Forest Management Plan

For the

Andrews
Community Forest

Town of Richmond

Chittenden County, Vermont

2019

Prepared by Ethan Tapper, Chittenden County Forester

Vermont Department of Forests, Parks and Recreation

In Conjunction with the Andrews Community Forest Committee

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Ethan Tapper, Chittenden County Forester Date

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Town of Richmond Date

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Vermont Land Trust Date

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Introduction.

The purpose of this Forest Management Plan (FMP) is to accompany the Andrews Community Forest (ACF)'s 2018 Management Plan (henceforth referred to as "MP"), adopted by the Richmond Selectboard on November 19, 2018. This FMP will provide detailed, specific recommendations for the management of forested areas of the ACF using forest inventory data and a scientific process. This FMP provides no binding mandates; however, the management recommendations in this document are intended to satisfy the goals and objectives put forth in the MP in addition to best practices for the responsible management and stewardship of forested ecosystems. This includes the range of benefits that forests provide, from wildlife habitat to aesthetic, cultural, economic and community values, local forest products and carbon sequestration and storage. The silvicultural recommendations put forth in this FMP are meant to be applied in the field by a licensed forester, in written agreement with the Town of Richmond (see appendices for draft agreement), utilizing best practices and complying with all pertinent laws and the conservation easement restrictions on the ACF. The Andrews Community Forest Committee will be responsible for implementing the day-to-day administration of this FMP, under the advisement of the Chittenden County Forester.

At the time of any planned forest management activities, the Richmond Selectboard will have the opportunity to vet any potential foresters and loggers considered for this work, who will be put forward by recommendation of the Andrews Community Forest Committee.

All of the silvicultural treatments prescribed in this FMP should be accompanied by public outreach and education before, during, and after their implementation. In addition to encouraging a healthy, vibrant forest, the demonstration of thoughtful, responsible forest management and stewardship should be considered an important goal of this FMP, and a way that the ACF can contribute to high quality forest management well beyond its borders.

This FMP is also intended to satisfy Section I.C. of the ACF's conservation easement. In accordance with this easement, this FMP shall be updated in 10 years, in 2029.

History.

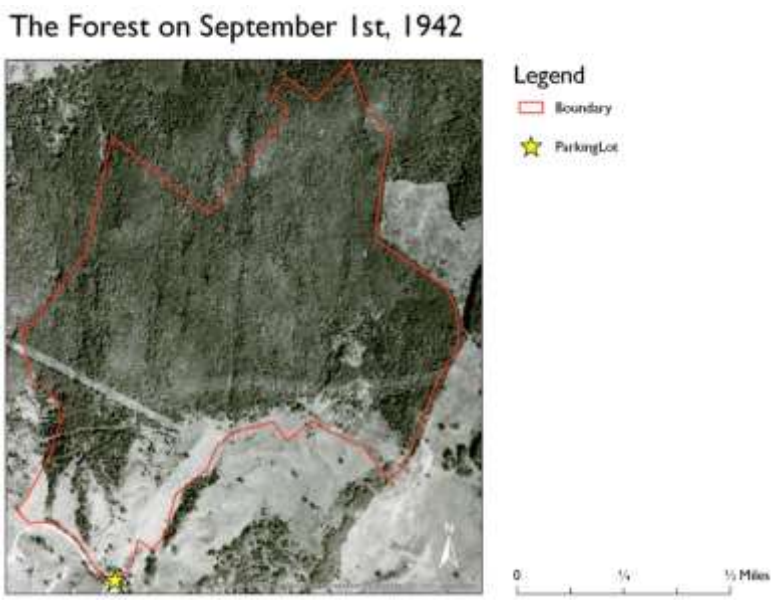


Figure 1: Current ACF boundary superimposed over 1942 aerial photograph. Map prepared by Grace Glynn, Eric Hagen and Meredith Naughton, 2018

Like the majority of Vermont, it is likely that even the steepest areas of the ACF were cleared for sheep pasture in the early-mid 1800's (more details on historic agricultural usage of the property can be found in the "Cultural History" section of the MP (p. 12)). Because of the rugged topography of the ACF, and the fact that the ACF is part of a historic farm which featured larger tracts of prime, flat agricultural land along the Winooski River, it is likely that the marginal pastures offered by the upper sections of the ACF were allowed to revert from agricultural use to forestland sometime in the late 1800's – early 1900's, with the

exception of small areas in the south of the property. The forested lands which now dominate the character of the ACF are a response to this clearing and subsequent regeneration, in combination with site characteristics and how the land has been managed since pasture abandonment. Figure 1 depicts the current boundaries of the ACF, superimposed over a 1942 aerial photo, showing that most of the ACF had reverted to forest at that time. A 1962 aerial photo shows many of the open areas shown in Figure 1 reverting to forest, and a 1980 photo shows open areas that match the current fields and pastures on the ACF.

The exact history of forest management in the ACF prior to the late 1900's is not known. It is likely it was used as a source for fuelwood throughout the 1900's, and portions of it may have been used as "night pasture" for cattle, allowing sheep and/or cows to browse in the forest, until sometime around the 1960's. Commercial harvesting is known to have occurred on the ACF on at least 3 occasions, once in 1994 – 1997, again in 2001 – 2004, and most recently in 2011-2013, when most of the western portion of the property was harvested. The former two harvests removed about 44 thousand board feet (MBF) of sawtimber and 120 cords of firewood, and 51 MBF and 200 cords respectively, probably using cable skidders and other small logging equipment. The most recent harvest removed approximately 333 MBF of hardwood and white pine logs, and 1,785 cords of firewood and pulp. This latter harvest was done by a "mechanized" or "whole-tree" logging crew, which utilized larger equipment to remove trees from the woods. The goal of the earlier treatments is not known, though they were probably driven by the desire to capture value in pine and hardwood sawlogs and veneer, in addition to releasing some high quality, immature trees. For a more detailed description of the effects of these treatments, see the Stand Description section of this FMP.

Ecological Protection Zones (EPZ's).

For the purpose of this FMP, the ACF has been divided into a series of "zones," based on ecological features and past land use.

The first and most important of these zones from an administrative perspective are the Ecological Protection Zones (EPZ's). EPZ's in the ACF are defined, mapped and afforded special protections in the ACF's conservation easement. These EPZ's include buffers around streams and vernal pools and special management considerations in mapped natural communities of significance (Dry Oak Forest, Dry Red Oak-White Pine Forest, Dry Oak-Hickory-Hop Hornbeam Forest and Red Pine Forest). The ACF's conservation easement states that within these natural community EPZ's "forest management is prohibited," however "limited vegetation management to protect public health and safety or to promote or restore the ecological integrity of the natural community may be permitted" with the Vermont Land Trust's approval. This vegetation management could include such activities as invasive species control. For a map of all of the ACF's EPZ's, please see Figure 2.

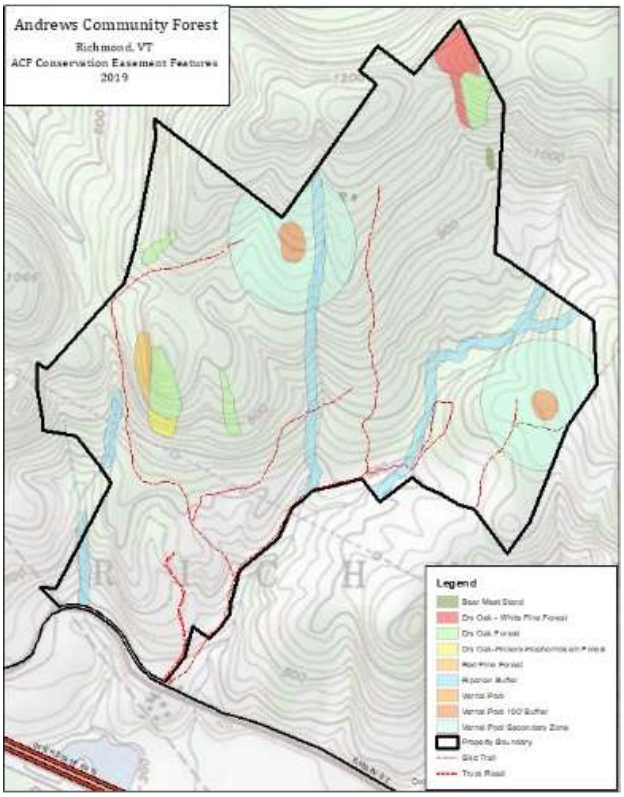


Figure 2. Conservation Easement Features Map

The mapping and recommendations in this plan also rely heavily on the "Landscape Analysis and Wildlife in the Andrews Community Forest, Richmond, Vermont" report produced by Grace Glynn, Eric Hagen and Meredith Naughton, students in the Field Naturalist MS Program at the University of Vermont. Their report expands on natural communities mapped by VLT, and maps several additional natural communities of import. Please see Figure 3 for a map of the ACF featuring Glynn, Hagen and Naughton's natural community data.

The areas mapped as natural community and riparian EPZ's in Figure 1 were expanded to include the data in Figure 2 and used to help define the property's Management Intensity Zones.

Larger versions of Figures 2 and 3 can be found at the back of this FMP.

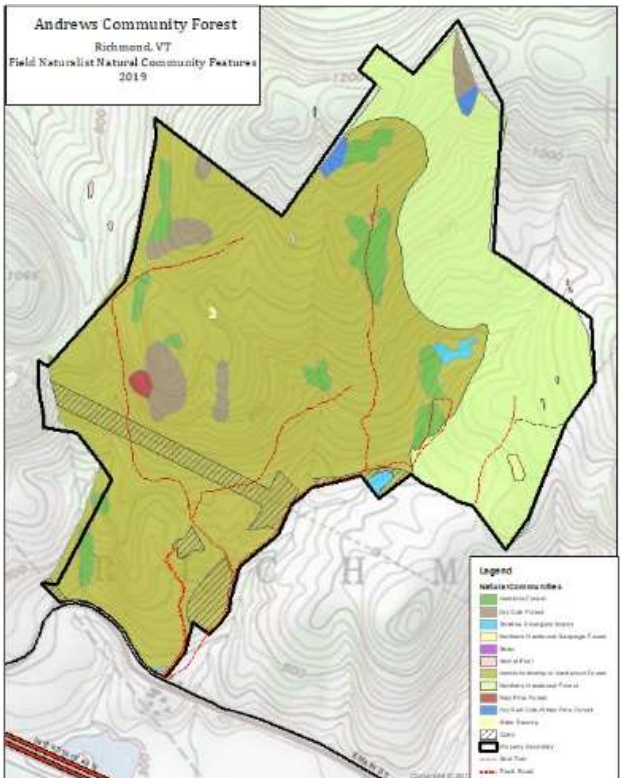
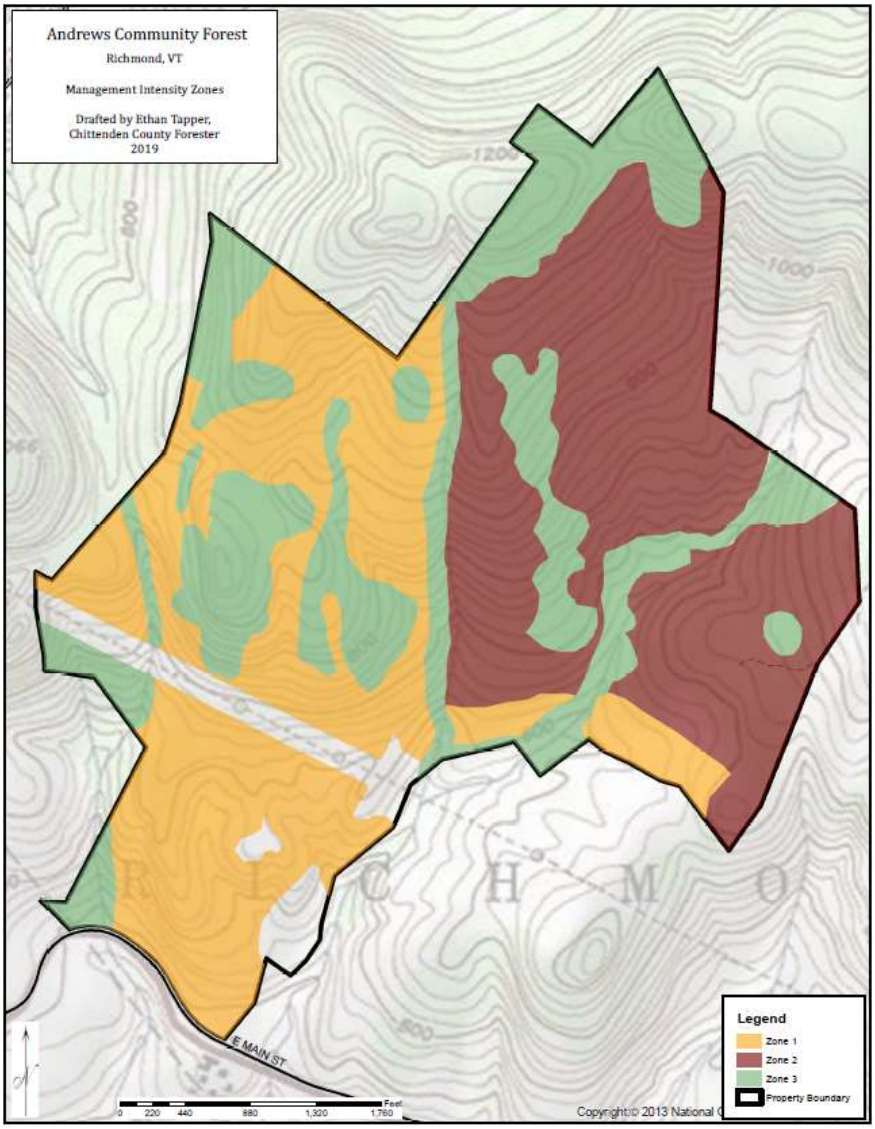


Figure 3. Field Naturalist Natural Communities Map

Management Intensity Zones.

In addition to EPZ's, the ACF has been divided into several "Management Intensity Zones" (MIZ's) using a "triad" approach. These MIZ's were delineated using natural community and other spatial data provided by Glynn, Hagen and Naughton, EPZ's mapped by VLT, and field data collected in the inventory of this property. These MIZ's were defined as such based on these ecological features, EPZ's and past land use.

There are three of these Zones, with differing management regimes:



- **Zone 1** (148 Acres; 36% of ACF)**:** This zone encompasses areas in the west of the ACF that were intensively harvested in 2011-2013 and young field-origin forests in the south of the property (Stands 1 and 2). Within this zone, more intensive forest management is allowed, including the use of even-aged silvicultural techniques and the creation of patch cuts up to 5 acres in size.
- **Zone 2** (145 Acres; 35% of ACF): This zone is primarily located in the eastern half of the property in the areas mapped as Stands 3-6 in this FMP. Within this zone uneven-aged silvicultural techniques should be used, with group openings no greater than 1 acre in size, and no more than 20% of the zone regenerated in a single entry. Forest management in this zone should expressly seek to enhance structural and species diversity and to encourage the development of late successional characteristics in the forest.
- **Zone 3: (**117 Acres; 28% of ACF) This zone includes mapped EPZ's, mapped natural communities of significance, areas with thin and/or sensitive soils, areas of hemlock forest in the east of the property and areas in the west of the ACF that were not subject to harvesting in 2011-13. Zone 3 is essentially a reserve zone --- within Zone 3 no forest management will occur, except for monitoring and controlling invasive exotic plants.

Recreational and forest management trails may cross this zone if no viable alternative exists to access a portion of the ACF, but should generally avoid these areas.

These Management Intensity Zones will help to create a more diverse forest in the ACF over time by allowing a variety of different disturbance regimes to occur, including encouraging areas which will be allowed to grow and develop without human interference. It is recommended that recreational trail development also honors these zones, with the highest trail densities in Zone 1, moderate trail densities in the Zone 2, and as few trails as possible in Zone 3.

A larger version of the MIZ Map can be found at the back of this FMP.

--- MANAGEMENT CONSIDERATIONS AND PRIORITIES ---

Diversity and Resiliency.

The encouragement of diversity is at the core of the forest management goals for this property. The ACF's conservation easement states that the forest management objectives for the property will maintain a "healthy, biologically diverse forest."

In forest management the terms "diversity" and "resiliency" are intertwined.

The concept of encouraging **diversity** in a forest has its roots in a number of different concepts (again, not in order of importance):

i. From a *wildlife management* perspective, offering the largest number of habitat conditions provides habitat for the widest array of wildlife species. This includes species diversity within a given area ("alpha diversity"), diversity between different types of sites ("beta diversity") and diversity of age and canopy classes of trees in the forest ("structural diversity"). A single wildlife species may require a range of habitat conditions in order to fulfill their basic needs, and different species of wildlife require different conditions at different times. Simply put, encouraging a diversity of site-appropriate habitat conditions to occur in a given area, especially those that may be uncommon across the broader landscape, is the best way to accommodate a range of wildlife. On the ACF, a diversity of habitat conditions should be encouraged using different active management regimes, capitalizing on habitat created by management that has already been done, protecting uncommon and sensitive natural communities and features, and also allowing some areas of forest to grow and develop without active management into the indefinite future.

ii. From an *ecological* perspective, studies have shown that over time most forest types in the northeast will develop a high degree of structural diversity, often supporting a variety of age classes of trees (usually at least 3). Encouraging several different age classes of trees, in combination with other features like dead standing trees, coarse woody debris on the forest floor and biological legacy trees (trees that are not managed for timber and are allowed to live out their natural lifespan) mimics natural forest growth and development, utilizing the forest's natural processes of development and regeneration to keep itself healthy, vibrant and productive over time. Due to the land use history of Vermont, forests with these features are uncommon, and so managing for forests with these features provides landscape-level diversity as well. Encouraging diversity also improves the forest's ability to respond to disturbance events, which is especially important given the unknown future effects of climate change and the increasing threat of invasive exotic pathogens and species. Finally, forests featuring multiple age classes generally store more carbon than even-aged forests.

iii. From a *renewable resource management* perspective, encouraging several age classes of trees provides the greatest opportunity for the periodic output of forest products and without necessitating intensive logging. For example, a forest with a single age class of trees may be subject to low-frequency, high-intensity management regimes, with long time periods between harvests. Forests with several age classes of trees can produce renewable forest products and local economic benefits more frequently as different age classes mature and require treatment at different times (high-frequency, low-intensity harvesting).

The ability of a forest to maintain its health and natural processes in response to disturbances and stress is known as **resilience**. Forests, in addition to being comprised of many independent species, have evolved as systems in many ways. Healthy forests are adept at remaining productive in the face of disturbance events, stabilizing nutrients and soil and creating

conditions suitable to the growth of subsequent generations of trees. The resilience of forests in the northeast is supported by both species and structural diversity.

While forests today encounter regular natural disturbance events, the largest sources of disturbance are, and will be into the indefinite future, human-related. In long-term forest management planning it is prudent to manage forests for resiliency in the face of an unstable climate, aggressive invasive species and pathogens and forest fragmentation and loss, among other issues. Practically, this means managing for species and structural diversity on a property as well as a landscape-level, protecting uncommon species, habitat types and ecological features and encouraging the features and processes endemic to natural forest growth and development.

Connectivity.

Forest fragmentation can be defined as the process by which blocks of intact forest are divided by human settlement and infrastructure. The fragmentation of forests by roads, homes, and development has a number of serious negative effects on wildlife habitat and ecosystem function.

For many wildlife species, the fragmentation of forests limits their ability to move through the landscape and access different habitats, which can affect their ability to hunt, forage, find cover, reproduce, and ultimately remain genetically "fit" as a species. In the case of some "interior dependent" species, such as black bear, shrinking habitat can drastically alter their behavior and ability to occupy a given area and cause negative interactions with humans.

Forest fragmentation also contributes to a host of other problems, including altering forest vegetation and structure and creating greater opportunities for the establishment and spread of invasive species. It is in the interest of the ACF's wildlife habitat objectives, in addition to overall forest health, to engage only in forest management activities which allow the ACF to maintain its utility as a wildlife corridor and interior habitat block.

In general, responsible forest management and light recreation are not seen to contribute to forest fragmentation, although intensive use of an area for recreation can alter wildlife behavior in some cases. Concentrating trail development near roads and other fragmenting landscape features and leaving interior portions of properties relatively "un-trailed," will preserve portions of the ACF where wildlife can move freely without being disturbed by human activity.

The ACF is part of a large, relatively unfragmented habitat block, approximately 70,000 acres in size, which includes approximately 10,000 acres of conserved land (the Chittenden County Uplands project area) in addition to the 44,000+ acre Mount Mansfield State Forest. This block is bounded to the south by Interstate 89, which marks the northern boundary of a habitat block of similar size featuring the Camels Hump State Forest. Unfragmented forest blocks of this size are uncommon in Vermont, and increasingly rare in Chittenden County.

More information about connectivity on the ACF can be found in the "Interior Forest and Connectivity" Section of the MP (p. 22).

Invasive Species Control.

Invasive exotic plants (hereafter called "invasives") are an enormous threat to the continued health and productivity in the ACF, and to ecosystems world-wide. These species are aggressive competitors which can outcompete native plants, especially on forest edges, the understory of disturbed forests and in field-origin, pioneer stands. The result of this is the interruption of ecological processes (such as the natural regeneration and succession of forests), decreased

diversity, decreased quality of wildlife habitat, decreased ecosystem resilience and diminished ecosystem function.

In lieu of the removal of these species, no other forest management or wildlife habitat management activities are likely to be successful over the long term. Failure to control these species will result in the eventual degradation of the ecological and aesthetic benefits of the forest, including recreation, aesthetics, wildlife habitat, forest productivity, health and resilience, climate change resiliency, carbon sequestration and storage, and water quality.

Most invasive exotic plants, unlike pathogens, fungi, or insects, were introduced to our environment intentionally. Species such as common buckthorn and multi-flora rose were used as living fences to eliminate the need to maintain wire, wooden, or stone fence lines. Invasives such as shrub honeysuckle, Norway maple, Japanese barberry and burning bush (*Euonymous*) were popular landscape plants. Autumn olive and Russian olive (*Eleagnus*) were planted by foresters and conservationists as food for wildlife. In each case, these plants spread into forests and other natural environments due to a combination of attributes including, but not limited to:

i. Resilience to disturbance (i.e. ability to survive even when repeatedly cut and/or pulled).
ii. Vegetative reproduction (the ability to reproduce asexually by sprouting, even from small chunks of root or stem).
iii. Abundant fruiting, often coupled with wildlife dispersion.
iv. Shade tolerance.
v. Allelopathic tendencies (the ability to inhibit the growth or establishment of other species by use of soil-borne chemicals).

Common buckthorn (*Rhamnus cathartica*) is one the most prevalent invasives in the ACF, present primarily in Stand 1. The infestation of this species is presently somewhat minor but will quickly increase in intensity if left untended. This species is extremely difficult to control. When it is small (up to about 2 feet in height), it may be possible to hand-pull, taking care to remove the entire root system. When it is larger than this, herbicide, applied to the cut surface of the plant's stump, is generally the only feasible control option.

Shrub honeysuckle (*Lonicera sp.*) also occurs in Stand 1 and 2. Honeysuckle is similar to buckthorn, although it tends to be slightly less resilient to treatment. This species may be hand-pulled until it is 2-3 feet in height (depending on soil qualities), taking care to remove the entire root system. Plants larger than this must generally be treated with herbicide, either through a cut stump treatment or a foliar spray.

Japanese Barberry (*Berberis* sp.) is present in Stand 1 and 2, with at least one spot infestation in southern Stand 3and sporadically scattered throughout other areas of the ACF. Barberry is a difficult species to control mechanically by hand-pulling due to its abundant thorns and powerful root system. This species is known to harbor large populations of deer ticks, increasing overall tick populations in forests, and is considered the most virulent invasive plant by many land managers in southern New England. Very small plants may be hand-pulled (with gloves), but most plants over 2 feet in height generally must be treated with herbicide, usually through a foliar spray.

A map of known invasives at ACF, with data collected and mapped by UVM intern Brian Bornique, can be found at the end of this FMP.

Invasive Species Control Priorities:

- Treatment/removal of invasives should be conducted Stands 1-3 as soon as possible.
- Monitoring for invasives should be ongoing in all areas, including areas where invasive species are not currently known to be.
- Herbicide, applied minimally as a foliar spray and cut-stump treatment, may be used as part of an Integrated Pest Management (IPM) approach to lower the populations of these species to a level manageable through mechanical means (hand-pulling).
- Following the initial treatments of these species, hand-pulling and other mechanical methods should be used as much as possible to control invasives.

Wildlife Habitat.

Wildlife habitat has been identified by the Richmond community in the development of the MP as an important focus of the Town's management strategy for the ACF, and the maintenance of high-quality habitat is identified in multiple places in the property's conservation easement. As is discussed in the discussion of diversity above, the management of forests for wildlife habitat is intertwined with other objectives for the ACF. Wildlife habitat management should be emphasized as part of a whole-system approach to forest management, which seeks to preserve intact, functional, vibrant forested ecosystems. The establishment, maintenance and protection of wildlife habitat with this approach will include the protection of uncommon and sensitive habitat features and the creation and maintenance of habitat conditions which may be lacking in abundance across the landscape. This approach serves both to encourage the charismatic wildlife species with which we are familiar, such as neotropical songbirds, white-tailed deer, moose, bobcat, black bear, and coyote, but also to support all species of native biota and the processes that sustain them.

A Forest Bird Habitat Assessment was done on this property in 2017 by Steve Hagenbuch of Audubon Vermont. In this report, Hagenbuch made a number of suggestions which are reflected in the recommendations in this FMP, with a goal for increasing the abundance, quality and diversity of habitat for birds in the ACF. Prominently, Hagenbuch recommended the use of uneven-age and irregular shelterwood silviculture (such as is prescribed in the Stand Descriptions section, below) and the creation/retention of dead standing trees and dead biomass on the forest floor, such as is recommended in several locations of this management plan.

At present, the ACF features extensive areas of early successional habitat in the west of the property. Two-aged and even-aged forest is present in the east of the property, where harvesting in the 1990's and early 2000's removed large diameter oak and white pine, regenerating mostly American beech, and in the west of the property, in the portion of the 2011-2013 harvest area where a variable density of dispersed seed trees were retained in the overstory. True multi-aged forest was not noted on the property, with the exception of small areas of hemlock forest.

White-tailed deer populations in Chittenden County and other portions of Vermont were noted in Vermont Fish and Wildlife's 2018 Antlerless Recommendation as being above the carrying capacity of their habitat, and local populations in the area of the ACF appear to be very high. Where deer are over-abundant their browse often contributes to decreased diversity in the

composition of the forest, increased abundance of invasive exotic plant species and the inability to regenerate certain species of native trees and plants. Deer populations tend to increase with forest fragmentation and development, decreasing winter severity, an increase in the abundance of "posted" lands and decreasing hunter numbers, all of which are issues across Vermont and most prominently in Chittenden County.

Field evidence suggests that portions of the ACF serve as a Deer Wintering Area (DWA, or "deer yard"). DWA's are critical resources for white-tailed deer in the winter, as continuous softwood canopies cause lower snow depths and higher temperatures. The southerly aspect of the ACF further increases the attractiveness of this winter habitat for deer. The presence of DWA's is thought to be limiting factor for deer abundance across the landscape.

In the ACF, deer browse damage is extremely evident and troubling. In eastern and northeastern areas, the understory is dominated by a near-monoculture of beech, a species that deer do not like to eat, with nearly all other species virtually eliminated or severely damaged by browse. In some of the portions of the property harvested in 2011-13, deer browse has vastly reduced the abundance of tree species besides beech and striped maple in the regenerating cohort.

Deer management on the ACF should be nuanced, both striving to provide excellent habitat for a healthy population of deer, including protecting the function of DWA's, while also keeping their population at a low enough level that forest growth and regeneration can occur. To strike this balance, it is recommended that deer hunting, including antlerless deer hunting, is encouraged in the ACF as a part of a holistic forest management approach. See the MP for details on hunting rules for the ACF. Steps can also be taken to limit the effects of browsing during forest management activities, such as leaving tops of trees "high" (un-lopped) and proactively creating larger openings in the canopy, when appropriate, to overwhelm the deer herd's browsing ability.

More information on wildlife habitat in the ACF can be found in the "Wildlife Habitat" section of the MP (p.21 - 25).

Wildlife habitat priorities:

- Protect and enhance the function of DWA's where they are present.
- Encourage trees of a diversity of age classes and site-appropriate species.
- Encourage late-successional characteristics in the forest.
- Buffer and protect sensitive features and features of great habitat significance, such as vernal pools, den sites, streams and wetlands.
- Protect uncommon natural community types and sensitive features.
- Act aggressively to control invasive exotic plant species.
- Seek to develop a landscape-level view to management --- encouraging habitat conditions that may be uncommon on the larger landscape.
- Continue to monitor deer browse impacts on the ACF.
- Investigate systems for encouraging the responsible, safe hunting of deer, especially antlerless deer, in the ACF.

Water Management.

Several perennial, intermittent, and ephemeral streams drain from the ACF, connecting to the Winooski River just south of the property boundary. Some of these streams are protected with specific considerations in the ACF's conservation easement. The primary purposes of buffering

these streams is to buffer aquatic and wetland plants and animals from disturbance; to prevent wetland and water-quality degradation; to provide important plant and animal habitat, and to provide organic matter, nutrients and structure to aquatic systems. These features also have significant aesthetic value and contribute to the water quality in the Lake Champlain Basin.

Beyond those identified in the ACF's conservation easement, additional seeps, wet areas and pocket wetlands are present in the ACF, including those identified in Figure 3. All of these features will be protected with a no-management buffer of at least 50 feet, and Vermont AMP's (see below) will be followed in the course of any forest management activities.

The Acceptable Management Practices for maintaining water quality on logging jobs in Vermont (AMP's) give guidance on how to cross and manage hydrologic features in the course of active forest management. These standards, in addition to the standards in the ACF's conservation easement, best practices for maintaining aquatic and riparian habitat, and laws pertaining to the protection of wetlands, should be strictly adhered to in the course of forest management in the ACF.

For more details on Water Management, see "Water Resources" section of the MP (p. 16).

Water Management Priorities:

- Any forest management activities should take the utmost care to preserve and enhance the quality of water on and flowing through the ACF.
- The streams and wetlands identified in the ACF's conservation easement will be protected with 50-foot RBZ's in which no management will occur. Any other perennial and intermittent streams identified in the ACF will be afforded the same protections.
- Vernal pools will be protected by the EPZ Primary and Secondary Zones, as defined above. No management will occur in the Primary Zone of either mapped vernal pool. Additional vernal pools, as they are identified and verified, will be afforded the same protections.
- If active management is recommended to improve the quality of wildlife habitat in wetland, riparian or aquatic environments, the Vermont Department of Fish and Wildlife and DEC Wetlands Program should be consulted for its recommendations and approval, and the approval of VLT will be sought.
- The AMP's and Vermont's wetland rules should be strictly adhered to in the course of forest management.

Soils.

Along with disturbance history and climatic variables, soils inform our knowledge of which tree species are likely to be most healthy, productive, and competitive in a given area. See soils map (attached) for details on the location of individual soil types in the ACF.

In general, mineral soils in Vermont are influenced by a combination of bedrock, glacial deposits, and lacustrine/riverine deposits. The latter influence is of special importance in the Champlain Valley, as this area has been filled with two large bodies of water, one an enormous freshwater glacial lake ("Lake Vermont") and the other a brackish, inland sea ("The Champlain Sea") in the last 13,500 years. Following the departure of the Laurentide ice sheet, Vermont was inundated with water to an elevation of approximately 600' ASL. This lake, draining south,

remained at approximately this level until approximately 12,000 years ago, when an ice dam in the Saint Lawrence Valley failed catastrophically, causing the water level to drop by about 300 feet over the course of a short period of time --- several hours to several days. The Saint Lawrence Valley had been compressed by the glacier to below sea level, causing saltwater to fill Vermont from the north to a level of approximately 320' ASL. The land under the Saint Lawrence Valley gradually rebounded from this compression, causing water levels to approach what they are today around 10,000 years ago.

Each of these large bodies of water caused the deposition of soil particles in the Champlain Valley; in general, areas covered by deep water were covered in fine particles like clays, whereas areas of shallow waters and the sites of coastlines, deltas and streams were covered in coarser particles, like sands and gravel. The southern portion of the ACF is at or below 600' ASL, and so features sandy and gravelly soils in places. In particular, this elevational gradient is at the approximate level of the established log landing on the property, where a large amount of gravel was extracted for the construction of I-89 in the 1960's. Many properties in the Champlain and Winooski River Valleys feature sand and gravel deposits at this elevation as a result of Lake Vermont's influence. Soils at greater than 600' elevation at the ACF are generally most influenced by bedrock, aspect, soil depth and steepness of slope.

According to the Natural Resource Conservation Service (NRCS), approximately 84% of the ACF's soils are "Lyman-Marlow Complex," very rocky soils from 5-60% slopes. This is a very common soil type in Vermont, especially in the Green Mountains. These soil types are a combination of Lyman soils, which are somewhat poor and often quite thin and rocky (Site Class II), and Marlow soils, which are deeper and more productive (Site Class I). Lyman-Marlow soils are well suited to the growth of white pine, red oak, American beech and hemlock, in addition to other associated dry-site and poor-site tree species. In areas of deeper soils, pockets of rich-site northern hardwood species, such as sugar maple, white ash, bitternut hickory and American basswood are present.

Other soils in the ACF which are more influenced by hydrology are generally deeper and more productive. As is common in Vermont, these are the soils which were kept in agricultural use longer due to their productivity and depth, so these soils host younger forests which are more strongly influenced by human land use. These soils in the ACF are dominated by silt loams and sandy loams, especially Munson and Belgrade Silt Loam and Peru Fine Sandy Loam and Monson and Raynham Silt Loams, which together cover about 10% of the property. These soils are well-drained and productive, well suited to the growth of a wide array of native hardwood and softwood species. They are also excellent soils for agriculture.

<u>Soil Management Priorities:</u>

- Minimize disturbance to soils in the course of any forest management activities or related infrastructure development.
- Strictly adhere to Vermont AMP's.
- Allow active forest management in areas with thin, wet, or sensitive soils only with frozen ground conditions.
- In areas with well-drained soils, forest management may occur in dry summer/fall months, and intentional scarification of soils may occur for silvicultural purposes as

prescribed in this FMP. Soil disturbance will be kept to the minimum required for silvicultural purposes in this case.
- Seek to keep forest management equipment on established forest management roads and trails as much as possible.
- In the course of any forest management activities, prioritize the deposition of fine and coarse woody debris for soil building and carbon sequestration purposes.

Carbon Sequestration and Storage.

Trees and plants sequester carbon from the atmosphere, storing it in biomass (wood and plant material). This carbon is found in both living and dead biomass in the forest, and a large portion of it can be found in forest soils. Globally, forests are a major carbon "sink," absorbing and storing large amounts of carbon. Forests can be managed to maximize their carbon sequestration and storage by avoiding large-scale disturbances (such as clearcutting), encouraging the accumulation of dead biomass in the forest, and performing management activities that support the increased health and resilience of the forest, such as the encouragement of structural diversity.

Carbon offsets are a quantification of addition carbon stored in the course of improved land management, reforestation and other practices. These offsets are monetized and sold to net producers of carbon, either to bring them into compliance with a regulatory carbon emissions cap (such as is the case in "regulatory" or "compliance" markets in California and Europe) or to provide a voluntary balancing of their carbon emissions ("voluntary" markets). Compliance markets are a more lucrative marketplace for carbon credits but are also more costly and difficult to enter into, requiring individual forested parcels to be thousands of acres in size to make them economically feasible. Voluntary markets are much more feasible for a piece of land the size of the ACF, especially when multiple additional parcels are "aggregated" into a single carbon project.

The enrollment of the ACF in a voluntary carbon project could produce an additional source of revenue for the property, which could help support practices like recreational trail maintenance and development, wildlife habitat management practices, non-commercial timber stand improvement and invasive species control.

The ACF should be managed to support and improve carbon sequestration and storage in the forest whenever possible. <u>Carbon sequestration and storage priorities:</u>

- Avoid creating large-scale disturbances (openings larger than 5 acres).
- Minimize soil disturbance in the course of forest management activities.
- Retain dead biomass in the form of dead-standing and fallen trees, and retain as much coarse and fine woody debris as possible during forest management.
- Retain biological legacy trees of a variety of species throughout the forest.
- Employ uneven-aged and low-impact silvicultural techniques to encourage a healthy, diverse, resilient forest.
- Over the next 10 years, investigate aggregating the ACF with other landowners' or municipalities' forested lands to enter into a voluntary forest carbon project.

Recreation and Aesthetics.

The importance of preserving and enhancing the qualities of the ACF that make it such an important cultural resource for residents of Richmond and beyond cannot be overstated. The property provides aesthetic benefits, access to nature, recreational offerings, and is a symbol of

a healthy, vibrant block of forestland in an increasingly developed and fragmented landscape. All management activities at the ACF should seek to maintain or enhance the way that this property benefits the Richmond community, while recognizing that these benefits must be framed within the context of a maintaining a healthy forest and a healthy broader ecosystem. Recreation is the way that most people enjoy these benefits and as such should be a critical consideration in any management decision in the ACF.

While some recreational trails will be established on old logging trails in the ACF, new recreational trails should seek to avoid existing logging trails whenever possible. This "recreation with forestry in mind" approach is based on the understanding that active forest management is an allowed and supported long-term use of the ACF, and so the maintenance of forest management infrastructure (i.e. skid/logging trails) as such is critical to protecting this use over time. This approach avoids conflict between recreation and forest management by ensuring that as little disruption as possible occurs to recreational trails and trail usage during the course of forest management activities.

During forest management activities some sections of recreational trail may need to be closed for safety reasons. Steps should be taken to minimize the disruption to trail usage as much as possible, and to minimize physical disruption to recreational trails caused by logging equipment. The use of interpretive signage that interacts positively with existing recreational resources during and following forest management is strongly recommended.

<u>Recreation and Aesthetic Priorities:</u>

- Establish recreational trails that largely avoid existing forest management roads and trails.
- Especially avoid creating extensive recreational trail improvements (bridges, adding gravel, etc.) on existing forest management roads and trails.
- Seek to establish trails that highlight interesting and charismatic natural and cultural features, in addition to different management zones and forest management activities.
- Avoid soil and water impacts from recreational trails by following established trail standards and BMP's.
- Concentrate trails in the south of the ACF, especially in Zones 1 and 2, and avoid EPZ's and sensitive features as mapped in this FMP.

Access and Operability

Access, in a forest management context, refers to the ability of forest management equipment to reach a property, transport any forest products to an area where they can be processed, sorted, and loaded onto log trucks, ultimately shipping them to a mill or other market. The trails on which logging equipment travels within the property are referred to as "skid trails," "logging trails," or "skid roads." The area where logs are piled, processed, sorted and loaded onto trucks is referred to as a "log landing" or "landing" (sometimes called a "header" or "log yard"). The roads, passable by log trucks, which access the landing are referred to as "truck roads" or "haul roads."

There are essentially two internal access points to the ACF:

1. The established road and landing in the south of the property affords easy access to western areas of the ACF. This road and landing were in good condition prior to the Town taking ownership of the property but were significantly improved by VELCO in summer 2018. VELCO also installed a gate on this road at the time of these

improvements. This established road is probably not a feasible access for Stands 3-6, in the eastern portion of the property.

2. The old "farm road" runs from the historic Andrews farmhouse's driveway along the southeastern boundary of the ACF, connecting to the ACF's northernmost pasture. This road is a possible access to eastern portions of the ACF, although it would need substantial improvements to afford log truck access. A gate was also installed on this access by volunteers in summer 2018.

A more likely access to eastern portions of the ACF may be through neighbors to the south or east, either Maple Wind Farm or VYCC. The specifics of access through these neighbors has not yet been investigated.

Operability refers to the ability of logging equipment to operate within the property. Operability may be limited by steep or rocky ground, natural features such as water bodies, wetlands and cliffs, and a lack of available, appropriate skid trail infrastructure.

Operability in the majority of the ACF is fair, with existing skid trails and old farm roads reaching most areas. Small portions of the property are steep, rocky, wet and/or feature thin soils which will limit the ability of logging equipment to operate but should not significantly limit operability in the ACF overall. For the most part, these sensitive areas should be avoided anyway in accordance with best practices for soils, as described above. Vermont AMP standards should be met or exceeded whenever harvesting occurs, to protect streams, wetlands, vernal pools and wet areas, especially near the property's mapped RBZ's and EPZ's.

Access and Operability priorities:

- Monitor existing forest management road infrastructure for erosion and stabilize as necessary.
- Investigate improvement of "farm road."
- Investigate access to eastern portions of the ACF through a neighbor to the east and/or south.
- If possible/necessary, install waterbars on steep sections of forest management roads and trails that lack them prior to harvesting.
- Investigate if improvements to historic roads and trails would improve their drainage, stability, and interaction with sensitive sites and habitats.

Cultural Features

Cultural features are elements of the landscape that speak to its history. Common examples of these are stone walls, the foundations of old homes, historical artifacts, and plant assemblages associated with agricultural use.

The ACF has tremendous cultural value to the Richmond community as a recreational and community resource. It also features many significant historical features that pre-date the municipal ownership of this property, dating back to when the area was farmed. These resources include old cars and agricultural implements, in addition to stone and wire fencing (see p. 13 of MP for more details). These and any other cultural artifacts found in the ACF should be protected in the course of forest management and recreational trail development.

Cultural features priorities:

- All cultural features should be buffered and protected during the course of forest management and recreational activities.

- All cultural features should be mapped as they are discovered.
- A 50-foot-wide buffer should be maintained around all cellar holes and cultural artifacts. All known locations of cultural resources should be located and marked prior to harvesting.

Boundaries

Boundaries of forested properties are usually marked by a combination of wire and stone fence line and trees which are "blazed" (marked with an axe) and/or marked with paint. Corners are usually marked by metal pipes, rebar, metal stakes, cement monuments or stone piles, in addition to blazed "witness trees." Depending on the way that boundaries were marked, and how they were subsequently maintained, these boundaries can be either very clear or virtually non-existent.

Clearly-marked boundaries are essential to the management of forested properties. Vermont law dictates that forest landowners must demarcate boundaries prior to harvesting of timber. Failure to locate or maintain boundaries may result in disputes with neighboring property-owners, and/or expensive surveying costs. For this reason, it is recommended that boundaries are walked and maintained continuously, but not less frequently than once every 5 years.

The boundaries of the ACF are in variable condition, but are present in most areas, marked by paint, blazes, flagging, and wire fence.

<u>Boundary maintenance priorities:</u>

- All unmarked boundaries that can be located using existing field evidence should be marked with durable, bright boundary marking paint in the next 5 years.
- Any sections of boundary lines that cannot be located should be identified, and options for surveying them considered.
- Monitor boundary lines regularly and re-paint every 5 years.

--- ACTIVE FOREST STEWARDSHIP ---

Forest stewardship is a term that describes the way we care for our forests, from the management of boundary lines, roads and trails to how we influence forest structure and composition through active management. Forest stewardship often involves harvesting some trees to encourage the growth of the healthiest trees in the forest, provide firewood or sawtimber, increase production of maple sap, generate some income for a landowner, and/or to create wildlife habitat and/or structural conditions that may be lacking across the landscape.

Vermont's Working Landscape.

The "working landscape" is a term that refers to actively-managed, undeveloped land and how this land contributes positively to Vermont's economy, ecology, and cultural identity. While the term is often used to refer to agricultural land, the vast majority of Vermont's working landscape is actually "working forest," engaged in long-term forest management for timber, wildlife habitat, maple syrup, forest-based recreation and other benefits. Vermont is about 76% forested and approximately 80% of these forested lands are privately-owned, meaning that individuals and families are ultimately responsible for the management of our forests and the benefits they produce, from local economic benefits to the production of local, renewable resources to scenic beauty, recreational opportunities, clean air, clean water, wildlife habitat and carbon sequestration and storage. The development and loss of forests and ecosystems is by far the greatest threat to Vermont's forests, and one that existentially threatens all of the benefits defined above and below. Land ownership can be challenging and costly, and so allowing private landowners to periodically harvest forest products in a responsible way for their own use and/or to generate income produces local, renewable resources and may help provide the economic means to keep forested land intact forested. Encouraging a healthy forest product economy based on responsible forest management may also be a force for economic justice in our communities, making it so that people of all different means can afford to own forested land.

Keeping the ACF "working" benefits Richmond and the surrounding community in a variety of ways. The harvesting of forest products benefits the local economy, providing work for local loggers, mills, truckers, firewood processors, value-added wood product producers and retailers by generating local, renewable resources in an intentional and sustainable way. Active forest management can also provide a means to address human-created conditions in the forest, improving wildlife habitat and forest health by increasing diversity and habitat conditions that may be underrepresented across the landscape. Finally, showcasing high-quality forest management through the harvesting of timber, as described above, provides opportunities for residents of Richmond and beyond to learn from and interact with this process. Incorporating extensive education and outreach as a critical component of any active forest management will produce benefits that emanate far beyond the boundaries of the ACF, helping make the public more aware and knowledgeable of modern, well-executed forest management and the production of local, renewable forest resources.

Demonstration of Responsible Forest Stewardship.

Beyond producing ecosystem services like clean air, clean water, wildlife habitat and carbon sequestration and storage, the ACF has the opportunity to serve as a model of responsible forest stewardship. By demonstrating high-quality forest management and having education and outreach around these activities be a priority the ACF can educate landowners, municipalities

and others on how to be good forest stewards, creating benefits that will emanate far beyond its borders. Every activity prescribed in this FMP is intended to be applied in conjunction with public events, forums, educational tools and activities that will showcase and build understanding around these practices. Care should be taken to cultivate an open, transparent, and inclusive process around all of these events, providing many opportunities for members of the Richmond community (and those in surrounding communities) to ask questions, comment, and be heard in different ways.

Any and all proceeds from timber harvested at the ACF should be used towards the maintenance of the ACF, its forest health and its recreational opportunities. It is recommended that at least 50% of proceeds be specifically dedicated towards wildlife habitat enhancement, non-commercial forest stand improvement work, forest road stabilization and improvement and invasive species control.

--- OVERVIEW OF FOREST CONDITIONS ---

Overall, the ACF is a diverse, vibrant forest featuring unique conditions and unusual forest and natural community types. Differing land use and timber harvesting histories have led to forest stands in a variety of developmental stages are present, though multi-aged forest and very old, or *late successional* forest types are generally not represented.

The majority of the ACF is dominated by forests typical of south-facing slopes in the Winooski River Valley in Chittenden County. At and below 600 feet in elevation, soils are dominated by sand and gravel deposits from Lake Vermont, which inundated this area from about 13,500 – 11,000 years ago at that approximate elevation, depositing these coarser materials. The presence of sand and gravel deposits generally contribute to dryer, more acidic soils overall, although some pockets of more enriched sand and silt loams exist in these areas, and portions of Stand 1 are influenced by calcareous bedrock. Above 600'ASL, soils are largely influenced by bedrock, soil depth, aspect and microsite factors. Most areas features forest and natural community types indicative of dry, acidic sites. Where concave slopes lead to increased water retention and organic matter/mineral deposition there are small areas of localized enrichment featuring rich-site indicator species like sugar maple, white ash and basswood, in addition to herbaceous species like blue cohosh and maiden-hair fern.

Forests in the ACF are generally even-aged and two-aged. In the east of the property, even-aged forests dominated by white pine and red oak appear to have been heavily harvested in the late 1990's and/or early 2000's, removing large white pine and some large red oak. This left a forest with an overstory of variable composition and quality, largely dominated by red oak, red maple, American beech and white pine. This harvest regenerated a midstory dominated by these same species but with a much higher presence of beech, likely due to deer browse impacts on regeneration. Since the establishment of this midstory, beech root sprouts have established in the understory in some areas.

In the northeastern portion of the property, harvesting around this same time period left a more highly-stocked residual stand, resulting in a largely even-aged forest dominated by red oak, beech, red maple and white oak. There is an understory of nearly pure beech in some portions of this area.

In western portions of the property, harvesting in 2011-13 sought to establish a new cohort of trees through patch cuts of various sizes and shelterwood areas, featuring dispersed retention of hardwood (oak, beech, sugar maple) seed trees in residual densities of 30 – 60ft^2/acre of basal area. The result of this harvest is a mosaic of different structural conditions, although most areas feature a generally two-aged structure. Some of this area features early successional habitat conditions, an important habitat type which is relatively underrepresented across Vermont's landscape. The regenerating cohort in these areas is variable in composition, though some areas feature extensive deer browse damage which has virtually eliminated all species but beech and striped maple.

Far southern portions of the ACF feature small areas of low-vigor, even-aged white pine forests. These areas are the result of field abandonment around the 1960's. White pine in these areas have a high incidence of white pine weevil damage and blister rust, and generally exhibit poor health. These trees have also begun to succumb to windthrow, creating small gaps. In southwestern areas, these forests and gaps have been invaded by invasive exotic species, mostly shrub honeysuckle (*Lonicera* spp.), Japanese barberry (*Berberis* sp.) and common buckthorn (*Rhamnus cathartica*).

There are a variety of interesting and unusual micro-sites on the ACF, from the natural communities identified by VLT in the property's conservation easement to areas with unusual vegetation, hydrology, soil conditions and aesthetic properties. Several areas of the property feature

charismatic views. Unique sites should be protected in the course of any active management of the ACF.

Forest Management Priorities

The Management Priorities outlined above give the framework for management decisions that will occur in the ACF. However, this framework must be translated into action on the ground. Forest Management is addressed most directly in the MP in the "Forestry" Section (pp 19-21).

Specifically, the prescriptions in this FMP will:

- Honor the terms and condition of the ACF MP, and the ACF's conservation easement.
- Act aggressively to control invasive exotic plant species.
- Work to enhance species and structural diversity over time.
- Encourage late-successional forest characteristics, including recruiting and maintaining fine and coarse woody debris and biological legacy trees.
- Protect uncommon natural community types and sensitive features.
- Protect water resources.
- Protect cultural resources.
- Protect and enhance opportunities for wildlife, including providing habitat conditions that are relatively uncommon across the landscape.
- Enhance the resilience of forests to climate change and natural/human-caused disturbance events.
- Increase carbon sequestration and storage capacity in the ACF.
- Demonstrate responsible forest stewardship, with a goal of increasing the quality of forest stewardship in the town/county/region.

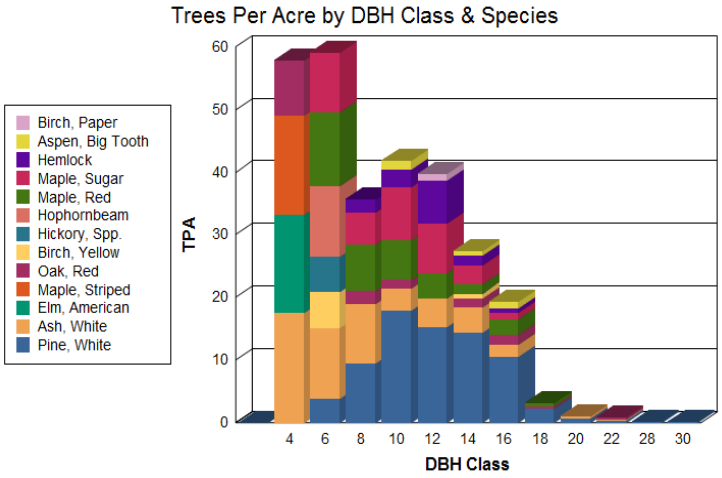
--- STAND DESCRIPTIONS ---

Stand 1

Size: 43 Acres

Forest Type: White Pine – Northern Hardwood Forest

Structure & Composition: This is a generally two-aged stand, dominated by white pine but with pockets of hardwoods. White pine accounts for 43.7% of the total basal area in the stand, followed by white ash (13.3%), sugar maple (12.7%) and red maple (11.6%). A variety of other species, including red oak, hemlock and other northern hardwoods were also noted during the field inventory. This stand is variable in structure, with large pockets having blown down in either the 2010 or 2012 windstorms that struck this region. Blowdown areas have regenerated into a mixed cohort of northern hardwood species with extensive deer browse damage.



General Description: Stand 1 is the youngest stand in the ACF. While the rest of the ACF was allowed to revert from field to forest in the late 1800's or early 1900's historic aerial photos show this area as open/agricultural land through the 1960's. The character of Stand 1 is largely dominated by the white pine component, although pockets of hardwoods are scattered throughout. Areas of white pine have partially succumbed to blowdown, especially in the west of the Stand, causing the regeneration of a 7-9 year old cohort of mixed hardwood regeneration. Soils in this Stand show signs of enrichment but are somewhat thin in most places, with exposed bedrock visible throughout the stand. This stand features moderate infestations of honeysuckle, common buckthorn and Japanese barberry, and extensive damage to the understory from an overabundance of white-tailed deer.

Stand Summary: 12 plots, 10 BAF prism

Total Basal Area/Acre:	139.2 ft^2
Acceptable Basal Area/Acre:	80.7 ft^2
Quadratic Mean Stand Diameter: in.	9.4
Trees/Acre:	286.6

Approximate Stand Age: 60 years/7-9 years (younger age class)

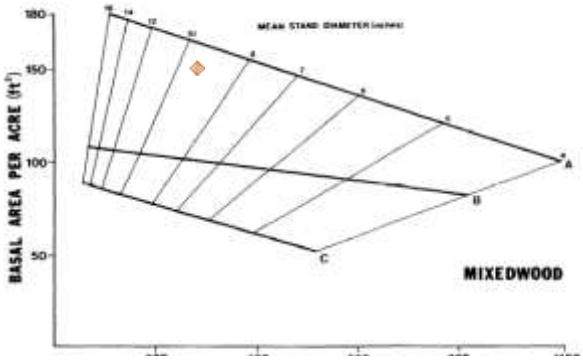


Figure 4: Mixedwood Stocking Guide. Leak, W.B., Yamasaki, Y., and R. Holleran. 2014. Silvicultural Guide for Northern Hardwoods in the Northeast Gen. Tech. Rep. NRS-132.

Stand Health: Invasive exotic plants are by far the biggest threat to the health of this stand. Additionally, deer browse damage is extremely prevalent in this stand, with over-browsing by deer contributing significantly to the poor composition of the regenerating cohort. White pine is declining in this stand and is likely to be subject to more windthrow in the future.

Invasive Species: Common buckthorn, shrub honeysuckle, Japanese barberry.

Soil Types: Lyman Marlow Complex, Peru Fine Sandy Loam, Marlow Fine Sandy Loam, Agawam Fine Sandy Loam.

History/Previous Activity: This area was cleared in the 1800's for pasture. Following this, it was managed as cow pasture and sugarbush until around the 1960's. No evidence of harvesting was noted prior to the blowdown event in 2010/12 but it is probably that the stand was thinned sometime in the last 20 years due to the presence of a distinct cohort of 4-6" DBH poles.

Access and Operability: This stand is accessed via the established road and landing extending from the ACF's parking area.

Management Objectives:

The primary objective for management of this area is the encouragement of a healthy, diverse, resilient forest, including the establishment and maintenance of structural and species diversity, the maintenance of high-quality wildlife habitat, the encouragement of carbon sequestration and storage and the maintenance of natural stand dynamics and ecosystem processes. Also of high importance is the sustained production of local renewable forest resources, the continued use of this area for dispersed recreation, the protection of water resources, and the use of this area as a site to demonstrate responsible forest stewardship.

Management Activities:

The priority for this stand should be the treatment of invasive exotic plants. The infestation of these species is at a level that will likely require the targeted use of herbicide in most areas. This work will likely need to be contracted out to an invasive plant removal contractor.

Other actions that would benefit the health of this Stand over the next 10 years would be to intentionally lower the deer population in this area, particularly through the hunting of antlerless deer. It is recommended that a system for attracting hunters to this area be investigated, with a goal to increase the amount of antlerless deer harvested from the ACF.

While no additional harvesting is prescribed in this Stand, should harvesting occur in Stand 2 it is recommended this Stand be at least partially treated using an expanding gap irregular shelterwood treatment:

- This treatment will create patches up to 2 acres in size within which all trees will be harvested, with the exception of occasional healthy seed trees of a variety of native species and wildlife trees, and existing high-quality regeneration. Patches will be preferentially placed to expand the gaps created by blowdowns, releasing established regeneration, creating more regeneration and harvesting poor-quality trees before they succumb to windthrow. No more than 10 acres in total patches will be harvested in Stand 1 in the course of this treatment.
- Occasional poor-quality trees, and/or trees crowding stems of superior form, quality and condition, between patches may be harvested, lowering basal area between gaps to ~110 $feet^2$/acre.

- Between groups, where red oak and other hard mast trees are found their mast production should be encouraged by conducting a crown release on 2-4 sides.
- Due to ground conditions in the Stand and access considerations harvesting should preferably be done in winter, under frozen ground conditions.

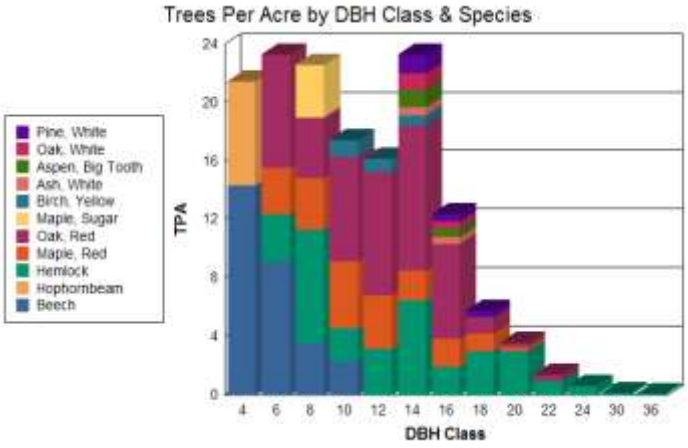
If harvesting is to occur in this Stand as described above, an amendment to this FMP will be brought before the Richmond Selectboard at that time.

Stand 2

Size: 105 Acres

Forest Type: Hemlock – Northern Hardwood Forest

Structure & Composition: This Stand is comprised of the most recently harvested areas on the ACF, the management of which has resulted in a two-aged strucutre, with an overstory of variable density overtopping a young cohort of regeneration. The dominant cohort is comprised mostly of red oak (36% of the stocking by basal area), in addition to hemlock (33.5%), red maple (14.2%) and beech (5.2%). Aspen, white oak, white pine and other hardwoods are present as minor associates. The younger/regenerating age class is comprised of a mix of northern hardwood species, with beech and aspen in abundance.



General Description: Stand 2 is the area of the ACF harvested in 2011-13. This harvest utilized several regeneration treatments, creating patches up to ~3 acres in size, in addition to shelterwood/seed tree patches throughout this stand. The result is a mosaic of regenerating areas and scattered slivers of uncut forest with a residual basal area ranging from 0 – 150 ft^2/acre, but with most areas between 0 – 60 ft^2/acre. Most trees retained within these shelterwood/seed tree patches were red oak, although a variety of other species are represented.

Stand Summary: 18 plots, 10 BAF prism

Total Basal Area/Acre:	84 ft^2
Acceptable Basal Area/Acre:	71 ft^2
Quadratic Mean Stand Diameter:	11 in.
Trees/Acre: 148	

Approximate Stand Age: 80/6-8 years

Stand Health: This stand is recovering from recent harvesting, with scattered mortality and decline noted in overstory trees at a low/acceptable level. The regenerating cohort is highly impacted by deer browse, which

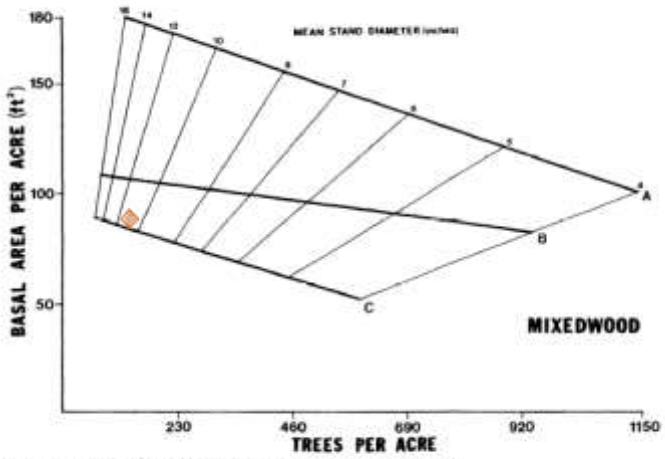


Figure 7.—Stocking guide for main crown canopy of mixedwood stands (25 to 65 percent softwoods) shows basal area and number of trees per acre and quadratic mean stand diameter. The A line is fully stocked, the B line is suggested residual stocking, the C line is minimum stocking.

appears to be having a significant impact on its health and composition.

Invasive Species: None noted, although some are likely present in regenerating areas.

Soil Types: Lyman-Marlow complex.

Figure 5: Mixedwood Stocking Guide. Leak, W.B., Yamasaki, Y., and R. Holleran. 2014. Silvicultural Guide for Northern Hardwoods in the Northeast Gen. Tech. Rep. NRS-132.

History/Previous Activity: This area was cleared in the 1800's for pasture. 1942 field maps show this area as forested, meaning that it was allowed to revert to forest sometime in the late 1800's- early 1900's. This stand was probably partially harvested in the late-1900's/early 2000's and then harvested aggressively in 2011-13. This most recent harvest retained trees of a variety of species at a variety of residual densities using whole-tree harvesting equipment, removing the understory from harvested areas.

Access and Operability: This stand is accessed via the property's main access road, which was improved and gated by VELCO in 2018. Both the road and landing are in very good condition.

Management Objectives:

The primary objective for management of this area is the encouragement of a healthy, diverse, resilient forest, including the establishment and maintenance of structural and species diversity, the maintenance of high-quality wildlife habitat, the encouragement of carbon sequestration and storage and the maintenance of natural stand dynamics and ecosystem processes. Also of high importance is the sustained production of local renewable forest resources, the continued use of this area for dispersed recreation, the protection of water resources, and the use of this area as a site to demonstrate responsible forest stewardship.

Management Activities:

The priority for this stand should be the treatment of invasive exotic plants. The infestation of these species in the south of the Stand is at a level that will likely require the targeted use of herbicide in most areas. This work will likely need to be contracted out to an invasive plant removal contractor.

Other actions that would benefit the health of this Stand over the next 10 years would be to intentionally lower the deer population in this area, particularly through the hunting of antlerless deer. It is recommended that a system for attracting hunters to this area be investigated, with a goal to increase the amount of antlerless deer harvested from the ACF.

From a purely silvicultural perspective, residual trees overtopping the regenerating portions of Stand 2 should be removed around 2020-21, 8 years after the most recent harvesting. Removing residual overstory stems would encourage the more rapid growth of the regenerating cohort in the Stand, doing so at a time when young trees will be able to respond vigorously to the disturbance associated with harvesting. Deferring harvesting to a later date may result in the loss or slowing of growth of the regenerating cohort and a higher chance of mortality as a result of this harvest.

That said, harvesting of this type also has aesthetic impacts which must be considered, especially as the Richmond community becomes acquainted with the ACF. For this reason, harvesting is this Stand is not prescribed at this time. However, the health and composition of the regenerating cohort in this Stand should be continually monitored. If it seems prudent for the health of the Stand to release this cohort, the Stand should be harvested as follows:

- A patch overstory removal treatment is recommended to occur in this Stand in 2020-21. This treatment will remove overstory trees in regenerating areas throughout Stand 2, retaining 10-30ft^2/acre of basal area of seed trees (primarily red and white oak) and wildlife trees per acre, in addition to all dead standing trees. This treatment should affect no more than 35% of Stand 2 (~37 acres). All portions of this Stand left uncut in 2011-13, in addition to pockets with a variety of retention species and densities, should be retained for diversity.
- Between patches, individual poor quality trees may be harvested to encourage the growth of the healthiest stems in the Stand. Basal area between patches should be reduced to no less than 70 ft^2/acre.
- Where red oak and other hard mast trees are found between patches, their mast production should be encouraged by conducting a crown release on 2-4 sides.
- This treatment may occur in dry summer months or in winter, and should be scheduled, if possible, to coincide with oak and/or white pine mast years. It is likely that this treatment, in order to be economical, may require the use of whole-tree harvesting equipment.

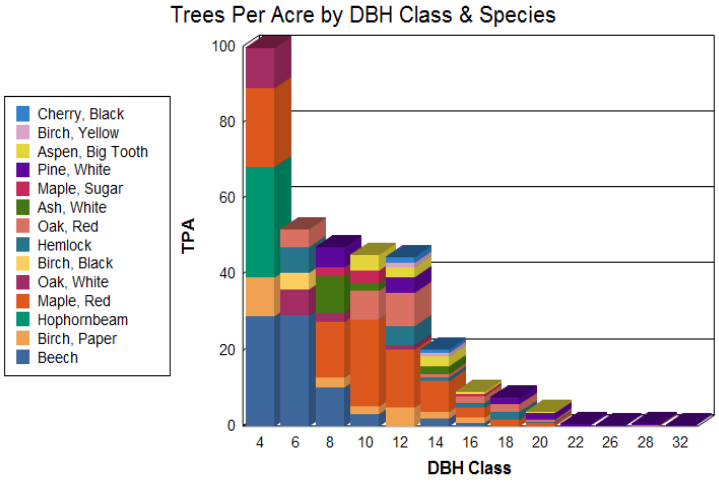
<u>If harvesting is to occur in this Stand as described above, an amendment to this FMP will be brought before the Richmond Selectboard at that time.</u>

Stand 3

Size: 54 Acres

Forest Type: Northern Hardwood Forest

Structure and Composition: This stand is dominated by red maple (32% of the basal area), with red oak (13.4%), white pine (11.4%), beech (9.5%), hemlock (8.3%) and paper birch (7%) present to lesser degrees. Ash, aspen, white oak, sugar maple and other hardwoods are present as associates. This is a two-aged stand resulting from field abandonment in the early 1900's and relatively heavy harvesting in the 1990's. The result is an overstory comprised of primarily red oak, red maple, white pine and beech overtopping a midstory of 2-6" DBH northern hardwood poles A third, relatively sparse age class of primarily beech has established in the understory as a result of root-sprouting and deer browse.



General Description: Aerial photos from 1942 show parts of this stand in a state of regeneration, with some areas still relatively open. Field evidence suggests that much of this Stand was allowed to succeed from field to forest around the 1930's. The result of this field abandonment appears to have been a Stand dominated by white pine, with red oak and red maple present as more minor associates. The majority of that white pine, in addition to some larger oak, was removed in the 1990's, regenerating a new cohort of hardwood poles, including red oak, sugar maple, yellow birch and beech, in addition to some paper birch and aspen. The data below (as shown in the graph above) reflects a large number of trees in this younger age class, which alter the data in the stand overall. In reality, basal area is somewhat lower and QMD is much higher in the overstory than the stand-wide data would suggest. This stand is well-stocked, but not overstocked to the extent depicted below.

Stand Summary: 15 plots, 10 BAF

Total Basal Area/Acre:	144 ft^2
Acceptable Basal Area/Acre:	100 ft^2
Quadratic Mean Stand Diameter:	9 in.
Trees/Acre:	330.9

Approximate Stand Age: 90/30 years

Stand Health: Some blister rust noted on white pine, and beech bark disease present throughout. Large red maple are generally declining.

Invasive Species: Several scattered Japanese barberry noted in the center of the Stand.

Soil Types: Lyman- Marlow complex, Munson and Belgrade silt loams.

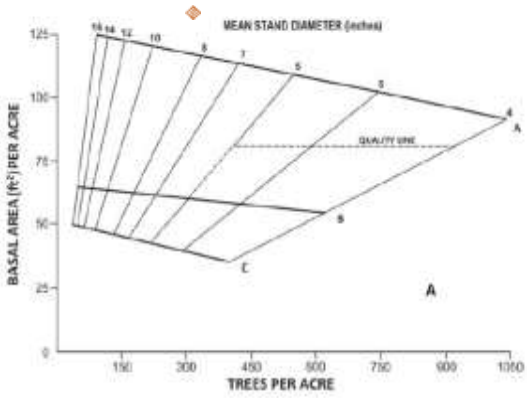


Figure 6: Hardwood Stocking Guide. Leak, W.B., Yamasaki, Y., and R. Holleran. 2014. Silvicultural Guide for Northern Hardwoods in the Northeast Gen. Tech. Rep. NRS-132.

History/Previous Activity: This Stand was cleared for pasture in the 1800's and allowed to succeed to forest in the 1930's-40's. According to field evidence, large white pine and red oak were removed in the 1990's in a relatively heavy harvest. No harvesting has occurred in the Stand since, except for perhaps occasional harvesting of small amounts of firewood.

Access and Operability: Access to this Stand may occur via the ACF's old "farm road," but will more likely require the use of a truck road and landing on the property of a neighbor to the south/east.

Management Objectives:

The primary objective for management of this area is the encouragement of a healthy, diverse, resilient forest, including the establishment and maintenance of structural and species diversity, the maintenance of high-quality wildlife habitat, the encouragement of carbon sequestration and storage and the maintenance of natural stand dynamics and ecosystem processes. Also of high importance is the sustained production of local renewable forest resources, the continued use of this area for dispersed recreation, the protection of water resources, and the use of this area as a site to demonstrate responsible forest stewardship.

Management Activities:

This Stand presents an excellent opportunity to showcase uneven-aged management in the ACF, especially as a contrast to the more even-aged methods used in Stand 2 in 2011-13.

Over the next 10 years, a single tree/group selection treatment should be implemented in this Stand, with a goal of increasing species and structural diversity in the Stand. Groups up to 1 acre in size, within which all stems except for scattered seed trees and wildlife trees will be harvested, should be established in areas of poor quality and mature trees. These groups should scattered throughout the Stand, occupying no more than 20% of the total Stand area (~11 acres). The goal of these groups is to establish regeneration of all native species, but especially red and white oak and white pine. Beech is an important part of the present and future composition in this Stand, but harvesting will generally seek to lower its abundance overall due to the effects of beech bark disease, its positive correlation with deer browse and its tendency to create a monoculture in the forest understory. Groups should be located around oak and pine seed trees and to the extent possible should be timed to occur around oak and pine mast years.

Between groups, a single tree selection treatment will lower stocking to 70-80 ft^2/acre of basal area, removing poor quality and mature trees of all age classes, and those competing with trees of superior form, quality and condition.

Red and white oak trees located between groups should have their crowns released from competition on 2-3 sides to increase their health and mast production.

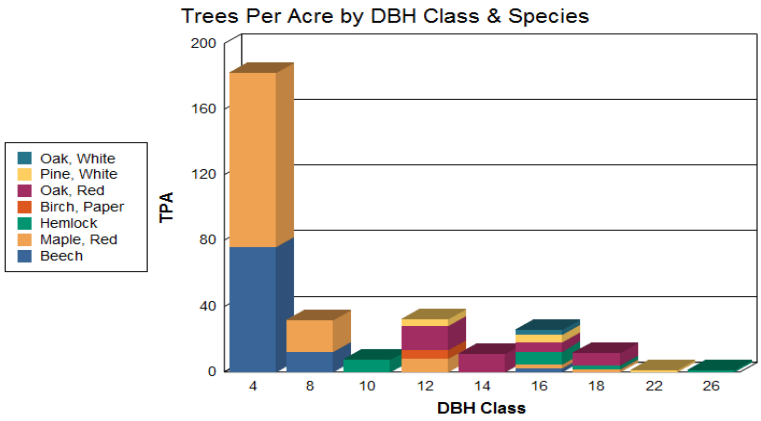
This harvesting may occur in dry summer/fall months (this may increase likelihood of oak and pine regeneration) or in winter, and may utilize a whole-tree ("mechanized") or cable-skidder logging crews. In the case of the latter harvesting equipment, language will have to be put into the timber sale contract that all stems must be felled within groups, including very small saplings.

Stand 4

Size: 30 Acres

Forest Type: Red Oak – Northern Hardwoods

Structure and Composition: This stand is similar to Stand 3 in many ways, but is located at a slightly higher elevation and differs from the former stand in composition. Stand 4 is primarily dominated by red oak (40% of the basal area), with red maple (27%), hemlock (20%), beech (13%), and white pine (13%) also present. White oak, paper birch and other hardwoods are present as associates. This is a two-aged stand resulting from field abandonment in the early 1900's and harvesting activity in the 1990's. The result is an overstory comprised of primarily red oak and red maple with scattered white pine and pockets of hemlock overtopping a mid-story of 2-6" DBH northern hardwood poles. A third, relatively sparse age class of (primarily) 1-2" DBH beech has established in the understory as a result of root-sprouting and deer browse.



General Description: Aerial photos from 1942 show this stand as primarily forested. Field evidence suggests that much of this Stand was allowed to succeed from field to forest in the early 1900's. The result of this field abandonment appears to have been a stand dominated by white pine and red oak, with hemlock and red maple present as associates. Large white pine and red oak was harvested in the 1990's, regenerating a new cohort of hardwood poles, including red oak, sugar maple, yellow birch and beech, in addition to some paper birch and aspen. The data below reflects a large number of trees in this younger age class which alter the data in the stand overall (see graph, above). In reality, stocking is somewhat lower and QMD is higher in the overstory than the data here suggests. This stand is well-stocked, but not to the extent depicted below.

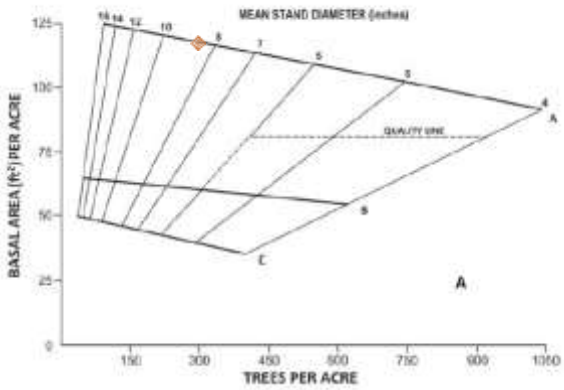
Stand Summary: 4 plots, 10 BAF prism

Total Basal Area/Acre: 120 ft^2

Acceptable Basal Area/Acre: 79 ft^2

Quadratic Mean Stand Diameter:
8.5

Trees/Acre
304



Approximate Stand Age: 90/30 years

Stand Health: Many red maples are multi-stemmed, and beech bark disease is ubiquitous.

Invasive Species: None noted.

Soil Types: Lyman Marlow complex.

History/Previous Activity: This area was probably maintained as open pasture until the early 1900's, when it was allowed to revert to forest. It was harvested in the 1990's, according to field evidence.

Figure 7: Hardwood Stocking Guide. Leak, W.B., Yamasaki, Y., and R. Holleran. 2014. Silvicultural Guide for Northern Hardwoods in the Northeast Gen. Tech. Rep. NRS-132.

Access and Operability: Access to this Stand may occur via the old farm road, but will more likely require the use of a truck road and landing on the property of a neighbor to the south/east.

Management Objectives:

The primary objective for management of this area is the encouragement of a healthy, diverse, resilient forest, including the establishment and maintenance of structural and species diversity, the maintenance of high-quality wildlife habitat, the encouragement of carbon sequestration and storage and the maintenance of natural stand dynamics and ecosystem processes. Also of high importance is the sustained production of local renewable forest resources, the continued use of this area for dispersed recreation, the protection of water resources, and the use of this area as a site to demonstrate responsible forest stewardship.

Management Activities:

This Stand presents an excellent opportunity to showcase uneven-aged management in the ACF, especially as a contrast to the more even-aged methods used in Stand 2 in 2011-13.

Over the next 10 years, in conjunction with work planned in adjacent stands, a single tree/group selection treatment should be implemented in this Stand, with a goal of increasing species and structural diversity. Groups up to 1 acre in size, within which all stems except for scattered seed trees and wildlife trees will be harvested, should be established in areas of poor quality and mature trees. These groups should scattered throughout the Stand, occupying no more than 20% of the total Stand area (~6 acres). The goal of these groups is to establish regeneration of all native species, but especially red and white oak and white pine. Beech is an important part of the present and future composition in this Stand, but harvesting will generally seek to lower its abundance overall due to the effects of beech bark disease, its positive correlation with deer browse and its tendency to create a monoculture in the forest understory. Groups should be located around oak and pine seed trees and to the extent possible should be timed to occur around oak and pine mast years.

Between groups, a single tree selection treatment will lower stocking to 70-80 ft^2/acre of basal area, removing poor quality and mature trees of all age classes, and those competing with trees of superior form, quality and condition.

Red and white oak trees located between groups should have their crowns released from competition on 2-3 sides to increase their health and mast production.

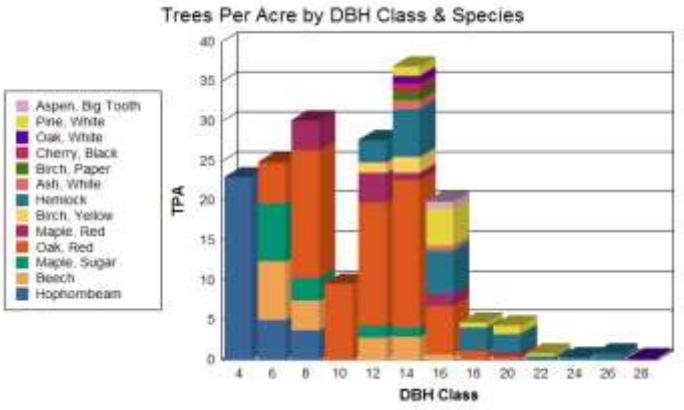
This harvesting may occur in dry summer/fall months (this may increase likelihood of oak and pine regeneration) or in winter, and may utilize a whole-tree ("mechanized") or cable-skidder logging crews. In the case of the latter harvesting equipment, language will have to be put into the timber sale contract that all stems must be felled within groups, including very small saplings.

Stand 5

Size: 29 Acres

Forest Type: Red Oak – Hemlock -- Northern Hardwoods

Structure and Composition: This stand differs from Stands 3 and 4 in composition, structure and topography. Stand 4 is primarily dominated by red oak (52% of the basal area), with hemlock (30%), white pine (11%), beech (8%), and red maple (8%) also present. Yellow birch, white oak, sugar maple and other hardwoods are present as associates. This is a two-aged stand resulting from field abandonment in the early 1900's and harvesting activity in the early 2000's, which resembled a shelterwood treatment. This treatment regenerated a stand which is still very young, with many stems <4" DBH. The regenerating cohort is dominated by beech, in addition to a mix of other northern hardwoods.



General Description: Aerial photos from 1942 show this stand as forested. Field evidence suggests that much of this Stand was allowed to succeed from field to forest in the late 1800's, early 1900's. The result of this field abandonment appears to have been a Stand dominated by white pine, red oak and hemlock. A shelterwood-type treatment in the early 2000's lowered the density in the overstory, regenerating a new cohort of hardwood saplings dominated by beech, in addition to a mix of other northern hardwoods. The data below reflects areas harvested in this most recent treatment, in addition to small areas that were not cut, including highly-stocked hemlock areas. In much of the stand, overstory stocking is significantly lower than the data below would suggest.

Stand Summary: 10 plots, 10 BAF prism

Total Basal Area/Acre:	127 ft^2
Acceptable Basal Area/Acre:	102 ft^2
Quadratic Mean Stand Diameter:	11.3
Trees/Acre	183.1

Approximate Stand Age: 90/30 years.

Stand Health: Many red maples are multi-stemmed, and beech bark disease is ubiquitous.

Invasive Species: None noted.

Soil Types: Lyman Marlow complex.

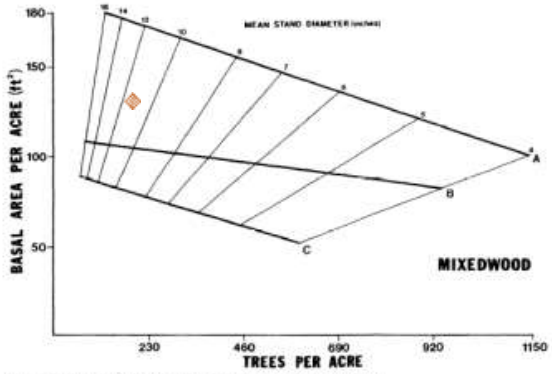


Figure 7.—Stocking guide for main crown canopy of mixedwood stands (25 to 65 percent softwoods) shows basal area and number of trees per acre and quadratic mean stand diameter. The A line is fully stocked, the B line is suggested residual stocking, the C line is minimum stocking.

History/Previous Activity: This area was probably maintained as open pasture until the early 1900's, when it was allowed to revert to forest. It was harvested in the 2000's, according to field evidence.

Access and Operability: Access to this Stand may occur via the old "farm road," but will more likely require the use of a truck road and landing on the property of a neighbor to the south/east.

Figure 8: Mixedwood Stocking Guide. Leak, W.B., Yamasaki, Y., and R. Holleran. 2014. Silvicultural Guide for Northern Hardwoods in the Northeast Gen. Tech. Rep. NRS-132.

Management Objectives:

The primary objective for management of this area is the encouragement of a healthy, diverse, resilient forest, including the establishment and maintenance of structural and species diversity, the maintenance of high-quality wildlife habitat, the encouragement of carbon sequestration and storage and the maintenance of natural stand dynamics and ecosystem processes. Also of high importance is the sustained production of local renewable forest resources, the continued use of this area for dispersed recreation, the protection of water resources, and the use of this area as a site to demonstrate responsible forest stewardship.

Management Activities:

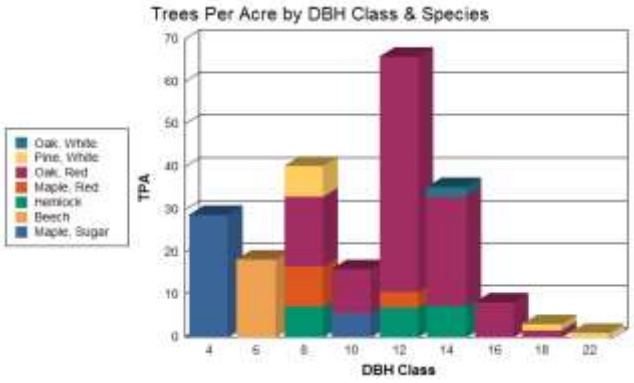
Due to the relatively recent treatment of this Stand, no harvesting is prescribed over the next 10 years. If possible, regeneration in the Stand should be inventoried to determine if further treatments are necessary to release/improve the younger cohort present.

Stand 6

Size: 38 acres

Forest Type: Hemlock – Northern Hardwood Forest

Structure & Composition: This stand is dominated by red oak (87.5% of the stocking by basal area). Hemlock (15%), and white pine (7.5%)/ Beech, red maple and other hardwood species are also present as minor associates. This is an even-aged stand which was most recently harvested in an intermediate treatment 15-25 years ago.



General Description: This Stand differs from others in the ACF in its management history, in in addition to the prominence of red oak. The agricultural history of this area is not known, though it is likely that it was at some point cleared for agriculture and allowed to revert to forest around the late 1800's or early 1900's. The most recent harvest in this area occurred in the mid-1990's or early 2000's, when the Stand was essentially "thinned," not creating enough room in the canopy to regenerate a robust younger age class. The understory of this stand is dominated by 1-3" DBH beech saplings as a result of root sprouting and deer browse impacts.

Stand Summary: 3 plots, 10 BAF prism

Total Basal Area/Acre:	125 ft^2
Acceptable Basal Area/Acre:	120 ft^2
Quadratic Mean Stand Diameter:	10.3
Trees/Acre	216.5

Approximate Stand Age: 100 years

Stand Health: Beech bark disease is present, deer browse impacts throughout.

Invasive Species: none noted.

Soil Types: Lyman-Marlow complex

History/Previous Activity: This stand was cleared in the early to mid-1800's, and then probably allowed to revert to forest in the late 1800's-early 1900's. It

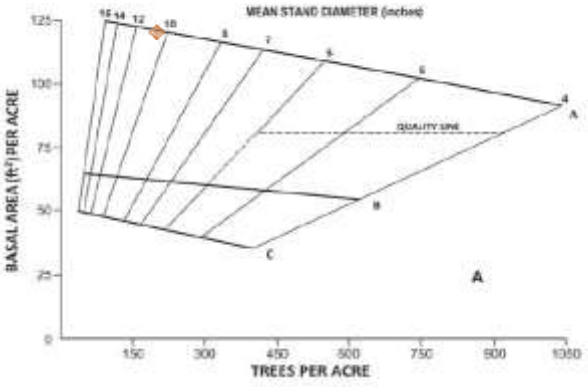


Figure 9: Hardwood Stocking Guide. Leak, W.B., Yamasaki, Y., and R. Holleran. 2014. Silvicultural Guide for Northern Hardwoods in the Northeast Gen. Tech. Rep. NRS-132.

was last harvested in an intermediate treatment in the 1900's or 2000's.

Access and Operability: Access to this Stand may occur via the old farm road, but will more likely require the use of a truck road and landing on the property of a neighbor to the south/east.

Management Objectives:

The primary objective for management of this area is the establishment and the maintenance of structural and species diversity, the maintenance of high-quality wildlife habitat, the sustained production of forest products using low-impact logging techniques, and the use of this area for dispersed recreation.

The use of uneven-aged management techniques will transition this stand over time to a condition which is rich in species diversity, structural diversity, and well-stocked with high-quality timber. This is a condition which is the most beneficial to forest health, wildlife habitat, and the sustained production of high-quality forest products.

Management Activities:

This Stand presents an excellent opportunity to showcase uneven-aged management in the ACF, especially as a contrast to the more even-aged methods used in Stand 2 in 2011-13.

Over the next 10 years, a single tree/group selection treatment should be implemented in this Stand, with a goal of increasing species and structural diversity of the Stands tree populations, improving wildlife habitat and regenerating a third age-class of healthy trees. Groups, within which all trees except for scattered seed trees and wildlife trees, up to 1 acre in size should be established in areas of poor quality and mature trees. Within these groups all understory stems should be severed, with the exception of pockets of high quality regeneration. These groups should scattered throughout the Stand, occupying no more than 20% of the total Stand area (~6 acres). The goal of these groups is to establish regeneration of all native species, but especially red and white oak and white pine. Beech is an important part of the present and future composition in this Stand, but harvesting will generally seek to lower its abundance overall due to the effects of beech bark disease, its positive correlation with deer browse and its tendency to create a monoculture in the forest understory. Groups should be located around oak seed trees and to the extent possible should be timed to occur around oak mast years.

Between groups, a single tree selection treatment will lower stocking to 70-80 ft^2/acre of basal area, removing poor quality and mature trees of all age classes, and those competing with trees of superior form, quality and condition.

Red and white oak trees located between groups should have their crowns released from competition on 2-3 sides to increase their health and mast production.

This harvesting may occur in dry summer/fall months (this may increase likelihood of oak and pine regeneration) or in winter, and may utilize a whole-tree ("mechanized") or cable-skidder logging crews. In the case of the latter harvesting equipment, language will have to be put into the timber sale contract that all stems must be felled within groups, including very small saplings.

Schedule of Management Activities

(Timing of specific activities may be shifted)

Stand	Activity	Scheduled Year	Priority	Cost	Funding Source/Partners
Stands 1-3	Invasive species removal	Ongoing (beginning in 2020)	1	Up to $10,000	County Forester, ACF budget, timber sale revenue.
All	Monitor for invasive species	Annually	1	N/A	Volunteers, service learning project (UVM)
All	Investigate how to facilitate safe hunting program at ACF	Ongoing	1	N/A	Vermont Fish and Wildlife, Volunteers, Town Forest Committee, County Forester
Stands 3,4,6	Single Tree/Group Selection	2021	2	N/A (Revenue positive)	County Forester
All	Monitor deer browse impacts	Ongoing	2	N/A	Volunteers/FPR Grant, UVM students
All	Boundary line maintenance	Ongoing	2	Approx. $120 - $150 (paint)	Volunteers

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Glossary

AGS: Acceptable Growing Stock (AGS) is a classification given to trees in a stand which are considered healthy and capable of producing a sawlog sometime in the future.

Age Class: See "Cohort."

Cable Skidder: A skidder which uses a cable winch to drag trees out of the forest. These skidders are generally smaller and lighter that skidding equipment used by whole-tree logging crews.

Cohort: A group or generation of trees of generally the same age, often initiating from the same disturbance event.

Composition: The proportion of trees of different species present in a given forest or stand.

Cover Type/Forest Type: A classification given to a stand based on the dominant tree species present at a given moment in time.

DBH: Diameter at Breast Height – the diameter measurement of the trunk of a tree 4.5' above the ground. DBH is the standard system for measuring tree diameter in forestry.

Even-Aged: A stand comprised of trees of a single age class (cohort), usually resulting from a single disturbance event.

Harvest: The process of cutting trees to extract a forest product from the woods.

Intermediate: The canopy position of trees who have been over-topped by other stems, but are still receiving some direct light from above. These stems are generally higher in quality than suppressed trees, and in the case of shade-tolerant species may be healthy, but overall they are poor in condition.

Irregular Group Shelterwood: There are many variants of this type of silvicultural treatment, but the version described here is a means for regenerating a stand over a period of time while creating a patchy, uneven structure. Specifically, irregular shelterwoods of this type remove the overstory of a stand in groups (which can be larger than the groups described as part of a group selection system), retaining trees which serve as potential growing stock, seed sources, and shade within the groups. Trees regenerated in this environment are likely to be moderately shade-tolerant to very shade-tolerant, with some intolerant species mixed in. These pockets of regeneration are expanded progressively over several entries, at each stage releasing the established regeneration from the previous harvest. Over time, the overstory in the stand is completely removed, replaced by a young stand with a somewhat patchy structure.

Group Selection: This treatment system involves harvesting all stems in a small area, usually no greater than 1 acre in size. These areas in which all trees are harvested are called "groups," and may be as small as 2-3 trees in size. The goal for these groups is to regenerate a new cohort of trees or to release existing regeneration. Usually, these groups will regenerate a portion of a stand in proportion to the frequency of cutting and the rotation age of the stand. For instance, in a stand with a cutting cycle (frequency) of 20 years and a target rotation age of 100 years, 20% of the stand would be regenerated using groups each time cutting is done. This way, by the time the full rotation age has passed, all areas have been regenerated and there are 5 age classes of trees in the forest. In reality, a fully-balanced age-class distribution would be next to impossible to achieve, but this is the general goal of this system.

Midstory: Trees with a canopy position below the overstory, but above the understory in a stand. The midstory of a forest usually consists of suppressed and intermediate stems and/or slow growing or shade tolerant species.

Natural Community: An assemblage of biotic/abiotic factors in an environment, and the processes that govern them. Natural communities consist of all levels of biota in a forest, and consider how forest composition and structure changes over time.

Overstory: The highest canopy position of trees in a forest. Overstory trees are generally those whose crowns are exposed to full or nearly full light.

Pole: An immature tree generally 4"-10" DBH

Prescription: A silvicultural strategy for how to manage a stand to achieve a desired result. A prescription will detail exactly how to harvest a forest, including providing metrics for the residual stand, and a detailed description of trees to be cut and those to be retained.

Release: The process of removing trees from competition, allowing them to grow more freely.

Regeneration: Young trees and plants (usually less than 4" DBH) in the forest, often growing in response to a human-caused or natural disturbance event.

Sapling: An immature tree generally 2-4" DBH.

Stem: A word used in forestry to refer to a tree.

Silviculture: The art and science of tending a forested stand, generally using timber harvesting as a tool.

Single Tree Selection: This treatment harvests trees of all age classes in a stand to encourage the growth of higher quality stems and the establishment of regeneration of shade-tolerant tree species. This treatment can also be used to ensure that there is an even distribution of trees of different species throughout the stand. This treatment is often employed between groups as part of uneven-aged management.

Skidder: A tractor-like machine, used to drag or "skid" trees out of the forest.

Stand: An area of forest in a similar enough condition, with regards to structure, composition, history and other factors, to be managed as a single unit.

Structure: In a forestry context, structure describes the presence of different age classes and canopy heights within a stand. Vertical structure is comprised of trees of different heights interspersed throughout an area, whereas horizontal structure described the presence of pockets of trees of different ages. In uneven-aged management, single tree selection usually encourages the creation vertical structure, whereas group selection creates horizontal structure. Structure may also describe the arrangement of dead wood across in a forest.

Succession: The process by which trees in a forest move from one generation and condition to the next. "Early successional" stands are those that establish following a disturbance, stocked by shade-intolerant and pioneer species, while "late-successional" (sometimes used interchangeably with "old-growth") stands, occur when stands have developed into older forest types, often stocked by larger, older trees of shade-tolerant species and a more complex, uneven-aged structure.

Suppressed: Trees which have been completely overtopped by overstory stems, receiving little to no direct sunlight, are considered "suppressed." Except in the cases of very shade-tolerant species, suppressed trees are often stunted and poor in quality.

Timber: Timber is used to describe the forest products (sawlogs, pulp, firewood, etc.) located inside the standing trees present in the forest. This word is sometimes also used to describe these products after the trees have been cut but before they have been processed or milled.

Treatment: A silviculturally planned and executed timber harvest.

Two-aged: A stand which is comprised of two distinct age classes. This is a common condition in managed forests, as the overstory is often targeted for logging, regenerating a new understory cohort while retaining some overstory trees.

UGS: Unacceptable Growing Stock (UGS) is a classification given to unhealthy trees unlikely to live long or to produce a sawlog in the future.

Uneven-aged: A stand comprised of three or more distinct age classes of trees. This forest type is common in undisturbed and "old-growth/late successional" forests.

Uneven-age management: This management system seeks to emulate natural disturbance regimes and natural forest growth patterns by establishing and maintaining multiple age classes of trees within a single stand.

Understory: Trees located at the lowest canopy positions in the forest, usually consisting of very young stems less than 10' in height.

Whole-Tree Logging Crew: A type of logging crew that utilizes large, mechanized machinery to process trees from the stump up. Trees are processed on the landing into a variety of products, and tree tops and limbs are chipped.