Forest Management Plan

PROPERTY of THE TOWN of MONTGOMERY

MONTGOMERY, VERMONT

MAY 2021

A Vision for the Montgomery Town Forest

The Montgomery Town Forest is a public land, open to all, that is a cherished resource of our community. Our vision for this land is that it is responsibly managed for sustainable forest products, watershed protection, wildlife habitat and connectivity, educational, and non-motorized recreational purposes. We also desire that the Town's stewardship of these lands will serve as an exemplary demonstration and an inspiration for other forest landowners.

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I. Property Data Summary

Prepared for:	The Town of Montgomery
Address:	PO Box 364 Montgomery Center, VT 05471
Phone:	(802) 326-4719
SPAN #:	402-125-10896
Town Where Land is Located:	Montgomery, Vermont
Grand List Acreage:	50.3 acres
Ortho Photo Number:	#136260, 140260; 2008
Sampling Method:	variable radius plot sampling; 10 baf prism
Inventory Date:	May 8th 2021

II. Introduction

This Forest Management Plan for the Montgomery Town Forest is designed to:

1. Analyze the timber and non-timber related natural resources on the property
2. Identify property objectives within the framework of landowner goals
3. Make recommendations for any timber stand improvements that may be possible in light of current stand conditions
4. Make recommendations for wildlife habitat enhancement or to improve recreation potential
5. Fulfill the requirements of Vermont's Use Value Appraisal (Current Use) Program (although not eligible as this is a municipally owned parcel); to update the January 2005 Forest Management Plan for the parcel; to fulfill the requirements for the Natural Resource Conservation Service (NRCS) Conservation Activity Plan (CAP).
6. Outline a comprehensive Schedule of Management Activities for plan implementation.

III. General Description

The Montgomery Town Forest is located in the southwest portion of the town of Montgomery, west of West Hill Road, and adjacent the Enosburgh town line. Access is via Class IV road extending west from the snow plow turn around at the junction with West Hill Extension. The eastern boundary of the parcel is West Hill Brook. The property is listed at 50.3 acres, with the entirety in productive forest. The terrain on the property is gradually sloping to the east. Future harvest operations utilizing heavy equipment may be limited to winter frozen ground conditions on portions of the property due to soil types and associated erosion concerns, though summer harvesting is recommended when feasible in some stands to scarify soil and encourage greater regeneration in priority species.

The property is located in the Northern Green Mountain biophysical region. The summer temperatures in this region are often 20 degrees cooler than the Champlain Valley. The Northern Green Mountains have the shortest growing season, and the coldest winter temperatures in Vermont are found on northern slopes. Annual precipitation can also be much greater, receiving up to twice as much as in the Champlain Valley. The present formation of the Greens is the result of glacial activity that carved the older metamorphic bedrock of these mountains 20,000 years ago.

The dominant soils found on the property are of the Woodstock rock-outcrop complex, Cabot, and Peru series. *Woodstock* soils make up about 30% of Franklin county soils. The Woodstock out-crop soils are a mix of Woodstock, Tunbridge, and Stowe soils that are intermixed with a bedrock primarily composed of Schist. The Schist bedrock is generally low in essential nutrients, but local sources of enrichment do exist. The bedrock will make up 40-50% of the area, with the Woodstock soils making up another 40%. The Tunbridge and Stowe soils are minor components. This soil type is excessively well-drained, with pockets of deeper loamy soil that has accumulated in undulating depressions over the years since the last glaciation. They are relatively shallow to bedrock (12-20”), potentially restricting root development, and are excessively to somewhat excessively well drained. The productivity on Woodstock soils is good, especially where soil had accumulated in the many hollows and between rock outcroppings. Woodstock soils have a forest productivity rating of II. *Cabot* soils are extremely stony and formed in glacial till that is derived from mainly schistose rock. These soils are deep and somewhat poorly drained and commonly have a fragipan at a depth or 12-15”, creating a perched water table and seasonally wet soils or ponding after periods of heavy rain. These soils also have a productivity rating of II. *Peru* soils are deep, moderately well drained fine sandy loam and can be stony to extremely stony. They formed in glacial till derived from quartzite, phyllite and schistose rock. Like Cabot soils, they commonly have a fragipan, though deeper at about 20” which may result in a seasonally high water table as well as prevent root penetration. These soils are found on the slopes of the Green Mountains and in the Champlain Valley, and have a forest productivity rating of I, the highest productivity rating for forested soils in Vermont.

Long term objectives for the property are to conserve the land in a forested condition, and practice long term forest stewardship that increases the health of the forest and the quality of the timber resource. Primary objectives also include the enhancement of wildlife habitat, and the maintenance of forest aesthetics associated with recreational use of the parcel.

IV. Management Planning

This Forest Management Plan is intended to be a guide in the ongoing management of the forest resources. It is designed for the 20-year period 2021-2041, with re-evaluation and updating on a ten-year cycle. A Schedule of Management Activities (Section VII) is included which specifies silvicultural treatments and other work for the 20 year period. Activities suggested for the immediate ten year period (2021-2031) are more detailed and specific than the following period. It is intended that upon re-evaluation activities for the subsequent ten years be more clearly defined. It is understood that modifications to the plan activities or schedule may be necessary as landowner objectives change. ***Any changes to the management activities prescribed herein must be approved by amendment by VT FPR Staff prior to execution.***

This management plan meets the requirements of the Use Value Appraisal Tax Program (*although the parcel is not eligible for enrollment given that it is municipally owned—information here for educational purposes)*. Use Value Appraisal status requires a commitment by the landowner to implement the plan as specified in the Schedule of Management Activities. Compliance with the plan is monitored by completion of each of the prescribed activities. It should be noted that the indicated year of implementation is, in most cases, a suggested time schedule that 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. Use Value guidelines allow for carrying out the individual prescribed activities within three years before or after the date. Compliance with the Use Value Appraisal Program and the management plan is reviewed annually through submission of a conformance report indicating activities completed, and by periodic field review by the County Forester. Landowners should be aware that when they place their land in the Use Value Program there is a permanent lien attached to their Deed by the State. This lien is removed if the state can no longer fund the program or if the landowner pays the land use change tax. The land use change tax is ten percent (10%) of the assessed fair market value on any land discontinued from the program, regardless of how long the land has been enrolled.

This Forest Management Plan also meets the requirements of the Natural Resource Conservation Service (NRCS) Vermont Conservation Activity Plan (CAP) program. Individual practices with the potential to be implemented on the property through the Environmental Quality Incentives Program (EQIP) are identified here-in, the location of which shown on the Forest Stand Map which accompanies this plan.

V. General Land Management Requirements

Forestry

Landowner objectives identify long term forest management that increases the health of the forest and the quality of the timber resource in concert with other objectives, primarily sugarbush management. As is evident on the property, there are a mixture of desirable and undesirable species, well-formed and mis-shaped trees, healthy and diseased trees, young growing stock, and mature timber. Management activities on the property are designed to remove defective and over-mature trees not retained as legacies, as well as a portion of the mature sawtimber, releasing quality stems in the understory while at the same time maintaining an ideal stocking for the production of high quality saw timber. Thinning is recommended in areas which have become over-stocked or are reaching a fully stocked condition in an effort to increase tree growth and vigor, and allow for full crown development. Harvests will also allow for the advancement of established regeneration, though regeneration is generally not a problem on the property. Species to be managed for on the property include sugar maple, white ash, northern red oak, black cherry, red maple, yellow birch, eastern hemlock, balsam fir, and red spruce. Trees should be selected based on stem character and crown development, as well as overall health and vigor. Amenities to wildlife such as mast, browse and cover should be considered as well. Both even-aged and uneven-aged silvicultural techniques will be implemented on the property. Other stands will be converted to an uneven-aged structure in the future. Specific recommendations based on the inventory conducted, follow in Section VI.

In an even-aged system the goal is to create large disturbances that result in the establishment of shade intolerant species such as pine, oak, birch or aspen. This system is also appropriate for natural communities that in nature regenerate after larger disturbances from wind or insect defoliation such as spruce-fir. The shelterwood system is an even-aged method for regenerating more shade tolerant species. An overstory is retained in the stand until the desired regeneration has become established. In all even-aged methods the overstory is eventually removed. A delayed shelterwood could retain a component of the overstory.

In an all-aged management system the goal is to mimic an undisturbed natural forest. In an undisturbed site, the trees will grow to biological maturity and die as individual trees or in small groups due to minor wind-throw events. In Vermont, the climax types that regenerate themselves and develop an all-aged system are northern hardwood (beech-birch-maple), hemlock, and red spruce. This natural disturbance paradigm for management coincides with small, frequent disturbances forming canopy gaps that result in diverse mosaic of age classes dominated by late successional species.

The all-aged system has an equal distribution of stand basal area in each of the following age classes: sapling, poles and sawtimber. The sawtimber class is further broken into small, medium and large sawtimber. All-aged management is generally more intense in terms of planning, and number of treatments over time than even-aged management; however, the all-aged silvicultural techniques have less overall impact to the site. The amount harvested at each entry is less than in an even-aged harvesting system. The all-aged system is also more aesthetically pleasing because large diameter trees are always retained to maintain the size distribution. These large diameter trees include final crop trees that will bring the highest return for timber, as well as trees that will be retained for their wildlife or aesthetic value. These latter trees will not be cut but left to natural senescence.

In order to establish a stand-structure goal, it is necessary to determine its present structure. Diameter distributions are approximated by a reverse J-shaped curve, with a slope of q, the quotient between numbers of successively smaller diameter classes. The stand structural goal does not remain fixed throughout the stand development period, but management is directed at increasing the proportion of sawtimber or lowering the Q value. Stand Q values range from 1.3 to 2.0. The lower Q values correspond to a higher percentage of sawtimber. Better sites approach a lower Q value than poor sites.

Water Quality

One of the most critical measures of a healthy forest is the ability to produce clean, clear water. The protection of streams, seeps, vernal pools and other wetlands is crucial for the maintenance and improvement of Vermont's water quality and aquatic habitat. Careful management of all forestry activities on the property is of high importance as run-off into waterways can lead to increased turbidity and reduced available oxygen content. A lack of shade can also increase water temperatures.

Riparian ESTA (Ecologically Significant Treatment Area) has been designated along West Hill Brook and the large perennial stream which bisects the southern portion of the parcel west to east. While most riparian areas are well suited for some degree of active forest management, others have characteristics making them ecologically inappropriate for timber harvesting and may be enrolled in UVA as ESTAs. The lands adjacent to streams, rivers, lakes, and ponds are specialized ecological areas that provide numerous functions, including protecting water quality and aquatic habitat, providing terrestrial wildlife travel corridors, supporting significant natural communities and adjacent wetlands, and protecting channel-forming processes and channel stability. Riparian areas are generally managed according to Acceptable Management Practices (AMPs) to protect surface waters from harmful discharges, but the riparian zones on the property deserve special treatment to protect riparian functions. The areas designated on the Montgomery Town Forest parcel as a Riparian ESTA is based on channel size and character, as well as the soil character of the surround slopes, and function of flood resiliency. ESTA boundaries are based on topography, as well as the latest Lidar data for this area which shows the bounds of the fluvial erosion hazard area within which the river will continue to move, as well as seasonally flooding occurs. The significant contributions to habitat and connectivity also support this designation. The Riparian ESTA on the property will be considered a no-cut zone, with the only active management the control of invasive species (as needed).

A 100 ft. buffer should be maintained on all other perennial drainages found on the parcel, within which stocking levels should be maintained at or above the B-line on the appropriate Northern Hardwood or Mixedwood stocking guide, with canopy openings extending into the buffer no more than 0.2 acre in size. A similar buffer at 50 ft. should be maintained on all ephemeral drainages encountered during future harvest operations.

The number and width of stream crossings within riparian buffers shall be kept to a minimum. ***In addition as well as a condition of enrollment in Vermont's Use Value Appraisal Program, all Acceptable Management Practices (AMP's) will be in place during any logging operation to prevent discharge into water bodies or sources.***

Wildlife Habitat

With some exceptions, wildlife can benefit from careful manipulation of the land. Forest management activities will create openings in the forest canopy, create slash for cover, and stimulate re-growth for wildlife browse and fruit and seed production. In general, the more diverse the flora (vegetation) in an area is in species and richness, the healthier and more diverse in fauna (wildlife) it will be.

Perhaps the most significant feature of the property concerning wildlife is it's adjacency to large un-fragmented and conserved forest blocks. The Town Forest property sits at the northern extent of an un-fragmented forest block of over 25,000 acres that extends between Belvidere, Montgomery, Bakersfield and Enosburg (Enosburg Mountain Road, a seasonal Class IV road, is not considered a fragmenting feature). This includes both private lands, as well as lands conserved by the State of Vermont as well as the former Atlas timber lands conserved by the Vermont Land Trust. Looking at an even greater scale—though partially fragmented by roads—the Town Forest property sits within an over 60,000 acres forest block that extends south from Canada to Waterville and Johnson. This area connects with additional blocks of unfragmented forest to the south totaling more than 30,000 acres, and encompassing a major travel corridor for wildlife between the northern Green Mountains and Sutton Range in Quebec, province of Canada. The area has been identified by Two Countries One Forest (2C1F) as one of nine critical linkage areas within the greater Northern Forest. Because of its connection to much larger forest systems, the potential species diversity on this property is much greater than adjacent parcels fragmented by development. One of the most destructive development practices to affect wildlife habitat is the fragmentation of the forest. Wilderness loving species such as bear, lynx, bobcat, moose, fisher, and even the catamount (puma) need very large areas to thrive. This property has the potential to support fisher, bobcat and moose, as well as black bear.

Other than Lynx and Catamount, black bear is currently as close to a "wilderness species" as we have in Vermont in that the bear require vast areas of undeveloped forestland for concealment and solitude. Black bear seek out areas that have low human impact such as wetlands and remote, rough terrain. Good black bear habitat requires a mix of hardwoods and softwoods, abandoned farmland, small forest cuttings, swamps and mountain terrain. Old logging roads and small clear cuts which have reverted to berries are a favored habitat when interspersed with mature hardwoods. The large home range of black bear (up to 180 square miles) makes black bear management impractical in meeting all the habitat needs, but there are practices that may be implemented on the property that would greatly benefit bear. Black bear return to the same area year after year to feed on beech nuts of certain trees. Bear will climb the mature beech trees to access the nuts, leaving tell-tale claw marks year after year, and often bear damage can be mistaken for ice damage as bear will reach out and pull branches into the main stem, creating "bear nests". Apples are also a major late food source. Spring and summer foods are primarily grasses, forbes and fruit (raspberries, blackberries, elderberries, etc.). Mature beech trees found on the property may be retained during future treatments, especially where occurring in small groves in a stand. Small patches may be implemented in areas of unacceptable growing stock to stimulate berry production.

The property has a number of other habitat characteristics that are beneficial to several wildlife species. There are abundant hard and soft mast species found on the property including American beech, black cherry, yellow birch. Hop hornbeam, and serviceberry.

Another important feature of the property are the larger diameter red maple and hemlock found through wooded portions of the parcel that have the potential to develop into den or cavity trees, if they are not already. Where appropriate, these trees should be retained as "*Legacy Trees*". Legacy trees are trees that are intentionally retained in the forest until they reach the end of their biological life span. These trees will become wildlife snag trees in the future. Snag trees are important because, as they decay, cavities are created inside them that can be used as den sites for many species. They also provide an important food source for woodpeckers that feed on the insects inhabiting them. Large branches or entire trees of this diameter that have fallen to the forest floor provide important down woody debris for use by small mammals and several amphibian species. Fisher is one species that prefers fallen hollow logs for denning and rearing young. ***Targets for Snag and Course Woody Material Retention:*** *Snags and cavity trees*: Retain and recruit a minimum of four secure snags or cavity trees per acre. These should include a diversity of diameters and sizes ranging from 5 to 6 inches to over 24 inches. Ideally, on each acre one snag over 24 inches should be retained or developed. *Downed woody material*: An ideal target would be to leave three to five stems at least 18 inches in diameter and 10 stems at least 14 inches in diameter per acre. All should be at least 16 feet long.

A number of seeps are also found on the parcel. A seep is a common but small community occurring on slopes or at the base of slopes, in coves or on benches. Groundwater discharge is evident at the margin of the seep. Hardpan or bedrock is a common impediment to downflow of water causing the groundwater to flow horizontally discharge at the surface. Seeps are often the headwaters of perennial streams and have often been used as sites for spring boxes that supply water to homesteads. Groundwater temperature in this region is usually within a few degrees of 47 degrees Fahrenheit. The flow of these warmer waters to the surface results in earlier spring growth and a winter water source. These sites are important for many species of wildlife. Characteristic amphibians include Spring Salamander, Northern Dusky Salamander, and Two-lined Salamander. The rare petalwing dragonfly is associated with seeps, and seeps are very important sites for Black Bear to feed in the early spring. Wild Turkey also frequent these through the winter to graze on forbes that may persist near the warmer water.

Most of the property has been mapped as Deer Wintering Area by the State of Vermont's Department of Fish and Wildlife, requiring special considerations: leaving a dense crown closure, protecting travel lanes (ideally they should be 200 ft. wide, comprised of dense softwoods cover, and located near a stream), maximizing and perpetuating the area of shelter, and providing preferred, accessible, browse. The area should be kept as diversified as possible, achieved by releasing regeneration and overtopped understory, thinning poles and small saw timber, and harvesting large sawtimber to stimulate regeneration. When these distinctly even-age practices are applied to many small, homogeneous patches by area regulation, uneven-aged structure results (*Management Guide for Deer Wintering Areas in Vermont* 1990. Vermont Department of Forests, Parks and Recreation and Department of Fish and Wildlife).

West Hill Brook is also a very important feature concerning wildlife (and water quality). The streams are excellent habitat for brook trout, several amphibians, and other aquatic species. In addition, mink, raccoon, fisher, several raptor species such as barred owl and a variety of songbirds use the stream and associated riparian zone. Other species such as black bear, deer and several bat species use the stream as a travel corridor. Proper management of the riparian zone will ensure that the stream habitat function is maintained.

Rare, Threatened or Endangered Species

A rare species is one that has only a few populations in the state and that faces threats to its continued existence in Vermont. Rare species face threats from development of their habitat, harassment, collection, and suppression of natural processes, such as fire. The Vermont Fish and Wildlife Department uses a ranking scheme that describes the rarity of species in Vermont. The range is from S1 (very rare) to S5 (common and widespread). Species are assigned a rank based on the number of known occurrences, the population size, and the degree to which the populations are threatened. For example, creeping juniper and lake sturgeon are S1 species, whereas sugar maple and raccoons are S5 species. Using this system, biologists and other experts assign an S1 rank to a species when it may occur in five or fewer populations in the state and/or when the species is threatened with extinction. Rare species with six to 20 populations are given an S2 rank; threats are also considered. Species with 21 to 100 populations are assigned a S3 rank and are generally considered to be uncommon or a watch-list species. The Vermont Non-game and Natural Heritage program (NNHP) part of the VT Fish and Wildlife Departments Wildlife division, maintains an inventory of Rare, Threatened and Endangered (RTE) species in Vermont. No occurrence of an RTE species or natural community has been documented on the Montgomery Town Forest property at this time.

Forests of Recognized Importance (FORI)

No Forests of Recognized Importance have been documented on site

Neo-Tropical Songbird Habitat

Songbird habitat is discussed separately from the general wildlife habitat in an attempt to highlight its special nature. Some neo-tropical songbirds are currently in decline for a variety of reasons, some due to habitat loss in the breeding territory and some due to habitat loss in wintering grounds. Northern Vermont is breeding habitat for these songbirds. Providing optimum breeding habitat will go a long way in allowing long term success for these species. The following songbirds are the species considered "responsibility birds" by Audubon Vermont (The Birder's Dozen): American woodcock, yellow-bellied sapsucker, eastern wood-pewee, blue-headed vireo (stable), veery, wood thrush, chestnut-sided warbler, black-throated blue warbler (stable), black-throated green warbler, Canada warbler, white throated sparrow, and scarlet tanager (stable).

The following management practices may be implemented to maintain and improve habitat for these at risk songbirds. It is important to understand that not all practices can be implemented on every property. Specific management practices will be highlighted in each stand description where applicable.

1) Create and enhance vertical structure; one way to accomplish this is to manage using single tree and small group selection silviculture, and to create small gap openings in the forest canopy.

2) Limit management activities to late summer, fall or winter, to minimize impact on nesting birds.

3) Keep forest buffers along streams.

4) Retain a percentage of fruit bearing overstory trees when harvesting, including beech, oak and black cherry, as well as mid layer trees such as serviceberry and apple where present.

5) Retain deadwood including standing snags and downed trees. Dead or dying trees will provide roosting, perching, foraging and nesting sites for roughly 40 bird species.

6) Soften edges between habitats. Negative edge effects caused by predation and nest parasitism can be minimized by feathering the edge, or developing irregular shaped edges.

7) Maximize forest interior. Forest blocks greater than 50 acres will increase the diversity of birds your woodlot can support. Forest interior is defined as habitat that occurs in unbroken forest at least 200-300 feet from the habitat edge. This is important for species such as scarlet tanager, black-throated green and black-throated blue warbler, and eastern wood-pewee.

8) Conversely, retain early-successional forest habitat. Early-successional habitat may be accomplished through patch cutting or managing abandoned agricultural land. Patch cuts may be created for early successional bird species such as chestnut-sided warbler, veery, and woodcock. The woodcock needs specialized habitat and where applicable will be discussed in detail in the stand descriptions

Cultural Resources and Aesthetics

Aesthetics is a factor that should be taken into account while completing any type of project on the property, whether it is forestry, wildlife or recreation related. Aesthetically important areas should be maintained and enhanced. Unique natural features such as unusually large and unique trees and shrubs should be preserved in their natural state. Individual large trees may be identified as "Legacy Trees" that will remain in the stand throughout all harvesting operations. These trees should be retained for aesthetics, as seed trees, and as future den and cavity trees for wildlife use.

Unique cultural resources should also be considered during future management activities on the property. These include old cellar holes, stone foundations, sugar arches or stone lined wells with potential historic value. Cultural resources of note documented during the present inventory include an old sugarhouse foundation adjacent the northern boundary of the parcel. Culture resources should be protected during any future harvesting operations on the parcel.

Recreation and Forest Roads

The parcel features a small trail network, accessing forested areas from the Class IV road south. The most developed portion of this network is shown on the Forest Stand Map. These trails provide potential opportunity for a number of activities including cross country skiing, snowshoeing, hiking, mountain biking, bird watching and wildlife viewing, and hunting, in addition to aiding in any potential future harvest operations.

Roads and trails may be kept clear by hand, or cleared and stumped using a dozer or excavator as needed. Trail improvements are necessary and required to guard against erosion and soils loss, especially where sedimentation into water sources is a concern. Specific attention should be directed at remediating the section of trail associated with the mapped stream crossing, where significant erosion is occurring within 200-300' on each side of the stream. Smoothing and grading is necessary, with installation of water bars and a permanent crossing structure installed. ***As a condition of enrollment in Vermont's Use Value Appraisal Program all AMPs shall be in place during and following any logging operation to prevent discharge into water bodies or sources.*** Future expansion of the trail network for enhanced recreational

experiences my be developed in partnership with local entities including the Conservation Commission, Recreation Board, and Grateful Treads mountain buke club.

If, during the course of any future harvesting activities on the parcel, weather or soil conditions are such that severe damage to truck roads, skid roads, or landings would result from continued operation, or the potential for a violation of the state AMPs (discharge into water courses, etc.) work will be temporarily shut down until the concern can be addressed.

Forest Health

While a number of forest pathogens/pests were noted on the property, there were no overtly significant forest health issues noted at the time of the inventory. Most pests are associated with over-mature trees and the defect inherent in old timber. As harvesting activities periodically remove defective trees, the opportunity for disease infection and insect attack on residual timber is decreased. Future management for insect and disease control will focus on the timely removal of mature and over-mature trees not retained as legacies to maintain the population of insect and disease organisms to a tolerable level. No forest health issues were noted at levels of concern during the present inventory, however three of the specific diseases/pests noted on or adjacent to the property at present include:

Beech bark disease

This disease is an insect/fungal association. The beech is first infected by a very small scale insect that exudes a white waxy substance that covers the insect and is readily visible to the naked eye on the tree. Usually in a few years the fungal associate of this disease complex enters the tree through the feeding woods the insect has created. This fungus produces small red fruiting bodies that mature in the fall and become readily visible on affected trees. Over time a pocked mark appearance develops on the stem where callus tissue is produced to wall off the points of infection as the fungus spreads. Mortality in the tree usually takes several years as the fungus spreads and eventually disrupts the vascular system of the tree, as well as making it susceptible to attack from other diseases or forest pests. Some research indicates that extreme cold will kill the scale insect, which may explain why disease-free beech can be found in colder pockets. No control measure for this disease is known at this time. Diseased beech may be removed from the stand during associated treatments. Clean, healthy beech should be retained at the greatest extent possible.

Sugar maple borer

This insect infects pole-sized sugar maple trees that are stressed from overcrowding or suppression in the understory. Damage is caused by the larvae of the insect that feeds under the bark, creating a ridged wound across the main stem. While rarely killing the trees, this severely damages timber quality and overall value of the tree. The best defense against the pest is to remove infected trees during associated work, and maintaining stocking levels that allow for optimum growth and increased vigor. With sound forest management the likelihood of an infestation of this pest is unlikely.

Euytepella canker

This canker is associated with a fungus that attacks pole and sawtimber sized maples. All maples are affected, though sugar maple is the most common host. Once infected, the pathogen remains in the tree

for many years, developing a large concentric, calloused canker and severally deforms the tree, often giving the affected portion of the stem a humped or cobra head looking form. The canker not only reduces timber quality, but creates a weak point often leading to stem breakage. The most effective control of this pathogen is removing infected trees from the stand to remove the source of innoculum and limiting spread of the disease. As with most pathogens, the best defense is also to practice sound management that maintains a vigorous stand.

Invasive Species

Another threat to forest health on the Town Forest property comes from the presence of invasive species noted in the area, principally buckthorn, barberry, honeysuckle, fragmities, and Japanese knotweed. Though not noted on the parcel during the present inventory, these have been found in the surrounding area, principally associated with the West Hill Stream corridor, where Japanese Knotweed has been documented. These are highly invasive species that can take over portions of the understory from native plants (greatly limiting long term development of the stand) and thrive in open sunlight common to stand openings and edges. Invasives should be cut and/or excavated if they are encountered in the woods or open portions in the future. Herbicide control is also an option. Invasive species control can be costly in both time and expense, however tackling the problem when populations are relatively low will make their eventual eradication possible, treating a defined portion of the property annually as feasible. Monitoring is most important in open areas and along wooded edges.

Emerald Ash Borer

Emerald ash borer has now been confirmed in Franklin, Orange, Orleans, Washington, Caledonia, Bennington, Grand Isle, and Addison Counties in Vermont, and it's likely that additional confirmations will continue to be made this spring as the flight season resumes. These are the first emerald ash borer (EAB) infestations discovered in Vermont. Emerald ash borer was first discovered in the Detroit, Michigan area in 2002, though it is believed to have arrived in the 1990's. EAB is now known to be established in 32 states and three Canadian provinces. The beetle is about one half an inch and metallic green. Its larvae tunnel through the wood just under the bark of ash trees; killing the tree by cutting off the flow of nutrients. Healthy ash trees can die within 1-4 years of showing their first sign or symptom. All species of ash trees are susceptible.

As part of the ongoing response to the recent discovery of the Emerald Ash Borer (EAB) within the state, Vermont has joined the United States Department of Agriculture (USDA)'s 31-state quarantine boundary. The quarantine will help reduce the movement of infested ash wood to un-infested regions outside of Vermont's borders.

While EAB has not been documented on the parcel at this time, it's now a question of *when*, not *if* the insect will arrive. Given that, management will account for the potential impact of this pest, both economically and ecologically. General recommendations for management are found in *Use Value Appraisal Standards for Forest Management Related to Emerald Ash Borer Infestations*, found in the appendix to this plan. Specific recommendations by stand are found in Section VI of this plan. Additional information on EAB can be found at https://vtinvasives.org/land/emerald-ash-borer-vermont, as well as in the appendix of this plan.

Carbon Sequestration and Climate Change

While climate change is expected to have a number of wide-ranging impacts on the forests of Vermont, specific impacts identified that are of particular concern to the property include: Extreme and variable precipitation, shorter winters, changes in tree species ranges, and increased risk of natural disturbance. These impacts will create challenges to meeting landowner objectives.

In response to the threat of climate change forest management on the Town Forest property will adhere to the following strategies:

1. Sustain Fundamental Ecological functions
2. Reduce the impact of existing biological stressors
3. Protect forests from severe fire and wind disturbance
4. Maintain or create Refugia
5. Maintain and enhance species diversity and structural diversity
6. Increase ecosystem redundancy across the landscape
7. Promote landscape connectivity
8. Enhance genetic diversity
9. Facilitate community adjustments through species transitions
10. Plan for and respond to disturbance

A full list of Strategies and Actions is included as an appendix to this Management Plan (*Adaptation Strategies and Approaches (Butler et al. 2014)*. Many of these are already addressed in this plan (addressing species diversity, for example). As a next step to understanding how the Town Forest property could be affected by climate change, a detailed landscape analysis may be conducted to identify actions that are already identified in this Forest Stewardship Plan that are beneficial in light of climate change, as well as gaps in management.

Logging Practices

Management objectives identify the maintenance of healthy wildlife habitat, enhanced recreational opportunity, and aesthetics as complimentary uses with the prime objectives conservation and timber management. In order that these objectives are met, the use of experienced and capable logging contractors is essential. A clear understanding of stand treatment, and the selection and marking of trees for removal is required. Care should be exercised to minimize residual stand damage, maintain pleasing aesthetics, and work in accordance with Vermont water resource protection and general forestry regulations.

The most important components of forest management and timber extraction include the sustainable management of the timber resource. This is best accomplished by hiring a forester with knowledge of the land and a clear understanding of both the owner's wishes and the proper silvicultural techniques to meet those goals. The marking of the trees to be removed is a critical component. Even the best loggers have an inherent conflict in deciding which trees to cut. For the logger economics is a priority. In the same vein, it is important to make sure that the forester is working with the landowner's best interest. The marking and administration of the job should not be related to volume or value of the timber that is cut. The second most important component of a logging operation is the amount of residual damage to the stand. Careful road layout, the right equipment for the job, and the ability of a skilled logger to economically perform

the job in a careful manner will result in less damage and higher future value of the timber. The third critical component is the condition of the roads and landing during and at the end of the job. Water quality standards should be strictly kept, and the erosion controls properly placed to last until at least the next cutting cycle.

Boundary Maintenance

Boundary line review and painting should be carried out on a periodic basis. Usually seven to ten years between paintings will suffice. Painting the boundary lines helps to ensure that no violation of timber rights will occur from adjoining lands. Well-maintained boundary lines also reduce the necessity for future re-survey of specific boundary lines, or the entire property. Boundary line condition on the Town Forest property ranges from fair to poor, with western and northern lines delineated by faded orange blazes and old barbed wire fencing. The class IV road forms the southern boundary, and West Hill Brook forms the eastern boundary.

To prevent future confusion over line location, it is recommended that all wooded lines be painted with good quality boundary paint on a ten-year cycle, with the next round of work due within five years of this plan. In addition, all corners should be located and painted. To prevent confusion over boundary line location it is recommended that the landowner complete a boundary line review every three or four years. During the review, note areas that require additional painting to ensure the integrity of the boundary lines.

VI. Stand Analysis

For management purposes, forestland is divided into stands, which are defined as areas of relative similarity (such as age, species, topography, etc.), and can be treated uniformly. Stands are identified on the Forest Stand Map located at the end of this report. The Stand Analysis for each unit is included in this section and contains a description, acreage, management objectives and recommendations. Stand analysis data, collected in the field cruise, is included to quantify the unit characteristics and monitor changes associated with future growth. The estimated sawtimber volume and cordwood volume is indicated. A total of 10 inventory plots were taken on the property, with a relative density of about one plot for every five forested acres.

It should be noted that stocking levels referring to the A, B, or C-line are given for every stand as a point of reference. These stocking levels are based on guides developed for even-aged stands and used for even-aged management. Recommended residual (post-treatment) basal areas and size distribution curves are used as a guideline for all-age forest management. The residual basal area for all-aged hardwood stands is recommended to be 65-75 ft^2/acre; for stands with 25-65% softwood the residual basal area is recommended to be 80-120 ft^2/acre. Management recommendations in this plan will utilize both even-aged and all-aged silviculture methods.

Stands are separated in part due to past logging history, but also due to soils, and the Natural Community Type that is prevalent in that stand. Natural Communities are distinguished from Stands as the stand type may be the result of human influence. Natural communities are a result of soils, weather, moisture, and glacial action and characterized as the interacting assemblage of organisms, their physical environment, and the natural processes that affect them. Stands are a result of past cutting history, age and species composition. Natural community types will be listed for each Stand where they can be determined, and are our best attempt at defining how different forest types exist naturally. Many natural resource managers are attempting to manage lands according to the natural community type and the natural disturbance regimes that affect them. Natural Community identification and descriptions are based on the book Wetland, Woodland, Wildland, A Guide to the Natural Communities of Vermont, by Elizabeth Thompson and Eric Sorenson.

Soils are one of the most important characteristics of forest ecology as the soils determine species, composition, growth rate and management strategies. There are 4 site productivity classes (rated by number I to IV, ranging from high to non-productive), which indicate the growth in volume per acre per year.

Map Area: 1	**Acreage:** 7.7
Stand One: Northern Hardwood	**Data Points:** 2

Stand Type: Northern Hardwood (sugar maple 41% yellow birch 32%, red maple 14%, American beech 5%). Also present in the stand is black cherry, white ash, eastern hemlock, hop hornbeam, and striped maple.

Description: This stand is found at upper elevations in the northwestern portion of the parcel. The overstory is comprised of variable density medium to large sawtimber sized beech and maple, with ash as an associate. The co-dominant canopy features pole sized sugar maple, yellow birch, and beech. Stem quality is generally low on the older age class, with the best quality in the stand found in the pole sized yellow birch and sugar maple. The southern portion of the stand is younger with a more even-aged structure, dominated by pole sized red maple of low stem quality and cherry as a principal associate. Blue cohosh and wild leek were noted in the northeastern unit of the stand, suggesting a moderately enriched stand.

Regeneration: Black cherry and sugar maple seedlings are found, however deer brose is significantly reducing success. Sapling regeneration is limited primarily to beech, though pockets of sugar maple found in the midstory.

Natural Community Classification: *Northern Hardwood*: This is Vermont's most abundant forest community. The main tree species are sugar maple, yellow birch, and beech. Other common species include red maple, white ash, white pine, black cherry, basswood, hemlock, and red spruce. This community may have several variations depending on the differences in slope, elevation, landscape position, and soil type. Natural disturbances include small single tree gaps to large gaps caused by wind events.

Age Structure: even-aged/two-aged **Size Class:** poles/sawtimber

Stocking: Well-stocked; approaching the A-line on the even-aged Northern Hardwood stocking guide

Approximate Stand Age: 65-70 years

Stand History: This area may have been tapped at one point, with an old sugarhouse foundation found just off the parcel across the northern boundary line. The stand was logged heavily 30-40 years ago, targeting larger diameter and higher quality stems and retaining lower vigor trees of reduced timber potential.

Forest Health: Heavy beech bark disease is found on the species component through all size classes.

Access Distance: Less than one mile to all portions of the stand.

Acceptable Growing Stock/acre: 60 ft^2/ac. **Total including UGS/acre:** 115 ft^2/ac.

Stems/acre: 203 **Mean Stand Diameter:** 10.0 inches

Slope: 15-25% **Aspect:** southeast **Site Index:** by soils

Site Class: I, II **Soils:** Peru extremely stony fine sandy loam; Woodstock rock-outcrop complex

Management Objectives: Manage on an uneven-aged basis for the production of high quality sawtimber and the maintenance of wildlife habitat.

Silvicultural Prescription: It's recommended that a Small-Group and Single-Tree Selection treatment be conducted in the stand to reduce stocking levels, maintain vigor and health on stems in the co-dominant and intermediate canopy classes, increase the structural complexity in the stand for the benefit of wildlife, and capture the value of portion of the economically mature sawtimber in the stand.

During this treatment variable sized openings should be created in the canopy ranging from 0.10 to .25 acres in size over approximately 12% of the stand (about 1 acre in total group area, or between 4-6 groups). Groups should be centered to remove clusters of high-risk, low-vigor or low-value-trees, to avoid sensitive sites, and to release advanced regeneration. Beech exhibiting beech bark disease should be targeted for removal however stems exhibiting tolerance or resistance should be retaining and released. Crop tree release may be employed in the matrix between groups to control quality in the intermediate and co-dominant canopy classes. This tending will generally be limited to along skid trails and around the edges of new groups. The residual basal area in the stand should be no lower than 70 ft^2/ac. Legacy trees such as those previously described should be maintained during the treatment, with new legacy trees designated for retention where this component is lacking. These stems may account for 5-10 ft^2/ac. of the residual basal area in the stand. Diameter distribution is described below:

	Present Total Basal Area	Present Acceptable Basal Area	Target Residual Basal Area
6-10"	45	20	30
12-14"	55	35	30
16-22"	10	5	5
24"+ (legacy)	5	0	5

This treatment has the potential to enhance wildlife habitat for a wide range of species, including number of forest songbird species of concern, specifically Eastern Wood-Pewee, Black-throated Blue Warbler and Veery.

Product: Sawtimber, pulp, cordwood

Cutting Cycle: 12-15 years **Desired Diameter:** 22 inches sugar maple

Sawtimber Volume/acre: 3,192 bd.ft/ac. **Cordwood Volume/acre:** 14 cords/ac.

Map Area: 2	**Acreage:** 32.9
Stand Two: Spruce-Hemlock-Hardwood	**Data Points:** 6

Stand Type: Spruce-Hemlock-Hardwood (eastern hemlock 30%, red spruce 29%, red maple 24%, yellow birch 5%, black cherry 4%). Also present in the stand is sugar maple, big tooth aspen, white ash, balsam fir, and striped maple.

Description: This stand encompasses the majority of the parcel. The overstory features variable density medium to large sawtimber hemlock through the dominant canopy, higher density west with hemlock in eastern areas found more in small inclusions. Stem quality is variable/low. Red spruce is found through the co-dominant canopy, heaviest east. Pole sized yellow birch, red maple (or variable/low quality), spruce, and hemlock comprise the intermediate canopy. Yellow birch pole development is greatest in openings created during the last harvest on the parcel. Scattered large diameter, open grown red maple are also found. A number of ephemeral streams and seeps are found. Heavy moose browse was noted on hobble bush found throughout the understory.

Regeneration: Good; the understory is generally well-stocked with red spruce and hemlock, as well as balsam fir, beech, and yellow birch.

Natural Community Classification: *Red Spruce-Northern Hardwood*: This is a variable community where softwoods and hardwoods occur in mixed stands and persist over time. They occur on locally shallow soils or on especially moist soils. They are found in the coldest regions of Vermont and located on either well-drained Knolls, or on moderately well-drained glacial till soils with a hardpan at 18-24 inches. The hardpan accounts for an increased moisture content. The species composition is typically red spruce, beech, yellow birch, and sugar maple, with white ash on richer sites, and red maple in younger stands. -and/or- *Hemlock-Northern Hardwood*: This forest community has a mix of species with 25-75% hardwood. It is more often found where the soils have a lower nutrient content. Soils are also usually well-drained to excessively drained. Species found in this forest community include red maple, beech, red pine, white pine, paper birch, red spruce, and in some climates red oak. The disturbance regime is similar to Northern Hardwood forest. This community needs to be further studied to determine long term successional trends.

Age Structure: two-aged/uneven-aged **Size Class:** poles/sawtimber

Stocking: Well-stocked; approaching the A-line on the even-aged Mixedwood stocking guide

Approximate Stand Age: 55-60 years old

Stand History: This stand was harvested 30-40 years ago. All merchantable red spruce was removed at that time, leaving a poor-quality red maple overstory with pockets of hemlock. Harvesting was conducted at variable density at upper elevations, targeting larger diameter and higher quality stems.

Forest Health: No significant forest health issues were noted in the stand during the present inventory.

Access Distance: Less than one mile to all portions of the stand.

Acceptable Growing Stock/acre: 90 ft^2/ac. **Total including UGS/acre:** 153 ft^2/ac.

Stems/acre: 267 **Mean Stand Diameter:** 10.5 inches

Slope: 3-25% **Aspect:** east **Site Index:** by soils

Site Class: II, I **Soils:** Peru extremely stony fine sandy loam; Cabot extremely stony fine sandy loam; Woodstock rock-outcrop complex

Management Objectives: Manage on an uneven-aged basis for the production of quality wood products and the maintenance of wildlife habitat.

Silvicultural Prescription: It is recommended that a Group Selection treatment be conducted in the stand to reduce stocking levels, release high quality spruce and hemlock regeneration in the midstory, increase the percentage of quality growing stock, and further diversify stand structure for the benefit of wildlife. Groups ranging from ¼ acre to ½ acre may be harvested across approximately 15% of the stand (approximately 5 acres in total group area), centered in concentrations of low quality overstory red maple or hemlock, or where dense softwood regeneration is found, as well as to avoid sensitive sites and seeps. Within groups all low-quality stems > 1" should be cut, with exception of retained legacy individuals in larger groups. Crop Tree Release may be conducted in the stand matrix between groups to maintain vigor on high quality yellow birch poles developing in the intermediate and co-dominant canopy classes. Between 15-30 stems per acre should be selected to receive a 10-ft. crown touching release on 2-3 sides. A portion of the worst quality cut stems may be cut and left in the woods to contribute to coarse woody debris volumes, and/or girdled to create standing snags. The residual basal area in the stand should be no lower than 100 ft^2/ac. This treatment has the potential to benefit a host of wildlife species, including interior forest songbirds of concern eastern wood-pewee, black throated green warbler, wood thrush, and Canada warbler.

Product: Sawtimber, pulp, cordwood

Cutting Cycle: 12-15 years **Diameter:** 16-18 inches red spruce, 20 inches hemlock

Sawtimber Volume/acre: 4,280 bd.ft/ac. **Cordwood Volume/acre:** 20 cords/ac.

Map Area: 3	**Acreage:** 1.8
Stand Three: Norway Spruce Plantation	**Data Points:** 2

Stand Type: Norway Spruce Plantation (Norway spruce 100%).

Description: This stand is comprised of pole and sawtimber sized Norway spruce. Stem quality varies, but crowns are generally small given tree height. Stems in the intermediate canopy exhibit signs of suppression and decline. The midstory and understory are devoid of growth, giving the stand almost no structural variability.

Regeneration: Inadequate; little vegetation is found in the understory.

Natural Community Classification: Somewhat unclear given the present condition, but likely to develop into a *Red Spruce-Northern Hardwood* natural community of variant.

Age Structure: even-aged **Size Class:** poles/small sawtimber

Stocking: Well-stocked; between the A and B-lines on the even-aged managed spruce stocking guide

Approximate Stand Age: 55-60 years

Stand History: This stand was planted in the early 1960s. No treatment has occurred in the stand since.

Forest Health: Some damage to the top leaders of these trees by white pine weevil has left some stems crooked or with multiple stems.

Access Distance: Less than ½ mile to all portion of the stand.

Acceptable Growing Stock/acre: 140 ft^2/ac. **Total including UGS/acre:** 210 ft^2/ac.

Stems/acre: 295 **Mean Stand Diameter:** 11.4 inches

Slope: 0-3% **Aspect:** east **Site Index:** by soils

Site Class: III **Soils:** Rumney variant, silt loam

Management Objectives: Manage on an uneven-aged basis for the production the enhancement of wildlife habitat and the production of high-quality wood products.

Silvicultural Prescription: An Overstory Removal with Reserves may be conducted in the stand to convert the stand to a more native suite of species and create an area of young forest/early successional habitat to primary species of concern, including American woodcock, ruffed grouse, and chestnut sided warbler. Approximately 6 reserve overstory trees per acre may be left for structure diversity, perch trees, a seed source, and to eventually become snag trees and/or woody debris. These reserve trees should be left in small groups of approximately 3-56 trees rather than single trees to provide small islands of micro-

habitat. This aggregation retention can produce habitat patches in the stand where the microclimate is more like the pre-harvest forest than dispersed reserves. The groups dispersed throughout the stand will also minimize competition between individual songbirds for perching and foraging. The residual basal area should be around 30 ft^2/acre.

If possible, it is recommended that the proposed harvest be conducted with a low-impact mechanized cut-to-length system, retaining all branches and fine woody material in the stand which reducing impact to the understory. A small CTL operation would be ideally suited to the work, and likely increase the margins on the timber sale.

It is recommended that following the harvest northern red oak be underplanted in the stand to introduce the species, which is both beneficial to wildlife and considered a 'climate change winner'. It is recommended that 200 oak stems be established within the area if feasible.

A small portion of this stand may be developed into a larger parking are and trail-head for enhanced recreational access.

Product: Sawtimber, pulp

Cutting Cycle: 12-15+ years **Desired Diameter:** 22 inches maple/oak

Sawtimber Volume/acre: 13,474 bd.ft/ac. **Cordwood Volume/acre:** 32 cords/ac.

VII. Schedule of Management Activities

AREA	YEAR	MANAGEMENT ACTIVITY
ALL	2022	Re-paint unmarked Boundary Lines (*recommended*)
	2022	Trail remediation to address erosion concerns/Stream crossing
3	2022	Overstory Removal with Reserves (Regeneration Harvest)
	2023	Additional recreational trail planning/development
1	2025	Single Tree/Small Group Selection
2	2025	Group Selection w/ Crop Tree Release in the stand matrix

Periodic monitoring/control for invasive species recommended in all stands.

ALL	2030	Re-evaluate and update Management Plan

Note: Management recommendations allow for carrying out the individual prescribed activity within three years, before and after the recommended date.