6.9	316	1.9	2.7
	balsam fir	4.2	462	0.8	2.1
	<b>Softwood Total</b>	<b>11.1</b>	<b>778</b>	<b>2.7</b>	<b>4.8</b>
<b>Grand Total</b>	<b>100.0</b>	<b>3,742</b>	<b>27.9</b>	<b>35.9</b>	

In 2013, an 11.3 acre area near the Hopkins Hill Trail was thinned/ harvested using Silviculture for the Birds guidelines developed by Audubon Vermont and the Vermont Department of Forests, Parks, and Recreation. The prescribed treatment was crop tree release with canopy gap formation, with the goal of improving habitat for species including black-throated blue warbler, white-throated sparrow and yellow-bellied sapsucker. Basal area in harvested areas was reduced from 120ft<sup>2</sup>/ac to 82 ft<sup>2</sup>/ac, with group selection sizes ranging from 1/20<sup>th</sup> to 1/5<sup>th</sup> acre. Total area in canopy gaps was approximately 0.8 acres, excluding skid trail openings. Percentage of acceptable growing stock (AGS) basal area increased from 32% pre-harvest to 49% post-harvest. Cut-and-leave and girdle trees were marked and cut/girdled to add coarse woody material and snags.

### **WILDLIFE STRUCTURAL ATTRIBUTES**

*(based on data collected using the Audubon Vermont “Silviculture with Birds in Mind” vegetation/ habitat survey protocol )*

**Canopy (>30 feet):** Estimated 81% canopy closure; patchy and primarily hardwood . Canopy gaps created by timber harvesting (group selections and skid trails)

**Midstory (5-30 feet):** Estimated 80% cover, patchy. Mix of hardwood and softwood species.

**Understory (1-5 feet):** Estimated 30% cover, patchy. Primary herbaceous species: New York fern, intermediate wood fern, northern wood sorrel, long beech fern, Jack-in-the-pulpit, Canada mayflower, blue-bead lily, shining clubmoss, Christmas fern, violet species, Indian cucumber-root, wake robin, and wild sarsaparilla. Herbs of special interest were beech-drops (limited distribution on the site), blue cohosh, and rattlesnake fern (both indicators of nutrient enrichment). The single exotic plant species in this stand is helleborine, our only non-native orchid species. Primary woody species: red raspberry, hobble-bush, mountain maple, American fly-honeysuckle, and alternate-leaved dogwood.

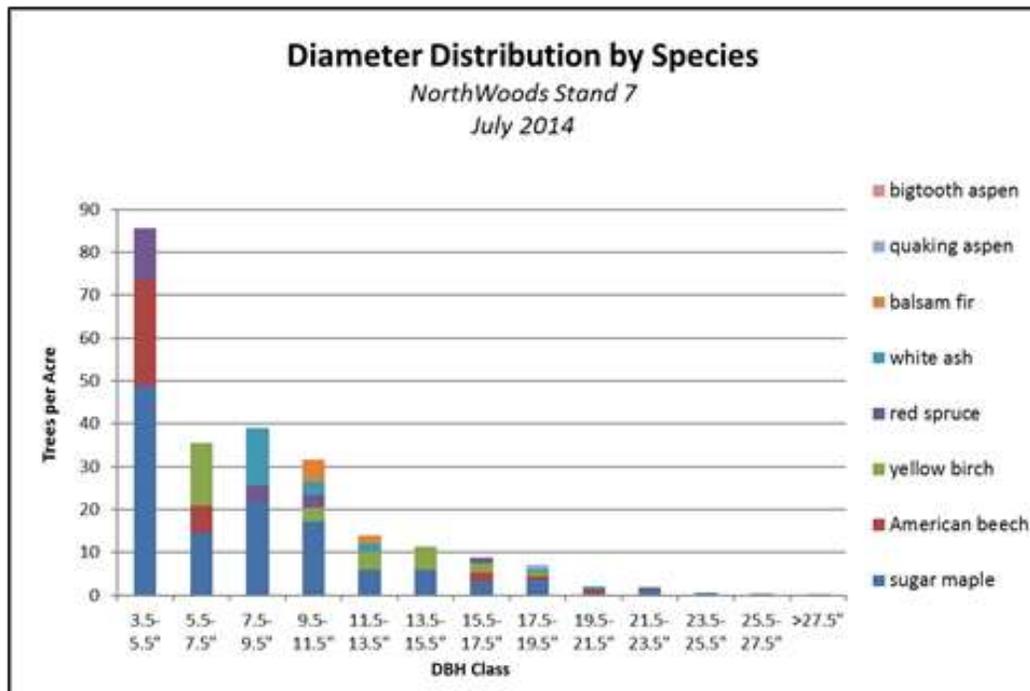
**Snags:** Medium-high density; 26.2 snags/acre, 79% smaller than 15” DBH

**Coarse Woody Material (>10” diameter and >3’ long):** 22 pieces/acre. Cut-and-leave trees and culled bole sections in 2013 timber harvest added new CWM.

**Fine Woody Material (<3” diameter):** 12 piles or tops per acre; higher density in 2013 harvest area.

**Leaf Litter:** Adequate (broad-leaved)

**Wildlife Attribute Summary:** The large diameter (>12”dbh) hardwoods found across the stand are uncommon parcel-wide (and on surrounding properties) due to past land-use trends. Therefore, the stand provides unique habitat benefits associated with this more diverse forest structure - including a supply of large snags and coarse woody debris. Monitoring by NorthWoods since 1999 has recorded use of the stand by moose, deer, black bear, bobcat, fisher, and red-backed salamander. Among birds, barred owl, pileated woodpecker, and broad winged hawk specifically benefit from the component of larger trees, and the latter species nested here in 2001. Other common birds during the breeding season include ovenbird, black-throated blue warbler, red-eyed vireo, hermit thrush, black-throated blue warbler (confirmed breeding), Swainson’s thrush and eastern wood pewee.



### **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- A small intermittent stream crosses the northern part of the stand, draining southward. A minimal canopy of 75% should be maintained within 30 feet of this stream and AMPs should be followed. Management activities should be limited to late summer/fall or frozen ground conditions, and in the southern extreme of the stand should only occur in frozen ground conditions.

### **STAND HEALTH**

A number of forest health issues were observed (below), but none require special action at this time.

### ***Human Impacts:***

- Hopkins Hill Trail and Echo Lake Connector Trail corridors are maintained through the stand for forestry access and non-motorized recreation. Hopkins Hill Trail, formerly a town road, is used illegally by off-road vehicles and has some rutting from this use. Signage should be installed in adjacent stands (where trail enters NorthWoods property) to clearly show prohibited trail uses.
- Timber harvesting and closeout activities in 2013 created some soil disturbance (rutting, scarification, water bars installed on trails) and should be monitored for erosion.

***Wildlife Impacts:***

- Moderate deer and moose browse

***Invasive Species:***

- None observed.

***Climate Change Considerations:***

- Variability in stream flows and greater chance for heavy rains could alter the size and course of intermittent streams in Stand 7, with potential for erosion and/or sedimentation. Maintaining a 30' forested buffer will help prevent erosion during high water events, and improvements to the Hopkins Hill Trail should account for increased runoff and groundwater movement from Tripp Hill.

***Other Pathogens and Health Concerns:***

- Beech bark disease is found on some (but not all) American beech, indicating some resistance to the disease. This species will likely remain an important part of the stand stocking and should be managed according to the Vermont Agency of Natural Resources (ANR) "Management Guidelines for Optimizing Mast Yields in Beech Mast Production Areas."

**RECREATION/ EDUCATION**

The Hopkins Hill Trail and Echo Lake Connector Trail, maintained by NorthWoods and open to the public, cross the upper part of the stand. Aesthetics are of higher concern in these areas and should be factored into any management activities. Trail uses include cross country skiing, hunting, horseback riding, and nature observation.

The area harvested in 2013 is designated as a demonstration site in the Lydia Spitzer Demonstration Forest, with informational signage describing Foresters for the Birds and the sustainable forestry practices implemented. Students and groups regularly visit this site as part of NorthWoods education and outreach programming.

**SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

***Age Class Structure:*** Unbalanced uneven-aged (q=1.23); 60-100 year old dominant/codominant age, most younger age classes represented.

***Sampling Method:*** Variable radius plots (BAF 10, all stems  $\geq 5$ " dbh)

***Number of Plots:*** 6 (1 per 3.9 acres)

**Sampling Date:** July 2014

*For all live intermediate-dominant trees >4.5" dbh:*

**Total BA (ft<sup>2</sup>/acre):** 120      **AGS BA:** 63 (53%)      **BA 95% CI:** 75-165 ft<sup>2</sup>/acre

**Total TPA:** 238      **AGS TPA:** 114 (48%)      **QMSD (inches):** 9.6

**Stocking Level:** Fully stocked. Nearly A line on hardwood stocking chart (US Forest Service 2008 Timber Management Field Book)

**Regeneration:**

0-1" DBH – 2,143 stems per acre

1-3" DBH – 214 stems per acre

Number of Plots – 7 (0.04% of stand / 1 plot per 3.3 acres)

Regeneration is patchy, with rapid growth response under 2013 canopy gaps expected in the next few years. Primary species include sugar maple, white ash and balsam fir. Striped maple and dense patches of New York fern are found occasionally throughout the stand and may be suppressing regeneration of more desirable species.

**Site Class:** II

**Site Index:** 55 (sugar maple), 66 (white ash)

**Soils:** Mostly moderately well drained deep sandy loams of the Dixfield soil series. The eastern edge of the stand enters onto well-drained fine sandy loams (Tunbridge), while the southern extreme extends onto poorly drained silt loams (Cabot).

**Access:** Fair to good. The former road that borders the north part of the stand is still passable, especially eastward to the landing at Hopkins Hill and the haul road out to Calhoun Road. Access to the southern part of the stand would be directly from the Hopkins Hill landing via skid trails used in the 2000 thinning (roughly 1,000 feet uphill).

**DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 15 years

**Diameter Objectives for Principle Species:**

12-18" dbh ----- spruce, balsam fir

16-22" dbh ----- sugar maple, white ash, yellow birch, black cherry

Improve stand quality and all-aged structure using single tree and group selection with groups up to 1/4<sup>th</sup> acre. Species to be favored for retention include sugar maple, white ash, American beech, yellow birch, black cherry and red spruce, with a product goal of high-quality veneer and sawlogs. Minor species will be kept as up to 20% of total stocking. The structural goal is q=1.4 with a target basal area of 90-100 sq ft.

The larger-diameter hardwoods here offer an opportunity to provide snags and legacy trees that are lacking property-wide. An effort will be made to retain at least two snag trees per acre in the 12-18" dbh size and two in the >18" dbh size. Snag trees will be selected from unmerchantable stems, preferably already showing signs of decay or potential for developing cavities. Select older canopy trees will also be retained at up to 5-10% of total stocking as legacy trees and future snags. If

possible, legacy trees should be sugar maples or bear scarred American beech and located either as part of a reduced-cut buffer along the access trail, or along the small brook that crosses the stand.

### **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

With the most recent entry being in 2013, the next scheduled cutting cycle will be in 2028. The next management plan update in 2025 should evaluate stocking and response to the 2013 harvest, scheduling future treatments accordingly.

### **OTHER WORK**

Optional work suggested for Stand 7 over the coming decade includes:

- Improvements to the Hopkins Hill Trail to repair muddy/rutted sections. This former road could eventually be restored enough to be used for frozen-ground (or even year round) access to the log landing in Stand 8, but this would require major drainage and surface work.

## STAND 8

### STAND DESCRIPTION

*Acres (pro-rated):* 177.5

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Northern Hardwood Forest/ Red Spruce-Northern Hardwood Forest

#### *Stand History and Overview:*

Forming most of the Tripp Hill parcel's southeast boundary, this stand takes in the large area of former farmland lying on either side of the historic Hopkins Hill road. Now part of the NorthWoods' recreational trail network, this road was improved in 1999 to accommodate log trucks from Calhoun road to a 2-acre landing on Hopkins Hill. The extensive logging of 1999-2000 focused on the west half of the stand and resulted in a multi-aged forest, with a patchy mixed overstory within a network of skid trails and 0.5 to 2-acre openings. Regeneration here is largely balsam fir, with lesser amounts of red maple, striped maple, pin cherry and red spruce. Red spruce and balsam fir make up more than half of the residual canopy (with slightly more spruce), but a mix of early to mid-successional hardwoods and other softwoods are also present in lesser amounts.



The northeast half of the stand is well stocked, with an even higher proportion of spruce and fir in the canopy. Patchy openings and skid trails from a thinning roughly ten years ago are regenerating largely in fir, which would benefit from additional sunlight. This area offers the most promising opportunities for small-scale commercial thinning using single-tree or small group selection. Because of the central road access and patchy dense balsam regeneration, the stand could also support a moderate level of balsam brush harvesting.

With the possible exception of a small (5-acre) poorly drained area at its northern edge, stand 8 was likely entirely open agricultural land in the late 19<sup>th</sup> century. Settlement first occurred with the Beebe family near Hopkins Hill in 1843 and clearing rapidly followed, with 100 surrounding acres deforested by 1850. Lorenzo Grow established another farm near the northeast edge of the stand by 1859, and the maximum extent of cleared land between these two farms was probably reached sometime between 1870 and 1890. The process of forest reclamation began first in the west half of the stand, and by the early 1940s all but 6 acres around the former homestead had become established with patches of variable-aged conifers. The northeast half of the stand was still mostly open land in 1940, and may have still been under cultivation, though by 1962 this area had also reverted to old-field conifers.

As forests began to recolonize the northeast part of the stand, the earlier abandoned western section was logged roughly in the order that it had reverted to forest, as is recorded on aerial photographs. About 23 acres in the first-abandoned southern region was clearcut circa 1940. Later logging was done in 1 to 5-acre patches circa 1955, 1975, and (near the western edge of the stand) about 1979.

The most recent entry into the northeast half of the stand was a relatively light and sporadic thinning sometime in the mid 1990s. From August 1999 through March 2000 a major logging operation was conducted throughout the west half of the stand (and in adjacent stands 6, 7, and 19), overseen by forester Richard Carbonetti and utilizing grapple skidders and a feller buncher. The haul road from Calhoun road to a 2-acre landing at Hopkins Hill was improved at this time. The cutting produced 296 tons of hardwood chips, 237 cords of hardwood pulp, 11.7 mbf of hardwood sawlogs, 482 cords of spruce/fir pulp, and 186 mbf of spruce/fir sawlogs.

The goal of this entry was to salvage declining spruce while releasing advanced softwood regeneration and promoting new seedling establishment. A two-stage shelterwood was chosen as the silvicultural system, with a corollary goal of avoiding large patches and concentrating cutting among the most high-risk stems. Although a fair amount of windthrow resulted, this logging appears to have had the desired effect, as softwood regeneration (mostly balsam fir) has responded well, and UGS BA has been reduced by half in the residual stand.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	red maple	18.9	583	3.8	5.0
	yellow birch	5.8	153	1.0	1.3
	gray birch	5.4	0	1.5	1.5
	quaking aspen	5.1	177	1.4	1.7
	paper birch	3.8	57	0.9	1.0
	sugar maple	3.2	30	0.8	0.8
	black cherry	1.0	39	0.3	0.3
	pin cherry	0.6	0	0.0	0.0
	American beech	0.3	0	0.1	0.1
	striped maple	0.3	0	0.0	0.0
	white ash	0.3	0	0.1	0.1
	<b>Hardwood Total</b>		<b>44.7</b>	<b>1,038</b>	<b>9.8</b>
Softwood	balsam fir	33.7	1,153	5.7	8.8
	red spruce	15.4	1,291	2.4	5.1
	white spruce	2.9	267	0.4	1.2
	tamarack	1.6	152	0.4	0.7
	northern white cedar	1.3	27	0.3	0.3
	eastern hemlock	0.3	26	0.1	0.1
<b>Softwood Total</b>		<b>55.2</b>	<b>2,915</b>	<b>9.2</b>	<b>16.2</b>
<b>Grand Total</b>		<b>99.9</b>	<b>3,953</b>	<b>18.9</b>	<b>28.0</b>

## WILDLIFE STRUCTURAL ATTRIBUTES

**Canopy (>30 feet):** Estimated 60% canopy closure; patchy. Open canopy in areas to the northwest, and distinct gaps in other areas from blowdown and logging. Mix of softwood and early-successional hardwood species (see diameter distribution chart below).

**Midstory (5-30 feet):** 67-100% cover, patchy. Primary species: balsam fir, red spruce and grey birch.

**Understory (1-5 feet):** 34-66% cover, patchy. Primary herbaceous species: Canada mayflower, intermediate wood fern, goldthread, ground-pine, bunchberry, trout lily, hayscented fern, mosses, club mosses, sensitive fern (scattered in wet areas), wild oats and starflower. Primary woody species: balsam fir, red raspberry, common blackberry, American mountain-ash, and common lowbush blueberry. Mountain holly was also found in several cool, poorly drained areas.



## **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Lowland Spruce-Fir Forest is restricted to cooler parts of the state and to the cooler pockets within these areas. Well-developed and stable examples of this natural community type are considered uncommon (S3) statewide. While most of the stand is dominated by spruce and fir because of its agricultural history, a roughly 7-acre area in the northwest corner (adjacent to the Stand 10 ESTA) is likely this natural community type. Though logging has occurred in this area in the past, large and older trees are present, including a cored 12" dbh tamarack that was 87 years old in 2006. The uneven-aged management currently planned for the stand will mimic this communities' tendency towards small gap wind disturbance events, though special care should also be taken to log only in frozen ground conditions and to minimize soil disturbance.
- Roughly 300 feet west of the Hopkins Hill landing in a small patch of sugar maples are foundations from the former Beebe and Hopkins homesteads. Located adjacent to a major recreational trail and in an open forest setting, this site offers excellent opportunities for land-use history research and education. While some tree cutting may be required from time to time to maintain the site, an area at least 100 feet out from the foundations should be excluded from other future management activities, with aesthetics, continued access, and protection of the ruins being the primary long-term goals here. Other cultural artifacts, such as stone walls and fence lines, occur throughout the stand and have been mapped by the NorthWoods Stewardship Center. Damage to these should also be avoided in the course of future management activities.
- Parts of Stand 8 are designated as Surface Water Buffer Zones in a conservation easement held by the Vermont Land Trust. Designated areas are 50' buffers along the boundaries with Stand 10 (forested wetland ESTA to the north) and Stand 6 (forested wetland ESTA to the south). Equipment use is generally prohibited in these buffers and management activities must retain a minimum of A-line stocking. A full description of Surface Water Buffer Zone regulations, excerpted from the conservation easement, can be found in Appendix D.

## **STAND HEALTH**

Though a number of forest health issues were observed (below), none require special action at this time.

### ***Human Impacts:***

- Some blowdown (mostly fir) and basal scars from 1999-2000 logging.

### ***Wildlife Impacts:***

- Some damage from moose, snowshoe hare, and deer feeding, mostly on hardwood saplings.

### ***Invasive Species:***

- None observed.

### ***Climate Change Considerations:***

- Boreal species such as balsam fir are predicted to decline in response to climate change. Current regeneration is dominated by softwood species, primarily balsam fir and red spruce; management should promote regeneration of species such as black cherry, white ash, red maple and white pine that are predicted to adapt well to future climate conditions, while allowing existing spruce/fir to reach maturity and continuing spruce/fir regeneration in areas near the northeast corner of the stand that could be a refugia for the lowland spruce-fir natural community type.

### ***Other Pathogens and Health Concerns:***

- Hay-scented fern, a light-loving allelopathic plant that inhibits sapling development of some hardwoods, was present at 64% of plots in 2006. Persistence of this fern in the stand should be closely monitored and future management should seek to limit canopy gaps or consider manual control in areas where the plant is present.

## **RECREATION/ EDUCATION**

Stand 8 is crossed by several major intersecting trails- the Hopkins Hill Trail, the recently constructed Above & Beyond Trail, and the Echo Lake Connector Trail. All trails are maintained by NorthWoods for forestry access and non-motorized recreation.

The conservation easement held by the Vermont Land Trust for this parcel permits a rustic cabin to be constructed at some time in the future in the vicinity of Hopkins Hill. There are currently no plans to build this structure and the long-term management goals outlined below are compatible with this future option.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

**Age Class Structure:** Mainly two-aged (residual trees ~80 years old, advance regeneration ~15 years old). Variable throughout due to logging history.

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 31 (1 per 5.7 acres)

**Sampling Date:** May 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 101                      **AGS BA:** 74 (73%)                      **BA 95% CI:** 86-115 ft<sup>2</sup>/acre

**Total TPA:** 266                      **AGS TPA:** 187 (70%)                      **QMSD (inches):** 8.3

**Stocking Level:** Slightly understocked. Just below B line on mixedwood stocking chart (US Forest Service 2008 Timber Management Field Book)

### ***Regeneration:***

**0-1" DBH** – 2,881 stems per acre

**1-3" DBH** – 576 stems per acre

**Number of Plots** – 59 (0.03% of stand / 1 plot per 3.0 acres)

Regeneration is patchy but generally well-stocked, except for areas underlying residual closed softwood canopies. Primary species include balsam fir (67-80% of stems sampled), red spruce and sugar maple. Gray birch and striped maple are also common, but generally are being out-competed by

more shade-tolerant species. Canopy gaps established in 1999-2000 are mostly regenerating with dense, 10-20' tall balsam fir. Skid trails in the southwestern part of the stand have been slow to regenerate, with dense ferns, raspberries and blackberries inhibiting growth of desirable tree species and moose browse damaging hardwood regeneration. The large landing near the center of Stand 8 is regenerating with 5 to 15' tall gray birch, tamarack, red maple, mountain maple and white spruce, with competition from mountain maple, raspberry/blackberry species, and various grasses.

**Site Class:** I

**Site Index:** 68 (red spruce), 61 (red maple)

**Soils:** Moderately deep and well drained fine sandy loams and sandy loams (Tunbridge-Dixfield complex). A 5-acre area in the northwest part of the stand occupies shallow poorly drained Cabot silt loams and is likely a Lowland Spruce-Fir Forest natural community type.

**Access:** Excellent- via Calhoun Road and Hopkins Hill road and the large landing on Hopkins Hill. A legal right-of-way through the Calhoun property may be necessary to assure long-term access.

### **DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 15 years

**Diameter Objectives for Principle Species:**

12-18" dbh ----- balsam fir, red spruce and other softwoods

16-22" dbh ----- sugar maple, yellow birch and other hardwoods

Gradually convert the stand to an all-aged mixed forest using single tree and group selection systems, with groups up to ¼ acre in size. To promote a component of mid-tolerant and intolerant hardwoods, patch cuts up to 1 acre will be created in less accessible areas not prone to windthrow. These ¼ to 1 acre early successional patches will be limited to less than 10% of the stand acreage at any given time. The long-term goal on well-drained areas will be a forest dominated by red spruce and mixed hardwoods (including sugar maple, yellow birch, and American beech), with up to 20% of total stocking in other minor species. In the poorly drained northeast corner balsam fir and red spruce will be favored, with a higher proportion of tamarack and northern white cedar retained as well. These goals will be achieved by reducing the stand-wide dominance of red maple, balsam fir, and early successional hardwoods and removing poorly-formed stems. Target basal area will be 110 ft<sup>2</sup>/ac and a structural goal of q=1.4. Large trees will be retained at up to 5-10% of total stocking as legacy trees and large hollow trees will also be retained whenever possible.

This stand remains dominated by balsam fir and red spruce – an artifact of its agricultural past. Current stocking (and seed source) of commercial hardwoods is very limited and the transition to a mixed forest with higher proportions of these species may require several rotations to achieve. The recommended cutting cycle, residual basal area, and structural goal are intended to best address the current softwood dominance and could be shifted as hardwoods re-colonize the stand.

## **PLANNED TREATMENTS**

### *Crown thinning 2018*

The northeast part of the stand was not thinned in the 2000 entry and would benefit from a light entry now to release the softwood co-dominants and promote regeneration. This thinning will remove mature or declining balsam fir and trembling aspen, as well as unacceptable growing stock from all size classes. Thinning should promote well-formed co-dominants with a residual basal area of 105 sq ft/ acre. Harvested products will be largely softwood pulp, with some softwood sawlogs and limited firewood from poorly formed red maples; this entry could be combined with scheduled thinning/harvesting in Stand 12 to be economically viable. Where possible, non-merchantable stems 12-18" dbh or larger will be retained as snag trees and girdled, if not already deteriorating. This entry should use existing skid trails to minimize damage to soils and advance regeneration.

## **OTHER WORK**

Optional work suggested for Stand 8 over the coming decade includes:

- Trail improvements to Hopkins Hill Trail and the Above & Beyond Trail, including drainage and treadwork, could improve these trails for easier recreational and forestry access. The large landing near the center of Stand 8 on the Hopkins Hill Trail can be maintained for future use as a landing, but the edges should be allowed to partially regenerate (creating a soft edge habitat) and a smaller core maintained as an early successional shrub habitat through delayed mowing every 3-5 years.
- Pre-commercial cleaning in areas of dense spruce/fir advance regeneration could be implemented to promote a higher proportion of red spruce and mid- to late-successional hardwood species (where present). This could be done using hand tools (brush saws, etc.) as staff or volunteer time is available.
- Balsam fir regeneration is very vigorous across much of the stand and would support a moderate level of balsam brush harvesting on an annual basis.



## STAND 9

### STAND DESCRIPTION

*Acres (pro-rated):* 19.4

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Northern Hardwood Forest

#### *Stand History and Overview:*

This small hardwood stand, nearly surrounded by old-field softwoods, is likely the legacy of an historic

sugarbush, though south and east edges of the area were once open and now show a higher proportion of fir regeneration. The hardwood dominated upper section presents a unique and very attractive glade-like setting, with a canopy ranging from 60 to 100 feet. Unfortunately, the source of this open understory is an almost complete understory dominance by hay-scented fern, which suppresses hardwood regeneration through a combination of dense shading of seedlings and the release of allelopathic chemical compounds into the soil. This unnatural fern abundance, which may signal a history of pasturing in the forest, was probably inadvertently enhanced with the thinning conducted here around 1994. Moderate but widespread crown thinning and some dieback in the overstory sugar maples may also be tied to this land use history and/or fern abundance, and should be monitored closely. Manual removal of the hay scented fern in patches could be done on an experimental basis to try to improve regeneration in the stand.



As an island of well-established shade tolerant hardwoods, the stand provides both unique wildlife habitat and forest diversity to this region of the property and will offer important seed source as the surrounding forests transition back to mixed or hardwood forest.

Based upon 19<sup>th</sup> century agricultural records, census data, aerial photos, and field evidence, this stand was likely used initially as a sugarbush, beginning as early as 1860 with settler Lorenzo Davis. Adjacent areas to the southwest were open farmland until almost the turn of the century, while areas to the east remained open until after 1942. One core taken from an 18" dbh 101-year old sugar maple showed a significant release about 1938, possibly an indicator of damage caused by the hurricane that swept the region in November of that year. Another thinning may have taken place about 1950. Growth slowed throughout the stand by the mid 1970s, but was rejuvenated with a single tree/ group selection thinning conducted around 1994. By removing the older sugar maples from the stand, this entry was successful in greatly increasing the proportion of Acceptable Growing Stock, though an opportunity was missed to introduce large diameter coarse woody debris to the system. Also, the abundant sugar maple regeneration that was noted in 1991 has largely disappeared, possibly due to the invasion of hay-scented fern following the thinning (and its allelopathic effects).

### WILDLIFE STRUCTURAL ATTRIBUTES

*Canopy (>30 feet):* Estimated 80% canopy closure; patchy with small canopy gaps around old skid

roads and in thinned areas. Mainly hardwood species (see diameter distribution chart below).

**Midstory (5-30 feet):** 34-66% cover, uniform. Primary species: balsam fir, American beech with lesser amounts of sugar maple, red spruce and striped maple.

**Understory (1-5 feet):** 0-33% cover, uniform. Primary herbaceous species: hay-scented fern (patches of nearly 100% cover), with lesser amounts of intermediate wood fern, New York fern and interrupted fern. Other forbs found include wild oat, shining clubmoss, Jack-in-the-pulpit, rough-stemmed goldenrod, and an unidentified violet species. Primary woody species: balsam fir, red spruce, American beech, red-berried elder, red raspberry, and common blackberry.

**Snags:** Low-medium density of small snags; 19.3 snags/acre, 89% smaller than 15” DBH

**Coarse Woody Material (>10” diameter):** Low volume, uniformly distributed, mostly old/decayed.

**Fine Woody Material (<3” diameter):** Low volume, uniformly distributed.

**Leaf Litter:** Not sampled

**Wildlife Attribute Summary:** The two most notable wildlife benefits of the stand are the vernal pool (described below) and the high density of beech present in the upper area. Many of the beech show evidence of both historic and recent feeding by black bears. Moose and deer sign is also often encountered in the stand. The dominance of hardwoods attracts several species of birds in higher densities than the surrounding softwood or mixed forests. Examples are the eastern wood pewee, ovenbird, red eyed vireo, and a variety of nesting woodpeckers

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	sugar maple	36.1	1,132	10.4	12.7
	American beech	16.0	53	3.4	3.5
	yellow birch	9.2	136	1.2	1.5
	red maple	8.4	316	2.3	2.9
	gray birch	3.4	0	0.1	0.1
	striped maple	3.4	0	0.0	0.0
	black cherry	2.5	116	0.4	0.6
	pin cherry	0.8	0	0.0	0.0
	<b>Hardwood Total</b>		<b>79.8</b>	<b>1,753</b>	<b>17.8</b>
Softwood	balsam fir	17.6	397	5.0	5.8
	red spruce	2.5	545	0.3	1.3
	<b>Softwood Total</b>	<b>20.1</b>	<b>942</b>	<b>5.3</b>	<b>7.1</b>
<b>Grand Total</b>		<b>99.9</b>	<b>2,695</b>	<b>23.0</b>	<b>28.4</b>

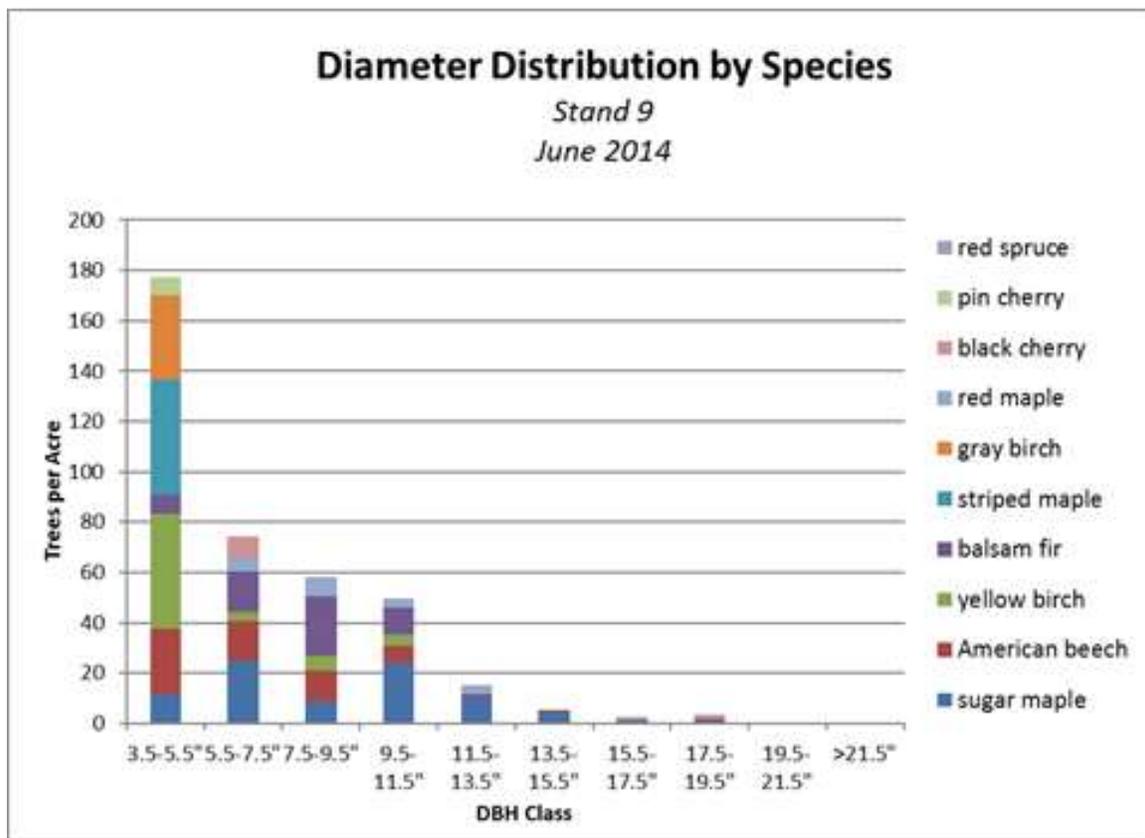
## **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Near the northwest corner of the stand is a vernal pool, used annually for breeding by amphibians that include wood frog, spotted salamander, and spring peeper. This natural community type is both uncommon across the landscape (S3-ranked) and easily disturbed by

logging or other mechanical activity. Future logging should maintain a 50-foot no-activity buffer around the pool depression, and areas within 200 feet should only be entered with equipment in frozen ground conditions. Cutting within this area should be limited to single tree selection, with the residual stocking maintained at or above the A-line.

- A 50' buffer along the boundary with Stand 10 (forested wetland ESTA to the northwest) is designated as a Surface Water Buffer Zone in a conservation easement held by the Vermont Land Trust. Equipment use is generally prohibited in these buffers and management activities must retain a minimum of A-line stocking. A full description of Surface Water Buffer Zone regulations, excerpted from the conservation easement, can be found in Appendix W.
- Roughly 300 feet west of the Hopkins Hill landing in a small stand of sugar maples are foundations from the former Beebe and Hopkins homesteads. Located relatively close to a major recreational trail and in an open forest setting, this site offers excellent opportunities for land-use history research and education. While some tree cutting may be required from time to time to maintain the site, an area at least 100 feet out from the foundations should be excluded from other future management activities, with aesthetics, continued access, and protection of the ruins being the primary long-term goals here. Other cultural artifacts, such as stone walls and fence lines, occur throughout the stand and have been mapped by the NorthWoods Stewardship Center. Damage to these should also be avoided in the course of future management activities.



## **STAND HEALTH**

Though a number of forest health issues were observed (below), none require special action at this time.

### ***Human Impacts:***

- None observed.

### ***Wildlife Impacts:***

- Evidence of some deer browse.

### ***Invasive Species:***

- None observed.

### ***Climate Change Considerations:***

- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species and age diversity. Transitioning to an uneven-aged structure with a more balanced mix of northern hardwood species will increase future stand resilience.
- Boreal species such as balsam fir are predicted to decline in response to climate change. Current regeneration includes a high percentage of balsam fir; management should promote regeneration of species such as white ash, red maple and black cherry that are predicted to adapt well to future climate conditions while allowing some vigorous advance regeneration of cold-climate species to reach economic maturity.

### ***Other Pathogens and Health Concerns:***

- The current open character of the stand, though attractive aesthetically, is unsustainable (due to the lack of regenerating sugar maple). The uneven-aged management described below will gradually introduce some young growth, while maintaining an element of older, open quality in the stand.
- Hay-scented fern, a light-loving allelopathic plant that inhibits sapling development of some hardwoods, occupies much of the understory in Stand 9. Research and implementation of experimental control methods (such as manual control, enrichment planting of desirable species, or silvicultural treatments) could benefit regeneration in Stand 9, and could provide information for future hay-scented fern control in other stands or properties.

## **RECREATION/ EDUCATION**

This stand is neither adjacent to nor visible from the nearby Hopkins Hill road. It probably receives little recreational use at this time.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

***Age Class Structure:*** Even-aged (~100 years old) with second cohort in smaller diameter class

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 10 (1 per 1.9 acres)

**Sampling Date:** June 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 119

**AGS BA:** 78 (66%)

**BA 95% CI:** 99-139 ft<sup>2</sup>/acre

**Total TPA:** 387

**AGS TPA:** 210 (54%)

**QMSD (inches):** 7.5

**Stocking Level:** Fully stocked. A-line on hardwood stocking chart (US Forest Service 2008 Timber Management Field Book)

**Regeneration:**

0-1" DBH – 947 stems per acre

1-3" DBH – 211 stems per acre

Number of Plots – 19 (0.1% of stand / 1 plot per 1.0 acres)

Regeneration is uniformly low throughout Stand 9. Hay-scented fern dominates much of the understory, especially in areas with pure sugar maple canopy in the eastern part of the stand. Primary species include balsam fir, red spruce and American beech. Sugar maple, yellow birch and gray birch are also found in the 1-3" DBH size class.

**Site Class:** II

**Site Index:** 54 (sugar maple)

**Soils:** Moderately deep and well drained fine sandy loams and sandy loams (Tunbridge-Dixfield complex).

**Access:** Good – about 200 feet southeast of the stand's south end is the recently improved former Hopkins Hill road, which can now accommodate small log trucks. Egress would be northeast to Calhoun Road.

**DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 20 years

**Diameter Objectives for Principle Species:**

16-22" dbh ----- sugar maple, yellow birch and red spruce

Gradually convert the stand to all-aged using single tree and group selection systems, with groups no larger than 1/10<sup>th</sup> acre. For retention, favor sugar maple, American beech, yellow birch and red spruce. The residual basal area goal is 70-85 ft<sup>2</sup>/ac, with a structural goal of  $q=1.3$ . At least four snags per acre (two  $> 18$ " dbh) and 5-10% of total stocking in legacy trees will also be retained. Bear scarred beeches and hollow den trees will be retained whenever possible and the vernal pool will be protected by special cutting limitations (see above).

A significant current threat to the stand is the lack of hardwood recruitment, due to the prevalence of hay-scented fern and competition from balsam fir regeneration. If resources allow, manual removal of both species should be undertaken in an attempt to establish hardwood regeneration. Firs in the lower part of the stand could be harvested for balsam brush. Canopy openings should be kept small in future thinnings to avoid a chronic problem with the hay-scented ferns, and the health of sugar maples in the

stand should be monitored closely. Historic pasturing or other factors (such as acid precipitation reducing soil calcium and magnesium) may have resulted in conditions that will no longer support healthy sugar maples. If ongoing monitoring bears this out, species priority should shift to other commercial species that are less susceptible to these limitations, such as beech and red spruce.

## **PLANNED TREATMENTS**

### *Crown thinning and group selection harvest (2020)*

Stocking in Stand 9 is close to A-line, and areas with dense, high-quality growing stock would benefit from thinning. Canopy gaps in thinned areas should be small (5-10 feet between residual canopies) to prevent spread of hay-scented fern. Residual basal area outside of groups should be 70-85 ft<sup>2</sup>/ac.

Group selections ranging from 1/10<sup>th</sup> to 1/3<sup>rd</sup> acre in size should be located to remove lower quality growing stock and mature balsam fir. One of the larger groups could be placed where hay-scented fern is dominant to see whether a high-light environment would allow mid-successional hardwood species to compete with the ferns.

Due to the small mean stand diameter, most product from this thinning/harvest will be firewood or small-diameter pallet sawlogs. However, close proximity to the Hopkins Hill landing and use of an existing skid trail into the southeastern end of the stand should make this entry viable.

Large (>12" DBH), unmerchantable trees should be retained as legacy trees if they exhibit good health and vigor, and should be girdled (to create snags/cavity trees) if they show declining vigor.

## **OTHER WORK**

Optional work suggested for Stand 9 over the coming decade includes:

- Hay-scented fern control- see Stand Health section, above.
- Balsam brush collection – in part to reduce competition with preferred hardwood regeneration.

# STAND 10

## *SPECIAL UVA CATEGORY*

Ecologically Sensitive Treatment Area (ESTA) - Forested Wetland

### **STAND DESCRIPTION**

*Acres (pro-rated):* 14.4

*Stand Cover Type(s):* Mixed Softwood

*Natural Communities:* Lowland Spruce-Fir Forest

#### ***Stand History and Overview:***

Stand 10 is comprised of five separate areas of forested wetland around the Tripp Hill height-of-land. Although geographically distinct, the areas share similar species composition, soil type and landscape position. Logging has occurred in this area in the past, but large and older trees are present, including a 12" dbh tamarack cored in 2006 that was 87 years old.

### **ECOLOGICALLY SIGNIFICANT FEATURE(S) TO BE PROTECTED**

The areas encompassed by Stand 10 are mixed softwood forest patches that occupy slight depressions in the very gradual dome of Tripp Hill. They are distinct from other nearby softwood forests in having a cooler micro-climate and slower growth conditions as a result of a higher water table and more stagnant condition of this hydrology. This difference is reflected in both the growth rates of the canopy trees and the understory plants present, including shrubs like mountain holly and an herb layer made up of boreal plant species.

***Age Class Structure:*** Even-aged (though additional tree cores are needed to verify the age classes present).

***Site Class:*** IV

***Soils:*** Cabot silt loam in the four southeast areas and Colonel-Cabot complex in the northwest area. These soils include hydric components with perched water tables from the surface to 18" deep and are characterized by silt to fine sandy loam textures and a shallow hardpan layer. They are poorly suited to forest management due to wetness.

### **JUSTIFICATION FOR ESTA ENROLLMENT**

Several attributes of this site justify its recognition and protection as a Forested Wetland ESTA.

- 1) Sensitivity:* Soil textures are silts over a hardpan, with the water table at or near the surface for much of the year. The soil conditions, hydrology, and micro-topography that have resulted in this forested wetland natural community type could be easily altered for centuries through the use of heavy equipment associated with timber harvesting. Disturbances associated with logging could facilitate the establishment of invasive exotic plants such as common reed or glossy buckthorn, at

the expense of native plants and tree saplings.

- 2) *Natural Community*: Lowland Spruce-Fir Forest is restricted to cooler parts of the state and to the cooler pockets within these areas. Well-developed and stable examples of this natural community type are considered uncommon (S3) statewide. Stand 10 represents appropriate site conditions for this natural community to persist even if climate change causes the Spruce-Fir Forest community type to decline in the surrounding area.
- 3) *Site Classification*: All areas of Stand 10 are mapped as Class 2 wetlands in the Vermont's Significant Wetlands Inventory (Vermont Agency of Natural Resources).
- 4) *Landowner Goals*: Forest health, wildlife habitat, and restoring natural community types are among the ownership goals, and protection of these unique and sensitive areas will best achieve these goals.

### **STAND HEALTH (INCLUDE THREATS TO THE ECOLOGICALLY SIGNIFICANT FEATURE)**

No immediate threats are known to occur in the areas encompassed by Stand 10, though ongoing monitoring is needed to prevent the establishment of invasive exotic plants.

### **DESIRED FUTURE STAND CONDITION**

The primary goal with this ESTA enrollment is to protect and enhance the natural characteristics of the forested wetland and its values to wildlife and overall ecological processes. The stand already features natural forest elements that are less common across the uplands (pit/mound topography, old trees, plant diversity, multiple vegetative layers, and coarse woody material). These values can best be further enhanced by allowing the forest to continue to develop naturally, with many trees growing to large diameters and others dying and contributing new snags and woody debris to the forest floor. Conservation of these sensitive wetlands will require ongoing vigilance against invasive plants, and care when operating in adjacent upland areas to avoid impeding water flow into the wetlands or causing erosion or chemical pollution (oil spills, etc) that might affect water quality.

### **PLANNED TREATMENTS**

*None*

### **OTHER WORK**

- Monitor periodically for invasive plants or other threats.
- Return during the 2015 growing season to refine mapping of the ESTA boundaries and better document the species and conditions present.

# STAND 11

## STAND DESCRIPTION

*Acres (pro-rated):* 34.1

*NED Cover Type(s):* Bottomland mixed

*Natural Communities:* Northern Hardwood Forest/  
Lowland Spruce-Fir Forest

*Stand History and Overview:* This stand occupies former agricultural land near the shoreline and Tripp Hill toeslope east of Echo Lake, and is bisected by the heavily traveled East Echo Lake road (town highway 33). Three forest conditions have resulted from the varying soil types and methods of reforestation from former agricultural land.

*Condition 1:* West and downslope of the road is natural softwood re-growth comprised of mixed amounts of white spruce, balsam fir, northern white cedar, and spotty early successional hardwoods including black cherry, aspen, white ash and American elm. This area was last thinned in 2005 (lightly) and supports sparse to dense regeneration of balsam fir and mixed hardwoods. Canopy height is about 60-90 feet.

*Condition 2:* East of the road is softwood plantation, with roughly 5 acres of Norway spruce adjacent to the road and 7 acres of white pine in the northeast interior section. Regeneration here is sparse, especially under the Norway spruce and includes some hardwoods. The northern section of pines has a more open canopy with dense raspberries and blackberries interspersed with hardwood regeneration. The northern part of this area (north of the Frizzel in-holding) was last thinned circa 2009 by logger Jeff Poirier using a cable skidder. Canopy height is approximately 75 feet.

*Condition 3:* More upslope areas east of the road have grown to a mixture of balsam fir, white spruce, and northern white cedar, with sparse to dense regeneration.

The stand contains several decrepit stone walls, fencelines and a partial foundation (south of the current Frizzel property inholding). Damage to these features, which serve as useful clues to the site's history, should be avoided during management operations. A powerline that runs west from the town road to a former camp location near Echo Lake creates a hazard for management and contact should be made with the power company to have this line removed.

Located along an early town road, this site was settled and cleared beginning in the late 1820s, with active farming continuing across most of the stand into the 1940s. Natural forest reclamation began soon after this west of the road, while the Norway spruce and white pine to the east was planted in the early to mid 1960s. A row thinning was completed in the plantations in the northeast part of the stand about 1995. The most recent entry west of the road was early 2005, when 20 MBF of spruce/fir sawlogs were removed in a single tree/small group selection harvest, and east of the road with the circa 2009 thinning.



Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	black cherry	5.7	349	2.1	2.7
	quaking aspen	1.9	231	0.7	1.1
	red maple	1.1	0	0.4	0.4
	white ash	1.1	35	0.5	0.6
	balsam poplar	0.4	0	0.2	0.2
	paper birch	0.4	30	0.1	0.2
	sugar maple	0.4	0	0.0	0.0
	<b>Hardwood Total</b>		<b>11.0</b>	<b>645</b>	<b>4.1</b>
Softwood	Norway spruce	29.7	3,943	10.9	18.9
	northern white ced.	18.3	1,064	5.8	7.8
	white spruce	17.1	1,345	7.9	10.6
	eastern white pine	14.8	2,553	5.8	10.9
	balsam fir	7.6	718	3.0	4.6
	tamarack	1.1	190	0.4	0.8
	<b>Softwood Total</b>		<b>88.6</b>	<b>9,813</b>	<b>33.8</b>
<b>Grand Total</b>		<b>99.6</b>	<b>10,458</b>	<b>37.8</b>	<b>58.7</b>

## WILDLIFE STRUCTURAL ATTRIBUTES

**Canopy (>30 feet):** Estimated 90% canopy closure; patchy with distinct gaps in harvested areas west of the road and lower canopy closure in thinned white pine area (northeast corner of stand)

**Midstory (5-30 feet):** 0-33% cover, patchy. Primary species: balsam fir (most common), elderberry, quaking aspen, white ash and sugar maple

**Understory (1-5 feet):** 0-33% cover, patchy. Primary herbaceous species: mosses, sensitive fern, intermediate wood fern, ostrich fern, hayscented fern (limited areas, mostly old skid trails), coltsfoot, starflower, Canada mayflower, common yellow wood sorrel, common speedwell\*, Jack-in-the-pulpit, dandelion\*, helleborine\*, and wall lettuce\*. Starred species are non-native and are widespread in this formerly plowed site. Primary woody species: white ash, balsam fir, red maple, sugar maple, beaked hazelnut, red-berried elder, American mountain ash and alternate-leaved dogwood. Red raspberry and common blackberry are dense in the white pine areas.

**Snags:** High density of small snags; 94 snags/acre, 96% smaller than 15" DBH

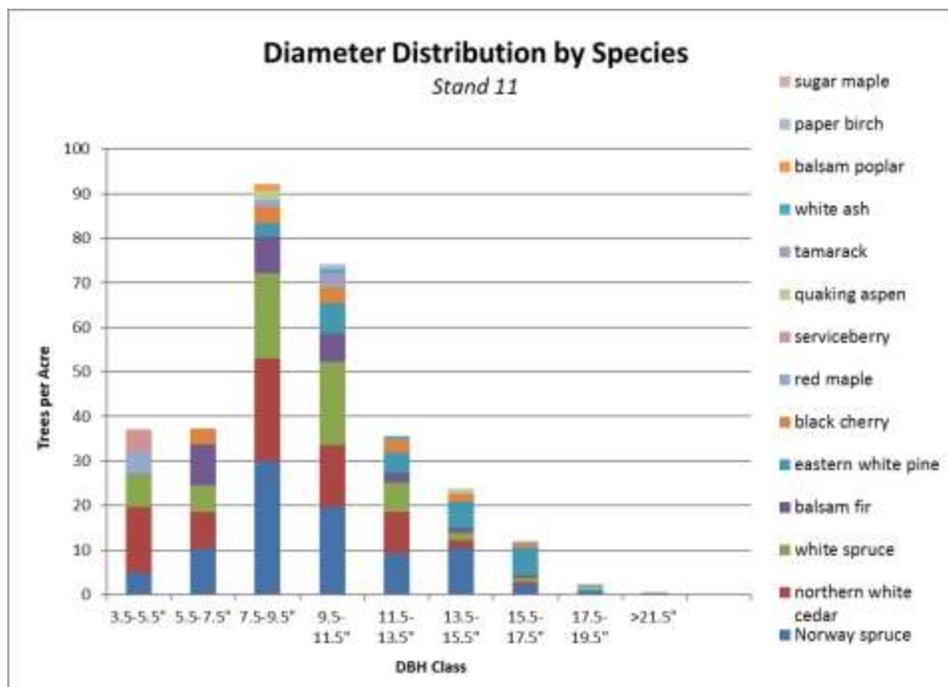
**Coarse Woody Material (>10" diameter):** Medium density in harvested area west of road, low density in plantations east of road. Decay condition primarily new/solid. CWM in plantations is primarily large, isolated blowdowns.

**Fine Woody Material (<3" diameter):** High density in harvested area west of road, low density in plantations east of road. Patchy.

**Leaf Litter:** Not sampled

**Wildlife Attribute Summary:** Deer are the most notable wildlife presence, yarding in the denser canopy areas during deep snow periods and feeding heavily on the hardwood regeneration of the toeslope area. Although deer habitat features (apple trees and softwood cover) should be maintained when this is compatible with other management goals, they are largely an artifact of former land-use patterns and will be gradually reduced as the stand is returned to a more natural hardwood or mixed forest type. Other wildlife known to utilize the stand are porcupine, bobcat, fisher, and moose.

Common ravens have nested for several seasons in the conifers west of the road, and a grouse nest was found while sampling in June 2014 just east of the road. Stand 11 provides a valuable largely undeveloped corridor for the movement of species from interior forests to the Echo Lake shoreline. Future management should strive to maintain forest cover along the town road, where this corridor is most compromised, and should reserve operating in at least ¼ of the stand’s north-south extent (roughly 450 feet) over any 15-year cutting cycle, to retain a minimally impacted travel corridor.



**SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Lowland Spruce-Fir Forest is uncommon statewide (S3) and is probably represented in the lower, more poorly drained areas of this stand. Careful attention should be paid to these areas in the future to observe which species appear best suited to the site conditions. If balsam fir is prominent among these and continues to compete well against the colonizing hardwoods, it should be promoted more vigorously in the future.
- A series of small streams bisect the stand on their way to the lake and AMPs will be followed closely to avoid any disruption or sedimentation during management.
- A 50’ buffer along the boundary with Stand 17 (forested wetland ESTA to the west) is designated as a Surface Water Buffer Zone in a conservation easement held by the Vermont Land Trust. Equipment use is generally prohibited in this buffer and management activities must retain a minimum of A-line stocking. A full description of Surface Water Buffer Zone regulations, excerpted from the conservation easement, can be found in Appendix D.

## **STAND HEALTH**

A number of minor forest health issues were observed (below), though only the invasive plants require special action at this time.

### ***Human Impacts:***

- Trail corridors are maintained through the stand for forestry access and non-motorized recreation. Occasional unauthorized use of ATVs on trails has been noted, but with minimal impact.

### ***Wildlife Impacts:***

- Some deer and hare browse on regeneration.

### ***Invasive Species:***

- Several invasive species are present around the East Echo Lake Rd. kiosk and parking area. Species of concern include common reed (approximately 0.1 acre patch, manually cut/pulled annually beginning in 2013) and bush honeysuckle (scattered around parking area, treated with cut-stump glyphosate application in 2014 by the landowner).

### ***Climate Change Considerations:***

- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species diversity. Current species diversity is low in plantation areas. Transitioning to uneven-aged northern hardwoods will increase future stand resilience.
- Greater chance for heavy rains could increase erosion in gullied drainages to the east of the road. Future management should minimize soil disturbance in these areas to allow native vegetation to stabilize soils, and monitor erosion to determine whether intervention measures such as drainage ditches or diversions would be beneficial
- Boreal species such as balsam fir are predicted to decline in response to climate change. Current regeneration is a mix of northern hardwoods and softwood species, primarily balsam fir; management should promote regeneration of species such as black cherry, white ash, red maple and white pine that are predicted to adapt well to future climate conditions, while allowing spruce/fir regeneration in areas west of the road that could be a refugia for the lowland spruce-fir natural community type.

### ***Other Pathogens and Health Concerns:***

- None observed.

## **RECREATION/ EDUCATION**

Used intensively by hunters (several deer stands), and to a lesser extent by lake-goers. Though the stand provides a valuable community service for those who can't afford to own or enjoy a lakefront setting, a gate has been installed at the access road to keep this area from becoming a party spot and to keep vehicular traffic out. Some minor problems with garbage and illegal cutting have occurred here in the past and should be monitored in the future.

Plantation spruce and pine in this stand would be well suited for Game of Logging chainsaw training courses, hosted regularly at NorthWoods. Trees to be cut during the classes should be clearly marked

according to the prescribed silvicultural treatments (see below).

A patch of the invasive plant common reed, located near the Echo Lake Road kiosk, is designated as a demonstration site in the Lydia Spitzer Demonstration Forest, with informational signage describing the measures used to control this invasive plant. Students and groups regularly visit this site as part of NorthWoods education and outreach programming.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

**Age Class Structure:** Even-aged (50-75 years old) with new cohort establishing in harvested areas

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 15 (1 per 2.3 acres)

**Sampling Date:** June 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 175      **AGS BA:** 151 (86%)      **BA 95% CI:** 146-204 ft<sup>2</sup>/acre

**Total TPA:** 315      **AGS TPA:** 245 (78%)      **QMSD (inches):** 10.2

**Stocking Level:** mid-way between A and B lines on the spruce-fir stocking chart (Frank and Bjorkbom, 1973).

### ***Regeneration:***

0-1" DBH – 3,929 stems per acre

1-3" DBH – 214 stems per acre

Number of Plots – 28 (0.1% of stand / 1 plot per 1.2 acres)

Regeneration density varies considerably, with almost no regeneration in the Norway spruce plantation, a mix of hardwood regeneration competing with *Rubus* species in the white pines, and dense balsam fir in the harvested area west of Echo Lake Rd. Primary species include balsam fir, white ash, red maple and sugar maple.

**Site Class:** I (based on soil types and tree growth characteristics)

**Site Index:** 81 (white spruce), 80 (white pine)

**Soils:** The moderately well drained sandy loams of the Dixfield soil series dominate, though poorly drained Cabot silt loams are present in southwest and northwest areas (about 20% of the stand). A band of deep, well-drained Monadnock fine sandy loams extends along most of the stand's shoreline, and has been mined in the past for gravel and sand.

**Access:** Good to excellent. Direct access from class III town highway 33, with a small access road and landing west of the road. The only limitations to access are the hydric soil areas described above and a series of deeply eroded gullies running east to west (mostly east of the road) that date back to the agricultural period of the stand.

## **DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 15 years

### ***Diameter Objectives for Principle Species:***

12-16" dbh ----- balsam fir  
14-18" dbh ----- Norway spruce  
18-22" dbh ----- white pine

Gradually transition to an all-aged northern hardwood forest, promoting hardwoods more aggressively in the better drained, mid-slope areas, and a mixed forest with a significant component of red spruce and balsam fir in the poorly drained toeslope areas. Minor species, especially white pine, white ash, and American beech, will be retained as up to 25% of the total stocking. This conversion, which will take multiple cutting cycles to achieve, will employ the single-tree and small group selection systems, with groups up to 1/10<sup>th</sup> acre in size. The basal area goal will follow stocking charts for the forest type during the transition to hardwoods, being initially >110 sq ft and dropping to 90-100 sq ft when the transition is complete. The long-term structural goal is  $q=1.3$ , and diameter goals will be 12-18" for balsam fir and 16-24" for other species. The goal for snags is at least 4 per acre > 12" dbh, with at least two of these >18" dbh.

### **PLANNED TREATMENTS**

#### *Condition 1: Leave to grow and reevaluate in 2025*

The forest west of the town road should be left to grow and re-evaluated after ten years. Future thinnings here will focus upon removal of high risk balsam fir and poorly formed trees, while promoting a mix of commercial and/or preferred wildlife species including yellow birch, white ash, black cherry, sugar maple, northern white cedar, and red spruce. If possible, minor species such as American elm, serviceberry, and tamarack should be retained as 10-20% of the total stocking. Finally, the current forest contains a scattering of large diameter trees that extend well above the canopy, including white spruce, quaking aspen, and white pine. These should be retained at up to 5-10% of total stocking as legacy and wildlife trees in future management operations, preferably in groups to reduce the risk of windthrow.

#### *Condition 2: Crown Thinning and Crop Tree Release (2018)*

The Norway spruce plantation east of the road would benefit from thinning, with a closed canopy and basal area of approximately 220ft<sup>2</sup>/ac (close to A-line on stocking guide from Halligan and Nyland 1999). This initial entry will follow even-aged intermediate thinning techniques, releasing well-formed co-dominant canopy trees on at least two sides. The target basal area of this intermediate thinning will be 130ft<sup>2</sup>/ac. Where possible, an effort will be made to introduce coarse woody debris and/or snags to the stand from cull trees >12" dbh, and to promote hardwood growth near the plantation edges.

The white pine plantation, also with approximately 220ft<sup>2</sup>/ac basal area, is also close to A-line stocking (US Forest Service 2008 Timber Management Field Book), but generally has less crown competition. This area could benefit from light crop tree release (5-15 crop trees per acre) with a residual basal area of approximately 160ft<sup>2</sup>/ac, especially in the southern half.

Later entries will focus on introducing small group openings (up to 1/4<sup>th</sup> acre) to encourage expansion of hardwoods into this area and establish uneven-aged structure, while promoting continued growth of select softwood crop trees. Diameter goals will be 14-18" for Norway spruce and 20-22" for white

pine. To preserve some of the nesting and roosting habitat provided by plantations for large corvids and raptors, several roughly 1/20<sup>th</sup>-acre groups of softwoods will be retained in an unthinned condition.

Ferns (hayscented and other species) are present in low densities in some plantation areas. When thinning or removing group selections, ferns could compete with desired regeneration. Experimental methods for controlling ferns could be used, such as manual removal or creating larger (1/4<sup>th</sup> acre) groups to allow regeneration to establish before ferns can dominate.

### *Condition 3: Small Group Selection (2018)*

The non-plantation forest east of the town road includes several areas of overstocked mature softwoods (white spruce, balsam fir, tamarack and northern white cedar). These should be harvested using small group selections (1/10<sup>th</sup>-1/4<sup>th</sup> acre groups, up to 2 acres total), with the goal of removing high risk balsam fir and tamarack while promoting well-formed spruce and cedar and any colonizing commercial hardwoods. Preference will be given to sugar maple, white ash, black cherry, and yellow birch among the regenerating hardwoods. Areas of vigorous, dense softwoods that have not reached maturity/high risk status may be thinned to promote healthy, high quality spruce and cedar. Some existing cedars in this area are an old field artifact and will grow rapidly on the well-drained soils. Residual stand basal area will be 110-130 sq ft/ acre outside of groups.

## **OTHER WORK**

Optional work suggested for Stand 11 over the coming decade includes:

- Invasive plant control- see Stand Health section, above.
- Trail maintenance for recreational use between Echo Lake Rd and the lakeshore, and new trail construction for uneven-aged management access east of the road
- Release and pruning of several apple trees along the access road west of the town.



## STAND 12

### STAND DESCRIPTION

*Acres (pro-rated):* 20.4

*NED Cover Type(s):* Plantation spruce

*Natural Communities:* Northern Hardwood Forest

#### *Stand History and Overview:*

This small plantation occupies former farmland on a gradual east slope and has a canopy height of 55 feet. Norway spruce is the only

exotic tree species being managed on the site and our long-term goal is to transition the stand back to a northern forest natural community (though this may require several rotations to achieve). During the next several cutting cycles the stand will be managed for a combination of large-diameter sawlogs and the gradual introduction of native regeneration. The current sparse regeneration is mostly balsam fir seedlings, but also includes some beech, black cherry, red maple, sugar maple, yellow birch, and white pine. A small, relatively mature area of mixed species (sugar maple, red maple, black cherry, yellow birch and balsam fir) in the eastern corner of the stand represents some of the structural attributes to work toward in Stand 12 and may act as a seed source as regeneration is established during future harvests.

Stand 12 was likely first settled and cleared about 1860 by Lorenzo Davis. By 1870 Davis had cleared 30 acres and was producing potatoes, oats, maple sugar and timber, while keeping a subsistence-level herd of cows, sheep, pig, and oxen/horse. Still open farmland in 1942, the area began to be reclaimed naturally by white spruce as early as 1950, and was partly planted to Norway spruce around 1970. A smaller area south and southwest of the current landing was planted later – probably about 1976. With the exception of some logging along the Hopkins Hill road and east of the landing in the 1980s, the stand continued to develop, becoming overstocked by 1991. A thinning conducted in 1999 with a feller buncher and grapple skidders removed open grown white spruce and reduced stocking by about 80 sq ft/ acre to the B-line. The residual trees have responded well to this thinning, with diameters increasing at a rate of about 1 inch every 3-4 years.



### WILDLIFE STRUCTURAL ATTRIBUTES

*Canopy (>30 feet):* Estimated 85% canopy closure; patchy with distinct gaps from past logging and blowdown. Mainly Norway spruce (see diameter distribution chart below)

*Midstory (5-30 feet):* 0-33% cover, patchy with very little midstory structure outside of gaps. Primary species: balsam fir and gray birch.

*Understory (1-5 feet):* 34-66% cover, patchy. Primary herbaceous species: rough-stemmed

goldenrod, witch grass, intermediate wood fern, drooping sedge, trout lily, mosses, club mosses and New York fern. Lower proportions of trillium, partridgeberry and goldthread. Primary woody species: balsam fir, (most common), Norway spruce, white pine, red maple, gray birch, striped maple, red spruce, meadowsweet and common blackberry.

**Snags:** Medium density of small snags; 31 snags/acre, 100% smaller than 15” DBH

**Coarse Woody Material (>10” diameter):** Very low volume, uniformly distributed. Decay condition primarily old/crumbling. Mainly balsam fir blowdown near the single large canopy gap.

**Fine Woody Material (<3” diameter):** Very low volume, uniformly distributed.

**Leaf Litter:** Not sampled

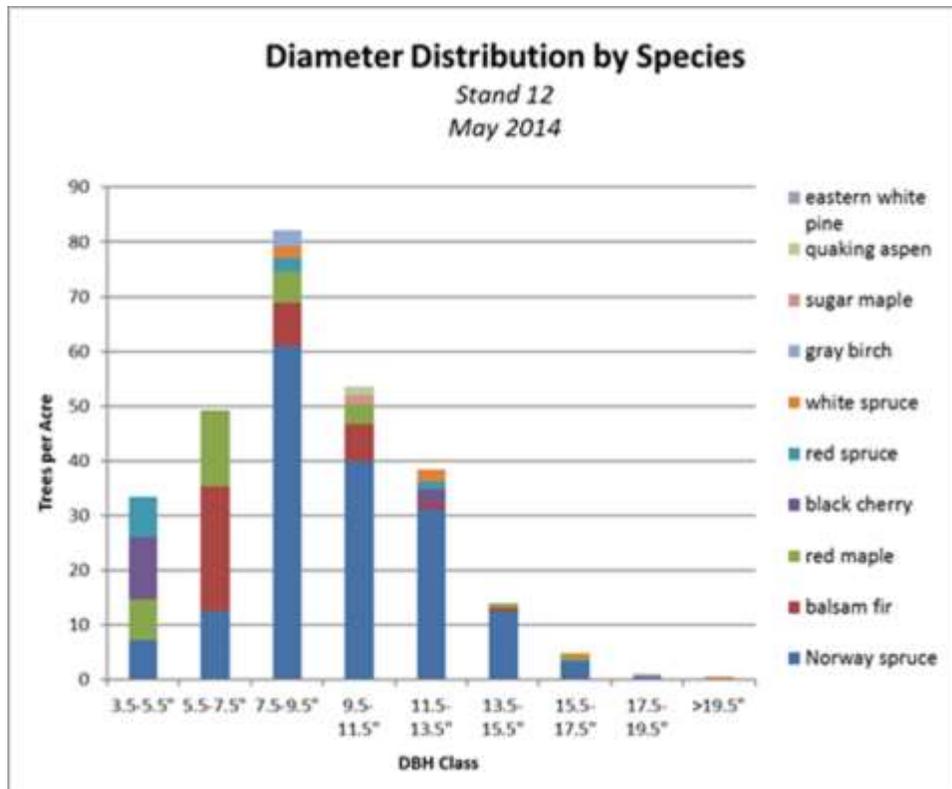
**Wildlife Attribute Summary:** Red squirrels are clearly benefiting from the current stand management, as evidenced by the abundant spruce cone midden piles and discarded cone fragments littering the ground. This concentrated food source also attracts a variety of finches during their cyclical irruptions from boreal habitats to the north, including white-winged crossbills. Deer and hare sign has also been frequently noted in the stand, which may provide a fungal food source and/or a respite from the deep snows found in neighboring stands. Bird species observed during sampling included ovenbird, white-throated sparrow and blue-headed vireo.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	red maple	7.2	211	1.2	1.6
	black cherry	2.2	0	0.3	0.3
	gray birch	0.7	0	0.0	0.0
	quaking aspen	0.7	0	0.4	0.4
	sugar maple	0.7	0	0.3	0.3
	<b>Hardwood Total</b>	<b>11.5</b>	<b>211</b>	<b>2.2</b>	<b>2.6</b>
Softwood	Norway spruce	71.7	8,286	16.1	35.8
	balsam fir	10.1	550	1.7	3.1
	white spruce	3.6	568	0.7	2.1
	red spruce	2.2	137	0.3	0.7
	eastern white pine	0.7	194	0.1	0.5
	<b>Softwood Total</b>	<b>88.3</b>	<b>9,734</b>	<b>19.0</b>	<b>42.1</b>
<b>Grand Total</b>		<b>99.8</b>	<b>9,945</b>	<b>21.1</b>	<b>44.7</b>

**SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- The foundations of several buildings associated with the historic homestead can still be found around the current landing area, in various stages of decay. These should be clearly flagged and protected in future management activities, as they continue to provide unique historical research and educational opportunities.



## STAND HEALTH

Though a number of forest health issues were observed (below), none require special action at this time.

### *Human Impacts:*

- The Hopkins Hill Trail corridor is maintained through the southern part of the stand for forestry access and non-motorized recreation. Occasional unauthorized use of ATVs on trails has been noted, but with minimal impact.

### *Wildlife Impacts:*

- Deer and hare scat found, but little evidence of browse (may be a concern when regenerating hardwoods)

### *Invasive Species:*

- None observed

### *Climate Change Considerations:*

- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species diversity. Current species diversity is very low in plantation areas. Transitioning to uneven-aged northern hardwoods will increase future stand resilience.
- Boreal species such as balsam fir are predicted to decline in response to climate change. Current regeneration is primarily balsam fir; management should promote regeneration of species such as black cherry, white ash, red maple and white pine that are predicted to adapt

well to future climate conditions, while allowing advance regeneration of cold-climate species to reach economic maturity.

***Other Pathogens and Health Concerns:***

- None observed.

**RECREATION/ EDUCATION**

Currently limited to a small number of hunters and the adjacent landowners. There have been some cases in recent years of ATV use and damage, especially during hunting season. Signs should be installed at the property line clearly forbidding ATV use while encouraging non-motorized recreation.

With excellent access and plans to establish this as a featured site in the Lydia Spitzer Demonstration Forest, Stand 12 will be used more frequently in the future by students, NorthWoods program participants and possibly researchers.

**SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

***Age Class Structure:*** Even-aged (45 years old) with advance regeneration

***Sampling Method:*** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

***Number of Plots:*** 10 (1 per 2.0 acres)

***Sampling Date:*** May 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

***Total BA (ft<sup>2</sup>/acre):*** 138

***AGS BA:*** 122 (88%)

***BA 95% CI:*** 111-165 ft<sup>2</sup>/acre

***Total TPA:*** 277

***AGS TPA:*** 221 (80%)

***QMSD (inches):*** 9.6

***Stocking Level:*** Fully stocked. A-B line on Norway spruce stocking chart (Halligan and Nyland 1999)

***Regeneration:***

*0-1" DBH* – 2,667 stems per acre

*1-3" DBH* – 0 stems per acre

*Number of Plots* – 18 (0.1% of stand / 1 plot per 1.1 acres)

Regeneration density varies considerably, with almost no regeneration in much of the plantation but other areas of very dense balsam fir understory (nearly 100% cover). Hardwood regeneration is sparse and mostly limited to areas near adjacent hardwoods. Primary species include balsam fir (83% of sampled stems), Norway spruce, white pine and gray birch.

***Site Class:*** I

***Site Index:*** 59 (balsam fir)

***Soils:*** Moderately well drained sandy loams – moderately deep to dense basal till and very deep to bedrock (Dixfield soil series).

***Access:*** Excellent- located adjacent to a large landing with nearby access to Calhoun road. This and adjacent stands are accessed through the dead-end Calhoun Road, passing close to a private home. Special efforts should be made to contact these landowners prior to any management-related activities and to keep them informed of long and short-range goals for these stands. It would be beneficial to acquire a right-of-way from neighboring landowner to assure long-term access.

A 0.6 acre landing in Stand 12 on Calhoun Road is regenerating with white spruce, gray birch,

balsam fir and red maple. This landing should be maintained for future use but reduced to approximately 1/4<sup>th</sup> acre with a loop or area to turn a large truck around. Use of forwarding equipment and processing logs in the woods will minimize necessary landing space in future management.

## **DESIRED FUTURE STAND CONDITION**

*Long Range Silvicultural Objectives:* Uneven-aged Management

*Cutting Cycle:* 15 years

*Diameter Objectives for Principle Species:*

14-18" dbh ----- Norway spruce

12-16" dbh ----- balsam fir

16-22" dbh ----- hardwood species

Gradually convert the stand to an all-aged northern hardwood forest (the natural community type for this site) using single tree and group selection systems, with group sizes <1/4 acre in size. This transition will be a long-term process, probably requiring 3-5 cutting cycles to attain. Initial patch cuts should be located at the periphery of the stand in areas adjacent to commercial hardwood seed sources. Subsequent thinnings will seek to increase the proportion of hardwood species gradually, while maximizing the growth of the remaining plantation softwoods and developing a late-successional irregular stand structure that includes multiple age classes, small gap disturbances and large legacy trees (>20" DBH) left to senesce naturally. Residual basal area goal will transition from 100 ft<sup>2</sup>/ac while plantation softwoods dominate, to 90-100 ft<sup>2</sup>/ac when the stand has been converted back to hardwood. Preferred long-range species composition will be sugar maple, American beech, yellow birch, and red spruce, with other minor species comprising up to 20% of total stocking. Commercial mid-tolerant and intolerant species such as white ash and black cherry will also be promoted during the transition period.

Because of its excellent access and good soils, this stand is also a candidate for experimental and value adding work such as under-planting of red oak and hardwood pruning. The introduction of large diameter snag trees should also begin with the next thinning operation (goal of two snags 12-18" dbh and two >18" dbh per acre), and several small (roughly 1/20<sup>th</sup> acre) softwood patches should be retained in an unmanaged condition for raptor and large corvid roosting and nesting habitat. Finally, any remaining homestead apple trees should be retained if possible and promoted for their benefit as soft mast for a host of wildlife species.

## **PLANNED TREATMENTS**

*Crown thinning, small group selections and expanding gap irregular shelterwood (2015)*

Intermediate thinning and group selections will be conducted earlier than 2018 (as predicted in the 2006 management plan). Areas thinned in 1999 have responded with rapid diameter growth on released trees, while previously unthinned areas are overstocked and at risk of competitive mortality. Current stocking stand-wide is between A- and B-line for even-aged Norway spruce (Halligan and

Nyland 1999), and basal area will be reduced to 90-100ft<sup>2</sup>/ac (B-line) outside of group selections. Thinning will favor trees with vigorous crowns, minimal defect, and larger diameters. Where present, minor species such as black cherry, red spruce and sugar maple will be released.

Group selections will remove up to 2 acres (10% of total stand) with individual groups being ¼ acre or smaller. Groups will be placed to release existing desirable regeneration (commercial hardwoods near stand boundaries, hardwood-dominated areas in the eastern part of the stand, and balsam fir in stand interior).

The expanding gap irregular shelterwood technique will be used in conjunction with an existing ~1/2 acre canopy gap where dense, 10-20' tall balsam fir regeneration has already established. This treatment will remove canopy trees from a 25-50 foot (up to 1/3<sup>rd</sup> acre) strip around the edges of the existing gap with the goal of diversifying vertical structure and promoting advance regeneration of shade-tolerant species.

Low-value trees throughout the stand will be girdled to create snags for wildlife habitat enhancement with a goal of 4 snags per acre larger than 12" DBH; due to the relatively small mean diameter of the stand, this goal may require several cutting cycles to achieve.

The landing and most areas of Stand 12 are operable during dry, non-frozen conditions. Some previous skid trails in good condition may be used in this entry; new harvest trails should be established to be usable after closeout as permanent access for uneven-aged management.

## **OTHER WORK**

Optional work suggested for Stand 12 over the coming decade includes:

- Pre-commercial cleaning of advance regeneration may be used to promote minor species such as red spruce, white pine, or commercial/wildlife hardwoods. This could be completed using hand tools (brush saws, etc.), and could be combined with scheduled thinning/harvesting.
- Areas of Calhoun Rd between the last house and the log landing may need minor surface improvement (addition of crushed stone or gravel) for non-frozen log truck access.
- Post-harvest signage should be installed to signify this area as a featured site in the Lydia Spitzer Demonstration Forest.

## STAND 13

### STAND DESCRIPTION

*Acres (pro-rated):* 228.0

*NED Cover Type(s):* Northern hardwoods

*Natural Communities:* Northern Hardwood Forest / Red Spruce-Northern Hardwood Forest



#### *Stand History and Overview:*

Stand 13, spanning the Charleston-Morgan town line, is one of the largest stands on the NorthWoods property and was previously divided into two stands (11 and 13) based on varying soils, slope, elevation and landscape positions. The area is now considered a single management unit because of its low diversity in age, structure and species composition due to heavy logging in the 1980s.

Overall, the stand needs to grow at this point, though there are some opportunities for pre-commercial crop-tree release work. The long-range goal is to gradually transition the stand to an uneven-aged distribution, selecting for better tree quality and emphasizing shade tolerant species such as red spruce and commercial tolerants and mid-tolerants such as sugar maple, American beech, and yellow birch. This transition will also work to re-build the now-absent structural components of large-diameter snags and coarse woody debris.

Although the stand itself was probably never cleared for agriculture, fields did historically abut it in several places, and the area could have been first logged as early as the 1860s. In the 1942 aerial photos several small woods roads can be seen crossing the forest and signs of earlier logging are evident, including selective cutting in the southern region near Tripp Hill and heavier regeneration cuts on slopes in the northern and eastern areas. A sawmill downstream on Webster Brook operated until at least 1896 and timber from the east corner of the stand might have been either floated or drawn with horses this short distance. With the exception of some small group selection thinnings in the northwest extreme of the stand around 1975, there is no other evidence of cutting from 1942 until roughly 1984. At that time a large-scale whole tree harvest was conducted throughout, removing virtually all timber for sawlogs or biomass. The effects of this harvest were dramatic and its severity was apparently unpopular with area residents. A landowner at the end of Calhoun Road remembers that his spring dried up the season following this logging - the only time that this occurred in nearly fifty years. Continued legacies today include a near absence of coarse woody debris and snags, and multiple eroded gullies along the steep lower slopes. No cutting has taken place since 1984.

### WILDLIFE STRUCTURAL ATTRIBUTES

*Canopy (>30 feet):* Estimated 98% canopy closure; uniform. Mainly hardwood species with a higher proportion of softwoods in some areas (see diameter distribution chart below).

**Midstory (5-30 feet):** 67-100% cover, uniform. Primary species: gray birch, paper birch, red maple, yellow birch, pin cherry, black cherry and white ash.

**Understory (1-5 feet):** 0-33% cover, uniform. Primary herbaceous species: New York fern, hay-scented fern, bunchberry, club mosses, goldthread, Christmas fern, intermediate wood fern, rough-stemmed goldenrod, Canada mayflower, foamflower, Jack-in-the-pulpit, and whorled aster. Distribution of herb species reflects slight soil enrichment in mid-slope and toe slope areas in a band crossing the northeast edge of the stand. Enrichment indicators found here include silvery glade fern, plantain-leaved sedge, blue cohosh, and white baneberry. Primary woody species: balsam fir, red-berried elder, common blackberry, mountain maple, hobble-bush and dwarf raspberry.

**Snags:** Medium density of small snags; 37.9 snags/acre, 98% smaller than 15” DBH

**Coarse Woody Material (>10” diameter):** Low volume, uniformly distributed, mostly new/solid.

**Fine Woody Material (<3” diameter):** Low volume, uniformly distributed.

**Leaf Litter:** Not sampled

**Wildlife Attribute Summary:** Much of the regenerating forest is beginning to reach the stem-exclusion stage of growth, when a closed canopy results in a relatively sparse understory and a temporary reduction in overall wildlife diversity. Nevertheless a large amount of moose feeding sign was observed, and a variety of wildlife is known to cross the area (including bobcat, fisher, and deer). Common birds during the breeding season include ovenbird, veery, red-eyed vireo, wood thrush, black-capped chickadee, rose-breasted grosbeak, and black-throated blue warbler. As the trees grow and future management promotes increased structural diversity and coarse woody debris, more habitats and food sources will be created for wildlife.

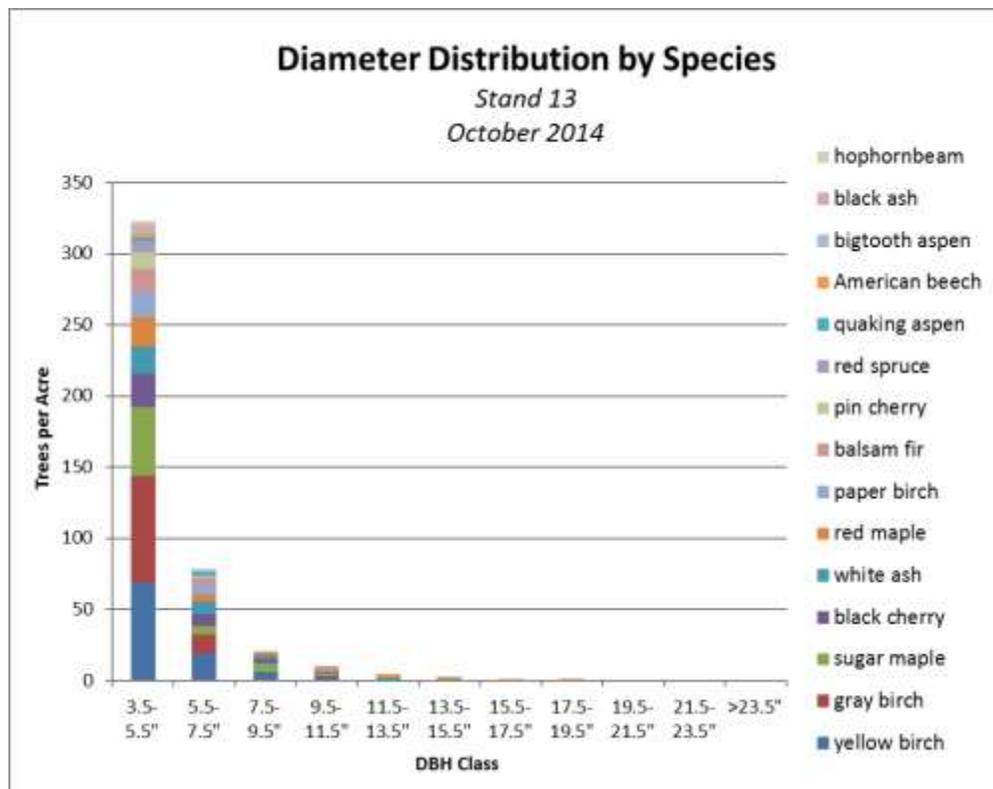
Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	yellow birch	22.7	100	2.5	2.7
	sugar maple	17.3	176	2.4	2.7
	gray birch	14.1	0	1.0	1.0
	red maple	9.1	141	1.3	1.6
	black cherry	8.2	17	1.1	1.2
	white ash	7.7	48	1.2	1.3
	paper birch	4.5	0	0.6	0.6
	American beech	2.7	19	0.5	0.6
	pin cherry	1.8	0	0.1	0.1
	quaking aspen	1.4	0	0.2	0.2
	bigtooth aspen	0.9	0	0.1	0.1
	black ash	0.5	0	0.0	0.0
	hophornbeam	0.5	0	0.0	0.0
<b>Hardwood Total</b>		<b>91.4</b>	<b>501</b>	<b>11.1</b>	<b>12.1</b>
Softwood	balsam fir	6.8	125	1.0	1.3
	red spruce	1.8	76	0.1	0.3
<b>Softwood Total</b>		<b>8.6</b>	<b>202</b>	<b>1.1</b>	<b>1.5</b>
<b>Grand Total</b>		<b>100.0</b>	<b>702</b>	<b>12.2</b>	<b>13.6</b>

## **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/

Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- A 50' buffer along the boundaries with Stand 10 (forested wetland ESTA in the southern half of the stand) is designated as a Surface Water Buffer Zone in a conservation easement held by the Vermont Land Trust. Equipment use is generally prohibited in these buffers and management activities must retain a minimum of A-line stocking. A full description of Surface Water Buffer Zone regulations, excerpted from the conservation easement, can be found in Appendix D.
- Multiple small intermittent streams drain the northeast edge of the stand, though none appear on topographic maps. Following the 1980s logging, unchecked runoff enlarged many of these stream channels and deposited sediment in the toeslope areas. Any future management along the eastern edge, where slopes exceed 10%, will retain at least 75% of the canopy within 30 feet of these stream channels to minimize runoff. Care should also be taken at the upper lip of these slopes to keep cut areas under 1/10<sup>th</sup> acre in size and to minimize disruption in seeps and low areas that feed these streams. Due to the variable soils, all future logging will preferably be done in frozen ground conditions. Localized entries are possible in some areas under dry late summer conditions, but will require careful scouting and trail layout.



**STAND HEALTH**

A number of forest health issues were observed, with recommended actions described below.

***Human Impacts:***

- None observed.

### ***Wildlife Impacts:***

- Two deer sighted. Fresh moose scat and rubbing.

### ***Invasive Species:***

- A patch of the invasive exotic plant common reed (~70 stems) was found in the southwest part of the stand. This should be manually cut or pulled and possibly treated with herbicide to prevent regrowth due to difficult access for repeated treatment ([www.vtinvasives.org](http://www.vtinvasives.org)). Herbicide treatment is only allowed to be conducted by the landowner or by a certified herbicide applicator. This phragmites population is isolated and should be monitored to ensure that it does not spread or establish new colonies in the forest interior.

### ***Climate Change Considerations:***

- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species and age diversity. Transitioning to an uneven-aged structure with a more balanced mix of northern hardwood species will increase future stand resilience.
- Boreal species such as balsam fir are predicted to decline in response to climate change. Current regeneration includes a high percentage of balsam fir; management should promote regeneration of species such as white ash, red maple and black cherry that are predicted to adapt well to future climate conditions while allowing some vigorous advance regeneration of cold-climate species to reach economic maturity.

### ***Other Pathogens and Health Concerns:***

- None observed

## **RECREATION/ EDUCATION**

Encompassing some of the most remote areas of the parcel, these stands provide a uniquely removed and wild experience for the more motivated hunter or nature enthusiast. This benefit should be preserved in the course of future management planning and implementation.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

***Age Class Structure:*** Even-aged (~30 years old) with reserves

***Sampling Method:*** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

***Number of Plots:*** 30 (1 per 7.6 acres)

***Sampling Date:*** October 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

***Total BA (ft<sup>2</sup>/acre):*** 76

***AGS BA:*** 40 (53%)

***BA 95% CI:*** 66-86 ft<sup>2</sup>/acre

***Total TPA:*** 441

***AGS TPA:*** 229 (52%)

***QMSD (inches):*** 5.6

***Stocking Level:*** Adequately stocked. A-B line on hardwood stocking chart (US Forest Service 2008 Timber Management Field Book)

### ***Regeneration:***

***0-1" DBH*** – 1,741 stems per acre

1-3" DBH – 722 stems per acre

Number of Plots – 54 (0.02% of stand / 1 plot per 4.2 acres)

Regeneration is well developed for a young, even-aged stand, and is uniform in most areas except for patches of dense, pure balsam fir, found mainly under declining gray birch canopy trees. Primary species include balsam fir (43% of stems sampled in 0-1" DBH class), sugar maple and yellow birch, with lower proportions of American beech, red maple, gray birch, paper birch and white ash.

**Site Class:** I

**Site Index:** 82 (paper birch), 56 (yellow birch)

**Soils:** Variable – all soil types found on the parcel are represented here. Midslope areas with north to northeast aspects are moderately well drained sandy loams, as are the steeper lower slope areas in the eastern part of the stand (Dixfield). Steep slopes along the northeast boundary are deep well drained fine sandy loams (Monadnock). In the western area near Tripp Hill are shallow, somewhat poorly drained sandy/ fine sandy loams (Colonel-Cabot). Finally, localized areas along the southern edge of the stand cross onto well-drained sandy/fine sandy loams (Tunbridge-Dixfield) and poorly drained shallow silt loams (Cabot).

**Access:** Fair to poor. Best achieved from several locations including: the Tripp Hill lower strip cut skid trails (for the Tripp Hill area), Calhoun Road (for eastern sections), and with landowner permission, from a side road off the Jordan Road for northern sections. Also, potential for resurrecting a former access trail crossing from Calhoun road toward the Jordan Road (for both recreational and forestry uses) should be investigated on the ground.

## **DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 20 years

**Diameter Objectives for Principle Species:**

12-18" dbh ----- red spruce, balsam fir

16-22" dbh ----- sugar maple, white ash, black cherry, yellow birch

Gradually convert the stand to all-aged using single tree, group selection, and patch selection systems, with group sizes up to 1 acre. Early successional patches >1/4 acre should be limited to 10% of the total stand acreage at any one time. Since the forest is still in the early stages of regrowth, a period of up to 100 years may be required to accomplish the transition to an uneven-aged stand. The first several entries will include even-aged intermediate treatments, with the goal of improving species composition and stand quality, while also increasing stand structure by creating small group openings to promote initiation of new age classes. Species to be favored will be commercial hardwoods (sugar maple, yellow birch, white ash, black cherry and American beech) on the better-drained soils, with a shift toward red spruce and balsam fir on the poorer drained areas around Tripp Hill. In all areas, other minor species will be retained as up to 25% of total stocking, and healthy butternut and basswood will be promoted for wildlife value. The goal for residual basal area will be 75-85 ft<sup>2</sup>/ac (increasing to 85-100 ft<sup>2</sup>/ac as mean DBH increases), with an ultimate structural goal of q=1.3.

A primary goal will be to re-introduce snags and coarse woody debris, beginning with the first thinning operation. The eventual goal will be to establish at least four snags per acre (two 12-18" dbh

and two >18" dbh) and as much coarse woody debris as possible of varying decay classes. A special effort will be made to leave large diameter trees as future den sites and logs >12" dbh and >6 feet long, as these become available.

## **PLANNED TREATMENTS**

### *Group selection harvest (2019)*

While most of the stand is far from commercial maturity and will benefit from time to grow, some areas have vigorous advance regeneration under a declining canopy of early-successional, non-commercial species. Group selection harvests in these areas will remove up to a total of 20 acres in groups ranging from 1/10<sup>th</sup> to 1 acre in size, releasing regeneration and initiating the conversion to an all-aged forest. Favored regeneration will include commercial hardwoods and balsam fir. Groups releasing balsam fir should be limited to less than half of total harvest area, and long-term species composition should transition toward longer-lived species that are better adapted to predicted climate change scenarios. Harvested product will be low-quality pulp or firewood, but funding to create early successional wildlife habitat may be available to defray costs- see NRCS practices schedule for details. Care should be taken to minimize damage to advance regeneration, using low-impact harvesting equipment or by leaving felled trees as coarse woody material (use of a brontosaurus or other mechanized precommercial harvester is not recommended due to soil and regeneration impact).

## **OTHER WORK**

Optional work suggested for Stand 13 over the coming decade includes:

- Areas with high-quality growing stock, mainly in the southwest corner of the stand (and smaller areas in the southeast finger and east above the steep eastern slopes), could benefit from precommercial thinning. Thinning should retain at least 350 stems per acre or B-line stocking, and should focus on releasing vigorous, well-formed yellow birch, black cherry, red spruce, sugar maple, white ash and other commercial mid- to late-successional species.
- Invasive common reed control- see Stand Health section, above.
- A multi-use trail connecting the northwest side of Tripp Hill to the southern "core" trails near the NorthWoods Center has been previously flagged and could be constructed with minimal impact to the stand. Old skid trails in good condition (limited rutting or erosion) may be used for part of the trail. Trail building would include minimal earthwork and little or no added material (gravel, stone, etc.) but may require drainage work and some treadwork. Intended uses will be non-motorized recreation and low-impact forestry/timber harvesting access (lightweight equipment and frozen ground use where necessary).

# STAND 14

## STAND DESCRIPTION

*Acres (pro-rated):* 29.0

*NED Cover Type(s):* Northern hardwoods

*Natural Communities:* Northern Hardwood Forest

### *Stand History and Overview:*

This small stand occupies the northeast-facing slopes that descend to the drainage feeding Webster Brook. It is very similar to the adjacent slopes of Stand 13, except here the forest is ecologically mid- to late-successional, with larger sugar maples being just over 100 years old and a cored 22" dbh beech that was approximately 153 years old. This stand appears to have escaped the heavy cutting of the surrounding areas in the mid 1980s due to a combination of moist seep areas and slopes exceeding 20%, which would have complicated access. For these reasons, operability for logging remains difficult, but not impossible, in both the toeslope and side slope areas of the stand.

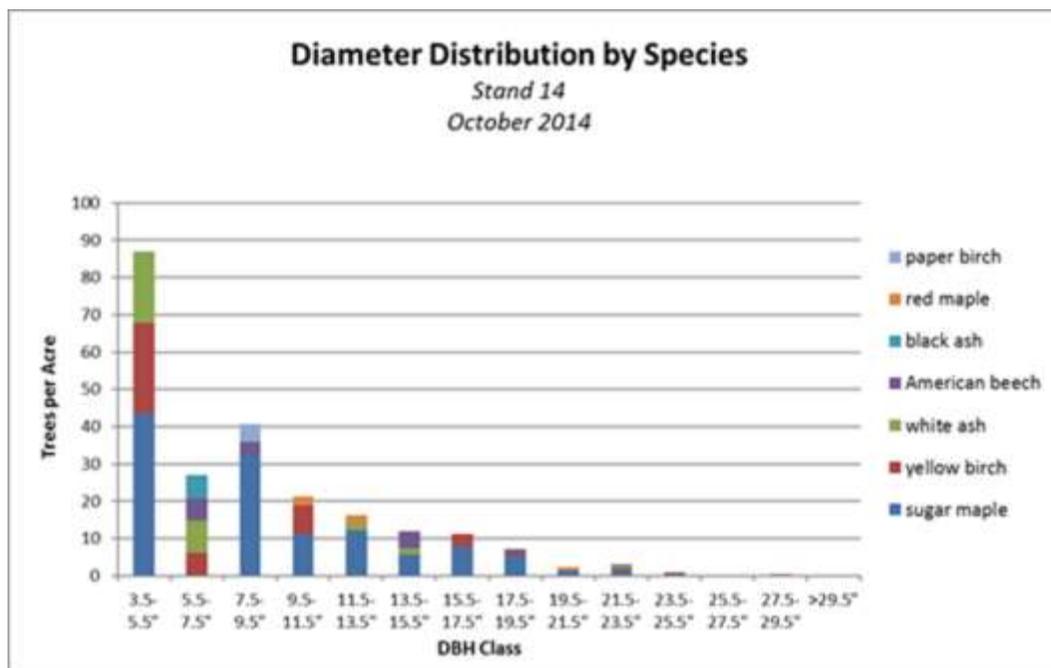


Many of the structural elements of an older forest can be seen here, including large diameter living trees and snags, coarse woody debris of various ages, a well-developed herb and shrub layer, and a midstory where small canopy gaps have allowed light to enter. Diameter distribution approximates the reverse J-curve that is characteristic of old-growth northern hardwoods in New England, and provides an on-site model of what we hope to achieve in other stands through several rotations of uneven-aged management. It is also likely providing important ecosystem functions ranging from protection of water quality in the riparian area downslope to harboring species of flora and fauna that can serve as source populations during the restoration of surrounding heavily logged areas.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	sugar maple	59.5	3,047	17.7	24.0
	yellow birch	17.6	518	4.6	5.6
	American beech	9.5	250	2.7	3.2
	white ash	6.8	498	1.1	2.0
	red maple	4.1	101	1.6	1.8
	black ash	1.4	0	0.3	0.3
	paper birch	1.4	0	0.5	0.5
	<b>Hardwood Total</b>		<b>100.3</b>	<b>4,414</b>	<b>28.4</b>
Softwood	<b>Softwood Total</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>
<b>Grand Total</b>		<b>100.3</b>	<b>4,414</b>	<b>28.4</b>	<b>37.5</b>

The fairly uniform canopy age and 1942 aerial photos suggest that a fairly heavy cut may have taken place here circa 1900, though the evidence remains somewhat unclear. By 1942 a woods road existed

near the upper edge of the stand and may have allowed some thinning in that area (a sugar maple cored in this area experienced a rapid increase in growth about 1963). Finally, the heavy cutting in adjacent areas circa 1984 reached into several parts of the stand.



## WILDLIFE STRUCTURAL ATTRIBUTES

**Canopy (>30 feet):** Estimated 95% canopy closure; uniform. Hardwood.

**Midstory (5-30 feet):** 34-66% cover, uniform. Primary species: yellow birch, American beech and sugar maple

**Understory (1-5 feet):** 0-33% cover, uniform. Primary herbaceous species: Christmas fern, evergreen woodfern, shining club moss, mosses, Jack-in-the-pulpit, intermediate wood fern, wake-robin, long beech fern, twisted stalk and blue-bead lily. Indicators of nutrient enrichment previously observed in Stand 14 include silvery glade fern, blue cohosh, maidenhair fern, plantain-leaved sedge, zig-zag goldenrod and Goldie’s wood fern. Primary woody species: American beech with lower proportion of sugar maple, yellow birch, red spruce, hobble-bush, red-berried elder and American fly honeysuckle.

**Snags:** Medium density with higher density of large snags than other stands; 47 snags/acre total, 3 snags/acre greater than 15” dbh.

**Coarse Woody Material (>10” diameter):** Medium volume, uniformly distributed. Decay condition ranges from soft/decaying to new/solid.

**Fine Woody Material (<3” diameter):** Medium density, uniformly distributed.

**Leaf Litter:** Not sampled, but thought to be high density (broad-leaved).

**Wildlife Attribute Summary:** Stand 14 offers diversity of structure, tree age, and hydrology that benefits various species of wildlife. Most notable may be black bear, which utilize the beech

component for critical fall mast and the seeps for forage on early spring nutrient-rich plant growth. A stony toe slope area provides regular refuge for a small porcupine population, in turn attracting regular visits from fisher. The moist soils and steady supply of decomposing leaves and woody matter provide habitat for a robust amphibian population that includes red-backed salamander, northern dusky salamander, northern two-lined salamander, and spotted salamander. Common birds include species associated with intact and well-developed hardwoods – ovenbird, wood thrush, scarlet tanager, eastern wood pewee, and pileated woodpecker.

## **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Several seeps were found in this stand, draining groundwater from the broad summit of Tripp Hill. Due to the influx of groundwater onto steep slopes, most areas of this stand are extremely sensitive to soil disturbance. Logging around these seeps should follow Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont. Equipment access should be routed to avoid wet soils and steeper slopes wherever possible, and harvesting should be conducted only in frozen ground conditions.
- Current structural attributes and species composition are much closer to a natural late-successional forest condition than any other stand on the property. Old forests- noted for their diversity of age classes, tree diameters (including very large trees and snags), vertical structure, soil organic matter, downed woody material and unique herbaceous species- are rare in northeastern Vermont. This stand should be managed with the primary goal of enhancing late-successional traits for ecological and educational benefits, and may be enrolled as an Old Forest ESTA in the future.

## **STAND HEALTH**

Very few issues were observed relating to stand health (below), and none require special action.

### ***Human Impacts:***

- Little or no evidence of recent human use.

### ***Wildlife Impacts:***

- None observed.

### ***Invasive Species:***

- None observed.

### ***Climate Change Considerations:***

- Increased storm intensity could alter disturbance regimes, and steep, wet slopes could become more vulnerable to tree damage and single/multiple tree blowdowns. Management activities should promote a structurally resilient forest by retaining healthy trees, regenerating the stand in small increments and anticipating natural disturbances.
- Variability in stream flows and greater chance for heavy rains could dramatically increase

runoff and groundwater flow into Stand 14. Steep slopes around seeps could be highly vulnerable to erosion. Maintaining vegetative cover (at least 75% canopy cover and as much understory/herbaceous cover as possible) and minimizing soil disturbance will protect the stability of slopes.

#### ***Other Pathogens and Health Concerns:***

- Beech bark disease is found on some (but not all) American beech. Fungal spores that spread the disease are airborne, therefore the best strategy for combating the disease is to maintain overall forest health, and to promote existing beech that have survived and may harbor a natural resistance to the disease. Specific management recommendations can be found in the Vermont Agency of Natural Resources (ANR) “Management Guidelines for Optimizing Mast Yields in Beech Mast Production Areas” (available online).

### **RECREATION/ EDUCATION**

Stand 14 is currently difficult to access and no evidence of recreational use was observed. However, its unique late-successional traits make this a valuable model area in the Lydia Spitzer Demonstration Forest. Future trails should be considered to access the stand with students and NorthWoods program participants.

### **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

**Age Class Structure:** Uneven-aged (100-150 year old dominant/codominants)

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 5 (1 per 5.8 acres)

**Sampling Date:** October 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 123      **AGS BA:** 77 (63%)      **BA 95% CI:** 83-164 ft<sup>2</sup>/acre

**Total TPA:** 230      **AGS TPA:** 167 (73%)      **QMSD (inches):** 9.9

**Stocking Level:** Approaching A-line on hardwood stocking chart (US Forest Service 2008 Timber Management Field Book)

#### ***Regeneration:***

**0-1" DBH** – 4,333 stems per acre

**1-3" DBH** – 250 stems per acre

**Number of Plots** – 12 (0.04% of stand / 1 plot per 2.4 acres)

Despite the canopy cover, a high density of regeneration is found in the stand, possibly due to preferential browsing by deer and moose in adjacent, flatter stands. Primary sapling species include sugar maple and American beech. Striped maple and hobblebush compete with other regeneration in some parts of the stand.

**Site Class:** I

**Site Index:** 64 (sugar maple)

**Soils:** Across most of the stand- moderately well drained sandy loams that are very stony and moderately deep to hardpan (Dixfield soil series). Roughly the northernmost third of the stand lies on very deep well drained fine sandy loams (also very stony) of the Monadnock soil series. Seeps are

common and soils are often saturated with groundwater draining from Tripp Hill.

**Access:** Poor. Mostly southeast 600 feet to the landing that is accessed from route 111. This would require improvements to the access road from route 111 and several seep and stream crossings between the stand and the landing.

### **DESIRED FUTURE STAND CONDITION**

***Long Range Silvicultural Objectives:*** Uneven-aged Management

***Cutting Cycle:*** 20 years

***Diameter Objectives for Principle Species:***

18-24”dbh ----- sugar maple, yellow birch, American beech

Due to steep slopes and frequency of seeps and intermittent streams, this stand presents both serious impediments to responsible logging and excellent wildlife and educational benefits as a more natural stand. Any future logging should be very light, maintaining stocking at or above the A-line, and should be done only in frozen ground conditions. The long term structural goal is  $q=1.2$  and residual basal area goal is 100 ft<sup>2</sup>/ac. Long-term ecological monitoring work by the NorthWoods Stewardship Center will allow comparison between this and adjacent managed lands, potentially providing insights into the effects of various management practices on the ecology of the site.

### **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

No silvicultural treatments are recommended at this time. Additional field evaluation in 2025 may justify enrollment as an Old Forest ESTA. Difficulty of access to the stand will require that stocking and timber value be high in order to justify the costs of entry.

### **OTHER WORK**

Optional work suggested for Stand 14 over the coming decade includes:

- Construction of a multi-use trail to access the stand, primarily for educational purposes
- Installation of interpretive signage describing unique ecological traits of the stand



## STAND 15

### STAND DESCRIPTION

*Acres (pro-rated):* 31.6

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Northern Hardwood Forest / Red Spruce- Northern Hardwood Forest

#### *Stand History and Overview:*

Covering a low, well-drained ridge between beaver-flooded wetlands, the young forest in Stand 15 is similar in composition and structure to nearby Stand 13. Whole tree harvesting of the mid 1980s removed most of the standing trees, resulting in a young forest today dominated by sapling-stage red maple, yellow birch, and balsam fir. Nonetheless, Stand 15 is popular with wildlife and hunters alike with proximity to a wide variety of wetland and upland habitats.



From 1860 through the turn of the century, ownership of this land was mostly held by farmers occupying adjacent tracts to the west and selective cutting may have gone on throughout this period. A 1913 deed noting the cutting of pulp and firewood (described in the history of Stand 16) could have referred in part to this stand. From 1920 to 1967 the stand was part of a larger holding by Clyde Durgin (again, see history for Stand 16). Selective logging probably occurred in the stand prior to 1962, though little is known about land use from this time until 1984. The whole tree harvesting that took place circa 1984 removed most of the standing timber in the stand, either as sawlogs or low-quality wood that was chipped. Long term effects included the removal of large candidate trees for future coarse woody debris or snags. Evidence that such trees existed in the former stand includes a single 38" dbh hollow yellow birch found in the cruise. No logging has been done in the stand since the 1980s.

### WILDLIFE STRUCTURAL ATTRIBUTES

*Canopy (>30 feet):* Estimated 80% canopy closure; patchy with distinct gaps. Mix of hardwood and softwood species (see diameter distribution chart below).

*Midstory (5-30 feet):* 67-100% cover, uniform. Primary species: red maple, balsam fir, yellow birch, paper birch, gray birch and black cherry.

*Understory (1-5 feet):* 34-66% cover, uniform. Primary herbaceous species: goldthread and club mosses. Sensitive fern was found in small patches of wetter soils. Primary woody species: red maple and balsam fir.

**Snags:** Medium density of small snags; 27.5 snags/acre, none larger than 15" DBH

**Coarse Woody Material (>10" diameter):** Medium volume, patchy with distinct areas of blowdown, mix of new and old material.

**Fine Woody Material (<3" diameter):** Medium volume, patchy.

**Leaf Litter:** Not sampled

**Wildlife Attribute Summary:** Stand 15 is nearly surrounded by wetlands and stream valleys which regularly attract a wide variety of species, including moose, deer, beaver, river otter, mink, long-tailed weasel, and bobcat. The beaver ponds and hydric soils nearby also provide unique and critical habitat for a number of bird species including American woodcock, great blue heron, and American black duck, as well as for painted turtle and native brook trout. Upland areas of the stand provide forage for deer, moose and snowshoe hare.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	red maple	29.5	403	4.2	5.0
	yellow birch	14.3	0	1.7	1.7
	black cherry	7.8	52	1.8	1.9
	gray birch	2.4	0	0.3	0.3
	pin cherry	2.4	0	0.2	0.2
	American beech	1.3	0	0.2	0.2
	paper birch	1.3	0	0.3	0.3
	<b>Hardwood Total</b>		<b>59.0</b>	<b>454</b>	<b>8.5</b>
Softwood	balsam fir	40.4	663	5.9	7.7
	red spruce	2.4	194	0.1	0.5
	<b>Softwood Total</b>	<b>40.4</b>	<b>663</b>	<b>5.9</b>	<b>7.7</b>
<b>Grand Total</b>		<b>99.4</b>	<b>1,117</b>	<b>14.4</b>	<b>17.1</b>

## SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Approximately 1.9 acres in the northeast corner of the stand (adjacent to Stand 26, a non-productive wetland area to the north) is designated as a Surface Water Buffer Zone in a conservation easement held by the Vermont Land Trust. Equipment use is generally prohibited in these buffers and management activities must retain a minimum of A-line stocking. A full description of Surface Water Buffer Zone regulations, excerpted from the conservation easement, can be found in Appendix D.

## STAND HEALTH

Though a number of forest health issues were observed (below), none require special action at this time.

### **Human Impacts:**

- The trail passing through Stand 15 and leading to VT Route 111 is used regularly by hunters

and other visitors. Illegal ATV use on this trail continues intermittently, although little damage to the trail was found within Stand 15.

**Wildlife Impacts:**

- Deer rubbing/ browse and hare browse.

**Invasive Species:**

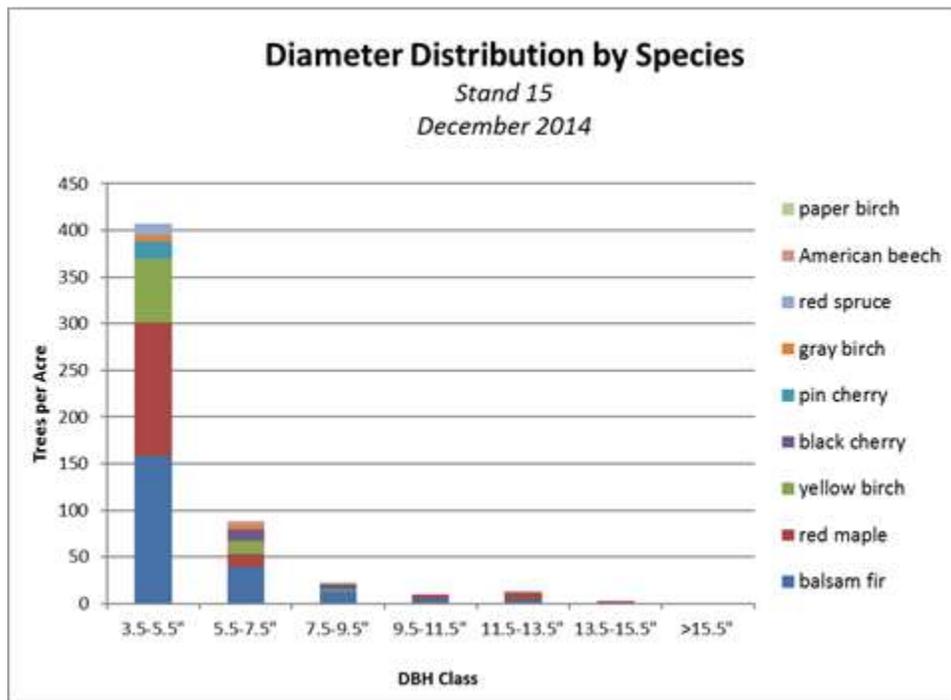
- None observed.

**Climate Change Considerations:**

- Boreal species such as balsam fir are predicted to decline in response to climate change. The current stand includes a high percentage of balsam fir; management should promote regeneration of species such as white ash, red maple and black cherry that are predicted to adapt well to future climate conditions while allowing vigorous, well-established balsam fir to reach economic maturity.
- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species and age diversity. Transitioning to an uneven-aged structure with a more balanced mix of northern hardwood species will increase future stand resilience.

**Other Pathogens and Health Concerns:**

- None observed



**RECREATION/ EDUCATION**

Stand 15 provides excellent hunting and wildlife observation opportunities, with relatively easy hiking access from VT Route 111. The unnamed trail corridor from Route 111 is maintained for forestry access and non-motorized recreation. Most of the trail follows old roads and is in good

condition, but areas around the beaver wetlands are frequently flooded. Despite clear signage, ATVs and off-road vehicles routinely use the trail illegally.

Future trail construction could connect Stand 15, the nearby wetlands and Route 111 to the NorthWoods core trail system located approximately 1.5 miles to the south.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

**Age Class Structure:** Even-aged (~30 years old) with reserves

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 10 (1 per 2.6 acres)

**Sampling Date:** December 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 92

**AGS BA:** 61 (66%)

**BA 95% CI:** 72-112 ft<sup>2</sup>/acre

**Total TPA:** 545

**AGS TPA:** 359 (66%)

**QMSD (inches):** 5.6

**Stocking Level:** Slightly understocked. Below B line on mixedwood stocking chart (US Forest Service 2008 Timber Management Field Book)

### ***Regeneration:***

**0-1" DBH** – 316 stems per acre

**1-3" DBH** – 842 stems per acre

**Number of Plots** – 19 (0.1% of stand / 1 plot per 1.7 acres)

This young stand still includes many canopy trees less than 3.5" dbh, and high canopy closure excludes seedling-sized regeneration of most species. Balsam fir is most abundant in both size classes; hardwoods including red maple, yellow birch, paper birch and gray birch are also common in the 1-3" dbh size class.

**Site Class:** II

**Site Index:** 50 (red maple), 50 (balsam fir)

**Soils:** Mostly moderately well drained sandy loams or well drained fine sandy loams that are somewhat deep to very deep to hardpan.

**Access:** Poor. Distance to Route 111 is between 0.5 and 0.8 miles, including flooded sections of trail that would need to be rebuilt, drained or solidly frozen to be used by equipment. Log landings could be located closer to the stand. Equipment use in the stand will be somewhat limited due to steep sideslopes along ridge.

## **DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 15 years

**Diameter Objectives for Principle Species:**

12-18" dbh ----- red spruce, balsam fir

16-22”dbh ----- red maple, sugar maple, white ash, black cherry, yellow birch

The primary long-term goals for this stand will be to promote wildlife values while also producing high-quality sawlogs. Stand 15 will gradually be converted to all-aged using single tree and small group selection systems, with a maximum group size of 1/4 acre. Due to the current early successional even-aged condition of the stand, this goal will require multiple cutting cycles to achieve, and the first few will employ intermediate even-aged techniques to improve stand quality and species composition. Later entries will gradually introduce new age classes, while moving toward a structural goal of  $q=1.4$  and a residual basal area of 90-100 sq ft. The long-term objective for species composition will be tolerant and mid-tolerant commercial species, including sugar maple, yellow birch, American beech, and red spruce, with other minor species comprising up to 25% of total stocking.

Future entries should also re-introduce snags and coarse woody debris, beginning with the first thinning operation. The eventual goal will be to establish at least four snags per acre (two 12-18”dbh and two >18”dbh) and as much coarse woody debris as possible of varying decay classes. A special effort will be made to leave large diameter trees as future den sites and logs >12” dbh and >6 feet long, as these become available.

### **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

Most of Stand 15 is young and minimally stocked. No harvesting or widespread precommercial treatment is recommended at this time.

### **OTHER WORK**

Optional work suggested for Stand 15 over the coming decade includes:

- Areas with high-quality growing stock throughout the stand could benefit from precommercial crop tree release. Stocking should be maintained close to B-line, removing as few stems as possible. Crop trees will be small in diameter but should be vigorous, well-formed yellow birch, black cherry, red spruce, sugar maple, white ash or other commercial mid- to late-successional species.



## STAND 16

### STAND DESCRIPTION

*Acres (pro-rated):* 122.9

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Northern Hardwood Forest / Red Spruce-Northern Hardwood Forest

#### *Stand History and Overview:*

Stand 16 extends from route 111, sloping very gradually southward across a plain before descending to the wetlands of adjacent Stands 25 and 26. Bisecting the stand north to south is a gated access road, improved in the 1980s, that descends past a small gravel pit, leading eventually to a landing in the parcel's main northeast drainage. The stand's table-like character is broken by a sinuous 100-foot wide valley that originates below the access road and descends to the wetland, but that contains only a seeping flow. This valley may have been isolated from the watershed to the north by the construction of the road, or its origins may be more ancient – in the meltwaters of the receding glacier 11,000 years ago. Close to Route 111 in the northwest corner of the stand is a ~1,000 foot wide band of very gradually sloped, poorly drained soils. Regeneration here is less vigorous than in other parts of the stand and is interspersed with patches of herbaceous growth and small pools of water.



Overall, the stand is regenerating well from the clearcutting 30 years ago. Average canopy height of dominants is 40 feet, indicating a high site index for the species present. These include mostly gray birch, balsam fir, and red maple. Higher value species such as black cherry, yellow birch, and paper birch are present, though in lower numbers. The stand is transitioning from sapling to pole-sized trees, and in most locations the canopy is closed. Several areas however remain patchy, with hay-scented fern common in the herb layer.

Based upon soil pits and other field evidence, this stand was probably never pastured or cleared for cropland. The early logging history is unclear, but could have begun as early as 1885, when parts of the adjacent lot 15 were first logged. The first direct evidence of logging is in a deed from 1913 which reserves "...all the pulpwood and firewood now cut on said lot." In 1920 Morgan resident Clyde Durgin acquired several adjacent Morgan lots, including this stand and proceeded to log them. To expedite this process Durgin built the road that today is route 111 (the earlier public road was located about 1,600 feet to the north at the base of Bear Hill). The 1942 aerial photo shows re-growth from heavy cutting in the northern part of the stand, as well as a roughly 3 acres of a larger patch cut in softwoods along the central west boundary. This latter area regenerated in spruce and fir and was largely passed over in the 1980s logging (though much has since blown down). An aerial photo of the southern half of the stand in 1980 shows uniformly small canopies, suggesting a possible heavy cut there, possibly in the 1940s or 1950s. This stand was probably not more than pole-sized when it was clearcut as part of the widescale logging of 1984-1985. Long time area residents who remember this cutting have said that almost everything was removed – either as sawlogs or woodchips, and this small stand may have been chipped. An attempt was made after this cutting to initiate a plantation of

Scotch pine, according to one source because of local outcries about the appearance of the job. After about a decade of growth these pines were overtaken by the naturally regenerating hardwoods and the remaining ones are now mostly branchy snags. After purchasing the property in 1993, landowner Lydia Spitzer installed power, sewer and water at an intended building site at the north end of the stand. For a period of several years she visited the site, staying in a camper, which remained there until about 2002. Precommercial thinning is now timely, to release preferred crop trees and to remove stump sprout red maples and poorly formed trees in areas with pole-sized stems and closed canopies. This treatment was started in 2011 with an area of approximately 20 acres thinned using NRCS EQIP funding. Similar thinning could be continued in much of the stand, although areas with more open canopies or lower quality growing stock should be left to grow.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
<b>Hardwood</b>	<i>gray birch</i>	27.7	0	3.3	3.3
	<i>red maple</i>	19.3	15	1.9	2.0
	<i>yellow birch</i>	10.2	0	1.2	1.2
	<i>black cherry</i>	9.5	0	1.2	1.2
	<i>pin cherry</i>	2.2	0	0.1	0.1
	<i>paper birch</i>	1.5	0	0.2	0.2
	<i>American beech</i>	0.7	0	0.1	0.1
	<i>black ash</i>	0.4	0	0.0	0.0
	<i>quaking aspen</i>	0.4	0	0.1	0.1
	<i>sugar maple</i>	0.4	0	0.1	0.1
	<b>Hardwood Total</b>		<b>72.3</b>	<b>15</b>	<b>8.1</b>
<b>Softwood</b>	<i>balsam fir</i>	27.0	34	3.7	3.8
	<i>northern white cedar</i>	0.7	38	0.1	0.2
	<b>Softwood Total</b>	<b>27.0</b>	<b>34</b>	<b>3.7</b>	<b>3.8</b>
<b>Grand Total</b>		<b>99.3</b>	<b>49</b>	<b>11.8</b>	<b>11.9</b>

A ten-acre area of the stand, closest to Route 111, is excluded from the VLT conservation easement as a potential future housesite and may also be sold as a subdivision from the larger property in the future. As a highly accessible and homogeneous forest, this stand offers unique research opportunities. Baseline data on soils, plants, and small mammals was gathered in 2005 in preparation for a future study into the effects of various levels of TSI on the ecology of the site. Additional funding is now being sought to continue with this research, which will be timed with future TSI activities.

The long-term goal for Stand 16 is to gradually transition the stand back to an uneven-aged forest, with high-quality sawlogs as the primary product, as well as large diameter snags and coarse woody debris of various ages. During this transition, the early successional species that are now dominant will provide wildlife benefits, as well as eventual products and coarse woody debris.

### **WILDLIFE STRUCTURAL ATTRIBUTES**

**Canopy (>30 feet):** Estimated 95% canopy closure; uniform. Mainly hardwood species with higher proportion of softwoods in some areas (see diameter distribution chart below).

**Midstory (5-30 feet):** 34-66% cover, uniform. Primary species: gray birch, balsam fir, yellow birch, red maple, pin cherry and black cherry.

**Understory (1-5 feet):** 0-33% cover, uniform. Primary herbaceous species: club mosses, rough-stemmed goldenrod, hay-scented fern, intermediate wood fern, Canada mayflower, painted trillium, whorled aster, New York fern, and ground-pine. Primary woody species: common blackberry (sparse). Uncommon shrubs for the site observed in 2005 included common juniper (found nowhere else on the property) and the native bush honeysuckle (found in only two other stands).

**Snags:** Low density with mostly small snags; 18.0 snags/acre, 97% smaller than 15" DBH

**Coarse Woody Material (>10" diameter):** Very low volume, uniformly distributed.

**Fine Woody Material (<3" diameter):** Low volume, patchy. Most FWM is slash in recently thinned areas.

**Leaf Litter:** Not sampled

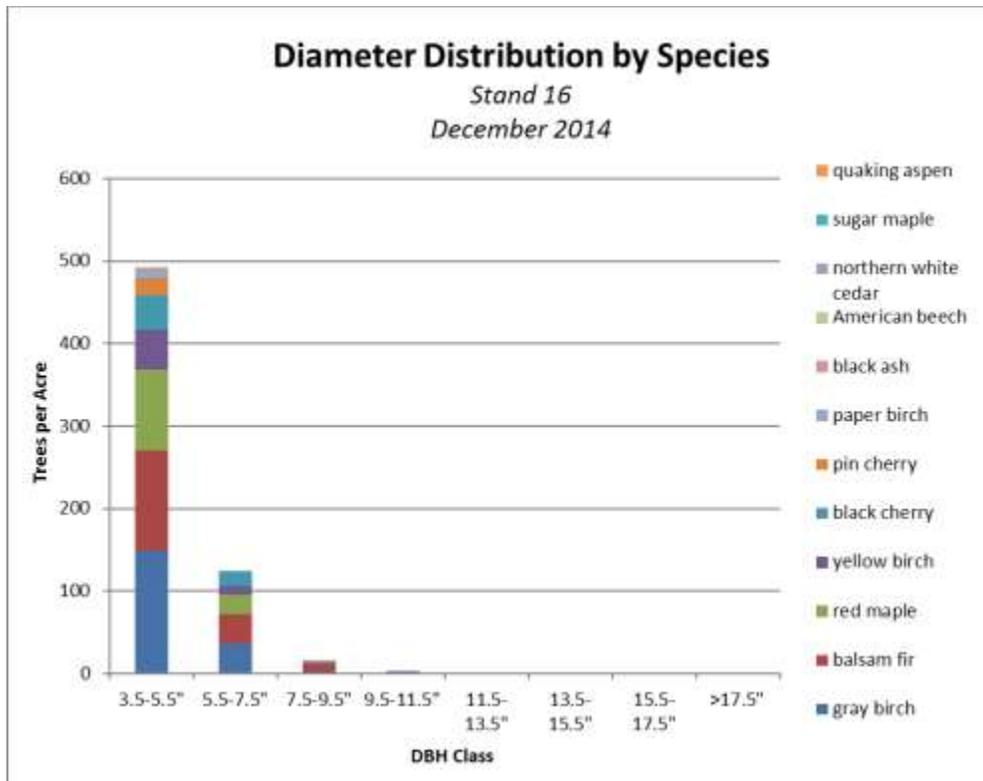
**Wildlife Attribute Summary:** Although at its current stage of growth the stand appears to lack most desirable habitat elements, surveys conducted since 1998 have revealed a surprising number of species utilizing the area. Moose and hare have fed heavily here in the past, but are losing their preferred forage and shelter as the trees mature. Coyote, red fox, black bear, raccoon and deer sign has all been repeatedly found along the access road, and does occasionally feed in the valley wetland, leaving their young fawns hidden among the dense saplings. Breeding birds include species commonly associated with early successional hardwoods- namely Nashville warbler, American robin, rose-breasted grosbeak, chestnut-sided warbler, American redstart, and American woodcock. Belted kingfishers have also made use in recent years of the small gravel pit for their bank nests. Research involving intensive small mammal trapping in 2005 found eight species here, including red-backed vole, short-tailed shrew, and (surprisingly) a high density of northern flying squirrels.

Beaver ponds and wetlands adjacent to Stand 16 to the south provide unique and critical habitat for a number of bird species including American woodcock, great blue heron, and American black duck, as well as for painted turtle and native brook trout.

## **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- A 50' buffer along most of the boundary with Stands 25 and 26 (non-productive wetlands and riparian area ESTA to the southeast) is designated as a Surface Water Buffer Zone in a conservation easement held by the Vermont Land Trust. Equipment use is generally prohibited in these buffers and management activities must retain a minimum of A-line stocking. A full description of Surface Water Buffer Zone regulations, excerpted from the conservation easement, can be found in Appendix D.
- The valleys that cross much of the stand from north to south have moist soils, where regeneration is a challenge. Future logging in the small steep-walled valleys should be avoided and, if it does occur to remove exceptionally high-quality trees, should be done only in frozen ground conditions, with the residual stocking equaling or exceeding the A-line.



## **STAND HEALTH**

Some stand health issues were observed, described below with recommended actions.

### ***Human Impacts:***

- The trail passing through Stand 16 from VT Route 111 is used regularly by hunters and other visitors. Illegal ATV use on this trail continues, although little damage to the trail was found within Stand 16.

### ***Wildlife Impacts:***

- Moderate deer browse.

### ***Invasive Species:***

- Two patches of the invasive exotic plant common reed were found in the central to western part of the stand. This should be manually cut or pulled annually until native vegetation is able to compete adequately. These populations are isolated and should be monitored to ensure that they do not spread or establish new colonies in the forest interior.

### ***Climate Change Considerations:***

- Potential future increases in forest pests, pathogens and invasive plants could be a serious threat to forests with low species and age diversity. Transitioning to an uneven-aged structure with a more balanced mix of northern hardwood species will increase future stand resilience.
- Boreal species such as balsam fir are predicted to decline in response to climate change. Current regeneration includes a high percentage of balsam fir; management should promote regeneration of species such as white ash, red maple and black cherry that are predicted to adapt well to future climate conditions while allowing some vigorous advance regeneration of

cold-climate species to reach economic maturity.

***Other Pathogens and Health Concerns:***

- None observed

**RECREATION/ EDUCATION**

The stand is currently used mainly by hunters. Problems have occurred in recent years with ATVs entering from the Route 111 parking area and traveling through the property toward Calhoun road. Impromptu log barricades have reduced this problem and some signs have been installed stating the site policy of no public ATV use. Potential exists to improve the recreational trail system by connecting this stand through to other trails maintained by the NorthWoods Stewardship Center. With ample parking at Route 111, improved trails will better benefit the community, but this development will need to be accompanied by careful monitoring and signage to minimize visitor impacts on wildlife.

**SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

***Age Class Structure:*** Even-aged (~30 years old) with reserves

***Sampling Method:*** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

***Number of Plots:*** 31 (1 per 4.0 acres)

***Sampling Date:*** December 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

***Total BA (ft<sup>2</sup>/acre):*** 88

***AGS BA:*** 43 (49%)

***BA 95% CI:*** 78-99 ft<sup>2</sup>/acre

***Total TPA:*** 638

***AGS TPA:*** 294 (46%)

***QMSD (inches):*** 5.0

***Stocking Level:*** Minimally stocked. B-C line on hardwood stocking chart (US Forest Service 2008 Timber Management Field Book)

***Regeneration:***

***0-1" DBH*** – 434 stems per acre

***1-3" DBH*** – 736 stems per acre

***Number of Plots*** – 53 (0.04% of stand / 1 plot per 2.3 acres)

This young stand still includes many canopy trees less than 3.5" dbh, and high canopy closure excludes seedling-sized regeneration of most species. Balsam fir is most abundant in both size classes; hardwoods including gray birch, yellow birch, red maple and black cherry are also common in the 1-3" dbh size class.

***Site Class:*** I

***Site Index:*** 76 (paper birch), 70 (balsam fir)

***Soils:*** Sandy loams- moderately well drained and moderately deep to hardpan (Dixfield). Somewhat poorly drained, shallow to hardpan and very stony Cabot silt loam and Colonel-Cabot complex are found in northern and northwestern parts of the stand, with some areas often having standing water.

***Access:*** Excellent- gravel access road cuts through stand from VT Route 111. Slopes are moderate and soils well drained.

## **DESIRED FUTURE STAND CONDITION**

*Long Range Silvicultural Objectives:* Uneven-aged Management

*Cutting Cycle:* 15 years

*Diameter Objectives for Principle Species:*

12-18" dbh ----- red spruce, balsam fir

16-22" dbh ----- sugar maple, yellow birch, black cherry, and other hardwoods

A primary goal is the production of high-quality sawlogs, with secondary goals of wildlife mast, aesthetics, and forest research. Gradually convert the stand to all-aged using single tree and small group selection systems, with a maximum group size of 1/4 acre. Due to the current young even-aged condition of the stand, this goal will require at least eight cutting cycles to achieve, and the initial few entries employing intermediate even-aged techniques to improve stand quality and species composition. Later entries will introduce new age classes, while moving toward a structural goal of  $q=1.3$  and a residual basal area goal of 90-100 sq ft. The long-term objective for species composition will be tolerant and mid-tolerant commercial hardwoods, including sugar maple, yellow birch, and American beech, with other minor species comprising up to 25% of total stocking. Easy access also provides excellent opportunities here for enhancing timber quality through hardwood pruning of select crop trees- particularly sugar maple and yellow birch. A secondary goal will be to re-introduce snags and coarse woody debris, beginning with the first thinning operation. The eventual goal will be to establish at least four snags per acre (two 12-18" dbh and two >18" dbh) and as much coarse woody debris as possible of varying decay classes. A special effort will be made to leave large diameter trees as future den sites and logs >12" dbh and >6 feet long, as these become available.

## **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

No silvicultural treatment is necessary in the next 10 years. See below for optional precommercial work.

## **OTHER WORK**

Optional work suggested for Stand 16 over the coming decade includes:

- Areas with high-quality growing stock, mainly in the southern and central parts of the stand, could benefit from precommercial thinning. Thinning should retain at least 350 stems per acre or B-line stocking, and should focus on releasing vigorous, well-formed sugar maple, yellow birch, white ash, black cherry, red spruce, American beech, balsam fir, and red maple. Minor species should be retained for biodiversity, ideally representing 10-15% of stocking. Cut trees should be left on the ground as coarse/fine woody material.
- Stand 16 has excellent access from Route 111 and soils/topography that are well suited to

timber management. Parallel or looping trails spaced ~150 feet apart could be established to prepare the stand for frequent future entries associated with uneven-aged management. Trails should be built for small- to medium-sized forestry equipment (tractor, small skidder or forwarder) with a 9-10' tread width, and located to minimize soil impact and water crossings. Small diameter fuelwood could be harvested while completing this work, although some larger slash and logs should be left as coarse woody material.

- Invasive common reed control- see Stand Health section, above.
- The property boundary on the eastern side of the stand is unclear, with discrepancies of up to 50' between GIS shapefiles and flagging/posted signs found on trees. These boundaries should be surveyed and marked as funding is available.



# STAND 17

## *SPECIAL UVA CATEGORY*

Ecologically Sensitive Treatment Area (ESTA) - Forested Wetland

### **STAND DESCRIPTION**

*Acres (pro-rated):* 8.3

*Stand Cover Type(s):* Northern White Cedar

*Natural Communities:* Northern White Cedar Swamp

#### ***Stand History and Overview:***

Stand 17 is located along the shoreline of Echo Lake at the west edge of the Tripp Hill parcel. Western parts of the stand appear as well-established forest in the 1940s series of aerial photographs, and may have never been cleared. The northeast third of the stand, in contrast, was cleared – presumably in the late 19<sup>th</sup> century, when much of the surrounding area was being settled and cleared for use as pasture or cropland. By the early 1940s, old field softwoods were well established in the southeast corner of the stand, while the northeast corner was still open field. The history of the stand since that time is less clear, but softwoods have generally emerged as the dominant cover type throughout, with northern white cedar being the most widespread and significant species.

### **ECOLOGICALLY SIGNIFICANT FEATURE(S) TO BE PROTECTED**

The stand is characterized by a lake edge Northern White Cedar Swamp natural community. Although clearing and use as farmland has altered the composition of part of the stand, a component of old trees remains, and offers a good starting point for rebuilding the natural community. The location of the swamp adjacent to the 500+ acre lake adds significantly to its ecological and wildlife habitat value, as undeveloped shoreline habitats are increasingly rare and threatened by development pressures.

*Age Class Structure:* Uneven-aged

*Site Class:* III

*Soils:* Poorly drained Cabot silt loams are mapped for the east and southwest corners of the stand. These soils are shallow to dense basal till and have a seasonal high water table at or near the surface. Localized hummocks and hollows provide some variation, creating both more moderately drained and very poorly drained micro-site conditions. NRCS mapping shows better drained Dixfield sandy loam and Monadnock fine sandy loam soils occurring in the central and northern parts of the stand. These are moderately to well-drained soils with fine sandy loam textures, with a seasonal high water table common in the Dixfield soil areas.

## **JUSTIFICATION FOR ESTA ENROLLMENT**

Several attributes of this site justify its recognition and protection as a Forested Wetland ESTA.

- 1) *Sensitivity*: Soil textures for parts of the stand are silt loams over hardpan, with the water table at or near the surface for much of the year. The soil conditions, hydrology, and micro-topography that have produced this forested wetland natural community type could be easily altered through the use of heavy equipment associated with timber harvesting. Disturbances associated with logging could facilitate the establishment of invasive plants at the expense of native plants and tree saplings.
- 2) *Natural Community*: Northern White Cedar Swamp is an uncommon (S3-ranked) natural community type statewide. Parts of the swamp that have been impacted by agriculture have re-established well, and overall plant diversity is moderate to high.
- 3) *Landowner Goals*: Promoting diverse wildlife habitat is a primary goal and Stand 17 contributes significantly to these values as a result of the species and forest conditions found here. This natural community is known to provide habitat for at least 84 species of wildlife (Miller 1990).

## **STAND HEALTH (INCLUDE THREATS TO THE ECOLOGICALLY SIGNIFICANT FEATURE)**

No threats were noted, though invasive plants are a potential threat, particularly considering the agricultural history in the east part of the stand.

## **DESIRED FUTURE STAND CONDITION**

The primary goal with this ESTA enrollment is to protect and enhance the natural characteristics of the forested wetland and its values to wildlife and overall ecological processes. The stand already features natural forest elements that are less common across the uplands (pit/mound topography, old trees, plant diversity, multiple vegetative layers, and coarse woody material). These values can best be further enhanced by allowing the forest to continue to develop naturally, with many trees growing to large diameters (>20" dbh) and others dying and contributing new snags and woody debris to the forest floor. The tree species found here can achieve lifespans over 300 years, and some of the cedars appear to be >100 years. Conservation of these sensitive wetlands will require ongoing vigilance against invasive plants, and care when operating in adjacent upland areas to avoid impeding water flow into the wetlands or causing erosion or chemical pollution (oil spills, etc) that might affect water quality.

## **PLANNED TREATMENTS**

*None*

The stand should be monitored regularly for invasive exotic plants, and control measures should be applied if these species appear. Additional fieldwork in 2015 will help to confirm the boundary of the stand and contribute additional details about its current structure and values.

# STAND 18

## STAND DESCRIPTION

*Acres (pro-rated):* 56.2

*NED Cover Type(s):* Northern Hardwood Forest

*Natural Communities:* Northern Hardwood Forest

### *Stand History and Overview:*

Stand 18 is a relatively narrow band of pole and small sawtimber- sized hardwood that extends from Tripp Hill north to the property line, wrapped between the old field softwoods of Stand 19 and the regenerating hardwoods of Stand 13. Site quality is quite good here, favoring sugar maple and white ash.

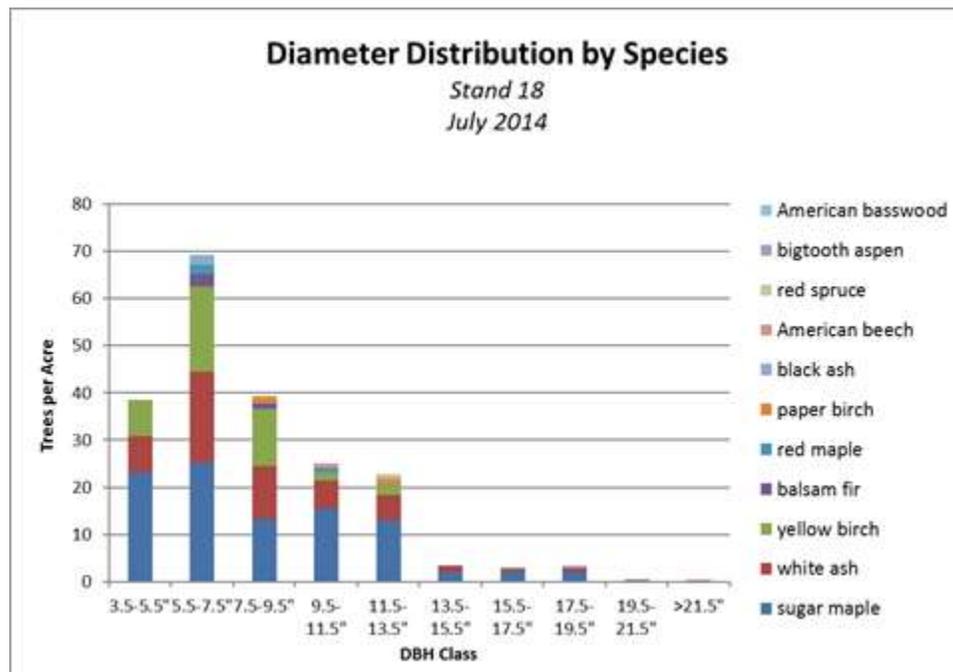


Though today Stand 18 occupies a remote part of the site, it lies adjacent to one of the earliest homesteads in the area and may have been logged or used as a sugarbush well before other stands were first utilized. By about 1870 the fields of the Tripp farm extended up to, or in some areas beyond, the southern edge of the stand. Beginning before the turn of the century these fields were gradually recolonized by softwoods. The 1942 aerial photo shows over 10 acres along the upper south edge of the stand dominated by these softwoods. The remainder of the stand at that time was forested in well-developed hardwoods, though several patches suggest earlier cutting. A woods road can also be faintly seen in this photo- crossing the stand and the entire property from east to west.

Based upon tree cores taken in 2005, partial cuts may have occurred in the stand circa 1913, 1921, 1931, and/or 1940. The first stand-wide heavy cut occurred between 1955 and 1960 and was the source of the pole-sized cohort that now dominates the stand. This cutting can also be seen on 1962 soil photos and appears to have also removed many of the old-field softwoods crossing the stand's south edge. Most of this forest has probably not been logged since 1960, though the extensive clearcut to the east in the 1980s did reach into the south end of Stand 18.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	sugar maple	50.9	1,366	9.0	11.7
	white ash	25.7	702	5.8	7.1
	yellow birch	15.0	163	3.0	3.3
	paper birch	1.8	77	0.4	0.5
	American beech	1.2	0	0.2	0.2
	bigtooth aspen	1.2	140	0.2	0.4
	red maple	1.2	0	0.2	0.2
	American basswood	0.6	0	0.2	0.2
	black ash	0.6	0	0.1	0.1
	<b>Hardwood Total</b>		<b>98.2</b>	<b>2,448</b>	<b>19.0</b>
Softwood	balsam fir	1.2	0	0.2	0.2
	red spruce	0.6	42	0.1	0.2
	<b>Softwood Total</b>	<b>1.2</b>	<b>0</b>	<b>0.2</b>	<b>0.2</b>
<b>Grand Total</b>		<b>99.4</b>	<b>2,448</b>	<b>19.3</b>	<b>24.1</b>

In 2013, most of the stand (43.8 acres) was thinned/ harvested using Silviculture for the Birds guidelines developed by Audubon Vermont and Vermont Department of Forests, Parks, and Recreation – as one of nine Vermont demonstration areas for this practice. Prescribed treatments were crop tree release with canopy gap formation and variable density thinning, with the goal of improving habitat for interior forest species such as black-throated blue warbler, white-throated sparrow, eastern wood-pewee and yellow-bellied sapsucker, while also improving future timber value. Basal area in harvested areas was reduced from 122ft<sup>2</sup>/ac to 90 ft<sup>2</sup>/ac, with group selection sizes ranging from 1/20<sup>th</sup> to 1/4<sup>th</sup> acre. Total area in canopy gaps was approximately 2.2 acres, excluding skid trail openings. Percentage of acceptable growing stock (AGS) basal area increased from 47% pre-harvest to 75% post-harvest. Cut-and-leave and girdle trees were marked and cut/girdled to add coarse woody material and snags.



## WILDLIFE STRUCTURAL ATTRIBUTES

*Data collected using Audubon Vermont “Silviculture with Birds in Mind” vegetation/ habitat survey protocol*

**Canopy (>30 feet):** Estimated 81% canopy closure; patchy with primarily hardwood species (see diameter distribution chart below). Canopy gaps created by timber harvesting (group selections and skid trails).

**Midstory (5-30 feet):** Estimated 45% cover, patchy. Primarily species: sugar maple, American beech, white ash and striped maple.

**Understory (1-5 feet):** Estimated 55% cover, patchy. Primary herbaceous species: hay-scented fern, lady fern, oak fern, sensitive fern, jewelweed, dwarf enchanters nightshade, foamflower and dwarf raspberry. Primary woody species: sugar maple, striped maple, white ash.

**Snags:** Medium density; 27.5 snags/acre total, 2.3 snags/acre larger than 15” DBH

**Coarse Woody Material (>10" diameter and >3' long):** 20 pieces/acre. Cut-and-leave trees and culled bole sections in 2013 timber harvest added new CWM.

**Fine Woody Material (<3" diameter):** 16 piles or tops per acre.

**Leaf Litter:** Adequate and broad-leaved.

**Wildlife Attribute Summary:** The component of larger (>12" diameter) hardwoods and snags provides structural diversity that benefits a variety of wildlife and is uncommon across the parcel and the larger region. Sign of moose, coyote, porcupine, and deer is often seen here. Common breeding birds are American robin, ovenbird, black-throated green warbler, least flycatcher, hermit thrush, red-eyed vireo, black-throated blue warbler, yellow-rumped warbler, and winter wren.

### **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites.

### **STAND HEALTH**

A number of forest health issues were observed (below), but none require special action at this time.

#### ***Human Impacts:***

- The Tripp Hill footpath enters Stand 18 and is used occasionally by skiers, snowshoers and hikers with no noticeable impact.
- Timber harvesting and closeout activities in 2013 created some soil disturbance (rutting, scarification, water bars installed on trails) and should be monitored for erosion.

#### ***Wildlife Impacts:***

- Moderate deer and moose browse

#### ***Invasive Species:***

- None observed.

#### ***Climate Change Considerations:***

- Stand 18 is well adapted to future climate change with a mix of species and a diverse structure. Management should continue to diversify structure and maintain minor species such as black cherry that are predicted to adapt well to climate change.

#### ***Other Pathogens and Health Concerns:***

- Beech bark disease is found on some (but not all) American beech. Fungal spores that spread the disease are airborne, therefore the best strategy for combating the disease is to maintain overall forest health, and to promote existing beech that have survived and may harbor a natural resistance to the disease. See the Vermont Agency of Natural Resources (ANR) "Management Guidelines for Optimizing Mast Yields in Beech Mast Production Areas" (available online)
- Hay-scented fern, a light-loving allelopathic plant that inhibits sapling development of some

hardwoods, is found occasionally throughout Stand 18. Prevalence of this plant should be monitored and controlled as necessary with manual cutting/pulling, enrichment planting of desirable species, limited herbicide application or silvicultural treatments.

- Emerald ash borer (EAB), an invasive insect that can cause nearly complete mortality in ash tree populations, will likely reach northern Vermont in the next 10 years. The larval stage of EAB tunnels through cambium of white, green and black ash trees, thereby girdling the tree and killing it. Ash trees that are under stress from other factors are more susceptible to EAB infestation. White ash is a dominant canopy species in some areas of this stand; future management activities should retain healthy ash trees while monitoring for EAB damage.

## **RECREATION/ EDUCATION**

Recreational use in stand 18 is largely limited to hunting, as the stand is isolated from all access points. At least one deer stand is maintained here by a Morgan resident and has been used annually since at least 1999. A footpath was cut in 2012 connecting the Jordan Rd. and East Echo Lake road trailheads to Stand 18, and another was established through the northwest part of the site in 2014. These will likely increase the number of Nordic skiers, snowshoers and hikers. Because of its aesthetic qualities and location, the area might be suitable for a future multi-use trail connecting western and eastern parts of the property. A historic woods road once crossed this stand and might be restored for this purpose.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

**Age Class Structure:** Even-aged with reserves, transitioning to uneven-aged; main cohort ~55 year old, reserves ~80 to 100 years old.

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 5$ " dbh)

**Number of Plots:** 19 (1 per 3.0 acres)

**Sampling Date:** July 2014

*For all live intermediate-dominant trees  $>4.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 88

**AGS BA:** 62 (70%)

**BA 95% CI:** 69-107 ft<sup>2</sup>/acre

**Total TPA:** 205

**AGS TPA:** 138 (67%)

**QMSD (inches):** 8.9

**Stocking Level:** Adequately stocked. A-B line on hardwood stocking chart (US Forest Service 2008 Timber Management Field Book)

### **Regeneration:**

**0-1" DBH** – 10,658 stems per acre

**1-3" DBH** – 158 stems per acre

**Number of Plots** – 19 (0.05% of stand / 1 plot per 3.0 acres)

Regeneration is patchy, with rapid growth response under 2013 canopy gaps expected in the next few years. Primary species include sugar maple and white ash. Striped maple and dense patches of mixed fern species, including hayscented fern, are common throughout the stand and may be suppressing regeneration of more desirable species.

**Site Class:** I

**Site Index:** 71 (white ash)

**Soils:** Mostly very stony, moderately well drained sandy loams, relatively deep to hardpan (Dixfield). In several areas of the stand that extend to the southwest soils are more poorly drained, finer textured loams that are shallow to hardpan (Colonel-Cabot). Despite this mapping, experience during the 2013 logging revealed that various parts of the stand are characterized by wet soil conditions, presumably due to a shallow hardpan layer. Future management activities should be scheduled for frozen ground conditions.

**Access:** Fair to poor. The easiest access is via the Tripp Hill fields, though landowner permission is required and log trucks will need to negotiate almost a mile of class 4 road leading to the landing. Skid trails to the landing north of the Tripp Hill field also need to be planned carefully due to wet soils. Some skid trails from the 2013 harvesting and previous strip cuts may be usable for future management.

### **DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 20 years

**Diameter Objectives for Principle Species:**

16-22" dbh ----- sugar maple, white ash, yellow birch, black cherry

The primary goals in this stand will be the production of high quality sawtimber and the promotion of ecological processes associated with the northern hardwood forest type. The stand will be gradually converted to all-aged using single tree and group selection systems, with group sizes up to 1/4 acre. The structural goal will be  $q=1.3$ , with a residual basal area goal of 90-100 sq ft/ acre.

Up to 5% of total basal area in the stand will be retained as legacy or den trees and left to senesce naturally. At least four snags per acre (two 12-18" dbh and two >18" dbh) will be retained, and as much coarse woody debris as possible of varying decay classes. A special effort will be made to retain hollow den trees and logs >12" dbh and >6 feet long, as these become available.

### **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

With the most recent entry being in 2013, the next scheduled cutting cycle will be in 2033. The next management plan update in 2025 should evaluate stocking and response to the 2013 harvest, scheduling future treatments accordingly.

Optional work suggested for Stand 18 over the coming decade includes:

- Remove flagging from 2013 harvest areas. Monitor harvest areas and skid trails annually for 2-3 years to check for erosion and/or invasive plants.



## STAND 19

### STAND DESCRIPTION

*Acres (pro-rated):* 228.0

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Red Spruce-Northern Hardwood Forest / Northern Hardwood Forest

#### *Stand History and Overview:*

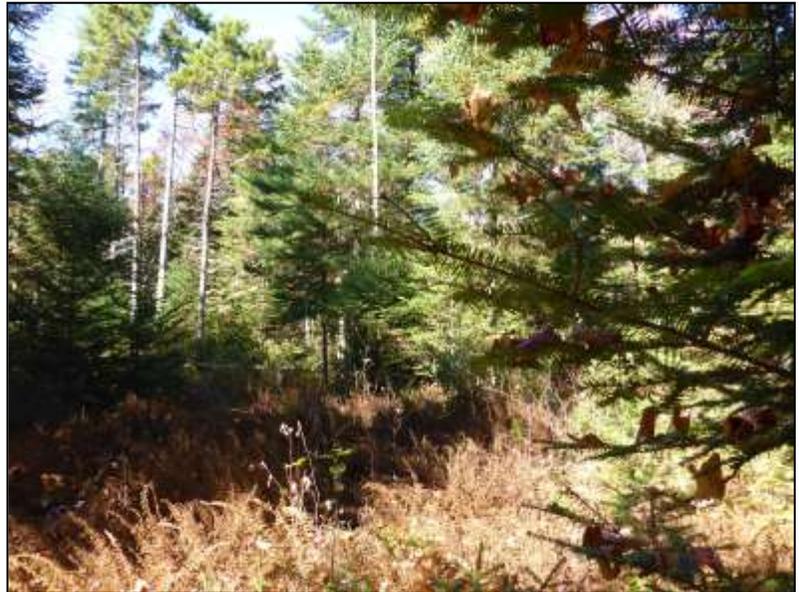
Located near the center of the parcel, this large and variable stand wraps around the north and east sides of the Tripp Hill fields, encompassing the flat highland forest of Tripp Hill itself. The entire area was once open farmland that progressively returned to forest between 50 and 110 years ago. Subsequent logging has resulted in three prevalent conditions, interspersed across the stand:

*Stand Condition 1:* Mid-successional mixed forest comprised mainly of red spruce, balsam fir and intolerant to mid-tolerant hardwoods, such as paper birch, aspen species, and red maple. These areas have not seen a heavy regeneration cut in 60 years and the understory is generally sparse or herb-dominated. Where regeneration is present, it is of tolerant to mid-tolerant species- predominantly balsam fir and red spruce.

*Stand Condition 2:* Early successional hardwood forest. Growing back from strip or clearcuts in the 1970s and 1980s, these areas generally have a canopy of gray birch, pin cherry, and red maple, though balsam fir and yellow birch are also locally common. The understory is either sparse or fern-dominated, with some balsam fir regeneration.

*Stand Condition 3:* Mixed forest with openings. This condition is the most prevalent and results from group and small patch selection cutting done in 1999-2000 in stands of 50-year old mixed forest. The current residual forest here is a mix of pole to small sawtimber-sized red maple, red spruce, balsam fir and paper birch, with moderate to heavy spruce/fir regen. Open areas are mostly gray birch, paper birch, and pin cherry saplings, interspersed with areas still dominated by grass or berry bushes (*Rubus* species).

Most of today's forest stems directly or indirectly from early settlement of the upper slopes west of Tripp Hill, now maintained as farm fields by the Moulton family. Forest clearing began in this area in 1826, when Theodore Tripp led a team of oxen from Alfred, Maine, cleared 4-acres, and built a log house. The Tripp family and farm grew steadily and by 1870 encompassed over 200 acres of cleared land and 110 acres of woodlot and sugarbush. The farm specialized in high quality Durham cattle and horses, but also maintained a dairy (12 cows in 1883), sheep (60 in 1883), and produced a variety of crops including potatoes (1,200 bushels in 1870). Although the land remained under Tripp family ownership until 1919, the farming operation probably peaked before 1900, with softwoods gradually recolonizing the former fields.



Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	<i>paper birch</i>	13.9	95	3.0	3.2
	<i>gray birch</i>	7.8	37	1.2	1.3
	<i>red maple</i>	7.8	69	1.8	1.9
	<i>yellow birch</i>	3.1	42	0.9	1.0
	<i>pin cherry</i>	2.4	0	0.2	0.2
	<i>sugar maple</i>	2.0	15	0.7	0.7
	<i>black cherry</i>	0.7	22	0.2	0.2
	<i>white ash</i>	0.7	39	0.2	0.2
	<i>balsam poplar</i>	0.3	0	0.1	0.1
	<i>quaking aspen</i>	0.3	0	0.1	0.1
<b>Hardwood Total</b>		<b>39.0</b>	<b>320</b>	<b>8.1</b>	<b>8.8</b>
Softwood	<i>balsam fir</i>	29.2	603	5.0	6.4
	<i>red spruce</i>	21.7	1,411	4.5	7.7
	<i>white spruce</i>	5.4	257	1.4	2.0
	<i>northern white cedar</i>	3.1	127	0.6	0.9
	<i>tamarack</i>	1.7	56	0.4	0.6
<b>Softwood Total</b>		<b>61.1</b>	<b>603</b>	<b>5.0</b>	<b>6.4</b>
<b>Grand Total</b>		<b>100.1</b>	<b>922</b>	<b>13.1</b>	<b>15.1</b>

By the early 1940s most of the northeastern half of the stand had a well-developed softwood forest, while the remainder was in the early stages of reverting to forest. About 12 acres in the southern corner, north of the Hopkins Hill road was logged heavily about 1935. The 1962 aerial photo shows recent heavy cutting scattered throughout the stand, but focused around Tripp Hill and adjacent areas to the north. Tree cores suggest that at least some of this cutting took place in the mid 1950s.

The next significant logging occurred in the late 1970s, when a series of strip cuts were made in several large areas of 50-60 year old softwood, under the supervision of Round Top Woodlot Management foresters. The presumed goal of these cuts was to regenerate balsam fir, though site conditions (and possibly poor timing with the fir cone crop) resulted instead in hardwood-dominated regeneration. During the heavy liquidation cutting of the mid 1980s, the lower strip cuts were used to access areas to the east, though the only parts of stand 19 logged at this time were in the eastern and southern region of these lower strip cuts, as well as a patch of forest northeast of Tripp Hill.

The most recent cutting in the stand took place in 1999-2000 and was directed by forester Richard Carbonnetti. In the strip cut areas the goal was to remove half of each residual strip to promote mixed regeneration. The goal in other areas was an improvement thinning to promote well-formed commercial species such as red spruce, red maple, yellow birch, and paper birch, and to establish new regeneration in some areas. This logging was done with a feller-buncher/ forwarder system.

### **WILDLIFE STRUCTURAL ATTRIBUTES**

**Canopy (>30 feet):** Estimated 70% canopy closure; patchy with distinct gaps around old skid trails and strip harvests. Mixed hardwood-softwood.

**Midstory (5-30 feet):** 67-100% cover, patchy. Primary species: paper birch, balsam fir and gray birch.

**Understory (1-5 feet):** 0-33% cover, patchy. Primary herbaceous species: goldthread, hay-scented

fern (in old skid trails), bunchberry, mosses, sedges, goldenrod (in seeps and old skid trails) and club mosses. Primary woody species: balsam fir.

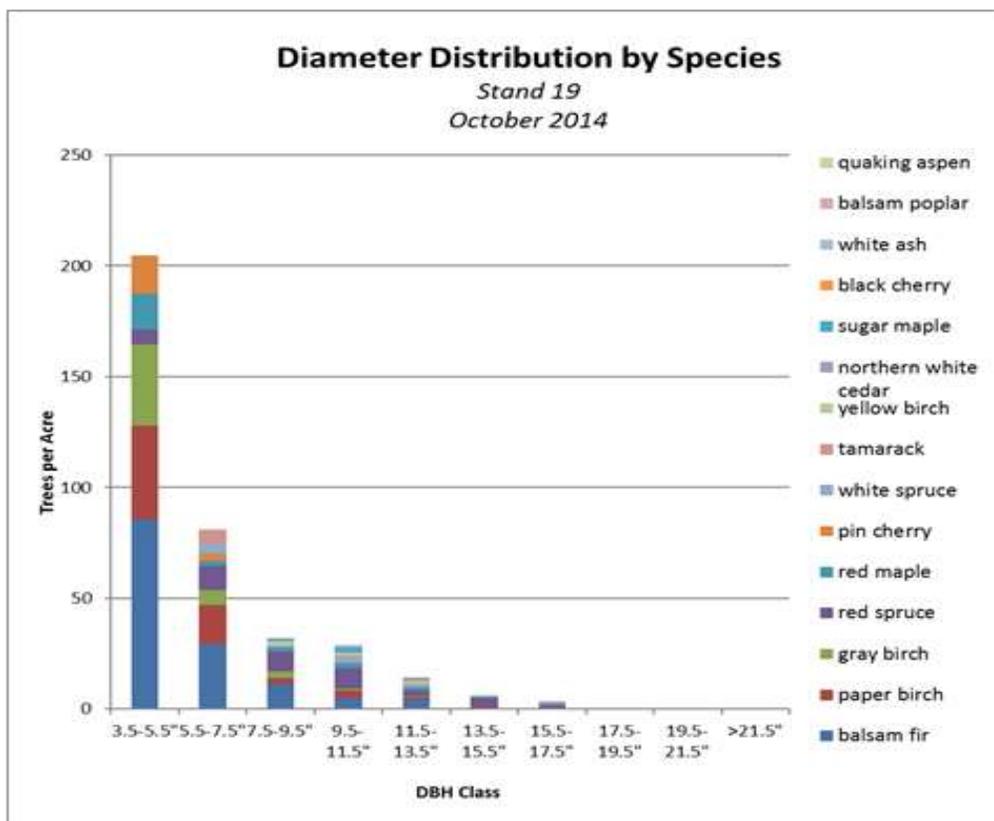
**Snags:** High density of small snags; 95 snags/acre, all smaller than 15” DBH

**Coarse Woody Material (>10” diameter):** Medium density, patchy. Decay condition ranges from new/solid to old/crumbling. Mainly large, isolated balsam fir blowdowns in areas with wet soils.

**Fine Woody Material (<3” diameter):** Medium density, patchy.

**Leaf Litter:** Not sampled

**Wildlife Attribute Summary:** Though the stand does not provide any uncommon or especially notable wildlife habitats, its remote location, structural diversity, acreage and abundance of edge and skidder trails all result in regular use by a range of species. Most notable is moose, which feed throughout the stand on red maple and balsam fir saplings and the abundant herbaceous growth. Edge habitat around the Tripp Hill fields is frequented by deer, coyote, black bear, and red fox, and is a favorite arena for displaying wild turkey toms in the spring. Other species noted include porcupine, fisher, bobcat, and unidentified bats (over the larger openings in the lower strip cut). Of 69 bird species observed in the stand, the six most abundant are black-capped chickadee, white-throated sparrow, hermit thrush, American robin, yellow-rumped warbler, and magnolia warbler. The most notable bird species are those associated with the coniferous habitat- bay-breasted warbler, boreal chickadee, gray jay, and white-winged crossbill, though none of these occur in abundance or have been confirmed breeding here. Edge habitat in the strip cuts has also attracted brown-headed cowbirds, a species that negatively affects many native songbirds through its brood parasitism.



## **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- A 50' buffer along the boundary with Stand 10 (forested wetland ESTA in the east-central part of the stand) is designated as a Surface Water Buffer Zone in a conservation easement held by the Vermont Land Trust. Equipment use is generally prohibited in these buffers and management activities must retain a minimum of A-line stocking. A full description of Surface Water Buffer Zone regulations, excerpted from the conservation easement, can be found in Appendix D.
- Stonewalls, rock piles, abandoned equipment, and other artifacts of the farming history are commonly encountered. During future management operations these features should be flagged and preserved, as they provide valuable tools for land use history research and education.

## **STAND HEALTH**

A number of forest health issues were observed, with recommended actions described below.

### ***Human Impacts:***

- The Hopkins Hill Trail is maintained through the stand for forestry access and non-motorized recreation. Unauthorized use of ATVs on this trail has been an ongoing problem, causing rutting and minor sedimentation. Signage should be installed clearly prohibiting motorized recreational use.

### ***Wildlife Impacts:***

- Some deer and moose browse on regeneration.

### ***Invasive Species:***

- A patch of invasive barberry (approximately 6' by 6') was found near the Hopkins Hill trail (southern edge of Stand 19). This should be cut, removed and monitored to prevent spreading. Cut-stump herbicide application may be used (by the landowner or a certified herbicide applicator) if manual removal is ineffective.

### ***Climate Change Considerations:***

- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species diversity. Transitioning to an uneven-aged mix of site-appropriate species will increase future stand resilience.
- Boreal species such as balsam fir are predicted to decline in response to climate change. Current stocking and regeneration includes a high proportion of balsam fir; management should promote regeneration of species such as black cherry, white ash, red maple and white pine that are predicted to adapt well to future climate conditions, while allowing spruce/fir saplings and trees to reach economic maturity.

## **RECREATION/ EDUCATION**

The stand is used mostly by local hunters, who maintain several deer stands around the Tripp Hill field edge. Neighboring landowners and others also use the Tripp Hill road, former Hopkins Hill road, and some larger skid trails for walking, snowshoeing, skiing, and horseback riding.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

**Age Class Structure:** Unbalanced uneven-aged ( $q=1.5$ ); residual trees 70-110 years old, at least two younger cohorts present

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 31 (1 per 7.4 acres)

**Sampling Date:** October 2014

*For all live intermediate-dominant trees  $>3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 95

**AGS BA:** 61 (64%)

**BA 95% CI:** 80-111 ft<sup>2</sup>/acre

**Total TPA:** 371

**AGS TPA:** 219 (59%)

**QMSD (inches):** 6.9

**Stocking Level:** Adequately stocked; B-line on mixedwood stocking chart (US Forest Service 2008 Timber Management Field Book)

### ***Regeneration:***

*0-1" DBH* – 3,033 stems per acre

*1-3" DBH* – 517 stems per acre

*Number of Plots* – 60 (0.03% of stand / 1 plot per 3.8 acres)

Regeneration is patchy and varies according to logging history and competition. Areas with closed canopy have sparse regeneration, while some strip cuts have dense cover of balsam fir and early successional hardwoods. Ferns and raspberries/blackberries may be inhibiting regeneration in some open areas. Balsam fir is the dominant species (over 60% of stems sampled), with lower proportions of paper birch, red spruce, white ash, sugar maple and gray birch.

**Site Class:** II

**Site Index:** 60 (balsam fir), 57 (red spruce)

**Soils:** Mostly somewhat poorly to poorly drained sandy loams or fine sandy loams - very stony and shallow to hardpan (Colonel-Cabot). A large area in the southwest part of the stand is on moderately well drained sandy loams that are deeper to hardpan (Dixfield).

**Access:** Good to excellent. Access is via the class 4 Tripp Hill road. This road is maintained by the Moultons for their farm operations and is in good shape for a class 4 road. Partial proceeds from future logging should be offered to help support this road upkeep. Northern and eastern areas of the stand can be accessed from a landing at the north end of the Moulton fields (with landowner permission). Southern areas can be accessed from a smaller landing located just south of the Moulton's fields on Tripp Hill Road or from Hopkins Hill Road (along the southern boundary), though parts of this road are in need of repair.

## **DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 15 years

***Diameter Objectives for Principle Species:***

12-18" dbh ----- balsam fir, red spruce  
16-22" dbh ----- all hardwood species

The primary long-term goals for the stand are high-quality mixed sawlog production, and healthy ecological structure and processes for the red spruce- northern hardwood forest type. The stand will be gradually converted to all-aged using single tree and group selection systems, with groups up to 1/10<sup>th</sup> acre. Patch cuts between 1/4<sup>th</sup> and 1 acre in size will be created in less accessible areas to maintain a proportion of shade intolerant and mid-tolerant tree species, many of which are beneficial to wildlife. These early successional patches should be limited to 10% of the total stand acreage at any one time.

The long- term species composition objective over most of the stand will be tolerant and mid-tolerant commercial hardwoods such as sugar maple, yellow birch, and American beech, and red spruce among the softwoods. Balsam fir will be gradually reduced and will be removed at its pathological age (roughly half of the rotation). Other minor species will be retained as up to 25% of total stocking. The long-term structural goal will be  $q=1.3$  (currently  $q=1.7$ ). The residual basal area goal will be 110 ft<sup>2</sup>/ac initially, but will transition to 90-100 ft<sup>2</sup>/ac as the species mix shifts to hardwoods.

From 5% of total stocking will be maintained in large diameter (>15") legacy trees, which will be left to senesce naturally. Red spruce and other shallow-rooted species should be retained in groups to prevent windthrow. At least four snags per acre (two 12-18" dbh and two >18" dbh) will be retained, and as much coarse woody debris as possible of varying decay classes. A special effort will be made to retain hollow den trees and logs >12" dbh and >6 feet long, as these become available.

The current stand condition is far from the desired one, with a healthy component of red spruce and a fairly even distribution of diameter classes providing the base to work from. Future entries should focus on improving stand quality by removing poorly-formed trees and economically mature balsam fir (12-18" dbh), and gradually promoting the species mix and structural goals described above. Where these species are absent, high vigor, well-formed white ash, black cherry, red maple and paper birch could be substituted during the period of transition.

**PLANNED TREATMENTS**

*Crop tree release and group selection harvest (2024)*

Most of the stand is currently either understocked or moderately stocked and needs time to develop. A few opportunities for stand improvement or other forest products do however exist, and the transition to a mixed species, uneven-aged structure can be initiated in the next 10 years.

Small group selections (1/10<sup>th</sup>-1/4<sup>th</sup> acre groups, up to 10 acres total) will be used to release advance regeneration and establish new regeneration of more shade tolerant hardwoods such as sugar maple, yellow birch, American beech and red spruce. Preferred areas for groups are those with mature or declining balsam fir and tamarack, or with a canopy dominated by gray birch and low-quality hardwoods. Hardwood regeneration should be given preference over balsam fir, but vigorous balsam fir regeneration under a gray birch canopy may be released in up to 50% of group selection areas.

Areas of vigorous, dense softwoods that have not reached maturity/high risk status will be lightly thinned to release healthy, high quality spruce and cedar crop trees (20-40 crop trees per acre). Some existing cedars in this area are an old field artifact and will grow rapidly on the well-drained soils. A small area in the southeast corner of the stand includes pole/small-sawtimber sized sugar maple, white ash and paper birch that would benefit from crop tree release and will provide seed source for species conversion; areas adjacent to this might be good candidates for groups selections to establish hardwood regeneration. Residual stand basal area will be approximately 110ft<sup>2</sup>/ac outside of groups. This thinning will be primarily in the southern half of the stand outside of strip cuts, and concentrated near trails used to access group selections. See below for suggested work on permanent access trails.

Where possible, coarse woody debris and/or snags will be created from cull trees >12" dbh. Healthy trees of desirable species with timber defects should be retained at up to 5% of stocking as future legacy trees.

## **OTHER WORK**

Optional work suggested for Stand 19 over the coming decade includes:

- Installing signage and a gate to exclude ATV use and damage.
- Abundant balsam fir regeneration in some parts of the stand could sustain a moderate level of annual picking for balsam brush. Preferably this should be done using appropriate pruning techniques and should remove no more than 1/3<sup>rd</sup> of the foliage from any single tree. The most accessible areas would be off of the former Hopkins Hill road and the central access trail of the lower strip cuts.
- Areas of dense, small-diameter softwood could benefit from pre-commercial thinning. Residual stocking should be at least B-line on an appropriate stocking chart. Species to favor include red spruce, white pine and commercial hardwoods, although balsam fir makes up most of the species mix in most areas and can be retained until reaching economic maturity.
- Invasive barberry control- see Stand Health section, above.
- A parking area could be developed off of Hopkins Hill Road approximately 500' east of the intersection with Tripp Hill Rd. Drainage work was completed in 2014 on this section of Hopkins Hill Rd, which could be a main forestry/recreation access point to Stand 19 and surrounding areas. Another old landing located just south of the Moulton's fields on Tripp Hill Road could also be used for logging operations, with a small open landing and a skid trail in good condition leading east into Stand 19. A network of permanent trails for uneven-aged management should gradually be established, using some existing skid trails that are in good condition.



# STAND 20

## STAND DESCRIPTION

*Acres (pro-rated):* 38.7

*NED Cover Type(s):* Northern hardwoods

### *Natural Communities:*

Northern Hardwood Forest

### *Stand History and Overview:*

Located on a north-facing aspect with moderate slopes, stand 20 is part of the interior region of the parcel and lies at the eastern edge of a 200-acre tract that was added to the property in 2002, soon after a liquidation cut was conducted there. The resulting stand is in the early stages of regenerating, with very few residual overstory trees remaining. Although about 1/3<sup>rd</sup> of the saplings are non-commercial striped maple, the remaining 2/3<sup>rd</sup>s includes sugar maple, beech, white ash and yellow birch in healthy numbers. In ten years this stand could be evaluated for possible TSI work, but currently it should be left to recover from past logging.



The early history of this stand is unclear, though parts of its southern half were likely either cleared agricultural land or heavily pastured forest during the mid to late 19<sup>th</sup> century. 1942 aerial photos show a large patch of uncut conifers along the southeast edge of the stand, and widespread dense conifer growth to the southwest. In this photo the remainder of the stand is patchy hardwoods, suggesting recent logging, and a fairly large regenerating patch can be seen in the north half. Tree cores support this, with several releases evident circa 1920-1936.

Some additional logging occurred before 1962, removing most of the softwoods located along the southeast edge of the stand. A 1980 aerial photo shows large hardwood canopies, especially in the southern part of the stand. Based upon a few cores and aerial photos, moderate to heavy selective logging may have occurred circa 1982 and possibly circa 1994 in the south. As part of a larger parcel stretching northwest to the Jordan Road, the stand was purchased in fall of 2001 by logger Larry Moffat, who completed a nearly parcel-wide liquidation cut before selling the land in April of 2002 to Lydia Spitzer. No logging or pre-commercial has occurred since then.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	sugar maple	31.5	91	3.8	4.0
	yellow birch	25.9	56	2.4	2.6
	striped maple	16.7	0	0.3	0.3
	American beech	11.1	0	0.5	0.5
	black cherry	5.6	0	0.4	0.4
	white ash	3.7	44	0.2	0.3
	hophornbeam	1.9	0	0.2	0.2
	<b>Hardwood Total</b>		<b>96.4</b>	<b>191</b>	<b>7.9</b>
Softwood	balsam fir	3.7	142	0.3	0.6
	<b>Softwood Total</b>	<b>3.7</b>	<b>142</b>	<b>0.3</b>	<b>0.6</b>
<b>Grand Total</b>		<b>100.1</b>	<b>333</b>	<b>8.2</b>	<b>8.9</b>

## WILDLIFE STRUCTURAL ATTRIBUTES

**Canopy (>30 feet):** Estimated 55% canopy closure; patchy with large gaps

**Midstory (5-30 feet):** 34-66% cover, patchy. Primary species: American beech, striped maple and yellow birch.

**Understory (1-5 feet):** 67-100% cover, uniformly distributed. Primary herbaceous species: lady fern, sorrel, goldthread, whorled aster, intermediate wood fern, shining clubmoss, sweet-scented bedstraw, foam-flower, purple-stemmed aster, rough-stemmed goldenrod, toothed wood fern, an unidentified grass species, and two unidentified sedges (*Carex* spp). Several herbs found in the stand indicate nutrient enrichment – silvery glade fern, white baneberry, and stinging nettle. Primary woody species: sugar maple, striped maple, red raspberry, red-berried elder and common blackberry.

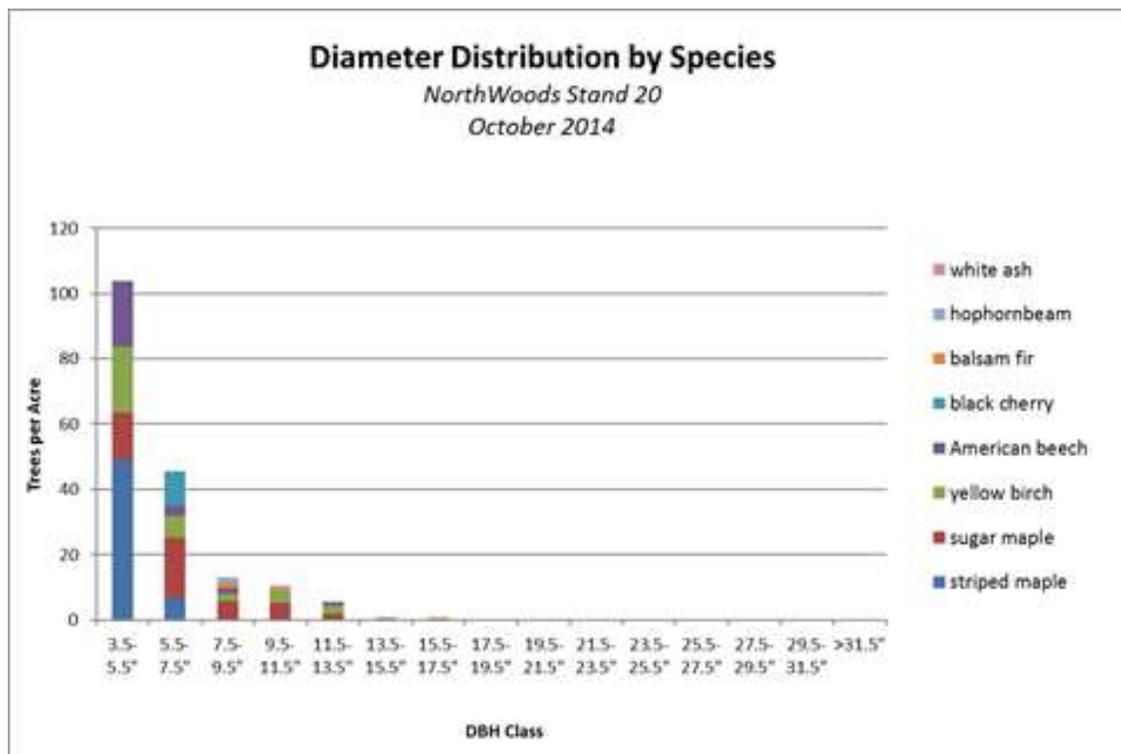
**Snags:** Low density but some larger snags present; 22.1 snags/acre total, 0.6 snags/acre larger than 15” dbh

**Coarse Woody Material (>10” diameter):** Low density, uniformly distributed. Decay condition ranges from soft/decaying to new/solid.

**Fine Woody Material (<3” diameter):** Very low density.

**Leaf Litter:** Not sampled

**Wildlife Attribute Summary:** In its current state, the stand provides early successional habitat features, most notably soft mast (berries) for a variety of species (including black bear), herbaceous and sapling forage for deer and moose, and dense sapling nesting habitat for bird species such as the chestnut-sided warbler, mourning warbler, indigo bunting, and rose-breasted grosbeak.



## **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Very poorly drained soils are found in the north and west parts of the stand. Logging around these seeps should follow Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont. New trails should be routed to avoid wet soils wherever possible, and existing trails should be maintained/improved to prevent rutting, erosion, and propagation of invasive plants.

## **STAND HEALTH**

A number of forest health issues were observed, with recommended actions described below.

### ***Human Impacts:***

- None observed.

### ***Wildlife Impacts:***

- Heavy deer and moose browse.

### ***Invasive Species:***

- A patch of common reed (~40 stems) was found in the north part of the stand. This should be manually cut or pulled and possibly treated with herbicide (by the landowner or a certified herbicide applicator) to prevent regrowth due to moderately difficult access for repeated treatment. This population is isolated and should be monitored to ensure that it doesn't spread or establish new colonies in the forest interior.

### ***Climate Change Considerations:***

- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species and age diversity. Transitioning to an uneven-aged structure with a more balanced mix of northern hardwood species will increase future stand resilience.

### ***Other Pathogens and Health Concerns:***

- None observed.

## **RECREATION/ EDUCATION**

Currently limited to very intrepid hunters. A single deer stand was being used here soon after the 2002 logging. Several woods roads once crossed the stand in an east to west direction and can be seen faintly on early aerial photos. One of these was used in 2014 to create a new small foot/ski trail connecting to the adjacent Cahill parcel to the north. These could be explored for a possible future woods road/ recreation trail to connect the Calhoun road with the Jordan Road. This stand has good views to the north of Lake Seymour and Elan Hill, and at least one large glacial erratic boulder that would enhance the value of such a trail, while improving access to this and other stands for future management work.

## SILVICULTURAL DATA AND GROWING SITE CONDITIONS

**Age Class Structure:** Even-aged (~15 years old) with reserves

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 13 (1 per 3.0 acres)

**Sampling Date:** October 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 42

**AGS BA:** 17 (40%)

**BA 95% CI:** 29-54 ft<sup>2</sup>/acre

**Total TPA:** 180

**AGS TPA:** 55 (31%)

**QMSD (inches):** 6.5

**Stocking Level:** Understocked. C-line on hardwood stocking chart (US Forest Service 2008 Timber Management Field Book)

### **Regeneration:**

0-1" DBH – 6,640 stems per acre

1-3" DBH – 1,080 stems per acre

Number of Plots – 25 (0.1% of stand / 1 plot per 1.5 acres)

The dominant 15 year old cohort is well established with a height of 10-20 feet and nearly 100% cover in much of the stand, despite heavy deer and moose browse. Primary species: sugar maple and striped maple with lower proportions of yellow birch, white ash and American beech. Grasses, sedges, shrubs and ferns compete with regeneration in some areas of the stand, creating canopy gaps with persistent early-successional structure.

### **Site Class:** II

**Soils:** Moderately well drained sandy loams in the northeast half of the stand (Dixfield) and somewhat poorly drained fine sandy loams with a shallow hardpan in the southwest half (Colonel-Cabot).

**Access:** Fair to poor - no woods roads currently access the stand. The best access to southern areas would be from the landing at the north edge of the Tripp Hill fields (with landowner permission). Northern areas could be accessed via old skid trails northwest to the town road, though this would require trail improvements and a half-mile skid.

## DESIRED FUTURE STAND CONDITION

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 20 years

### **Diameter Objectives for Principle Species:**

12-18" dbh ----- balsam fir, red spruce

16-22" dbh ----- all hardwood species

The primary long-term goals for the stand are sustained high-quality hardwood sawlog production and healthy ecological structure/processes for the northern hardwood forest type. Gradually convert the stand to all-aged using single tree/group selections with group sizes up to 1/4<sup>th</sup> acre. Since the forest is still in the early stages of regrowth, more than five cutting cycles may be required to

accomplish the transition to an uneven-aged stand. The first several entries will be even-aged intermediate treatments, with the goal of improving species composition and stand quality. Subsequent entries will add the goal of increasing stand structure by creating small group openings to promote initiation of new age classes.

Species favored for retention will be commercial hardwoods - sugar maple, yellow birch, white ash, black cherry and American beech. Other minor species will be retained as up to 25% of total stocking. The residual basal area goal will be 70-80 ft<sup>2</sup>/ac for the first few entries, transitioning to 90-100 ft<sup>2</sup>/ac as mean stand DBH increases. The structural goal will be  $q=1.3$ .

Large diameter (>15") legacy trees, which will be left to senesce naturally, should be retained at ~5% of total stocking. At least four snags per acre (two 12-18" dbh and two >18" dbh) will be recruited over several cutting cycles, and as much coarse woody debris as possible of varying decay classes. A special effort will be made to retain hollow den trees and logs >12" dbh and >6 feet long, as these become available.

## **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

Stand 20 is far from commercial maturity and should be left to grow for the next 10 years. Precommercial thinning is not yet necessary but may become beneficial in 10-20 years.

## **OTHER WORK**

Optional work suggested for Stand 20 over the coming decade includes:

- Invasive common reed control- see Stand Health section, above.



## STAND 21

### STAND DESCRIPTION

*Acres (pro-rated):* 121.4

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Red Spruce-Northern Hardwood Forest

#### *Stand History and Overview:*

Located on a northwest slope with gradually increasing steepness, and descending to a broad valley that drains south into Echo Lake. Stand 21 covers most of the parcel acquired by Lydia Spitzer in 2002 following a liquidation cut by logger Larry Moffat. The stand includes a few small patches of residual pole to sawtimber-sized trees- mostly balsam fir, red maple, and quaking aspen. Most of the stand is densely regenerating with red maple, balsam fir, black cherry, paper birch American beech, sugar maple and yellow birch, although early-successional species such as pin cherry and gray birch compete in some areas. As a result of soil and land-use history differences, the northeastern part of the stand has a lower proportion of balsam fir (both in the residual overstory and sapling stage), and a greater proportion of mixed hardwoods than the west or southwest areas.



Most of Stand 21 has good access, operability and regeneration. This can become a productive and easily managed timber stand in the future, but needs to recover at this point. Some opportunities for balsam brush collection and pre-commercial thinning exist; see sections below for suggested practices.

Though today the stand is relatively isolated by the valley that forms its west boundary, it was previously home to one of the first settlers of the property and remains of this former homestead can still be seen today. The first clearing probably began about 1838 when Emerson Wolcott purchased and settled the southwest half of the stand with his small family, accessing this area via an early road from the East Echo Lake road. After twenty years of farming the parcel, the Wolcott legacy began to unravel when the elderly couple passed away in March 1861. Less than 18 months later the remaining son Hiram enlisted in the Union army and in 1864 the parcel was sold to Morgan sawmill owner Moses Fuller. We do not know whether Fuller used the land for his residence or for timber, but in 1868 he sold to William Morse, who then continued farming the parcel for nearly another decade. By 1870 most of the southwest half of the stand was cleared and supported a small number of livestock, producing also that year small amounts of corn, and buckwheat, ten tons of hay, and a thousand bushels of potatoes. There was no active maple sugaring recorded in the agricultural census.

The southwest half of the stand was probably abandoned on or around 1877, when the parcel again changed hands, and by 1942 this area had become reforested in dense softwoods (except for a small area around the house site). The north half of the stand was at this time in mixed forest, with some evidence of earlier logging. Widespread logging then occurred through much of the stand before 1962 (probably around 1957), removing much of the original old-field softwood and some hardwood. Tree

cores suggest possible additional logging in the north circa 1968 and 1984.

Selective logging (high-grading) may have occurred again in the early 1990s, though evidence of this was largely removed with the liquidation cutting of 2001-2002. This most recent entry resulted in a number of areas being deeply rutted and eroded, the most egregious being a steep slope to the west valley that was used to skid trees out to a landing at Jordan Road. No water bars were installed following the logging, resulting in erosion of roughly 9 vertical feet of soil from this slope and deposition into the more moderate slopes and wetland below. This area was stabilized in 2003 through the combined efforts of then landowner Lydia Spitzer and the NorthWoods Stewardship Center.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	sugar maple	13.5	0	2.3	2.3
	red maple	12.4	52	2.5	2.6
	yellow birch	10.8	69	1.6	1.7
	black cherry	4.3	42	0.3	0.4
	paper birch	3.2	20	0.6	0.6
	white ash	3.2	0	0.5	0.5
	American beech	1.6	0	0.1	0.1
	pin cherry	1.1	0	0.0	0.0
	quaking aspen	1.1	20	0.3	0.3
	striped maple	0.5	0	0.0	0.0
	<b>Hardwood Total</b>		<b>51.7</b>	<b>203</b>	<b>8.0</b>
Softwood	balsam fir	44.9	568	5.5	7.3
	red spruce	2.7	40	0.5	0.6
	<b>Softwood Total</b>	<b>47.6</b>	<b>568</b>	<b>5.5</b>	<b>7.3</b>
<b>Grand Total</b>		<b>99.3</b>	<b>771</b>	<b>13.5</b>	<b>15.7</b>

## WILDLIFE STRUCTURAL ATTRIBUTES

**Canopy (>30 feet):** Estimated 80% canopy closure; patchy with large gaps. Average canopy height is only ~55'. Mostly hardwood species (see diameter distribution, below)

**Midstory (5-30 feet):** 67-100% cover, uniform distribution. Primary species: yellow birch, sugar maple, striped maple, red maple, balsam fir, paper birch and American beech.

**Understory (1-5 feet):** 0-33% cover, uniformly distributed. Primary herbaceous species: bunchberry, unidentified sedge (*Carex* sp), New York fern, whorled aster, an unidentified violet (*Viola* sp), intermediate wood fern, blue-bead lily, Canada mayflower, hay-scented fern, and goldthread. Primary woody species: red raspberry, common blackberry, mountain maple, and hobble-bush.

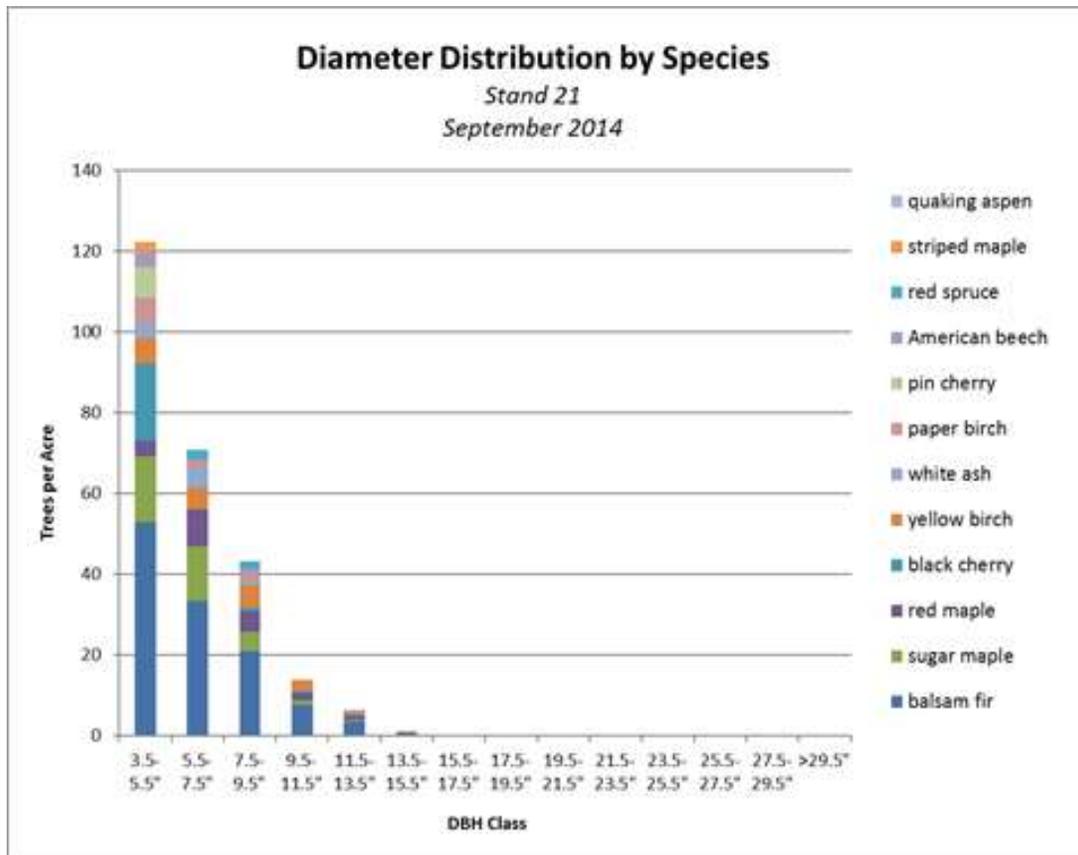
**Snags:** Medium density with some larger snags present; 30.0 snags/acre total, 3.1 snags/acre larger than 15" DBH

**Coarse Woody Material (>10" diameter):** Low density, patchy. Decay condition ranges from soft/decaying to new/solid.

**Fine Woody Material (<3" diameter):** Low density, patchy.

**Leaf Litter:** Not sampled

**Wildlife Attribute Summary:** This stand offers many of the same early successional habitat benefits described for Stand 20, with a few added features. Stand 21 retains slightly more structural diversity due to a greater number of residual trees and more snags. Also, the valley and its associated wetlands provide additional plant and habitat diversity, which should benefit a greater range of wildlife.



**SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Valley areas in the northwestern part of the stand are poorly drained and may be the Lowland Spruce- Fir Forest natural community type. Good examples of this community are uncommon statewide (S3). Several waves of logging have made identification of the community type difficult, but management here should promote balsam fir and red spruce as major canopy components if they continue to do well on this site.
- The former Wolcott and Morse homestead can still be seen in the south central part of the stand. The site includes a house cellar hole with nearby well and the partial foundation of a former barn. These ruins provide a striking visual reminder of the history of this landscape offer excellent teaching opportunities. Long term management of an area at least 100 feet from the foundations should prioritize aesthetics and the preservation of the historical features present. In the short term, this may involve some clearing of brush and poorly formed trees around the foundations, though in the long term it will mean limited cutting in this area.

- The small stream that drains the western valley south to Echo Lake appears as a blue line waterway on USGS topographic maps, and a 50' buffer along this stream is designate as a Surface Water Buffer Zone in a conservation easement held by the Vermont Land Trust. Equipment use is generally prohibited in this buffer and management activities must retain a minimum of A-line stocking. A full description of Surface Water Buffer Zone regulations, excerpted from the conservation easement, can be found in Appendix D. A larger area (up to ~15 acres) in the surrounding valley has very hydric soils, limiting site productivity and access; equipment use here should be minimal and care should be taken to meet or exceed Acceptable Management Practices and minimize soil impact.
- An area in the western valley badly eroded in the 2001/2002 logging was stabilized in 2003 by re-grading the area, adding waterbars above and below the main slopes, adding geo-jute fabric, and planting winter rye. Site visits since 2003 have shown that the stabilization efforts succeeded and the area has since recolonized with 5-10' tall hardwood seedlings and saplings.

## **STAND HEALTH**

Though a number of forest health issues were observed (below), none require special action at this time.

### ***Human Impacts:***

- Trail construction, maintenance and signage installation. One incident of unauthorized ATV use was noted in 2014, but with minimal impact.

### ***Wildlife Impacts:***

- Minor deer browse.

### ***Invasive Species:***

- None observed.

### ***Climate Change Considerations:***

- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species and age diversity. Transitioning to an uneven-aged structure with a more balanced mix of northern hardwood species will increase future stand resilience.

### ***Other Pathogens and Health Concerns:***

- None observed.

## **RECREATION/ EDUCATION**

The stand is now most used by the occasional hunter and nearby landowners. Multi-use trails have been cleared or reclaimed and now connect Jordan Road and East Echo Lake Road parking areas, with a recently constructed footpath continuing to the Forestry for the Birds demonstration harvest site in Stand 18. Recreational use (hiking, snowshoeing and skiing) has increased since the improvement of these trails and installation of kiosks at both Jordan and East Echo Lake Roads in 2013.

## SILVICULTURAL DATA AND GROWING SITE CONDITIONS

**Age Class Structure:** Even-aged (~15 years old) with some residual overstory (~60 to 110 years old)

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 30 (1 per 4.0 acres)

**Sampling Date:** September 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 62                      **AGS BA:** 43 (69%)                      **BA 95% CI:** 47-76 ft<sup>2</sup>/acre

**Total TPA:** 320                      **AGS TPA:** 243 (76%)                      **QMSD (inches):** 6.6

**Stocking Level:** Understocked. Below C-line on mixedwood stocking chart (US Forest Service 2008 Timber Management Field Book)

### **Regeneration:**

0-1" DBH – 3,276 stems per acre

1-3" DBH – 1,362 stems per acre

Number of Plots – 58 (0.05% of stand / 1 plot per 2.1 acres)

The dominant 15 year old cohort of advance regeneration is well established with a height of 10-20 feet and nearly 100% cover in much of the stand. Primary species: red maple, balsam fir, black cherry, paper birch American beech, sugar maple and yellow birch. Striped maple is present in high densities and competing with regeneration.

**Site Class:** I

**Site Index:** 98 (red maple), 82 (quaking aspen)

**Soils:** Mostly somewhat poorly to poorly drained sandy loams and fine sandy loams that are shallow to hardpan (Colonel-Cabot). Better drained sandy loams (Dixfield) lie toward the east and northeast stand borders, while deep well-drained loams are located along the valley slopes at the west side of the stand.

**Access:** Fair to good. Northern areas via skid roads from the north property corner and Jordan Road. Southeastern areas via the log landing at the north end of the Tripp Hill fields (with landowner permission). Southwestern areas via old trails to a landing at the East Echo Lake road. All access points would currently be usable in frozen ground conditions but would require significant improvements for summer/fall use.

## DESIRED FUTURE STAND CONDITION

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 20 years

**Diameter Objectives for Principle Species:**

12-18" dbh ----- balsam fir, red spruce

16-22" dbh ----- all hardwood species

The primary goals are sustained high-quality mixed sawlog production, and healthy ecological structure and processes for the red spruce- northern hardwood forest type. The stand will be gradually converted to all-aged using single tree and group selection systems, with groups up to 1/10<sup>th</sup> acre.

The long-term species objective will be tolerant and mid-tolerant commercial hardwoods such as sugar maple, yellow birch, and American beech, and red spruce among the softwoods. Balsam fir will be gradually reduced and will be removed at its commercial maturity (60-80 years). Other minor species will be retained as up to 25% of total stocking. The long-term structural goal will be  $q=1.4$ , with a residual basal area goal of 90-110 ft<sup>2</sup>/ac.

Up to 5% of stocking will eventually be maintained in large diameter (>15") legacy trees, which will be left to senesce naturally. Red spruce and other shallow-rooted species should be retained in groups to prevent windthrow. At least four snags per acre (two 12-18" dbh and two >18" dbh) will be recruited, and as much coarse woody debris as possible of varying decay classes. A special effort will be made to retain hollow den trees and logs >12" dbh and >6 feet long, as these become available.

Currently a patchy, regenerating clearcut, the stand will require at least five cutting cycles to attain an uneven-aged structure. In the meantime, the first few entries will employ even-aged pre-commercial and intermediate thinning techniques to create the preferred species mix and stem quality. Later entries will add goals of increasing structure and re-establishing a balance of snags and coarse woody debris. During this transition, commercial shade intolerant species such as black cherry, paper birch, and white ash may occupy a large part of the stocking, and vigorous well-formed individuals should be promoted as interim crop trees, and for their wildlife values.

## **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

Stand 21 is far from commercial maturity and should be left to grow for the next 10 years.

## **OTHER WORK**

Optional work suggested for Stand 21 over the coming decade includes:

- Pre-commercial cleaning and/or thinning could be used to direct species composition toward desired hardwoods. Cleaning completed early in the management period (2015-2020) should focus on removing undesired species such as pin cherry and gray birch, while thinning later (2020-2025) will begin to select for high-quality growing stock. Thinning should retain at least 350 stems per acre or B-line stocking, and should focus on releasing vigorous, well-formed yellow birch, black cherry, red spruce, American beech, sugar maple, white ash and other commercial mid- to late-successional species and minor species.
- Improvements to the Tripp Hill Trail and Wolcott Trail are needed to ensure their long-term stability and recreational value. At a minimum, these trails should be mowed annually and stumps in the new footpath (southeast corner of Stand 21, and into Stand 18) should be removed. Some drainage work and surface hardening could make these access trails usable in dry, unfrozen conditions and should be completed as funding is available.

## STAND 22

### STAND DESCRIPTION

*Acres (pro-rated):* 19.6

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Northern Hardwood Forest

#### *Stand History and Overview:*

Stand 22, located along Jordan Road, is of a very mixed type that was high-graded in 2001, resulting in a pole to small sawtimber-sized residual overstory dominated by red maple, balsam fir, and paper birch, but including a variety of other mixed species. Regeneration here is mainly red maple, pin cherry, striped maple and balsam fir and ranges from dense in openings to non-existent where a residual overstory remains. Although small in acreage, Stand 22 has excellent access and soils/terrain well suited to timber management, and will be restored to become a productive and sustainable working forest in the future.



The earliest land-use history of this stand is unclear, though its proximity to a town road, good soils, limited slopes, and field evidence all point to some form of agricultural use in the 19<sup>th</sup> century. Rapid early growth in a cored 85-year old sugar maple (sampled in 2005) suggests either a partial logging operation or a return to forest about 1920.

The 1942 aerial photo shows a mixed canopy, with conifers close to the road and a patchy overstory, suggesting recent thinning. Several larger regenerating patches are seen in the southern half of the stand. By 1962, an additional small area in the southeast part of the stand appears to have been logged. Tree cores suggest possible partial logging again circa 1976 and 1984. In 1992 the stand contained a mixed canopy with a high proportion of softwood.

Most recently, in the winter of 2001/2002, logger Larry Moffat high-graded Stand 22 and much of the surrounding parcel. This logging used a roughly half acre landing south of the Jordan road, enlarged from a landing that existed from previous logging. In spring of 2005 half of this landing was planted in 150 balsam fir seedlings by the NorthWoods Stewardship Center, for later harvest as Christmas trees. In fall of 2005 other areas of the landing were planted with sugar maple, white ash, northern white cedar and a range of native fruiting shrubs, as part of a bird habitat enhancement project completed by the NorthWoods Stewardship Center.

The log landing on Jordan Road is described in the VLT conservation easement as a special Development Zone, allowing for eventual construction of a public interpretive center. There are currently no plans to pursue this development right.

### WILDLIFE STRUCTURAL ATTRIBUTES

*Canopy (>30 feet):* Estimated 85% canopy closure; patchy with distinct gaps from past logging.

**Midstory (5-30 feet):** 34-66% cover, uniform distribution. Primary species: pin cherry, red maple, balsam fir.

**Understory (1-5 feet):** 34-66% cover, uniform distribution. Primary herbaceous species: mosses, club mosses, goldthread, hay-scented fern (in old skid trails) and Canada mayflower. Primary woody species: balsam fir, red raspberry, American fly honeysuckle, common blackberry, hobble-bush, and alternate-leaved dogwood.

**Snags:** Medium density of small snags; 31 snags/acre, 98% smaller than 15” DBH

**Coarse Woody Material (>10” diameter):** Low volume, uniform distribution. Decay condition mostly old/crumbling.

**Fine Woody Material (<3” diameter):** Low volume, uniform distribution.

**Leaf Litter:** Not sampled

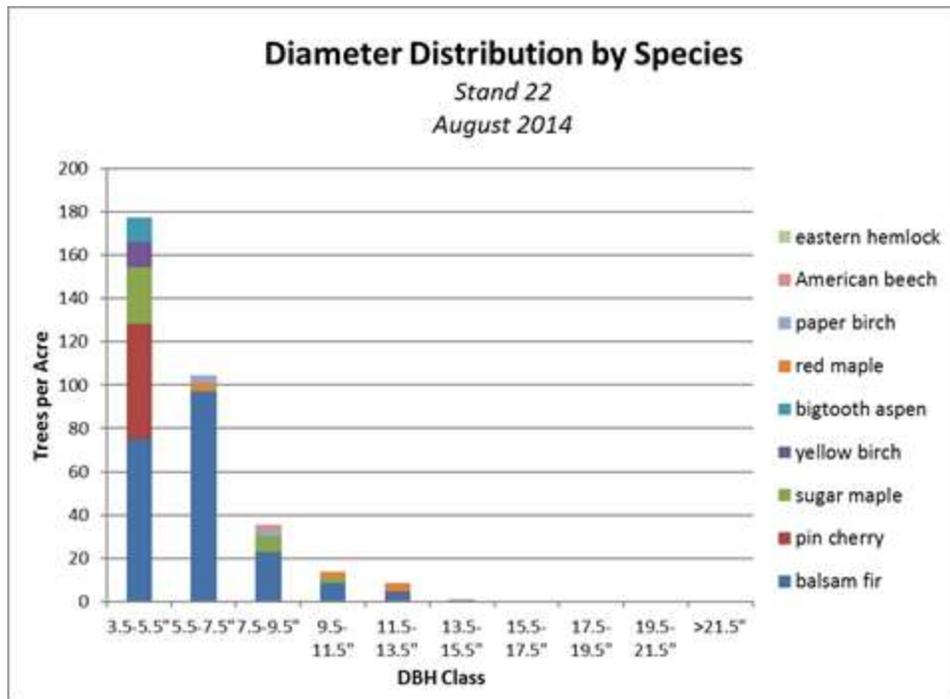
**Wildlife Attribute Summary:** Probably the most important wildlife value of the stand is its role as an undeveloped and forested corridor allowing safe passage for wildlife moving across the landscape southeast- northwest. Some development along the Jordan Road and the shape and size of nearby Seymour and Echo lakes create a potential bottleneck for wide-ranging wildlife species like bobcat, black bear, moose, deer, fisher, and coyote. Future management should prioritize maintaining as dense a forest cover as possible within 50 feet of the town road in the western part of the stand to enhance the corridor benefits. Though no formal mammal surveys have been done in this stand, evidence of deer, coyote, and moose has been observed in the past.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	sugar maple	9.6	0	1.9	1.9
	red maple	8.2	53	1.7	1.8
	pin cherry	6.8	0	0.0	0.0
	yellow birch	4.1	0	0.5	0.5
	paper birch	2.7	0	0.8	0.8
	American beech	1.4	0	0.1	0.1
	bigtooth aspen	1.4	0	0.0	0.0
	<b>Hardwood Total</b>		<b>34.2</b>	<b>53</b>	<b>5.1</b>
Softwood	balsam fir	64.4	872	11.0	13.1
	eastern hemlock	1.4	79	0.2	0.3
	<b>Softwood Total</b>	<b>65.8</b>	<b>872</b>	<b>11.0</b>	<b>13.1</b>
<b>Grand Total</b>		<b>100.0</b>	<b>925</b>	<b>16.0</b>	<b>18.3</b>

### **SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Stonewalls and rock piles are commonly encountered in southern parts of Stand 22. During future management operations these features should be flagged and preserved, as they provide valuable tools for land use history research and education.



## STAND HEALTH

A number of forest health issues were observed, with recommended actions described below.

### *Human Impacts:*

- The Tripp Hill Trail and a trailhead parking area are maintained for forestry access and non-motorized recreation. These areas show minimal impact from recreational use (hiking, snowshoeing, skiing and hunting).

### *Wildlife Impacts:*

- Some deer and moose browse on regeneration.

### *Invasive Species:*

- None observed.

### *Climate Change Considerations:*

- Potential future pressure from increases in forest pests, pathogens and invasive plants can be a serious threat to forests with low species diversity. Transitioning to an uneven-aged mix of site-appropriate species will increase future stand resilience.
- Boreal species such as balsam fir are predicted to decline in response to climate change. Current stocking and regeneration includes a high proportion of balsam fir; management should promote regeneration of species such as black cherry, white ash, red maple and white pine that are predicted to adapt well to future climate conditions, while allowing spruce/fir saplings and trees to reach economic maturity.

### *Other Pathogens and Health Concerns:*

- Hay-scented fern, a light-loving allelopathic plant that inhibits sapling development of some hardwoods, is found throughout Stand 22, mainly in old skid trails. Prevalence of this plant

should be monitored and controlled as necessary using manual cutting/pulling, enrichment planting of desirable species, limited herbicide application or silvicultural treatments.

- With close proximity to Jordan Road, the northwestern boundary of this stand is impacted by dust, salt and other edge effects from the road. This could also be a vector for invasive plant introduction. The stand should be closely monitored for forest health impacts (dieback along the road, invasive plants, etc.)

## **RECREATION/ EDUCATION**

As a result of the easy access from the Jordan road, and the parking at the former log landing, neighboring hunters and nature enthusiasts use this stand fairly frequently. The long term management will reduce the current dominance of early successional species, in turn reducing the attractiveness of the stand to game species like ruffed grouse and deer. Nevertheless, the overall aesthetics and value of the stand for other recreation (birding, nature observation, walking, snowshoeing) will be enhanced. The Tripp Hill Trail originates in Stand 22 at the Jordan Road parking area and follows old skid trails through Stand 21 as it climbs the northwest side of Tripp Hill.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

**Age Class Structure:** Even aged (~13 years old) with residual overstory from high-grading (~70-90 years old)

**Sampling Method:** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

**Number of Plots:** 10 (1 per 2.0 acres)

**Sampling Date:** August 2014

*For all live intermediate-dominant trees  $> 3.5$ " dbh:*

**Total BA (ft<sup>2</sup>/acre):** 73

**AGS BA:** 58 (79%)

**BA 95% CI:** 31-115 ft<sup>2</sup>/acre

**Total TPA:** 341

**AGS TPA:** 257 (75%)

**QMSD (inches):** 6.3

**Stocking Level:** Minimally stocked; C-line on mixedwood stocking chart (US Forest Service 2008 Timber Management Field Book)

### ***Regeneration:***

**0-1" DBH** – 1,684 stems per acre

**1-3" DBH** – 737 stems per acre

**Number of Plots** – 19 (0.1% of stand / 1 plot per 1.0 acres)

The newly established cohort dominating most of the stand is still in the large sapling stage, contributing to high regeneration densities and low reported basal area. Regeneration is vigorous and includes a mix of commercial and non-commercial species. Hay-scented fern and raspberries/blackberries may be inhibiting regeneration in some open areas. Primary species: red maple, sugar maple, pin cherry, balsam fir and black cherry.

**Site Class:** II

**Soils:** Very deep, well-drained fine sandy loams of the Monadnock soil series.

**Access:** Excellent- the entire stand is located on flat or minor slopes with well-drained soils and no more than 1,000 feet from the class 3 town road.

## **DESIRED FUTURE STAND CONDITION**

*Long Range Silvicultural Objectives:* Uneven-aged Management

*Cutting Cycle:* 15 years

*Diameter Objectives for Principle Species:*

12-18" dbh ----- balsam fir, red spruce

16-22" dbh ----- all hardwood species

Due to its location along a well-traveled town road and an important wildlife corridor, the stand will be managed primarily for aesthetics and wildlife habitat, with high-quality sawlog production as a secondary goal. Management will gradually transition the stand back to its naturally community type (northern hardwood forest) using the single tree and small-group selections, with groups 1/10<sup>th</sup> to 1/4<sup>th</sup> acre in size. The long-term structural goal is  $q=1.5$ , with a target basal area of 90 ft<sup>2</sup>/ac. Specifically, future management should:

- Promote tree species diversity, maintaining up to 40% of total stocking in minor species.
- Emphasize aesthetics along the town road, retaining a mix of well-formed species that include birches, aspens, sugar maples, and fewer softwoods.
- Minimize cutting within 100 feet of the town road, except to manage for the aesthetic or wildlife cover values described here.
- Maintain a component of early successional shrub and tree species for wildlife food sources, using small group selection up to 1/4<sup>th</sup> acre and intermediate thinnings.
- Maintain some dense understory cover within 75 feet of the town road (e.g. softwoods, early successional growth, shrubs) to enhance wildlife corridor values.
- Retain unmanaged softwood groups up to 1/10<sup>th</sup> acre as roosting cover for raptors and large corvids.
- Beyond the 100 foot road buffer, manage for high-quality sawlogs whenever possible. Given the excellent access, consider hardwood pruning to increase sawlog value.
- Promote natural northern hardwood structural diversity, including up to 5% of stocking in legacy/den trees, at least four large snags per acre (two 12-18" dbh and two >18" dbh), and large coarse woody debris.

## **PLANNED TREATMENTS**

*Leave to grow and reevaluate in 2025*

The main cohort in this stand is very young, and overall the forest needs time to grow and develop. Areas of dense regeneration show self-thinning tendency (favoring later successional species such as sugar maple while eliminating pioneer species such as pin cherry), and would not benefit greatly from any precommercial work at this time.

## **OTHER WORK**

Optional work suggested for Stand 22 over the coming decade includes:

- Hay-scented fern control- see Stand Health section, above.
- Tripp Hill Trail and trailhead maintenance.

## STAND 23

### STAND DESCRIPTION

*Acres (pro-rated):* 88.4

*NED Cover Type(s):* Spruce-northern hardwoods

*Natural Communities:* Northern Hardwood Forest



#### *Stand History and Overview:*

Stand 23 lies on the west side of the parcel, facing toward Echo Lake. From a nearly flat topography on poorly drained soils northwest of the Tripp Hill fields, the stand descends increasingly to the west, finally dropping with steep slopes to a stream valley and the East Echo Lake road.

The forest is predominately 20-year old hardwood regeneration with small pockets of larger-diameter hardwoods and softwoods scattered across the stand. Although variable, soils here are generally fairly well drained and somewhat enriched, supporting a high proportion of sugar maple in the young forest. Other common tree species in the sapling size class include yellow birch, white ash and balsam fir.

At this early development stage, the stand mostly needs to grow, though it would benefit from pre-commercial thinning to promote future crop trees and to maintain species diversity. The long-term goal will be to transition the even-aged structure to all-aged and to develop both high-value sawlogs and more natural northern hardwood stand characteristics (large diameter snags, small canopy openings, and overmature legacy trees).

From the earliest period of settlement in East Charleston (the 1820s), this stand was owned and used by farmers living along the East Echo Lake road. Between 1837 and 1907 four generations of the Pierce family owned the land, farming the toeslopes below and possibly pasturing their small dairy herd and sizeable sheep flock across the acreage. Ownership transferred to the Piper farm in 1907 and stayed in that family until 1946.

Although the early land-use here is somewhat unclear, extensive conifer forest on the 1942 aerial photo suggest that most of the stand may have been open farmland at some point in the mid to late 19<sup>th</sup> century. If so, old-field conifers probably began to re-colonize the abandoned fields between 1870 and 1890. These trees were large enough to support heavy widespread logging in the stand in the 1930s and early 1940s.

After passing from the Piper family in 1946, stand ownership changed hands multiple times before it was acquired by the Vermont Lumber Corporation in 1969. In 1977 title transferred again to the Vermont Land Corporation, part of an extensive consolidation of acreage by that group. In 1985, a year after liquidating a large area of forest northeast of Tripp Hill, this owner did the same across most of Stand 23, leaving only a few remnant patches of softwood. Wood from this cutting was skidded to a landing at the west corner of the stand along the East Echo Lake Road. No logging has taken place since this liquidation cut.

Group	Species	% of Total Basal Area	Sawlog (bf/ac)	Pulpwood (cords/ac)	Total (cords/ac)
Hardwood	yellow birch	14.8	225	3.6	4.1
	white ash	14.2	550	4.4	5.4
	sugar maple	10.5	299	3.1	3.7
	paper birch	7.8	85	2.9	3.1
	red maple	6.9	175	1.9	2.3
	bigtooth aspen	3.3	111	1.5	1.7
	quaking aspen	2.4	233	0.7	1.2
	striped maple	2.1	0	0.1	0.1
	gray birch	1.5	0	0.5	0.5
	black cherry	1.2	28	0.3	0.4
	hophornbeam	0.9	0	0.3	0.3
	pin cherry	0.9	0	0.0	0.0
	American basswood	0.6	0	0.2	0.2
	American beech	0.6	0	0.2	0.2
	black ash	0.6	0	0.1	0.1
	Allegheny serviceberry	0.3	0	0.0	0.0
	balsam poplar	0.3	0	0.1	0.1
<b>Hardwood Total</b>		<b>68.9</b>	<b>1,705</b>	<b>19.7</b>	<b>23.2</b>
Softwood	northern white cedar	14.8	1,358	3.3	5.9
	balsam fir	10.2	84	2.3	2.5
	eastern hemlock	2.7	262	0.4	1.1
	red spruce	2.1	174	0.5	1.0
	white spruce	1.2	167	0.3	0.7
	<b>Softwood Total</b>		<b>31.0</b>	<b>1,358</b>	<b>3.3</b>
<b>Grand Total</b>		<b>99.9</b>	<b>3,063</b>	<b>22.9</b>	<b>29.1</b>

## WILDLIFE STRUCTURAL ATTRIBUTES

**Canopy (>30 feet):** Estimated 95% canopy closure; uniform. Mainly hardwood species with higher proportion of softwoods in some areas (see diameter distribution chart below).

**Midstory (5-30 feet):** 67-100% cover, uniform.

**Understory (1-5 feet):** 0-33% cover, uniform. Primary herbaceous species: Christmas fern, sensitive fern, New York fern, Indian pipe, unidentified sedge (*Carex* sp), intermediate wood fern, toothed wood fern, helleborine and long beech fern. Indicators of soil enrichment include silvery glade fern, ostrich fern, Goldie's wood fern, zig-zag goldenrod, and white baneberry. Primary woody species: sugar maple, white ash, yellow birch, dwarf raspberry, red raspberry, mountain maple, common blackberry and beaked hazelnut.

**Snags:** High density of small snags; 49 snags/acre, only 1 snag/acre larger than 15" DBH

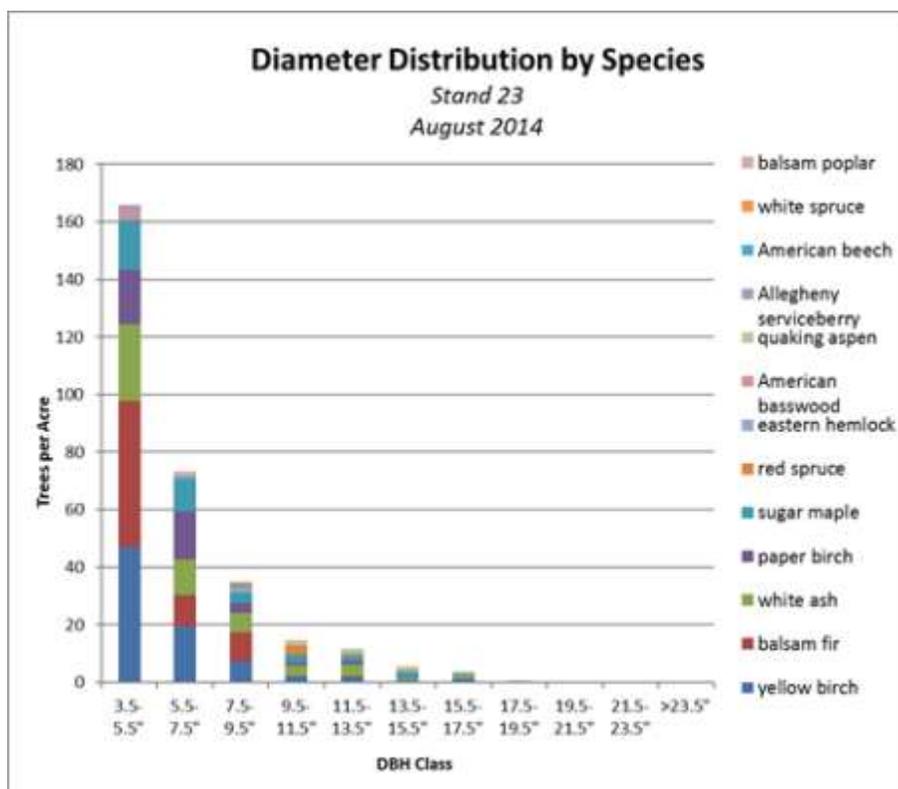
**Coarse Woody Material (>10" diameter):** Medium volume, patchy. Decay class ranging from new/solid to old/crumbling.

**Fine Woody Material (<3" diameter):** Medium volume, patchy.

**Leaf Litter:** Not sampled

**Wildlife Attribute Summary:** This forest is beginning to transition from sapling stage, which

generally attracts a high diversity of wildlife, to pole stage - which tends to be more depauperate. Nevertheless, the stand contributes to the extensive forested interior of the property and provides a broad corridor for wildlife traveling between Echo Lake and interior areas of the site. General observations here have included black bear feeding sign on beeches in the east corner of the stand, moose and deer sign throughout, and evidence of coyote, fisher, and bobcat passing through and bedding here. Porcupine feeding sign is also common, especially on tamarack saplings. Of 39 bird species observed in this stand during the breeding season, the five most common were veery, red-eyed vireo, American robin, ovenbird, and American redstart. White throated sparrow has been confirmed nesting here. Overall wildlife values in the stand will increase as natural processes and management gradually improves the structural diversity and re-introduces snags and coarse woody debris.



**SIGNIFICANT WILDLIFE HABITAT/ SPECIAL PLACES AND SENSITIVE SITES**

No areas within the stand qualify for enrollment as Significant Wildlife Habitat or Special Places/ Sensitive Sites. However, the following areas offer unique, ecologically valuable and/or fragile features:

- Though none have been found to date, the lower west corner of the stand near East Echo Lake road may contain old cellar holes or other historic artifacts dating back to the 1820s. Foundations, stonewalls or other clear historic features should be flagged and protected from damage during any future management activities.
- Several small, unmapped streams drain the stand to the west and these will be protected by closely following the state AMPs during harvests. Forming the western edge of the stand is a larger stream that drains south to Echo Lake. This is a topographic blue line waterway and lies

as the bottom of a deeply cut valley with slopes exceeding 25%. A 50' buffer along this stream is designate as a Surface Water Buffer Zone in a conservation easement held by the Vermont Land Trust; equipment use is generally prohibited in this buffer and management activities must retain a minimum of A-line stocking. A full description of Surface Water Buffer Zone regulations, excerpted from the conservation easement, can be found in Appendix D. Areas along this valley with slopes steeper than 20% will not be logged.

## **STAND HEALTH**

Though a number of forest health issues were observed (below), none require special action at this time.

### ***Human Impacts:***

- Some erosion caused by trail location, lack of drainage structures and recreational use.

### ***Wildlife Impacts:***

- Some porcupine damage around western slopes, which likely provide den habitat.

### ***Invasive Species:***

- None observed.

### ***Climate Change Considerations:***

- Greater chance for heavy rains could increase erosion in gullied drainages to the east of the road. Future management should minimize soil disturbance in these areas to allow native vegetation to stabilize soils, and monitor erosion to determine whether intervention measures such as drainage ditches or diversions would be beneficial

### ***Other Pathogens and Health Concerns:***

- None observed

## **RECREATION/ EDUCATION**

Mostly used by hunters, especially the western areas along the historic access road. This historic road and a parking lot at the old log landing on East Echo Lake Road has been improved for recreational use, although drainage and treadwork are needed where the trail traverses steep sideslopes. This trail is the primary access to the historic foundations of the Wolcott homestead, and also leads through Stands 21 and 18 to a Forestry for the Birds demonstration harvest area.

## **SILVICULTURAL DATA AND GROWING SITE CONDITIONS**

***Age Class Structure:*** Even-aged (~30 years old) with reserves

***Sampling Method:*** Variable radius plots (BAF 10, all stems  $\geq 4$ " dbh)

***Number of Plots:*** 28 (1 per 3.2 acres)

***Sampling Date:*** August 2014

***For all live intermediate-dominant trees  $> 3.5$ " dbh:***

***Total BA (ft<sup>2</sup>/acre):*** 119

***AGS BA:*** 78 (66%)

***BA 95% CI:*** 104-133 ft<sup>2</sup>/acre

***Total TPA:*** 453

***AGS TPA:*** 255 (56%)

***QMSD (inches):*** 6.9

**Stocking Level:** Adequately stocked. A-B line on mixedwood stocking chart (US Forest Service 2008 Timber Management Field Book)

**Regeneration:**

0-1" DBH – 1,000 stems per acre

1-3" DBH – 500 stems per acre

Number of Plots – 56 (0.1% of stand / 1 plot per 1.6 acres)

Regeneration is well developed for a young, even-aged stand. Distribution is patchy and heavily influenced by canopy closure. Primary species include sugar maple (46% of stems sampled in 0-1" DBH class), white ash, balsam fir and yellow birch with lower proportions of American beech, black cherry, paper birch and other hardwoods.

**Site Class:** I

**Site Index:** 87 (paper birch), 68 (white ash)

**Soils:** Mostly moderately deep and moderately well drained sandy loams (Dixfield). More poorly drained and shallow to hardpan silt loams/ sandy loams lie along the east and northeast edges (Cabot and Colonel-Cabot). Finally, the slopes of the northwest valley are very deep and well drained loams of various textures.

**Access:** Fair to good. Western areas would be accessed through the East Echo Lake road landing used during the 1980s logging. Eastern areas are as much as a half mile from this landing and might be better accessed via the landing at the north edge of the Tripp Hill fields (with landowner permission).

**DESIRED FUTURE STAND CONDITION**

**Long Range Silvicultural Objectives:** Uneven-aged Management

**Cutting Cycle:** 15 years

**Diameter Objectives for Principle Species:**

12-18" dbh ----- red spruce, balsam fir

16-22" dbh ----- sugar maple, yellow birch, white ash, black cherry

Gradually convert the stand to all-aged using single tree and group selection systems, with group sizes up to 1/4<sup>th</sup> acre. Since this forest is still in the early stages of regrowth, up to eight cutting cycles may be required to accomplish the full conversion to an uneven-aged stand. The first and probably the second entries will require even-aged thinning techniques, with the goal of improving species composition and stand quality. Subsequent entries will add the goal of increasing stand structure by creating small group openings to promote initiation of new age classes. Species to be favored will be commercial hardwoods (sugar maple, yellow birch, white ash, black cherry and American beech) on the better-drained soils, with a slight shift toward red spruce and balsam fir on poorer drained soils. In all areas, other minor species will be retained as up to 10-25% of total stocking. The eventual structural goal will be  $q=1.3$ , with a residual basal area goal of 90-100 ft<sup>2</sup>/ac.

From 5-10% of total stocking will eventually be maintained in large legacy trees, which will be allowed to senesce naturally – providing genetic and structural continuity. At least four snags per acre (two 12-18" dbh and two >18" dbh) will be recruited, and as much coarse woody debris as possible of varying decay classes. A special effort will also be made to retain hollow den trees and

unmerchantable logs >12" dbh and >6 feet long, as these become available.

Due to soil types and aspect, windthrow, erosion, and rutting are all hazards in this stand and should be considered in any future planning.

## **PLANNED TREATMENTS**

### *Pre-commercial thinning and group selection harvest (2018)*

Much of Stand 23 is well-stocked with high-quality trees at the stem exclusion stage of stand growth; precommercial thinning would benefit the stand by reducing competition from early-successional species, and by promoting well-formed stems of desirable species. Thinning should retain at least 350 stems per acre or B-line stocking, and should focus on releasing vigorous, well-formed sugar maple, white ash, black cherry, yellow birch and American beech. Basswood and butternut should also be released wherever they are encountered, as should other species that are uncommon across the stands.

Small and occasional patches of low-quality overstory (typically early-successional species such as gray birch and pin cherry) should be removed in group selections between 1/10<sup>th</sup> and 1/4<sup>th</sup> acre in size, with a total of up to 4.5 acres harvested (5% of the stand). Where advance regeneration of desirable species is present, care should be taken to minimize damage to regeneration by using low-impact harvesting equipment or by leaving felled trees as coarse woody material (use of a brontosaurus or other mechanized precommercial harvester is not recommended due to soil and regeneration impact). Group selections where advance regeneration is sparse or non-existent could be intentionally scarified to promote regeneration of yellow birch.

## **OTHER WORK**

Optional work suggested for Stand 23 over the coming decade includes:

- The multi-use Wolcott Trail, following an historic road from the East Echo Lake Road parking area, needs drainage and surface improvements where it traverses steep sideslopes. This work could be combined with prescribed pre-commercial treatments and group selection harvests. A network of permanent harvest trails could also be established at this time; parallel or looping trails should be located approximately 200' apart and placed to minimize soil impact and drainage/surface work required.

## STAND 24

### *SPECIAL UVA CATEGORY*

Ecologically Sensitive Treatment Area (ESTA) – Vernal Pool

#### **STAND DESCRIPTION**

*Acres (pro-rated):* 2.0

*Stand Cover Type(s):* Northern Hardwoods

*Natural Communities:* Northern Hardwood Forest

#### ***Stand History and Overview:***

The stand is dominated by pole to small sawtimber-sized northern hardwoods, including sugar maple, beech, yellow birch, and white ash, as well as eastern hemlock and other minor species. The history has included several logging entries, the most recent taking place in the late 1960s, and is the same as that for adjacent stand 4. More details about the stand history and species composition can be found in that description.

#### **ECOLOGICALLY SIGNIFICANT FEATURE(S) TO BE PROTECTED**

The vernal pool that forms the focal point of this ESTA occurs as the result of bedrock exposures, which prevent drainage along a roughly 300 foot long and 60 foot wide area at a relative high point on the landscape. As a result, surface waters collect here via overland flow and leave primarily through gradual evaporation. The result is a seasonal pool that will dry in some years in late summer, excluding predatory fish or amphibians like green frog or bullfrog, and creating the unique conditions required by a host of other amphibians (including spotted salamander and wood frog) for successful breeding.

*Age Class Structure:* Even

*Site Class:* II

*Soils:* Tunbridge-Lyman and Tunbridge-Dixfield complex. Moderately deep and well-drained, these soils support a northern hardwood forest natural community.

#### **JUSTIFICATION FOR ESTA ENROLLMENT**

Several attributes of this site justify its recognition and protection as a Forested Wetland ESTA.

- 5) *Sensitivity:* The hydrology and micro-topography that have produced this natural community type could be easily altered through the use of heavy equipment associated with timber harvesting. Disturbances associated with logging could facilitate the establishment of invasive plants, change the hydrological patterns of the pool, or change the water chemistry through organic matter inputs or changes in light exposure.

- 6) *Natural Community*: Vernal pools are recognized by the State of Vermont as Class II wetlands and are therefore protected by the same wetland rules described in the Property Summary at the beginning of this plan (Hydrology Section). This pool is one of only six known or potential vernal pools catalogued by the Vermont Vernal Pool Mapping Project for the town of Charleston.
- 7) *Species*: Monitoring by the NorthWoods Stewardship Center circa 2005-2008 confirmed regular use of this pool for breeding by spotted salamander, wood frog, and spring peeper. Over 300 egg masses of spotted salamander were noted in some years, and the pool was found to be the most reliable of any amphibian breeding pools, in terms of water level stability and egg mass development, over 3000 acres surrounding the NorthWoods main facility. The pool also supports other wildlife species indirectly as a productive source of food and water, as evidenced by sightings of broad winged hawks feeding here in recent years and the siting of their nest in a nearby forest on the adjacent property.
- 8) *Landowner Goals*: Promoting diverse wildlife habitat is a primary goal and this feature contributes a unique and valuable habitat type for the entire ownership. Education is also a landowner goal and good access to the stand allows for excellent teaching opportunities.

### **STAND HEALTH (INCLUDE THREATS TO THE ECOLOGICALLY SIGNIFICANT FEATURE)**

No health issues are known at this time. The most likely potential threats are new infestations of invasive plants, sedimentation or pollution from surrounding upland areas, or degradation of habitat in the surrounding forest that might affect the salamander populations utilizing the pool.

### **DESIRED FUTURE STAND CONDITION**

The primary goal with this ESTA enrollment is to protect and enhance the natural characteristics of the forested wetland and its values to wildlife and overall ecological processes, using the most current recommended conservation practices for vernal pools. This includes maintaining a 100-foot no-harvest, no equipment use intact forest buffer around the pool itself (included within the ESTA area). Forest management in a buffer extending 300-600 feet from the pool edge (into adjacent stand 4) will use uneven-aged methods that maintain at least 75% forest canopy cover, promote high amounts of coarse woody material, and avoid any disruption to the hydrology of the pool.

### **PLANNED TREATMENTS**

*None*

The stand should be monitored regularly for invasive exotic plants or other threats to the integrity of the pool, and control measures should be applied if threats occur.

### **OTHER WORK**

- Signs should be installed to clearly define the boundary of the ESTA, both for educational purposes and to ensure that the correct management guidelines are followed within the ESTA area.

# STAND 25

## *SPECIAL UVA CATEGORY*

Ecologically Sensitive Treatment Area (ESTA) – Riparian Area

### **STAND DESCRIPTION**

*Acres (pro-rated):* 20.6

*Stand Cover Type(s):* Forested wetland, open water, and shrub wetland

*Natural Communities:* Lowland Spruce-Fir Forest, Alder Shrub Swamp, Sedge Meadow

*Stand History and Overview:* This stand includes a narrow band of land along the Webster Brook tributary stream that drains the northeastern part of the site on the Morgan side of the Tripp Hill parcel, as well as a non-contiguous 50-foot riparian buffer occurring to the northeast of this stream valley around beaver pond portions of the non-productive wetland area described in stand 26. The history of these areas is similar to the stands surrounding them, particularly stand 16 (see that stand description for more details). Most notably, this area was impacted somewhat by the logging of the mid 1980s. Since that time, beaver populations have expanded, using the entire ESTA area for their ponds and adjacent upland tree harvest areas.

### **ECOLOGICALLY SIGNIFICANT FEATURE(S) TO BE PROTECTED**

This ESTA protects the wetland complex created and maintained by beavers in the main stream valley and the 50-foot upland forest buffer surrounding the two beaver ponds to the northeast.

*Age Class Structure:* Even-aged

*Site Class:* II

*Soils:* NRCS mapping shows a variety of soil types, including Colonel-Cabot complex, Monadnock fine sandy loam, and Dixfield sandy loam, though flooding by beavers has altered these soils.

### **JUSTIFICATION FOR ESTA ENROLLMENT**

Several attributes of this site justify its recognition and protection as a Riparian Area ESTA.

- 1) Sensitivity:* The area within this ESTA encompasses soils and surface waters in the main drainage area that could easily be altered and damaged by direct or indirect impacts from logging equipment. In the case of the beaver pond buffers to the northeast, the ESTA protects the sensitive wetlands of stand 26 by maintaining an intact forest cover on slopes leading to the wetlands.
- 2) Species and Significant Habitat:* The wetlands protected by this ESTA are some of the richest on the site in terms of species diversity and biological productivity, as measured through a variety of inventory and monitoring surveys carried out by NorthWoods between 1998 and 2007. These surveys documented regular use specifically along the stream corridor by mink, river otter, and other large mammals, and over 90 species of breeding birds utilizing the beaver ponds to the northeast, including confirmed breeding by the declining and state uncommon breeding species

rusty blackbird.

- 3) *Landowner Goals*: Promoting diverse wildlife habitat is a primary goal and Stand 25 contributes significantly to these values as a result of the species and habitat conditions described above, while also protecting water quality.

### **STAND HEALTH (INCLUDE THREATS TO THE ECOLOGICALLY SIGNIFICANT FEATURE)**

No threats were noted, though invasive plants are a potential threat, particularly considering the increased light exposure associated with past logging entries and the activity of the beavers themselves. The other primary threat is sedimentation or pollution from forest management activities in the adjacent upland areas.

### **DESIRED FUTURE STAND CONDITION**

The primary goal with this ESTA enrollment is to protect and enhance the natural characteristics of the riparian area and its values to wildlife and overall ecological processes. These values can best be further enhanced by allowing the forest to continue to develop naturally, with many trees growing to large diameters (>20" dbh) and others dying and contributing new snags and woody debris to the forest floor. Conservation of these sensitive wetlands will require ongoing vigilance against invasive plants, and care when operating in adjacent upland areas to avoid impeding water flow into the wetlands or causing erosion or chemical pollution (oil spills, etc) that might affect water quality.

### **PLANNED TREATMENTS**

*None*

The stand should be monitored regularly for invasive exotic plants, and control measures should be applied if these species appear.

## STAND 26

UVA Enrollment Category– *Non-productive land*

**Acres (pro-rated):** 16.4

**Cover Type:** open and forested wetland

**Description:** Stand 26 is located in the northeast part of the Tripp Hill parcel and includes a wetland complex that encompasses a roughly 5-acre beaver pond, a smaller lower pond, and associated forested wetlands that connect these ponds and extend to the southeast boundary line.

**Management Considerations:** Though enrolled in UVA as non-productive land from a timber management standpoint, the wetland is extremely productive and beneficial in terms of its wildlife habitat values, biodiversity, and water quality. Bird surveys at the main pond from 1998-2007 recorded over 90 species during the breeding season and the uncommon state breeding species rusty blackbird was confirmed breeding here. The pond is also an important reptile and amphibian breeding site, with confirmed populations of spotted salamanders, wood frog, spring peeper, green frog, northern leopard frog, mink frog, and painted turtle. Many mammals also utilize both the wetlands and the trail that crosses them from route 111.

Potential threats to the health of this habitat include invasive plants and sedimentation or nutrient inputs from upslope or upstream forest management. None of these impacts are currently apparent.

The open canopy and slow regeneration rates in this area also make it vulnerable to invasive plant colonization and monitoring should be carried out at least every 3 years to ensure early detection and control.



## STAND 27

### *SPECIAL UVA CATEGORY*

Ecologically Sensitive Treatment Area (ESTA) – Riparian Area

#### **STAND DESCRIPTION**

*Acres (pro-rated):* 1.8

*Stand Cover Type(s):* Mixed Forest

*Natural Communities:* Northern Hardwood Forest, Red Spruce-Northern Hardwood Forest

#### ***Stand History and Overview:***

Stand 27 is located on the east shore of Echo Lake at the northwest edge of the site and lies between this shoreline and the adjacent stand 11. It encompasses the forest extending 100 feet back from the shoreline, which roughly corresponds with the top of a moderate slope. The forest here includes a mix of northern hardwood and softwood species, including yellow birch, northern white cedar, sugar maple, paper birch, balsam fir, and red spruce. Portions of this area were cleared in the past for use as farmland and a small area in the north was mined at one time for its gravel, while other areas may have never been cleared. A small stream crosses the southern end, emptying into Echo Lake.

#### **ECOLOGICALLY SIGNIFICANT FEATURE(S) TO BE PROTECTED**

Echo Lake is a prominent regional surface water in the upper Clyde River watershed and an important influence on water quality downstream. Undeveloped shoreline is very uncommon around this lake, and the 1800 feet of shoreline on the NorthWoods property provides important wildlife access and habitat, as well as recreational access via a small footpath.

*Age Class Structure:* Even-aged

*Site Class:* II

*Soils:* Monadnock fine sandy loam

#### **JUSTIFICATION FOR ESTA ENROLLMENT**

This area is enrolled as a Riparian Area ESTA to recognize and ensure adequate protection of Echo Lake and its important shoreline habitat. This habitat is regularly used by many wildlife species, as shown by well-worn game trails and regular sightings a species ranging from bobcat to mink to bald eagle. While wetland and lake edge habitats are biological hotspots in general, the value of this area is enhanced by its connectivity to the parcel's extensive upland forests to the northeast. In addition to its value for wildlife, the riparian area hosts a small recreational footpath used regularly by local camp owners and visitors. The intact forest canopy is integral to these benefits and values and would not be adequately protected through AMPs alone.

## **STAND HEALTH (INCLUDE THREATS TO THE ECOLOGICALLY SIGNIFICANT FEATURE)**

No threats were noted, though invasive plants are a potential threat, as is blowdown from winds coming off of the lake.

## **DESIRED FUTURE STAND CONDITION**

The primary goal with this ESTA enrollment is to protect and enhance the natural characteristics of the riparian area forest and its values to wildlife and overall ecological processes. The stand already features natural forest elements that are less common across the uplands (pit/mound topography, old trees, plant diversity, multiple vegetative layers, and coarse woody material). These values can best be further enhanced by allowing the forest to continue to develop naturally, with many trees growing to large diameters (>20" dbh) and others dying and contributing new snags and woody debris to the forest floor. Several of the tree species found here can achieve lifespans over 200 years. Conservation of the area will require ongoing vigilance against invasive plants, and care when operating in adjacent upland areas to avoid creating large openings that might encourage wind throw.

## **PLANNED TREATMENTS**

*None*

The stand should be monitored regularly for invasive exotic plants, and control measures should be applied if these species appear.

## STAND 28

*NOT ENROLLED IN UVA*

*Acres (pro-rated):* 11.8

*Cover Type:* open and forested wetland

*Description:* A wedge of wetlands located on the north bank of the Clyde River and bordered by VT Route 105 to the northeast. A small well drained meadow is also present on the parcel.

*Management Considerations:* Recently donated to NorthWoods, this parcel is protected from development and other uses by a conservation easement held by The Nature Conservancy. Much of the site was planted with native wetland-adapted tree and shrub species prior to the donation, as part of a restoration project. In addition to the value of its wetland habitats – including an area mapped as Class II significant wetland by the Vermont Significant Wetland Inventory – the upland field portion of the site represents one of the few such habitats occurring on the NorthWoods ownership and provides benefits to a host of open habitat specialist songbirds and invertebrates. This habitat should be maintained through delayed mowing every 3-5 years to prevent regeneration from becoming established.

## **APPENDIX A: METHODS**

The field survey for this plan was completed in May-December 2014 by Jayson Benoit and Sam Perron of the NorthWoods Stewardship Center. Stand boundaries were modified from the 2006 Spitzer Forest Management Plan and 2007 NorthWoods Stewardship Center Forest Management Plan with ArcView v9.2 GIS software. Parcel boundaries were based on survey maps provided by the landowner and were confirmed and/or adjusted based on GPS data acquired during the fieldwork.

Randomly located permanent plots used for sampling in previous plans were revisited while conducting inventory for this update. Additional plots were randomly placed within the stand using ArcView; sampling intensity goal was 1 plot per 3 acres, with a minimum of 10 plots and a maximum of 30 plots per stand. The resulting plots were uploaded to a Garmin 76Csx GPS unit, which was used to locate them in the field. Stand boundaries were later adjusted based on fieldwork findings. A total of 353 tree plots and 656 regeneration plots were sampled.

Variable radius sampling was conducted at each plot using a 10 BAF prism, recording all “in” trees (including snags)  $\geq 4$ ”DBH. Diameters were measured in 1-inch size classes using a Biltmore stick or diameter tape. Tree species, acceptability, canopy position, product class, merchantable height, and health notes were recorded. Photos were taken at permanent plots, looking in each cardinal direction and straight up at the canopy. Regeneration was sampled at each tree plot (and at additional locations between tree plots) using 1/1000<sup>th</sup> acre fixed area plots. At regeneration plots all healthy stems 12” tall -1”dbh and 1-3”dbh were tallied by species. Site index and history were based on fieldwork completed for previous management plans- see previous plans for specific methods. Other general information gathered throughout the stand included forest health issues, cultural features, surface waters, special habitat features, soil and bedrock, past land-use, wildlife evidence, and plant species. Herbaceous and shrub species observations from more intensive inventories in 2005 (Spitzer parcels) and 2007 (original NorthWoods parcels) were included in stand descriptions. Digital photographs were taken at representative locations. Data were processed using Microsoft Excel and NED2.

Data collection in Stands 7 and 18 followed protocols used for Forestry for the Birds pre-harvest sampling, which were similar to those described above except that prism plots counted only trees  $\geq 5$ ” DBH, and regeneration plots were 1/750<sup>th</sup> acre.

In drafting the management plan and maps, GIS layers acquired from the Vermont Center for Geographic Information were also used, including bedrock, surficial geology, E911 roads, surface waters, Vermont Significant Wetland Inventory, Caledonia County soils (NRCS), landcover types, deer wintering areas, VT RT&E species and natural communities, 20-foot contours, and core habitat.

## **APPENDIX B: NOTES ON STAND DESCRIPTION CATEGORIES**

**Cover Type:** Tree associations identified by NED-2 forest ecosystem management decision support software, produced by the USDA Forest Service Northern Research Station.

**Natural Communities:** Based on *Wetland, Woodland, Wildland- A Guide to the Natural Communities of Vermont*, E.H. Thompson and E. Sorenson, 2000.

**Age Class Structure:** Even or Two-aged = two or less distinct classes of trees separated by no more than 20% of the stand rotation age, Uneven= at least three distinct classes of trees separated by at least 25 years in age.

**Site Class/ Site Index:** Site index is a measure of site quality- specifically the height that this species would reach on this site in 50 years. Derived in this case from soil series information and general field observations, including tree cores. Site class is a broader designation based on site index and a site class table is available from the Current Use program office or website.

**Soils:** Soil descriptions are based on mapping completed by the Natural Resource Conservation Service (NRCS), obtained from the web-based soil survey (<http://www.soils.usda.gov/survey/>) or from staff at Vermont's NRCS county offices.

**Stocking (BA, TPA, diameter):** A measure of stand density relative to a desirable goal. Stocking is based on Basal Area, Trees Per Acre and mean tree diameter, plotted on a chart specific to forest type. Stands falling above the A-line on these charts are considered overstocked and in need of thinning to achieve maximum tree growth and development. Stands between the A and B line are considered well stocked, while those below the C-line are understocked.

**Basal Area (BA):** The cross-sectional surface area (basal area) of all trees at 4'6" high on the trunk (units are square feet per acre). Normally tallied using special glass cruising prisms of various angles, or Basal Area Factors.

**Trees Per Acre (TPA):** Value given is based upon live canopy trees >4" dbh tallied at sample plots, (all species, acceptable and unacceptable growing stock), unless otherwise noted.

**AGS BA:** Acceptable Growing Stock refers in this plan to all healthy stems that are capable of eventually producing a minimum of one 16-foot sawlog (grade 2 or higher). AGS BA per acre is given in square feet (along with the percent of total basal area that AGS represents).

**UGS BA:** Unacceptable Growing Stock basal area. Trees tallied using the prism that don't meet the above minimum characteristics.

**Quadratic Mean Stand Diameter:** The diameter of the tree of average basal area in the area unit of interest, for our purposes the stand.

**Regeneration Data:** Based upon a tally of all vigorous stems 12" tall to 1" dbh and 1-3" dbh sampled within a series of 1/1000<sup>th</sup> acre plots.

## APPENDIX C: SOURCES USED

Beer, F.W. 1878. *Atlas of Lamoille and Orleans Counties, Vermont*.

DeGraaf, R.M., M. Yamasaki, W.B. Leak, A.M. Lester. 2006. *Technical Guide to Forest Wildlife Habitat Management in New England*. University of Vermont Press, Burlington, VT.

Flatebo, Gro, Carol Foss, Steven Pelletier. 1999. *Biodiversity in the Forests of Maine: Guidelines for Land Management*. University of Maine Cooperative Extension.

Forest Guild Biomass Working Group. 2010. *Forest Biomass Retention and Harvesting Guidelines for the Northeast*. Forest Guild. Santa Fe, NM.

Frank, R.M. and J.C. Bjorkbom. 1973. *A Silvicultural Guide for Spruce-Fir in the Northeast*. USDA Forest Service GTR NE-6.

Hagenbuch, Steve, K. Manaras, J. Shallow, K. Sharpless and M. Snyder. 2011. *Silviculture with Birds in Mind: Options for Integrating Timber and Songbird Habitat Management in Northern Hardwood Stands in Vermont*. Audubon Vermont. Huntington, VT.

Hamelin, Paul L., Wildlife Biologist. 2011. *Vermont Agency of Natural Resources Management Guidelines for Optimizing Mast Yields in Beech Mast Production Areas*

Leak et al. 1987. *Silvicultural Guide for Northern Hardwood Types in the Northeast* (revised). USDA-USFS-NA-FES. Leak, Solomon, De Bald. Research Paper NE-603.

Miller, Raymond. 1990. *Ecology and Management of Northern White Cedar*. Presented at the "Regenerating Conifer Cover in Deer Yards" workshop, North Bay, Ontario, Canada. December 5, 1990

Raymon, Patricia, Steve Bedard, Vincent Roy, Catherine Larouche, and Stephane Tremblay. 2009. *The Irregular Shelterwood System: Review, Classification, and Potential Application to Forests Affected by Partial Disturbances*. Journal of Forestry. December, 2009.

Schlossberg, Scott and D. King. 2007. *Ecology and Management of Scrub-shrub Birds in New England: A Comprehensive Review*. University of Massachusetts, Amherst, MA.

Thompson, Elizabeth H., and E. Sorenson. 2000. *Wetland, Woodland, Wildland- A Guide to the Natural Communities of Vermont*. University Press of New England, Hanover, NH.

## **APPENDIX D: VERMONT LAND TRUST (VLT) SURFACE WATER BUFFER ZONES**

*Excerpt from conservation easement*

Those areas lying within 50' of each bank or shore of the streams, rivers, ponds and wetlands depicted on the Spitzer II Conservation Plan which plan depicts so-called "blue line streams" as identified on 7.5 minute United States Geologic Survey Quadrangle maps, or any successor maps approved by Grantor and Grantee, depicting the Protected Property: shall be designated as Surface Water Buffer Zones (hereinafter "SWBZ").

Within the SWBZ described herein, the goals, prescriptions and restrictions of this Section IV are in addition to the provisions of Sections II, III and V, and where inconsistent, the provisions of this Section IV shall supersede the provisions of Sections II, III and V.

The principal goal for management within the SWBZ is the establishment and maintenance of a high quality buffer that provides an array of ecological benefits including but not limited to:

- 1) buffering aquatic and wetland plants and animals from disturbance;
- 2) preventing wetland and water-quality degradation;
- 3) providing important plant and animal habitat; and
- 4) providing organic matter, nutrients, and structure to aquatic systems.

Within the SWBZ the following restrictions shall apply:

- 1) There shall be no machinery operated within the SWBZ as depicted on the Conservation Plan.
- 2) Harvesting of single, exceptional quality trees is allowed provided the residual stocking level within 100 linear feet along the buffer, parallel to the stream, equals or exceeds the A-line as determined by applying the protocol set forth in the current U.S. Department of Agriculture, Forest Service Silvicultural Guidelines for the Northeast or by applying a similar, successor standard approved by Grantee.
- 3) Stream crossings, for the purpose of constructing roads for transporting machinery and harvested timber, are exempt from this restriction, but the number and width of such crossings shall be kept to a minimum and said crossings shall include the installation of all erosion control devices and employ all recommended practices described in the AMPs.



**USE VALUE APPRAISAL PARCEL DATA ENTRY FORM**     new     update     amendment     change of ownership

**\*\*\*FP&R COUNTY FORESTER USE ONLY\*\*\***

Parcel ID For Data Entry (by state) # \_\_\_\_\_, \_\_\_\_\_  
 Year of Plan \_\_\_\_\_

Year of Entry \_\_\_\_\_  
 Year of Last Inspection \_\_\_\_\_

- 1) Landowner Names (last name, first name): NorthWoods Stewardship Center
- 2) Landowner Address (Street, PO Box): P.O. Box 220    (Town): East Charleston    (State): VT    (Zip Code): 05833  
 Phone Number: 802-723-6551    Email Address: jayson@northwoodscenter.org
- 3) Town That Parcel Is In: Charleston    4) Total Forestry Acres in Parcel: 1124.7 (Grand list acreage, minus active agricultural and open land and exclusions)
- 5) Plan Preparer (last name, first name): Benoit, Jayson    6) Previous Owner (last name, first name): N/A
- 7) SPAN #: 135-042-10800
- 8) Stand information (this information is for data entry only and does not override what is in actual plan):

Stand #	Acres	Even-aged Uneven-aged (existing)	Predominant Site Class (I, II, III or IV)	Stand Type	Quadratic M.S.D.	Total BA	AGS BA	Management Activities	Treatment Year
3	35.3	Even	II	09	6.5	136	102	12	--
4	23.6	Even	II	06	7.3	120	78	14,8	2016
5	48.4	Even	I	11	8.9	138	102	12	--
6	13.3	Uneven	II	13	-	-	-	12	--
7	23.3	Uneven	II	06	9.6	120	63	12	--
8	177.5	Even	I	11	8.3	101	74	2	2018
9	19.4	Even	II	06	7.5	119	78	2, 8	2020
10	14.4	Even	III	13	-	-	-	12	--
11	34.1	Even	I	12	10.2	175	151	2, 8, 14	2018
12	20.4	Even	I	12	9.6	138	122	2, 8, 3	2015
13	150.5	Even	I	06	5.6	76	40	8	2019

Stand #	Acres	Even-aged Uneven-aged (existing)	Predominant Site Class (I, II, III or IV)	Stand Type	Quadratic M.S.D.	Total BA	AGS BA	Management Activities	Treatment Year
17	8.3	Uneven	III	13	-	-	-	12	--
18	56.2	Even	I	06	8.9	88	62	12	--
19	228	Uneven	II	11	6.9	95	61	8, 14, 2	2024
20	38.7	Even	II	06	6.5	42	17	12	--
21	121.4	Even	I	11	6.6	62	43	12	--
22	19.6	Even	II	11	6.3	73	58	12	--
23	88.4	Even	I	11	6.9	119	78	8, 1	2018
24	2.0	Even	II	13	-	-	-	12	--
27	1.8	Even	II	13	-	-	-	12	--

- 9) No activity – (identify stand # and reasons): Stands 3,5,7,18,20,21,22 - understocked; Stands 6,10,17,24,27 -ESTA
- 10) Management Activities – other (identify stand #) \_\_\_\_\_
- 11) Stand Types – other (identify stand #) stand 12- spruce plantation, stand 11- mixed softwood
- 12) Amended prescriptions – (identify stand #) \_\_\_\_\_

**USE VALUE APPRAISAL PARCEL DATA ENTRY FORM**     new     update     amendment     change of ownership

**\*\*\*FP&R COUNTY FORESTER USE ONLY\*\*\***

Parcel ID For Data Entry (by state) # \_\_\_\_\_, \_\_\_\_\_ — \_\_\_\_\_  
 Year of Plan \_\_\_\_\_

Year of Entry \_\_\_\_\_  
 Year of Last Inspection \_\_\_\_\_

- 1) Landowner Names (last name, first name): NorthWoods Stewardship Center
- 2) Landowner Address (Street, PO Box): P.O. Box 220 (Town): East Charleston (State): VT (Zip Code): 05833  
 Phone Number: 802-723-6551 Email Address: jayson@northwoodscenter.org
- 3) Town That Parcel Is In: Morgan 4) Total Forestry Acres in Parcel: 298.4 (Grand list acreage, minus active agricultural and open land and exclusions)
- 5) Plan Preparer (last name, first name): Benoit, Jayson 6) Previous Owner (last name, first name): N/A
- 7) SPAN #: 411-128-10740
- 8) Stand information (this information is for data entry only and does not override what is in actual plan):

Stand #	Acres	Even-aged Uneven-aged (existing)	Predominant Site Class (I, II, III or IV)	Stand Type	Quadratic M.S.D.	Total BA	AGS BA	Management Activities	Treatment Year
13	77.7	Even	I	06	5.6	76	40	8	2019
14	29.1	Uneven	I	06	9.9	123	77	12	--
15	31.6	Even	II	11	5.9	92	61	12	--
16	123.1	Even	I	11	5.0	88	43	12	--
25	20.6	Even	II	13	-	-	-	12	--
26	16.4	Even	IV	12	-	-	-	--	--

- 9) No activity – (identify stand # and reasons): Stands 14,15,16 - understocked; Stand 25-ESTA
- 10) Management Activities – other (identify stand #) \_\_\_\_\_
- 11) Stand Types – other (identify stand #) stand 26- non-productive
- 12) Amended prescriptions – (identify stand #) \_\_\_\_\_

STAND TYPES	CODE #
aspen and/or white birch	01
white pine, red oak	02
white pine	13
hemlock	04
sugar maple	05
beech, birch, sugar maple	06
beech, red maple	07
spruce	08
spruce/fir	09
pioneer species	10
mixed wood (25%-65% softwood)	11
other (identify other in section 11)	12
ESTA	13
open	14
significant wildlife habitat	15
special places and sensitive sites	16
miscellaneous	17

MANAGEMENT ACTIVITY CODES (if one of the following choices reasonably describes the planned management activity, use it. If not, use #13 other and describe the management activity in Section 10. Note these descriptions are for choosing codes only; they are not the silvicultural standards).

1. Non-commercial forest stand improvement

EVEN-AGED MANAGEMENT

2. Intermediate thinning
3. Shelterwood cut
4. Overstory removal cut
5. Clearcut
6. Progressive clearcutting

UNEVEN-AGEDD MANAGEMENT

7. Single Tree Selection
8. Group Selection

MISCELLANEOUS CHOICES

9. Salvage cut
10. Sugarbush management
11. Species conversion
12. No Activity
13. Other
14. Crop Tree Release
15. Invasive Species Control