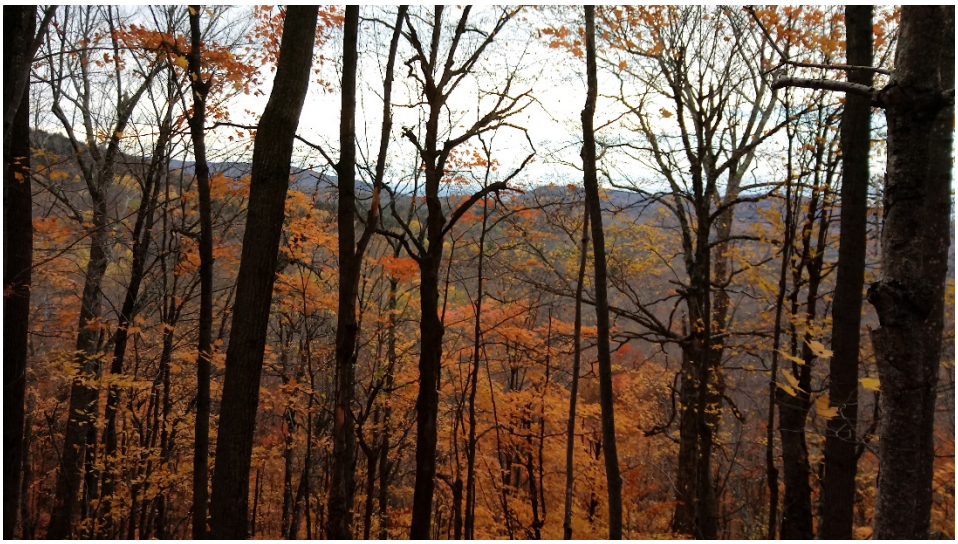
Forest Management Plan

Property of

Vermont Land Trust

"Hill-Robert Property"



located in

Starksboro, Vermont

March 2018

Prepared by

Caitlin Cusack
Stewardship Forester
Vermont Land Trust

Vermont Land Trust
Conserving Land for the Future of Vermont

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Caitlin Cusack 3/7/18

Caitlin Cusack **Date**
VLT Stewardship Forester
License # 148.0122334

Chris Olsen 3/30/18

Chris Olsen **Date**
Addison County Forester

Property Data Summary

Landowner's Name: Vermont Land Trust
Address: 8 Bailey Avenue, Montpelier, VT 05602
Town Where Land is located: Starksboro, Vermont
Grand List Description: 72.5 acres
Orthophoto: Addison Co. 2016 FSA Imagery
SPAN: 615-193-10910

Introduction

The following forest management plan was developed by and for the Vermont Land Trust (VLT) for the former Hill-Robert property in Starksboro, Vermont. This plan is intended to guide the management of the forest resource on the property for the ten-year period from 2018-2028, meet the requirements of the Vermont Use Value Appraisal (UVA) program and the requirements to serve as an Audubon Vermont Forestry for the Birds Demonstration Site. Use Value Appraisal status requires a commitment by the landowner to implement the plan as specified in the Schedule of Management Activities. The plan is consistent with the Vermont Land Trust's mission to conserve productive farm and forest lands that give Vermont its distinctive, rural character. It is the intent of this plan to guide the management of the property in a manner that is consistent with the state of Vermont's Stewardship Ethic which states:

> *Stewardship is an ethic recognizing that the land and its natural inhabitants have an inherent worth and that we have a responsibility to manage our actions as part of that. It guides us to manage our activities to the utmost of our abilities, to ensure the future health, productivity, and well-being of the land, its natural communities and species, and to allow our successors opportunities at least equal to ours to use the land and its resources.*

General Property Description

Location

The Hill-Robert lot contains 72.5 acres and is located in south-central Starksboro on the hillside above Russell Young Rd. The southern boundary line of the property is also the Starksboro – Lincoln town line. The eastern half of the property is highly visible from Route 17.

Topography

The lot is located along a ridge to the northeast of Mount Pleasant (2002' ASL) and west of the Monroe skyline. Terrain generally ranges from moderate to steep with a few flat and gently sloping areas in the north and western sections. Elevation ranges from 1600' to 1970' ASL. Because the property encompasses the ridgeline, aspect is variable from west, to north, to east.

Landscape Context

The property is located in the Northern Green Mountains biophysical region; an area that is cooler and moister than the Champlain Valley. The landscape surrounding the Hill-Robert property is roughly 80% forested, with the remainder of the land in agriculture or residential development. In fact, contiguous forest stretches far beyond the landscape

boundary in all directions. The Vermont Conservation Design (2015), a landscape-level conservation prioritization from Vermont Land Trust and the Vermont Agency of Natural Resources, considers the entire property to be part of a 'Priority Connectivity Block' providing critical ecological function on a statewide level.

Boundaries

A survey of the property was conducted in 1986 by Rodney Orvis (RLS #539). A stone pile along a stone wall marks the southwest corner. A section of the northern boundary is along the northern edge of an old woods road with evidence consisting of old blue paint and blazes. An iron pipe painted in blue was found at the northeast corner. Some old fence and old ribbons mark the southern portion of the western line. The western portion of the southern line is delineated by a stone wall for several hundred feet, then the line is more difficult to follow with some old fence sporadically visible. The blazes were repainted with red boundary marking paint in 2016. A small portion of blue paint was left at the top edge to maintain historic evidence.

Access

The property is accessed via Russell Young Road. The property has no road frontage, but two rights of way (ROW) exist. The first is an unrestricted 20' ROW from Russell Young Road to the northeast boundary corner. The second is a 20' winter only ROW from the Russell Young Road to the old woods road along the northern boundary. The ROWs cross a field that is conserved with the Vermont Land Trust.

History

In 1986 Jean M. Robert and Constance F. Robert conveyed Conservation Restrictions on an 11.9 acres (Parcel "A") to the Ottauquechee Land Trust (now the Vermont Land Trust) via a Warranty Deed and Grant of Development Rights, which is recorded in Volume 39, Pages 243-250. An additional 72.5 acres (Parcel " B ", the current property) were conveyed in fee to the Ottauquechee Land Trust in the same Warranty Deed. Conservation Restrictions on a third parcel, owned by Elisabeth B. Hill and Constance F. Robert, were also conveyed on 13.03 acres of land to the Ottauquechee Land Trust via Warranty Deed and Grant of Development Rights, and is recorded in Volume 39, Pages 236-242 of the Starksboro, Vermont land records.

Little is known about the history of the parcel prior to its acquisition by VLT. It is likely that portions of the property were cleared for agricultural use and other portions remained forested, perhaps used as a sugar bush. A forest management plan was originally developed for the property by Forest Resource Associates in 1988. In 1994, Greenleaf Forestry conducted a timber sale on the property and then updated the forest management plan in 1998. Dan Kilborn, VLT forester, prepared the 2008 management plan. No activity has occurred on the parcel since 1998.

At some point in the future VLT may decide to sell the property. If this occurs, a conservation easement will be placed on the property when it is sold. The easement will be held by VLT for the purpose of conserving productive forestry uses, wildlife habitats,

non-commercial recreational opportunities and activities, and other natural resource and scenic values for present and future generations.

Landowner Goals & Objectives

The primary goal of the landowner is to maintain a healthy and productive forest ecosystem that maximizes the opportunities for growing high-quality sawtimber or other non-timber forest products, such as maple sap. To accomplish this VLT will manage the property for a number of goals described below.

Conserve Forest Health

A healthy forest does not simply imply healthy trees, but also involves the conservation of soil resources, water quality, nutrient and energy cycles, and rare plant and animal species. Species diversity is directly related to forest health. Researchers at the University of Vermont have found that the presence of maple insect and disease pests, such as pear thrips, eutypella canker and sugar maple borer, have a significantly higher presence in stands that have less than 25% of the basal area in non-sugar maple. Sugar maple represents forty-five percent of the basal area on the property followed by red spruce (18%), paper birch (15%), yellow birch (7%) and associated species such as white ash, quaking aspen, and American beech. There was some sugar maple borer and eutypella canker damage observed on a number of sugar maples. Beech bark disease was also observed on some of the beech. Otherwise, no uncommon pathogens were noted during the inventory. Management activities that encourage species diversity will reduce the risk of future forest health impacts and develop a forest more resilient to climate change.

No non-native invasive plant species were noted on the property during the inventory. These plants can be introduced intentionally through landscape plantings or accidentally by birds, other wildlife, vehicle tires, boots or pets, so it is important to monitor the property annually. Particular attention should be given to areas that have been disturbed, such as recently harvested areas, roads and trails, and canopy gaps created by wind throw or tree mortality.

Produce High Quality Sawtimber and Non-Timber Forest Products

The forest will be managed for the production of large diameter, high quality forest products, primarily utilizing all aged silviculture techniques to regenerate species well suited to the site. VLT will consider leasing maple taps on the east side of the ridge to a neighboring sugarmaker.

Protect Water Quality and Forest Hydrology

The Hill-Robert property is located within the headwaters of the New Haven River Watershed in the Otter Creek Basin. Water from the property flows to the New Haven River to Otter Creek and eventually to Lake Champlain.

Two areas of seepage-driven, hardwood-dominated wetland occur in the southwestern corner of the property, supplied by seeps emerging on or at the base of the steep west-facing hillside. One such seep supplies a small headwater wetland that transitions to a narrow seepage slope and additional wetland off the property's western boundary. This

headwater wetland is somewhat linear in shape and characterized by yellow birch, red spruce, red maple (up to 24" in diameter), and paper birch. Red spruce occurs mostly in the midstory and understory, with a few overstory trees, suggesting a future where this species is more dominant. Other plants occurring here include striped maple, alternate-leaved dogwood, sugar maple, cinnamon fern, goldthread, foamflower, wild leek, blue cohosh, Jack-in-the-pulpit, sensitive fern, toothwort, melic mannagrass, water avens, water pennywort, and oak fern. The seepage in this wetland begins in hollows around trees at the upslope side of the wetland, which then opens to a more extensive swamp. It could be described as a Red Maple-Black Ash Swamp or a Red Spruce-Cinnamon Fern Swamp.

South of this wetland complex, additional seeps on or at the base of a rich hardwood forest slope supply another hardwood swamp that continues off the property's southern boundary down a gently sloping concave headwater slope. Ostrich fern, sensitive fern, hemlock, and green ash are a few of the species found in this complex. This wetland shares qualities of both a Red Maple-Black Ash Swamp and a Northern Hardwood Sloping Seepage Forest.

Due to the sensitive nature of wetland soils and the importance of Red Maple-Black Ash Seepage Swamps for certain species of breeding birds, amphibians and other wildlife species, the larger wetland along the western boundary will be enrolled as an Ecologically Sensitive Treatment Area (ESTA).

Protection of water quality and riparian zones is a primary objective on all lands owned by Vermont Land Trust. The wetland will receive a 50' operational buffer consistent with the publication *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont* (AMP's) prepared by the Vermont Department of Forests, Parks and Recreation dated October 22, 2016. Within 50' of these wetlands VLT will maintain a vegetated buffer with a natural level of canopy closure and retain large diameter legacy trees that will provide inputs of large diameter coarse woody material over time.

Appropriate measures must be taken before, during, and after harvesting operations to minimize erosion and sedimentation, including harvesting during times of very dry or frozen soil conditions. Much of the property is well drained and could be logged during a dry summer. The AMPs referenced above will be used as a guide for skid trail and landing design, maintenance, and post-harvest closure.

Conserve Soil Resources

The property is underlain by a primarily non-calcareous metamorphosed sedimentary slate, greywacke and conglomerate. The surficial geology is unsorted glacial till. This parent material interacts with other factors including climate, topography, living organisms and time to form three soil series on the Hill-Robert property—Peru fine sandy loam, Berkshire and Marlow stony loams, and Berkshire and Marlow extremely stony loams. The Peru loams are moderately well drained and underlie about a third of the property, including most of stand, 1 while the Berskshire and Marlow soil types are well drained. Pockets of enrichment on the western side of the ridge suggest a calcium

carbonate component to the glacial till. Here maidenhair fern, blue cohosh, and seersucker sedge grow. The steep slopes pose challenges to woodland management by limiting equipment operability and increasing the erosion hazard.

In order to maintain forest productivity, bole-only harvesting will be used throughout the forest so the biomass in twig and limb wood will be left on site to help buffer any nutrient loss due to leaching processes of acid deposition. Piles of fine woody material also provide cover and a nesting substrate for breeding birds such as veeries. Winter harvests will be used when appropriate to protect the soil from compaction and strict adherence to AMPs will control erosion.

Protect Rare Plants, Animals and Natural Communities

VLT Ecologist, Allaire Diamond, did a field assessment of the property and identified two hardwood-dominated seepage wetlands and a rich northern hardwood forest. The Vermont Department of Natural Heritage has not mapped any rare, threatened or endangered species on the property and none were observed during the inventory. If any are identified in the future, the Nongame Natural Heritage Program of the Vermont Department of Fish and Wildlife will be consulted to determine the best course of action.

Protect Historic and Cultural Resources

One stone foundation is located west of the ridge in stand 2. The foundation will be protected with a 25' equipment-exclusion buffer during timber harvesting activities.

Enhance and Protect Wildlife Habitat

Enhancement and protection of wildlife habitat easily complements other management objectives on the property. Perhaps the most notable wildlife attribute of the property is its position in a relatively large unfragmented block of forestland that provides interior forest habitat for area-sensitive birds and travel corridors for large mammals such as black bear and bobcat.

In July 2015, Audubon Vermont conducted a forest bird habitat assessment and concluded that while there were some small pockets of dense understory in small natural gaps, this important habitat feature for certain breeding birds was generally lacking. Further, although there are many snags on the property, many of them are smaller than 10" in diameter and therefore of lower habitat value. In addition, softwood should be selected as a priority in order to maintain its presence in the forest, thereby benefitting softwood-preferring bird species. Since then, annual bird monitoring has been conducted for the past two years during the breading season. Bird observations were made during 10-minute point counts at 4 monitoring points twice during June. The following responsibility bird species were heard by habitat type:

Mature hardwood/mixed hardwood

Black-throated blue warbler
Black-throated green warbler
Eastern Wood-pewee
Ovenbird
Blackburnian Warbler
Veery

Wood Thrush

Young hardwood/mixed forest
Chestnut-side warbler

Other species recorded include red-eyed vireos, blue jays, yellow-bellied sapsuckers, eastern phoebes, winter wrens, tufted titmice and red-tailed hawks. An ovenbird nest was observed in the spring of 2015.

During the 2017 inventory direct observations of wildlife and wildlife sign were recorded. A number of structural components were also measured to gauge the quality of wildlife habitat. The methods are described in the forest inventory section. A number of game animals, nongame birds and mammals, amphibians and reptiles use these structures for nesting, roosting, foraging, perching, and territorial or other displays. For example, pileated woodpeckers, yellow-bellied sapsuckers, great horned owls, barred owls, hairy woodpeckers, black-capped chickadees, red-tailed hawks, and winter wrens nest in cavities.

Overall the property has a low level of vertical and horizontal diversity and low age class diversity. Amounts of retained organic material such as downed logs, snags and cavity trees could be improved. American beech is the only nut-producing species present on the property. No soft mast producing species, such as black cherry or raspberry, were observed. During the forest inventory bear claw marks were observed on a couple of beech on the ridge and a pileated woodpecker was heard calling.

General guidelines[1] for wildlife include retention of hard and soft mast trees, where appropriate, to provide sources of food for various species. A minimum of six cavity or snag trees should be retained per acre (four should exceed 14 inches in diameter and two should exceed 24 inches) to provide habitat for forest birds and mammals. Fifteen downed trees (ten large down trees per acre with a diameter greater than 14" and 3-5 greater than 18") should be retained to provide habitat for small mammals, salamanders and mollusks. Achieving these levels of structure property-wide will be a long term process that will be achieved over many cutting cycles.

Enhance Non-Motorized, Non-Mechanized Recreational Opportunities
Properties owned by Vermont Land Trust are typically open to all forms of non-motorized, non-mechanized recreation. Providing this opportunity will be a secondary objective of management. It is currently unknown what level of recreational use the property receives. At a minimum the existing skid trails are used for occasional walking, hunting, cross-country skiing and snowshoeing by neighbors. ATV use is not allowed on the property and no signs of use were noted during the inventory.

[1] Vermont Department of Forests Parks and Recreation. 2015. Voluntary Harvesting Guidelines for Landowners in Vermont. Accessed on February 12, 2018. Available on the World Wide Web at: http://fpr.vermont.gov/sites/fpr/files/Forest_and_Forestry/Your_Woods/Voluntary_Harvesting_Guidelines/VHG_FINAL.pdf

Maintain Scenic Qualities
Maintenance of scenic qualities will be a secondary objective. Because the forest will primarily be managed using all aged silviculture techniques, long term aesthetic disturbance should be minimal. Aesthetic considerations also apply at a smaller scale in the forest during harvesting operations. Tops should be lopped to a uniform height during timber harvesting to help achieve this objective. Tops will not be lopped where the goal is to establish regeneration, as high tops may help deter browsing deer.

Climate change
Forests are always changing and responding to new conditions. At the same time, the climate is changing in ways that humans have never experienced before, resulting in rising temperatures and shifts in seasonal precipitation patterns. Climate change will not affect all forest species, communities, and parts of the landscape in the same way. Additional stress will amplify some threats that forests already face, such as invasive species, insect pests, forest diseases, and deer browse. Species and forest types that are more tolerant of disturbances may have less risk from climate change, and forests with greater diversity (species, genetic, and structural diversity) may also have less risk. Land managers can choose different forest management actions to resist change, boost resilience, or even encourage change, depending on their goals and tolerance for risk.

Ensuring that forests can adapt to climate change will also help ensure that forests continue to remove greenhouse gases from our atmosphere. Forests play a vital role in the earth's carbon cycle, as they remove carbon dioxide from the atmosphere and store it in biomass (trunks, branches, foliage, and roots) and soils. Sustainable forestry practices can increase the ability of forests to absorb and store atmospheric carbon while enhancing other ecosystem services, such as soil and water quality. Harvesting and regenerating forests can also result in net carbon sequestration in wood products and new forest growth.

The Hill-Robert property, generally-speaking, has a moderate to high level of species diversity for northern hardwoods, but not a lot of age class diversity. Enhancement of species and vertical diversity should be a priority. Past and future climate changes in Vermont, potential impacts to the Hill-Robert property, and tactics for adapting to climate change are summarized in Table 1 included in Appendix A and the Climate Change Adaptation Plan (VLT, 2017).

Inventory Overview

A timber inventory cruise was conducted in October, 2017 to evaluate forest stand conditions. The cruise design consisted of variable radius, 10 BAF prism points systematically located on a 6 chain by 6 chain grid covering the entire forested portion of the tract. I added a third inventory point to stand 1 at the same location where I annually collect bird data. In total, 19 points were established on 68 acres of forest, which translates to 1 sample point for every 3.6 acres.

For uneven-age stands the tally included all trees in the 6-inch class and larger, and for even age stands the tally included all trees in or touching the main crown canopy (excluding suppressed trees). For every tree tallied in each sample point, variables measured included 1) tree species, 2) diameter of tree at breast height (DBH), 3) canopy position, 4) classification of tree as either “acceptable” or “unacceptable”, 4) type and number of merchantable products of each tree in 8 foot sections.

A 1/1000th of an acre fixed 3.72’ radius plot was embedded at each sample point to quantify regeneration. Each woody stem less than 2” in diameter within the regeneration plot was counted and recorded by species.

A 1/10th of an acre fixed 37.2’ radius plot was embedded at each sample point to quantify course and fine woody material. The number of logs >3’ in length and >10” in diameter were recorded. For logs with multiple stems, one log should be tallied for each stem >= 10”. Any piece partially in the plot is included. Dead trees that are leaning >45 degrees are considered Coarse Woody Material; otherwise they are standing dead trees (snags). Fine Woody Material (FWM) was recorded as the number of piles, which are clustered groups of small branches >3” in diameter (tree tops, slash, etc.) that would be sufficient to provide cover and feeding opportunities for birds. Any pile partially in the radius is included.

Additional data collected at sample points included forest type, size class, timber stocking level, stand structure, crown cover, horizontal and vertical diversity, and water resources. The data was then processed with the NED-2 software produced by the U.S. Forest Service.

The stocking level of each stand was determined using USFS stocking guides. The stocking level is determined by comparing the basal area of a stand with that of a stand that produces the maximum annual growth per acre (Figure 1).

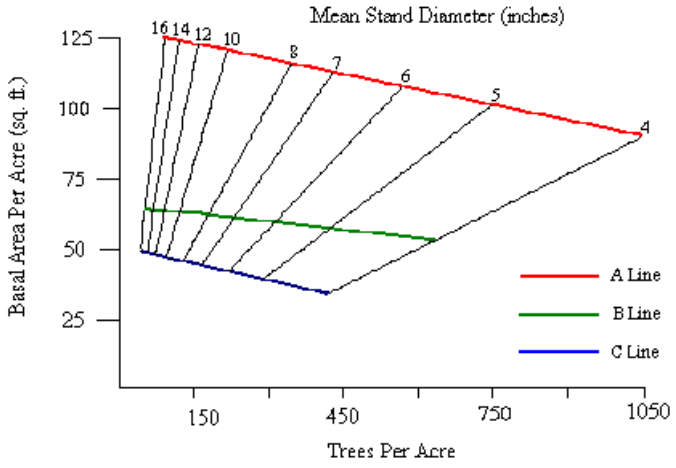


Figure 1: Stocking guide for main crown canopy of even-aged hardwood stands (beech-red maple, beech-birch-maple) shows basal area and number of trees per acre and quadratic mean stand diameter. The A line is fully stocked, the B line is suggested residual stocking, and the C line is minimum stocking. USFS Research Paper NE-603

Forest stand typing was done after the timber cruising, and is based on digital orthophotographs, information gathered at each sample point, as well as field observations made between points on cruise lines. Stand typing is based on tree species, size class and crown closure (Figure 2). For example, a stand type of H3B represents a predominately hardwood stand, a size class of "3" (with most stems being pulpwood sized, 5"-11" DBH), with crown closure of "B" (between 61% and 80%). Sometimes a secondary species group code is used if the stand consists of a mix of hardwood and softwood species. For example, a stand typed as SH3C is a predominately softwood stand with a significant component of hardwoods. As a comparison, a HS3C type is similar in size class and crown closure to the SH3C, but is predominately hardwood with a significant component of softwood. These stand types are found on the attached Forest Stand Map.

Figure 2

Size Class and Density Codes used for forest stand types

Size Class		Crown Closure	
1	Seedling or Cutover: 90% of stems in stand are less than 1" DBH	A	81-100%
2	Sapling - Small Poles: Over 50% of stems in stand are 1" to 4" DBH	B	61-80%
3	Pulpwood Size: Over 50% of volume in stand is in stems between 5" and 11" DBH	C	31-60%
		D	0-30%
4	Sawlog Size: Over 50% of volume in stand is in stems greater than 11" DBH		

Stand Number: **1**

Stand Size: **12 measured acres**

Cover Type: **HS4A – Red Spruce-Sugar Maple-Beech (SAF 31)**

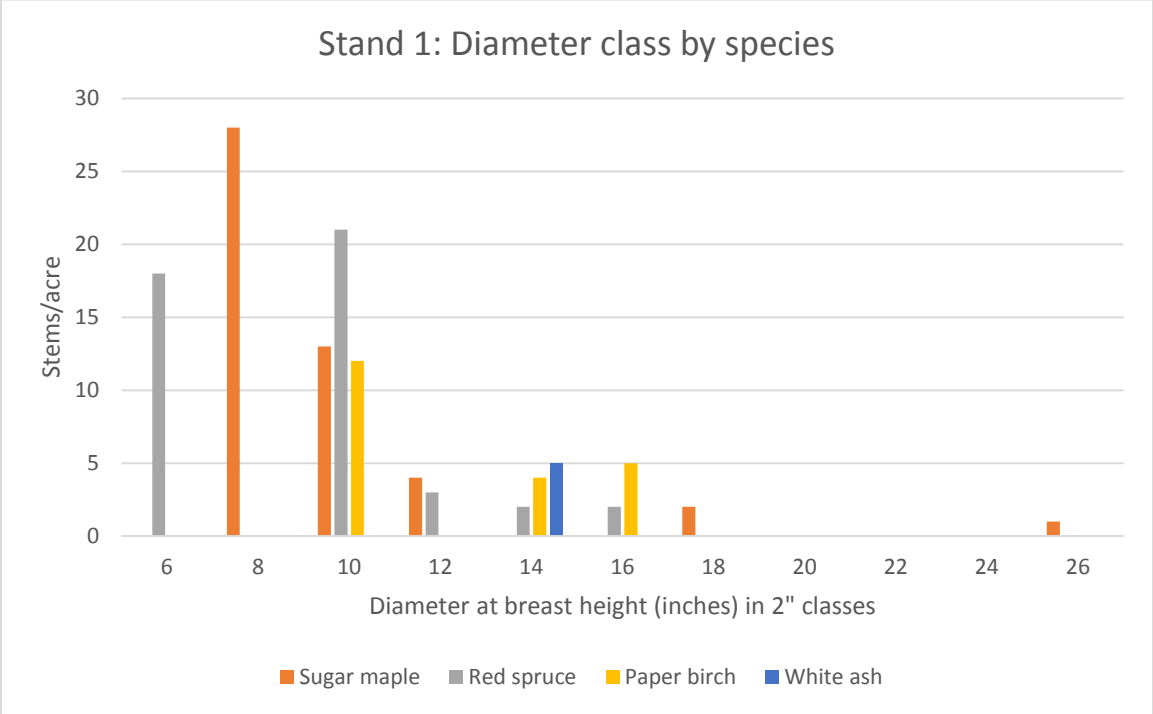
Natural Community Type: **Northern Hardwood Forest or Red Spruce-Northern Hardwood Forest**

Stand Summary: 3 plots, 10 BAF

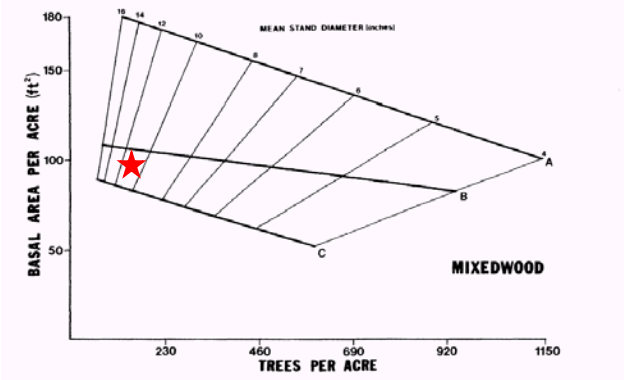
Total Basal Area/Acre	86	sq.ft.
Acceptable Basal Area/Acre	66	sq.ft.
Quadratic Mean Stand Diameter	11.3	in.
Stems/Acre	124	
Sawtimber Volume	2,249	bd.ft./acre
Cordwood Volume	13	cords/acre

Structure & Composition: This stand most likely reverted from pasture 80-100 years ago, as indicated by scattered open-grown, candle arbor-shaped hophornbeam, stone walls, its close proximity to the existing field edge, and slope. Although it is likely that portions of it were used as a sugarbush where large-diameter sugar maple legacy trees remain in clusters. As the forest returned, two age classes have established: an overstory of red spruce and paper birch, and new cohort of pole-sized sugar maple that has established over time as the leaf litter developed and soils recovered from agricultural use. Species present include red spruce (30%), sugar maple (38%), and paper birch (20%). Less abundant associate canopy species include white ash, quaking aspen, yellow

birch and hophornbeam. Overall the abundance of mast trees was low.



According to the stocking guide for even-aged mixedwood stands containing 25-65% softwood, this stand is understocked, below the B-line stocking. The B line (the recommended stocking level after a harvest) for this type of stand is 105 sq. ft. (Leak, Yamasaki, and Holleran; 2014)



Previous activity

Harvesting activity within the last several decades has been light. The stand was treated in January 1998 with a single tree selection harvest. No cutting has occurred since this treatment.

Size Class Distribution		Existing Basal Area (sq. ft./acre)		
(name)	(inches DBH)	Total	AGS	UGS
Seedlings-Saplings	2-4”	0	0	0
Poles	6-10”	31	31	0
Small sawtimber	12-14”	32	25	7
Large sawtimber	16”+	20	10	10
Elders and seedlings	24”+ and declining	3	0	3
Total		86	66	20

Most of the stand has a patchy two-aged vertical structure with a low level of diversity. Regeneration in the 0-5’ layer is dominated by white ash and sugar maple with scattered pockets of red spruce. Herbaceous species include intermediate wood fern, Christmas fern, winterberry, long beech fern, hay-scented fern, interrupted fern, and wood sorrel. Sugar maple dominates the 6-30’ layer with American beech, striped maple and pockets of red spruce as associates.

The number of snag and cavity trees for most cavity-nesting bird and small mammal species appears adequate, but recruitment of snags and cavity trees >18” could be improved. The amount of large downed woody material (DWM) could also be increased to benefit wildlife, as summarized in the table below.

	Existing (#/acre)	**Goal (#/acre)**
Snags/Cavity ≥6” and ≤12”	24	
Snags/Cavity >12” and ≤18”	7	4
Snags/Cavity >18” and ≤24”	2	
Snags/Cavity > 24"	1	2
Down trees >10”	7	
Down trees ≥14” and <18”	0	10
Down trees ≥18”	0	3-5

Regeneration: Regeneration of desirable species (mainly sugar maple and white ash) is patchy throughout the stand.

Species	**Stems/acre**
Sugar maple	666
White ash	2000
Paper birch	666
Striped maple	666

Soil Type: Berkshire and Marlow, and Peru

Site Class: I & II (by soils).

***Access and Operability*:** Good access to the stand is available from the existing woods roads. Some portions of the stand may require special care to work around the steep slopes and fragile soils near seeps.

Long-term Management Objectives: Manage the stand using uneven age management techniques in order to:

1. produce high quality veneer and sawtimber;
2. enhance wildlife habitat, specifically breeding bird habitat for responsibility bird species, by increasing the number of standing snags, amount of large diameter coarse woody material, and increasing vertical structure in the 0-5' and 6-30' layer;
3. retain a diversity of tree species well suited to the site, including a spruce component in the seepage forest and northwest-facing slope;
4. monitor for non-native invasive plant species and remove immediately upon detection;
5. protect soil and water quality by leaving tops and limbs in the woods and harvesting during frozen ground or dry summer conditions;
6. provide opportunities for non-motorized recreation;
7. contribute to the scenic qualities of the Route 17 corridor.

Cutting Cycle: approximately 15-20 years.

Target Diameters: Target diameters for all species will be as follows:

- Sugar maple, white ash, yellow birch - 18" - 22" DBH
- American beech - 16" - 18" DBH
- White birch, red maple, red spruce - 14" - 16" DBH

Management Activities: While the stand density and sawtimber volume is not critically high, the stand would benefit from a light crown thinning to remove mature or declining red spruce and white birch in favor of more vigorous red spruce sawtimber and sugar maple poles. As a guide during the harvest, approximately 10 ft^2/acre should be removed from the small sawtimber size classes and 10 ft^2/acre from the large sawtimber size classes. While this is technically a mixedwood stand, the softwood component is low so the residual basal area of 65-70 ft^2/acre, typical of hardwood stands as proposed in 2008, seems more appropriate. There are a couple of patches of red spruce advanced regeneration. Removal of two small groups (no more than $1/10^{th}$ of an acre) of mature, declining, or unacceptable growing stock in the overstory to release this regeneration will continue the conversion to an all age stand.

Additional Activities:

- Retain and permanently mark wind-firm "legacy" trees that are >24" in diameter, with cavities or other defects that deem them to be unacceptable growing stock.

- Protect existing large coarse woody material and large snags during harvest operations.
- Leave tops and limbs in the woods.
- Species that are underrepresented in the stand, such as quaking aspen and yellow birch, should be retained for diversity and as a source of seed.
- Retain existing large diameter (>18” diameter) snag and cavity-trees.
- Identify and retain any disease-resistant beech trees and buffer around them to protect the tree from sunscald and possible wind throw.

Stand Number: **2**

Stand Size: **57 measured acres**

Cover Type: **H4B – Sugar Maple-Beech-Yellow Birch (SAF 25)**

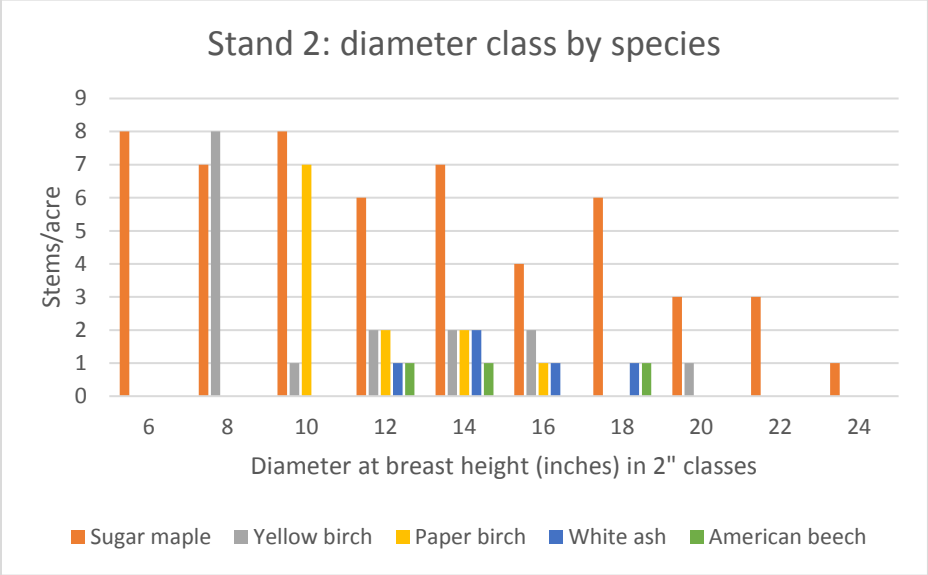
Natural Community Type: **Northern Hardwood Forest with an inclusion of Rich Northern Hardwood Forest**

Stand Summary: 16 plots, 10 BAF

Total Basal Area/Acre	104	sq.ft.
Acceptable Basal Area/Acre	58	sq.ft.
Quadratic Mean Stand Diameter	13.4	in.
Stems/Acre	97	
Sawtimber Volume	3,947	bd.ft./acre
Cordwood Volume	13	cords/acre

Structure & Composition: This is an all aged northern hardwood stand of sugar maple (58%), yellow birch (13%), paper birch (10%), white ash (7%). Less abundant associate canopy species including American beech, quaking aspen, red maple, green ash, striped maple and hophornbeam. Overall the abundance of mast trees is low. Sugar maple is present in all age classes. As was noted in the 2008 FMP, the size-class distribution can

be managed for the maximum production of quality sawlogs.



According to the stocking guide for even-aged hardwood stands, this stand is overstocked, above the B-line stocking. The B line (the recommended stocking level after a harvest) for this type of stand is about 65 sq. ft. (Leak, Yamasaki, and Holleran; 2014)

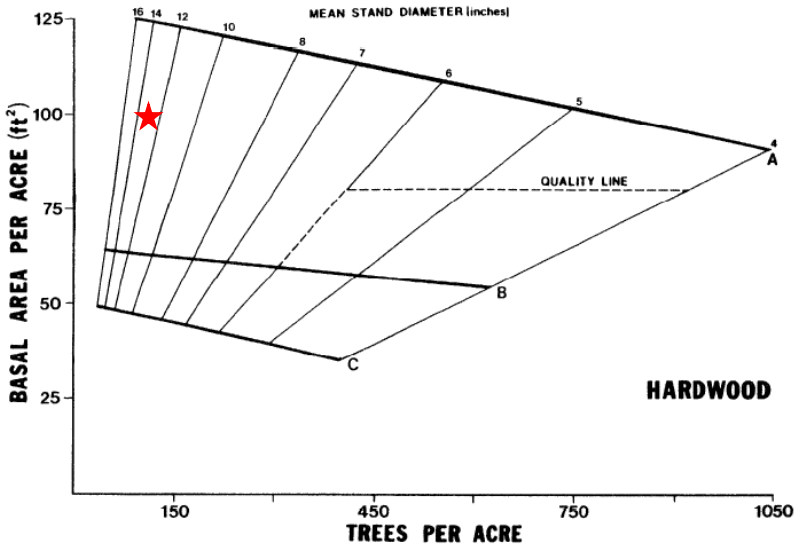


Figure 6.—Stocking guide for main crown canopy of even-aged hardwood stands (beech-red maple, beech-birch-maple) shows basal area and number of trees per acre and quadratic mean stand diameter. The A line is fully stocked, the B line is suggested residual stocking. The C-line is minimum stocking. The quality line is the density required to produce high quality stems of beech, sugar maple, yellow birch, and red maple.

Previous activity: Harvesting activity within the last several decades has been light. The stand was treated in January, 1998 with a single tree selection harvest. No cutting has occurred since this treatment.

Size Class Distribution		**Existing Basal Area (sq. ft./acre)**		
(name)	(inches DBH)	Total	AGS	UGS
Seedlings-Saplings	2-4”	0	0	0
Poles	6-10”	19	10	9
Small sawtimber	12-14”	27	16	11
Large sawtimber	16”+	51	31	20
Elders and seedlings	24”+ and declining	7	1	6
Total		104	58	46

Most of the stand has a patchy two-aged vertical structure with a low level of diversity. Sugar maple and, to a lesser extent, American beech dominate the 6-30’ layer with scattered pockets of red spruce, white ash, yellow birch, hophornbeam and striped maple. Regeneration in the 0-5’ layer is dominated by sugar maple and patches of red spruce and American beech. Herbaceous species include intermediate wood fern, Christmas fern, winterberry, long beech fern, hay-scented fern, interrupted fern, ground cedar, marginal wood fern, tree club moss, lady fern, and wood sorrel. Allium, foam flower, seersucker sedge, blue cohosh, and maidenhair fern occur in pockets of enrichment in the rich northern hardwood inclusion along the western toe slope.

As with stand 1, the number of snag and cavity trees for most cavity-nesting bird and small mammal species appears adequate, but recruitment of snags and cavity trees >18” could be improved. The amount of large downed woody material (DWM) could also be increased to benefit wildlife, as summarized in the table below.

	Existing (#/acre)	**Goal (#/acre)**
Snags/Cavity ≥6” and ≤12”	5	
Snags/Cavity >12” and ≤18”	5	4
Snags/Cavity >18” and ≤24”	0.6	
Snags/Cavity > 24"	0.9	2
Down trees >10”	9	
Down trees >14”	1.9	10
Down trees >18”	1.25	3-5

Regeneration: Regeneration of desirable species (mainly sugar maple and white ash) is patchy throughout the stand. As mentioned in 2008, hay-scented fern was controlling small areas of the forest, particularly on the ridge.

Species	**Stems/acre**
Sugar maple	937.5
White ash	1000
American beech	562.5
Black cherry	562.5
Paper birch	562.5
Striped maple	187.5

Soil Type: Berkshire Marlow, and Peru

Site Class: I & II (by soils).

***Access and Operability*:** Good access to the stand is available from the existing woods roads. Some portions of the stand may require special care to work around the steep slopes and fragile soils near seeps.

Long-term Management Objectives: Manage the stand using uneven age management techniques in order to:

1. produce high quality veneer and sawtimber and non-timber forest products, such as sap;
2. enhance wildlife habitat, specifically breeding bird habitat for responsibility bird species, by increasing the number of standing snags, amount of large diameter coarse woody material, and increasing vertical structure in the 0-5’ and 6-30’ layer;
3. retain a diversity of tree species well suited to the site, including rich northern hardwood forest natural community on the mesic calcium-rich toe slope west of the ridge;
4. monitor for non-native invasive plant species and remove immediately upon detection;
5. protect soil and water quality by leaving tops and limbs in the woods and harvesting during frozen ground or dry summer conditions;
6. provide opportunities for non-motorized recreation;
7. contribute to the scenic qualities of the Route 17 corridor.

Cutting Cycle: approximately 15-20 years.

Target Diameters: Target diameters for all species will be as follows:

- Sugar maple - 18" - 22" DBH
- White ash, yellow birch - 18" - 20" DBH
- American beech - 16" - 18" DBH

- White birch, red maple, red spruce - 14” - 16"DBH

Management Activities: Based on NE – 603: Silvicultural Guide for Northern Hardwood Types – Prescription D: “This stand has suitable quality, structure and basal area to implement uneven-age management. Develop and apply marking guides to meet goals for residual basal-area structure, tree condition, and regeneration. Consider both single-tree and group selection.” Silviculture with Birds in Mind Option 2B (Hagenbuch et al., 2011) recommends a single tree and small group selection harvest.

As a guide during the harvest, approximately 10 ft^2/acre should be removed from the small sawtimber size classes and 20 ft^2/acre from the large sawtimber size classes to begin to transition to the traditional reverse J-shaped growth curve. Single tree selection should be used to remove single mature trees and poor quality trees competing with crop trees. Small group selection should be used to establish or promote regeneration and increase species and age class diversity. The majority of the groups should be relatively small (approximately $1/10^{th}$ of an acre) to encourage the reproduction of shade tolerant sugar maple and release patches of sugar maple and red spruce advanced regeneration. In an effort to improve species diversity an occasional larger group (up to ½ acre) should be utilized in areas of unacceptable growing stock (declining white birch and poorly formed or borer-damaged sugar maple) particularly east of the ridge where beech is more common. This larger gap will promote the establishment of intermediate shade tolerant species such as yellow birch and white ash. No more than $1/5^{th}$ of the stand area (approximately 11 acres) will be regenerated in this entry. The residual basal area between the groups should be no lower than 70 ft^2/acre, higher (80-85 ft^2/acre) in the wetter soils to the west of the ridge. Consider planting oaks on the ridge in gaps where hay-scented fern dominates and it will be hard for natural regeneration to establish.

Additional Activities:

- Retain and permanently mark wind-firm “legacy” trees that are >24” in diameter, with cavities or other defects that deem them to be unacceptable growing stock.
- Protect existing large coarse woody material and large snags with a buffer during harvest operations.
- Leave tops and limbs in the woods.
- Species that are underrepresented in the stand, such as red maple, green ash and quaking aspen, should be retained for diversity and as a source of seed.
- Retain existing large diameter (>18” diameter) snag and cavity-trees.
- Identify and retain any disease-resistant beech trees and buffer around them to protect the tree from sunscald and possible wind throw.

Schedule of Management Activities

Stand	Year	Management Activity
---	Ongoing	Boundary line maintenance
1	2018	Crown thinning, residual basal area of 65-70 ft^2/acre with two small (less than $1/10^{th}$ of an acre) gaps to release red spruce advanced regeneration
2	2018	Single tree & small group selection harvest, residual basal area no lower than 70 ft^2/acre, higher (80-85 ft^2/acre) in the wetter soils to the west of the ridge
All	2028	Re-evaluate stand conditions & update management plan

NOTE: Use Value guidelines allow for carrying out the individual prescribed activity within three years before or after the indicated year of implementation. In most cases a suggested time schedule can be adjusted to compensate for market conditions, operating conditions as influenced by the weather, and other reasonable factors that might cause postponement or delay.

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Appendix A – Table 1 Climate Change Impacts and Adaptation Tactics

Past & future climate changes	Property-level impacts	Adaptation tactic
Temperatures have risen more than 2°F since the late 1800s, with the greatest warming occurring in winter (more than 3°F increase). By the end of this century, average annual temperatures are projected to increase another 5-10°F, increasing both the length of the growing season and the frequency of extremely hot days.	A longer growing season, warmer temperatures, and more variable summer rain are likely to increase summer moisture stress leading to potentially harmful droughts. This could cause moisture stress for trees on the Hill Robert property, particularly those growing in the well-drained soils along the ridge, and may impact regeneration success. Hay-scented fern may further impede or compete with new seedlings for moisture and light.	Maintain and enhance species diversity. Implement single tree selection harvests to regenerate sugar maple and small group selection harvests (up to ½ acre) to encourage yellow birch and other intermediate species. Smaller openings maintain more canopy, thus providing shade that can help maintain soil moisture if drought stress is increased. Cut mature aspen to encourage coppice growth. Consider planting oaks on the ridge in gaps where hay-scented fern dominates and it will be hard for natural regeneration to establish. Increased attention will be needed to ensure harvesting tracks proper seed timing and creates conditions for regeneration of desired species.
Annual precipitation has increased by several inches during this time. The heaviest rainfall events increased 71% in the Northeast U.S. during 1958 to 2012, and this trend is expected to continue. Additionally, warmer temperatures will result in more rain than snow.	Increased surface water runoff may change ephemeral stream flow and will require careful road maintenance to prevent hydrologic impacts and erosion. A shorter winter with less snowpack will limit the harvest window for accessing the western half of the property. More saturated soils coupled with windstorms can lead to greater wind damage to the timber resource. With more rain than snow during the winter will increase the probability of ice storms.	Maintain wind-firm trees and trees with branching structure better able to withstand snow and ice loads as legacy trees and leave trees. Particularly on the western side of the ridge, orient gaps in a SW/NE direction to limit edge exposure to prevailing winds. Retain a protective strip along the field edges to protect interior trees from direct wind exposure. Permanently mark legacy trees. Protect existing large coarse woody material and large snags with a buffer during harvest operations. Leave tops and limbs in the woods.
As the climate continues to change, conditions are expected to become less favorable for many northern and boreal tree species, such as spruce and fir, but habitat will become suitable for more southern species, such as oaks and hickories. Conditions affecting tree regeneration and recruitment will change in New England.	The spruce/fir component, despite most of its presence being the result of past land use, may be reduced with warming temperatures. The cooler microsite with high moisture toward the toe slope could be a local refuge for these species.	Maintain a spruce-fir component on the property in the seepage forest and northwest-facing slope in stand 1 by placing groups in areas to release softwood advanced regeneration, thinning around immature spruce growing stock and retaining spruce legacy trees for future seed. Manage mesic calcium-rich slope and toe slope west of the ridge for rich northern hardwood forest natural community. Retain all basswood, use single tree and group selection to regenerate sugar maple and white ash. Retain large-diameter legacy sugar maples along the southern boundary.
Certain insect pests and pathogens, such as the emerald ash borer and forest tent caterpillar, and invasive plants, such as honeysuckle and barberry, will increase in occurrence or may become more damaging.	No invasive plants have been detected on the Hill-Robert property. If they should become established and spread they can simplify stand structure, exclude native plants, inhibit regeneration of desirable species and reduce overall biodiversity. Exotic earthworms have invaded stand 1. They may spread more rapidly and impact the regeneration of desirable spices by changing soil structure and chemistry. Coupled with drought, forest tent caterpillar and other pests can further stress host trees, particularly sugar maple.	During the annual monitoring visits include monitoring for non-native invasive plants in the protocol. Focus invasives monitoring on skid trails, field edges, and access points. Remove invasive plants as they are detected. By reducing the number of trees in the stand, thinning concentrates more insects on each remaining tree. Therefore, postpone harvesting where forest tent caterpillar or other pests are building. If defoliation by forest tent caterpillars has occurred, “tap conservatively” (not tapping small diameter trees, or with more than one tap regardless of diameter) and delay thinning or other harvesting for up to 3 years. Uneven age management will increase age class diversity. Group selection will increase species diversity. Both strategies should decrease pest impacts.

USE VALUE APPRAISAL PARCEL DATA ENTRY FORM

☐ new ☒ update[1] ☐ amendment[2] ☐ change of ownership

FP&R COUNTY FORESTER USE ONLY

Parcel ID For Data Entry (by state) # __ __ __ __ __, __ __ __ __ __ — __ __ __ __ __

Year of Entry _____

Year of Plan _____

Year of Last Inspection _____

1) Landowner Name (last name, first name) Vermont Land Trust

2) Landowner Address (Street, PO Box) 8 Bailey Ave

(Town) Montpelier (State) VT (Zip Code) 05601

Phone Number 802-861-6504 Email Address caitlin@vlt.org

3) Town That Parcel Is In Starksboro 4) Total Forestry Acres in Parcel 72.5 (Grand list acreage, minus active agricultural and open land and exclusions)

5) Plan Preparer (last name, first name) Cusack, Caitlin 6) Previous Owner (last name, first name) _____

7) SPAN 615-193-10910

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
1	11.9	Even	I, II	11	11.3	86	66	2	2018
2	57.6	Uneven	I, II	06	13.4	104	58	7, 8	2018
3	2.9	ESTA		13					

[1] Update of an existing plan that includes all new stand descriptive data required every 10 years at minimum.

[2] Change to an approved existing plan does not change the 10-year cycle of the existing plan. If this form is filed with an amendment, indicate the amended information in the appropriate stand, and write an explanation in section 12. Amendments must be signed by the landowner(s).

9) No activity – (identify stand # and reasons) _____

10) Management Activities – other (identify stand #) _____

11) Stand Types – other (identify stand #) Stand 3 - ESTA - Red Maple - Black Ash Seepage Swamp

12) Amended prescriptions – (identify stand #) _____

STAND TYPES	CODE #
aspen and/or white birch	01
white pine, red oak	02
white pine	03
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-AGED 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

Rev. 11/9/09