An Ecological Assessment and Natural Resources Inventory of Boyce Hill Town Forest, Fayston, VT

A Report to the Fayston Conservation Commission

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Introduction

Purpose & Objectives

This project seeks to assess the natural resources and valuable wildlife habitat located on the Boyce Hill Town Forest parcel. The purpose of this report is to

1) Identify, describe, and map the parcel's natural communities and other natural features, including water resources and rare, threatened, and endangered species
2) Describe current ecological condition of the parcel and predict future natural community composition under natural succession
3) Provide management recommendations to the Fayston Conservation Commission for use in long-term management and conservation planning

Property Description

The Boyce Hill Town Forest is a 93-acre parcel located in North Fayston, Vermont. Elevations range from 1,400ft at the parking lot to 1,800ft in the northeast corner of the property. A packed, mowed road loops around the property and is used by dog-walkers, mountain bikers, and hikers enjoying sweeping views of the Shepard Brook Valley. A 1.25-acre human-made pond is located in the southwest corner of the parcel west of an old cellar hole and scattered apple trees, relics of a time when homesteaders grazed livestock on the slopes of Boyce Hill.

The ecology of Boyce Hill has been significantly altered by decades of land management. The parcel was largely cleared for potential subdivision development in the 1970s and has since been kept open by intensive mowing. The road and its associated culverts, a large human-created ditch, and pipes installed to direct water into the pond have altered the natural hydrology of the area. Large rock piles and gravel pits were left behind when the land was cleared for development. Intensive clearing has caused significant soil erosion, especially on the parcel's steeper slopes.

Ecological Setting & Greater Landscape Context

The parcel is located in the Northern Green Mountains Biophysical Region, which is characterized by high elevations, cool summer temperatures, abundant precipitation, and acidic metamorphic rocks (Thompson & Sorenson, 2019). The property straddles two types of bedrock: the Fayston formation and the Hazens Notch Formation. Both formations are made up of schist and include beds of quartzite. Though generally acidic, these bedrock types can be locally calcareous, influencing plant composition aboveground. Matrix natural communities in this biophysical region include Northern Hardwood Forest on lower slopes and Montane Yellow Birch-Red Spruce Forest on mid-slopes.

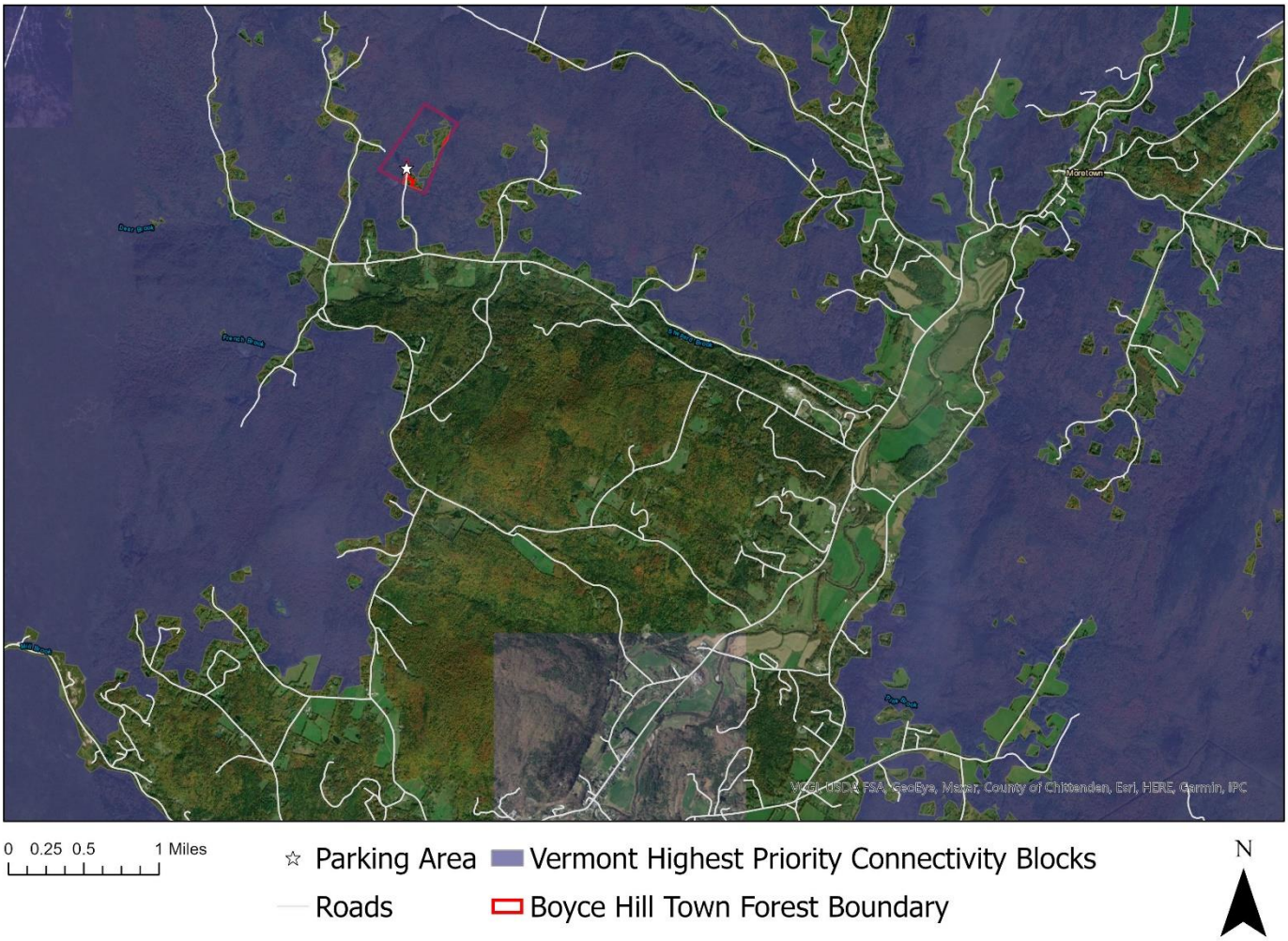
Atop bedrock, the parcel is blanketed by a layer of rocky glacial till. The soils at Boyce Hill—which are derived from this glacial till—are generally rocky, well drained, sandy loams. Bedrock ledges are exposed in some places, and soils on the parcel's steep south- and west-facing slopes are dry and exposed. Decades of pasturing, clearing, and intensive mowing have resulted in significant soil erosion on these slopes, which exhibit >25% slope over a large swath of the parcel (see Appendix III of this report), leaving soils thin and nutrient-poor.

The Vermont Conservation Design, a landscape-level conservation planning tool developed by Vermont Land Trust and the Vermont Agency of Natural Resources, considers Boyce Hill to be part of a 54,972-acre Highest Priority Interior Forest Block, an unfragmented swath of forest that stretches north to the Winooski River and south to Route 17 in Fayston (Map 1). This forest block includes vast tracts of Montane Yellow Birch-Red Spruce Forest and Montane Spruce-fir Forest as well as the alpine tundra of the Camel's Hump summit. Patches of structurally-complex mature forest in the interior of this forest block—which includes one of the largest exemplary Northern Hardwood Forest communities in the state—make it unique in Vermont, where mid-successional forest dominates. This structural diversity provides varied niche space for wildlife, and connected forest allows for genetic diversity and migration in the face of climate change (Sorenson and Zaino, 2018). Interior forest habitats within this block provide habitat for species that have large home ranges and travel long distances, such as bobcat, fisher, and black bear.

Before it was cleared for development, Boyce Hill would have been part of this vast swath of mature Northern Hardwood Forest. Though its ecology is significantly altered, the parcel remains connected to the interior forest block, increasing its potential as valuable wildlife habitat for a diversity of species. The parcel contains habitat elements such as wetlands and food plants that make it valuable—at least seasonally—to large mammals. However, the integrity of Boyce Hill as part of connected, interior forest has been diminished by intensive clearing. For example, lack of vegetated buffers along streams and wetlands in the parcel may prevent wildlife from moving freely between the forest block onto Boyce Hill.

Management of natural resources beyond the parcel's human-drawn boundary lines has the potential to shape the ecology of the town forest. For example, the headwaters of the parcel's main perennial stream lies in part outside of the northern boundary, on a private parcel where intensive forest management and sugaring occurs. The town forest is flanked by two private parcels that are currently sub-divided but undeveloped. Development of these parcels would reduce connectivity between Boyce Hill and the rest of the high priority interior forest block to the north and west, reducing the parcel's value to wildlife.

Map 1. The Boyce Hill Town Forest sits at the edge of a 54,972-acre interior forest block, in purple, which stretches north to Camel's Hump



Methods

A remote desktop review of aerial imagery, LiDAR imagery, topographic maps, and data available through the Vermont Natural Resource Atlas was conducted in order to gain insight into the ecological underpinnings and greater landscape context of the parcel. Previous work in the Mad River Valley provided an excellent foundation for this study and included natural community mapping by Arrowwood Environmental (2007) and watershed analysis by Stone Environmental (2016).

In order to guide management and describe wildlife habitat at a fine scale, the parcel's current ecological conditions were mapped in the field by assessing current vegetation cover, soil conditions, hydrology, and landscape position. Some of these communities were named using professional judgement and are not formally acknowledged as natural community types in Vermont's natural community guide, *Wetland, Woodland, Wildland* (Thompson & Sorenson, 2019). Projected natural

communities were then predicted based on current conditions observed on the parcel. All projected natural communities described in this report are based on the classification scheme described in *Wetland, Woodland, Wildland*.

All field work was completed over the course of four days between 9/9/20 and 9/25/20. Natural communities and other features were mapped in the field using a handheld Garmin GPS. Maps were created using ArcGIS Pro.

Findings

Water Resources

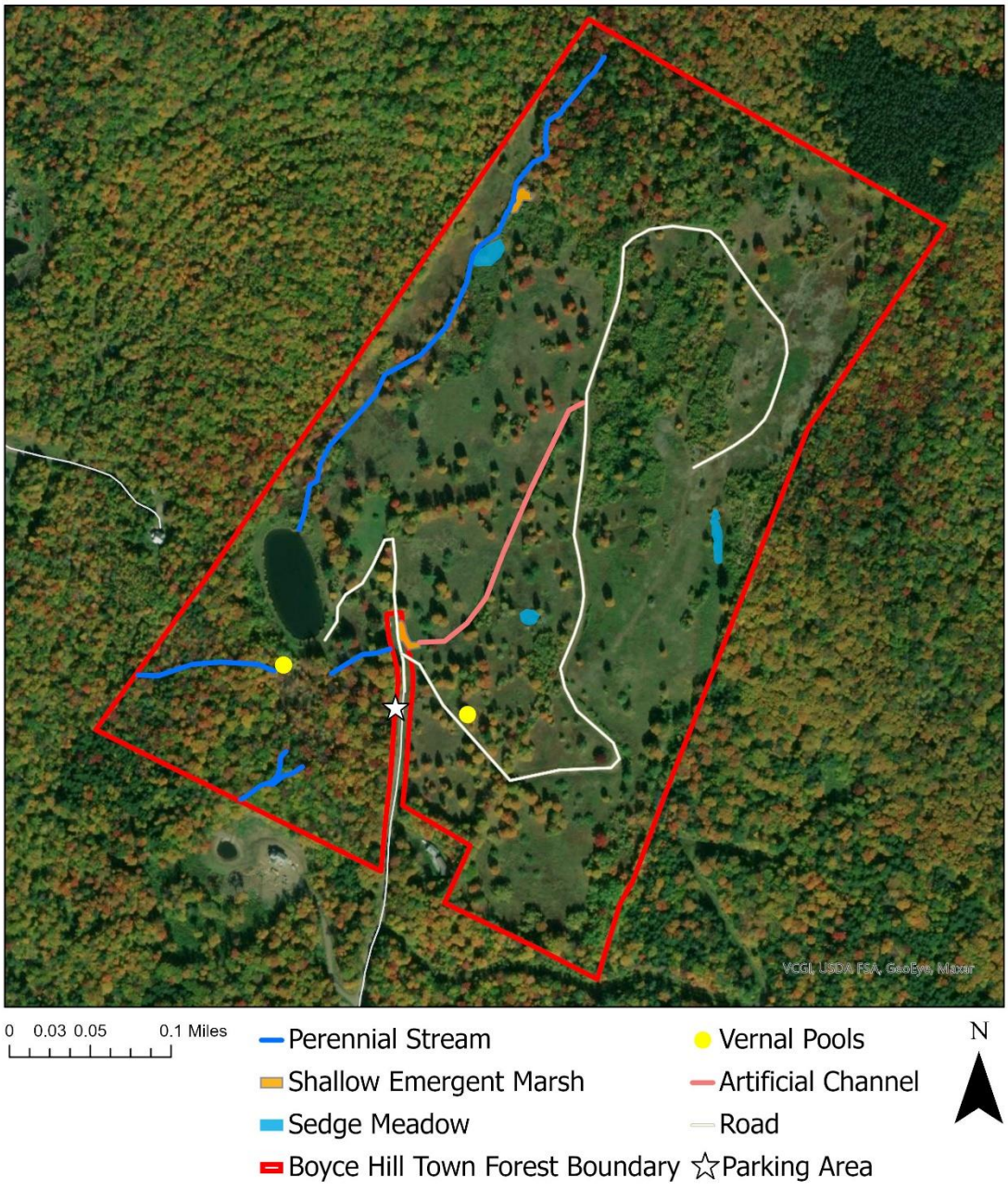
Two perennial streams run through the property (Map 1). The western stream, which eventually enters the pond in the southwest corner of the parcel, originates from seeps located in the northwest corner of the parcel and on the adjacent property. An artificial channel runs down a steep slope to a wet depression across from the cellar hole. Beside the cellar hole, a stream apparently originates from a spring near a cistern, flowing west into a seepage wetland. At the western edge of this forested wetland, several channels coalesce and continue to flow west and out of the parcel.

Vegetated riparian buffer width varies across the parcel, ranging from 2 feet to >50 feet. Forested stream buffers offer a suite of ecological benefits, anchoring the stream shoreline and limiting streambank erosion, preventing water quality degradation. They offer important plant and animal habitat by providing shade and coarse woody debris which provide structural and substrate diversity. They also provide organic matter and nutrients that fuel stream food chains.

Management Recommendations

- Maintain a 50’ Riparian Buffer Zone on all perennial streams as required by the Conservation Easement.
- Maintain a 50’ vegetated buffer zone on all wetlands, artificial channels, and seeps.
- Maintain a 250’ unmowed ecological protection zone around vernal pools (see page 14 of this report).
- Trail networks should be designed to avoid parallel alignment within a riparian buffer.
- Avoid construction of recreational trails through wetlands.
- Monitor and control non-native invasive species.

Map 2. Water resources in the Boyce Hill Town Forest, with human-created pond in the southwest corner



Non-Native Invasive Species

The most common invasive species seen on the parcel was reed canary grass (*Phalaris arundinacea*), which forms several small stands in Boyce Hill's old fields. This non-native grass can also be found scattered throughout the fields, particularly in wet spots in the lower parts of the parcel, and in the seepage wetland in the southwest corner of the property.

An approximately $2m^2$ patch of *Phragmites australis* is present near the SW edge of the pond. *Phragmites* is known to be an aggressive invader of wetlands, ditches, and riparian areas. However, it is apparently contained to this small site, and because the steep pond edge quickly transitions to upland this area does not appear to be at imminent risk of invasion by *Phragmites*.

In addition, a 2020 invasive plant survey by the Vermont Land Trust found small populations of bush honeysuckle, common buckthorn, glossy buckthorn, and winged euonymus on the eastern edge of the parcel. VLT's report includes a location map of these species.

A handful of other non-native plants grow on the parcel. A small population of bittersweet nightshade (*Solanum dulcamara)* is present on a stone wall in the SW corner of the parcel. Purple orpine (*Hylotelephium telephium*), an escaped cultivar, is also present in the SW corner of the parcel, where it grows just above the wetland boundary, and a cultivated species of iris grows on the parcel's highest point. These non-native species are not known to have significant adverse effects on the ecology of natural systems in Vermont.

Management Recommendations

- Prioritize removing *Phragmites* while it is small and manageable.
- Monitor populations of reed canary grass, especially if management regimes are altered. If mowing is reduced, reed canary grass could proliferate. Consider mowing areas with reed canary grass to keep it under control, or consider more intensive removal.
- Refer to treatment recommendations provided in VLT's Invasive Plant Management Plan.

Current Condition

The Boyce Hill Town Forest contains a diversity of early- and mid-successional habitats (Map 2, Table 1). Because of Boyce Hill's long history of disturbance through clearing, pasturing, and repeated mowing, the majority of the parcel cannot be classified using Thompson and Sorenson's natural community classification scheme for Vermont. In order to provide a snapshot of the current condition of the parcel, cover types across the parcel are described below based on vegetation, soils, and hydrology currently present.

Map 2. Current ecological conditions at Boyce Hill Town Forest. Unmapped areas represent old field—the parcel's matrix-forming community.

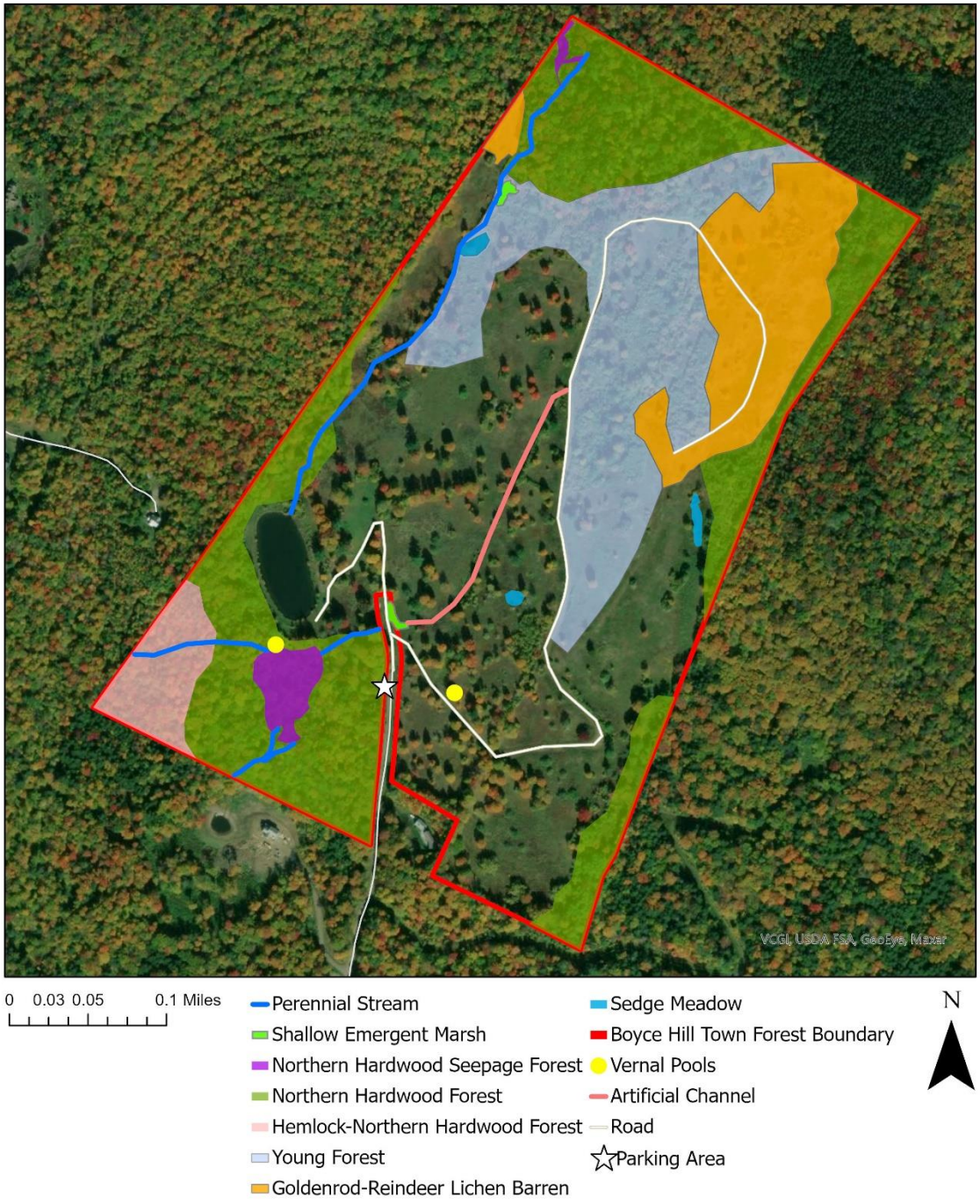


Table 1. Current conditions on the Boyce Hill Town Forest parcel, with acreage for each cover type

Current Cover Type	Occurrences	Acreage
Old Field	Matrix-forming	42
Young Forest	1	15
Goldenrod-Reindeer Lichen Rocky Barren	2	8.5
Sedge Meadow	2	<1
Shallow Emergent Marsh	1	<1
Northern Hardwood Seepage Forest	2	1.5
Northern Hardwood Forest	Matrix-forming	24
Hemlock-Northern Hardwood Forest	1	2.7

Old Field

Likely a mix of former agricultural field, pasture, and land cleared to create a viewshed, this approximately 42-acre area is dominated by agricultural species orchard grass, timothy, clover, and hawkweeds. Scattered apple trees can be found in these old fields, along with old sugar maples that have long escaped cutting. Other mature trees, including red maple, white pine, black cherry, and white ash, also stand in clumps or alone in these fields. These areas form the matrix community at Boyce Hill, constituting the background cover type against which other natural communities are found. If left undisturbed, much of this area will soon grow into young forest.

Wetter sections of this old field are dominated by sensitive fern, with scattered Bebb's willow, marsh fern, and reed canary grass. These areas are likely seasonally wet as a result of snowmelt running downhill and collecting here in the spring. Drier areas are dominated by bracken fern, rough goldenrod, and running club moss, grading into the Goldenrod-Reindeer Lichen Rocky Barrens described below.

These early-successional areas are important for birds like Ruffed Grouse and Wild Turkey to bring their young for foraging; both species were observed on the parcel during the course of field work. Unmowed and left to bloom, an abundance of flowering plants such as goldenrods and milkweed were supporting pollinators during this study. These open areas may also provide a stage for the American Woodcock's courtship displays in the spring.

Management Considerations

- It is unknown what affect altered mowing regimes will have on reed canary grass on the parcel. Targeting patches of reed canary grass for mowing may help suppress this aggressive non-native grass.
- Parts of these old field areas are dominated by non-native agricultural grasses. Reducing the frequency of mowing to every 3-4 years may encourage native plants such as goldenrods, raspberries, and blackberries, which have greater wildlife value.
- Vermont Conservation Design recommends managing for grassland only outside of high priority landscape blocks in order to avoid conflicts with other ecological functions. According to this recommendation, other early successional habitat types such as shrubland or young forest

would be more ecologically valuable options for these parts of Boyce Hill. These habitat types are unable to develop when mowing occurs on a yearly basis. Mowing should be limited to every 3-4 years in order to lend more habitat values to these old fields.

- Mowing should only be done in the fall, after breeding birds and pollinators have reaped the benefits of the flowers and shrub thickets abundant in these areas.
- Concentrate mowing in flatter areas. Allowing steeper slopes to succeed to shrub thicket or young forest will mitigate soil erosion, improve water quality, and provide food sources for pollinators and other wildlife.

Young Forest

Young forests are areas dominated by dense seedlings and saplings less than 20 years old. In the Boyce Hill Town Forest, young forest forms an approximately 15-acre swath dominated by gray birch, quaking aspen, red maple, sugar maple, white pine, and black cherry. Young trees range from approximately 4-15 years old.

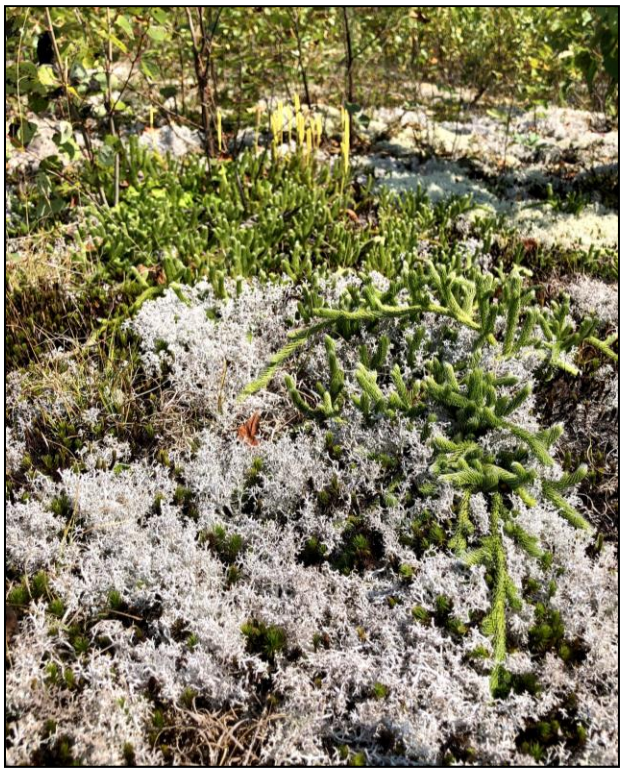
Young forests support an array of species adapted to early successional habitats, such as bobcats and shrubland-nesting birds. Red and gray fox, ermine, coyote, raccoon, and bobcat often find food in young forests, and ruffed grouse feast on the abundant aspen buds. Many bird species thrive in early successional forest such as common yellowthroat, indigo bunting, brown thrashers, veery, American woodcock, field sparrow, song sparrow, and gray catbird. Species in decline that may utilize these young forests include the golden-winged warbler and prairie warbler.

Because young forest is less abundant that it was prior to European settlement, many species that rely on young forest and shrublands are in regional decline (VT Conservation Design, 2015). In Vermont, an increase in the amount of both young and old forest is needed to maintain an ecologically functioning landscape. Vermont Conservation Design recommends a return to 3-5% young forest. In a 2005 study, Arrowwood identified 1,500 acres of early successional habitat in Waitsfield and Fayston, which is approximately 3.7% of the landscape across the two towns, placing them within Vermont Conservation Design's recommended percentage of early successional habitat. It should be noted that intense weather events resulting from climate change are predicted to cause an increase in young forest creation, which could result in an overabundance of young forest on the landscape.

Management Considerations

- Allowing young forest to mature—especially in the northern portion of the parcel—will increase the parcel's ability to function as part of the larger interior forest block in which it sits, as increased cover will allow wildlife to move through the parcel more freely. Mature forest will also contribute to climate change mitigation through carbon sequestration and storage.

- Maintenance of a percentage of the parcel as young forest through infrequent mowing or cutting would benefit species that rely on its shrub thickets and young forests. Young forest patches should be 5 acres or larger in order to meet the needs of obligate young forest species.
- A single red oak sapling was seen in the patch of young forest in the center of the parcel. Encouraging regeneration of red oak—an uncommon species in the Mad River Valley—may eventually provide a source of hard mast for wildlife and provide Boyce Hill with greater resiliency as climate change prompts species range shifts.



Reindeer lichens and running club-moss dominate dry, thin soil and bedrock outcrops on Boyce Hill's south-facing slopes

Goldenrod-Reindeer Lichen Rocky Barren

These dry slopes are dominated by running clubmoss, blue clubmoss, silverrod, gray goldenrod, and reindeer lichens. Soils are excessively drained, shallow to bedrock, and nutrient poor. Gray birch and red spruce saplings are common in areas with enough soil to support woody plants. Without interference, these areas would likely be slow to succeed to forest, remaining stunted shrublands with only a sparse cover of woody vegetation before transitioning to a matrix-forming community, likely Red Spruce-Northern Hardwood Forest. Areas of exposed bedrock and very thin, gravelly soils would likely remain open and dominated by reindeer lichens, lending these communities a park-like feel reminiscent of an open-canopied woodland.

This early successional community includes dense swaths of hay-scented fern. This fern, which often establishes monotypic stands following intensive clearing or deer browsing, provides little wildlife value and prevents regeneration of hardwood trees.

In contrast, the small blackberry-goldenrod shrub thickets found within this community type likely provide valuable cover and food for a variety of birds and other animals.

Management Considerations

- Limit mowing in steep areas, defined as places exhibiting >20% slope (see Appendix III of this report). Just as intensive past management has likely resulted in soil erosion from these areas, allowing steep and exposed slopes to revegetate will reduce soil erosion downhill, preventing sedimentation and improving water quality in the Shepard Brook watershed.
- If mowing is done, disturbance to soil and plant roots should be minimized in order to reduce erosion of thin, depleted soils in these barrens.
- Studies have shown that mowing areas of hay-scented fern 4 times over 2 years (in both June and August) leads to reduced fern density and an increase in naturally established tree seedlings (Cretaz & Kelty, 2006). Mowing monotypic swaths of hay-scented fern in the upper area of Boyce Hill could prompt natural regeneration of native tree species, increasing wildlife value in these areas.

Sedge Meadow

While most of Vermont's sedge meadows occurs within the floodplains of rivers and streams, the two sedge meadows on Boyce Hill occur as isolated, sloping features punctuating old fields. Both wetlands are fed by hillside seeps, which occur where shallow bedrock results in horizontal discharge of groundwater. Though decades of mowing have likely altered vegetation composition of these wetlands, non-native plants are notably absent in these wetland pockets.

These small wetlands are dominated by blister sedge, nodding sedge, woolgrass, porcupine sedge, soft rush, tearthumb, American water pennywort, and sensitive fern. Soils are a thin layer of muck over mineral soil and are permanently saturated. Surface water was present at the time of this study despite moderate drought conditions.

Management Considerations

- Seeps are threatened by hydrologic alteration from use of heavy machinery and motorized vehicles in the vicinity of the seep. Machinery should be kept out of these seepage wetlands and their 50ft buffers.
- Sedge meadows may be particularly vulnerable to invasion by reed canary grass and *Phragmites* and the presence of non-native plants in their vicinity should be monitored.

Shallow Emergent Marsh

These wetlands are differentiated from the parcel's sedge meadows by their higher plant diversity and presence of shrubs. These small wetlands appear to be drier than the parcel's sedge meadows, though soil saturation was observed during the field visit. The northern wetland may be fed by seeps, and also abuts the stream channel on its western edge, where a thicket of young gray birch, red maple, and

willows line the channel. The southern wetland appears to be fed by the artificial channel that runs through the center of the parcel (see Map 1). Both wetlands have been mowed repeatedly and lack developed vegetated buffers.

The northern wetland is notably diverse, dominated by meadowsweet, nodding ladies' tresses, rough goldenrod, royal fern, cinnamon fern, bottle gentian, narrow-leaved gentian, soft rush, marsh fern, woolgrass, Bebb's willow, silky willow, purple-stemmed aster, and interrupted fern. Scattered red maple, quaking aspen, gray birch, and white pine seedlings are present in the drier areas, and soft mats of Sphagnum moss line the seepy outer margins. Deer bed in this wetland and browse on willows, and a diversity of wildflowers likely attracts many pollinators. The southern wetland is dominated by willows, sensitive fern, and American bur-reed; a small patch of reed canary grass is present in the wetland.

Management Recommendations

- Monitor these wetlands for non-native invasive plants, particularly reed canary grass, which can pose a threat to the integrity of this wetland natural community.
- The northern shallow emergent marsh should be considered part of the headwaters of the parcel's major stream. Its sediment retention and groundwater recharge functions should be protected by establishing a vegetated buffer around the wetland and routing recreational activity away from it.

Northern Hardwood Seepage Forest

These forested wetlands sprawl across gently sloping land where groundwater seepage occurs. Shallow-rooted trees fall to form tip-up mounds, creating hummock and hollow topography and resulting in a mosaic of upland and wetland conditions. These natural communities frequently form the headwaters of small streams; atop Boyce Hill, a seepage forest feeds the parcel's most significant perennial stream, providing a relatively constant flow of cold groundwater.

These wetlands are dominated by jewelweed, golden saxifrage, slender mannagrass, drooping woodreed, rough-stemmed sedge, foamflower, and sensitive fern, with abundant bryophytes such as woodsy thyme moss (*Plagiomnium spp*.) and *Sphagnum* mosses. Shallow-rooted yellow birch, hemlock, red maple, and spruce are present, along with several tip-up mounds.

A tip-up mound in a seepage forest in the Boyce Hill Town Forest

Though small, the seepage forests at Boyce Hill are wildlife hotspots. Seepage areas are some of the first places to green up in the spring, and the flush of food is often utilized by black bears and wild turkeys. In the Mad River Valley, remote forested seeps are likely the most heavily utilized wetlands by bear (Arrowwood, 2005). Winter wrens may nest in tip-up mounds, and northern two-lined salamanders, northern dusky salamanders, and spring salamanders may lay their eggs in the cool running water of seeps and connected streams.

Management Recommendations

- Seeps are threatened by hydrologic alteration from use of heavy machinery and motorized vehicles in the vicinity of the seep. Machinery should be kept out of seepage wetlands and a buffer of at least 50 feet in order to prevent soil compaction and permanent hydrologic damage. Sugaring should be discontinued in seepage forests and their buffers in order to minimize soil disturbance.
- Recreational trails should be routed away from the northwest and southwest corners of the parcel, which contain an abundance of seeps.

Vernal Pools

Vernal pools are wetlands that fill with water for part of the year and typically dry up during summer or fall, allowing amphibians to reproduce and mature in these safe havens without the threat of predation by fish. Reptiles, insects, crustaceans, birds, and mammals also use vernal pools for food, water, and breeding. The persistence of vernal pools as viable habitat relies on maintenance of shade, coarse woody debris, leaf litter, and the health of the surrounding upland habitat, where breeding amphibians spend most of the year outside of breeding season.

Management Considerations

- Amphibians travel an average of 400 feet away from vernal pools for food and cover in winter (Marchand, 2016). Accordingly, a 500-foot ecological protection zone can be an effective

strategy if managing for amphibian habitat around vernal pools. Mowing is not recommended in this ecological protection zone, and disturbance by trails should be limited.
- Allow a buffer to revegetate around the eastern-most vernal pool. Mowing should be discontinued in this buffer in order to promote the shade and woody debris that are required for vernal pool ecological integrity.

Hemlock-Northern Hardwood Forest

This shady mixed forest community is dominated by hemlock and hardwood species such as yellow birch and American beech. At Boyce Hill, this natural community is limited to the southwest corner of the parcel. Though small in size, this west-facing forest may receive a disproportionately high use by deer because of its warmer microclimate—in the winter, areas with abundant hemlock are used as wintering yards. This forest type is also utilized by breeding birds such as blue-headed vireos, black-throated green warblers, and Blackburnian warblers. Wood frogs and spotted salamanders are likely residents of this community, which includes stream channels exiting a seepage forest.

Management Considerations

- Avoid the introduction of new trails in this natural community, where deer may seek shelter in the winter.

Northern Hardwood Forest

Vermont's most abundant forest type, this community is found in patches across Boyce Hill, particularly at the edges of the parcel. These areas are dominated by sugar maple, red maple, yellow birch, American beech, white ash, white pine, and black cherry. Hobblebush and striped maple form a sparse shrub layer. The understory is dominated by Canada mayflower, hay-scented fern, and intermediate wood fern. Areas boasting abundant ash seedlings, sugar maple seedlings, and jack-in-the-pulpit indicate slight mineral enrichment.

Management Considerations

- Coarse woody debris—often lacking in mid-successional forests—should be left to provide valuable habitat for amphibians and other wildlife as these patches of forests age.
- White ash trees are predicted to be decimated by the emerald ash borer in the coming years. However, some white ash trees have shown resistance, making it worthwhile to leave ash trees on the landscape in hopes that they might survive.
- Recent bear marks were observed on a large beech tree on the western boundary of the parcel. Stands of beech may be included in this forest type and should be considered potentially important wildlife features.

Projected Natural Community Composition

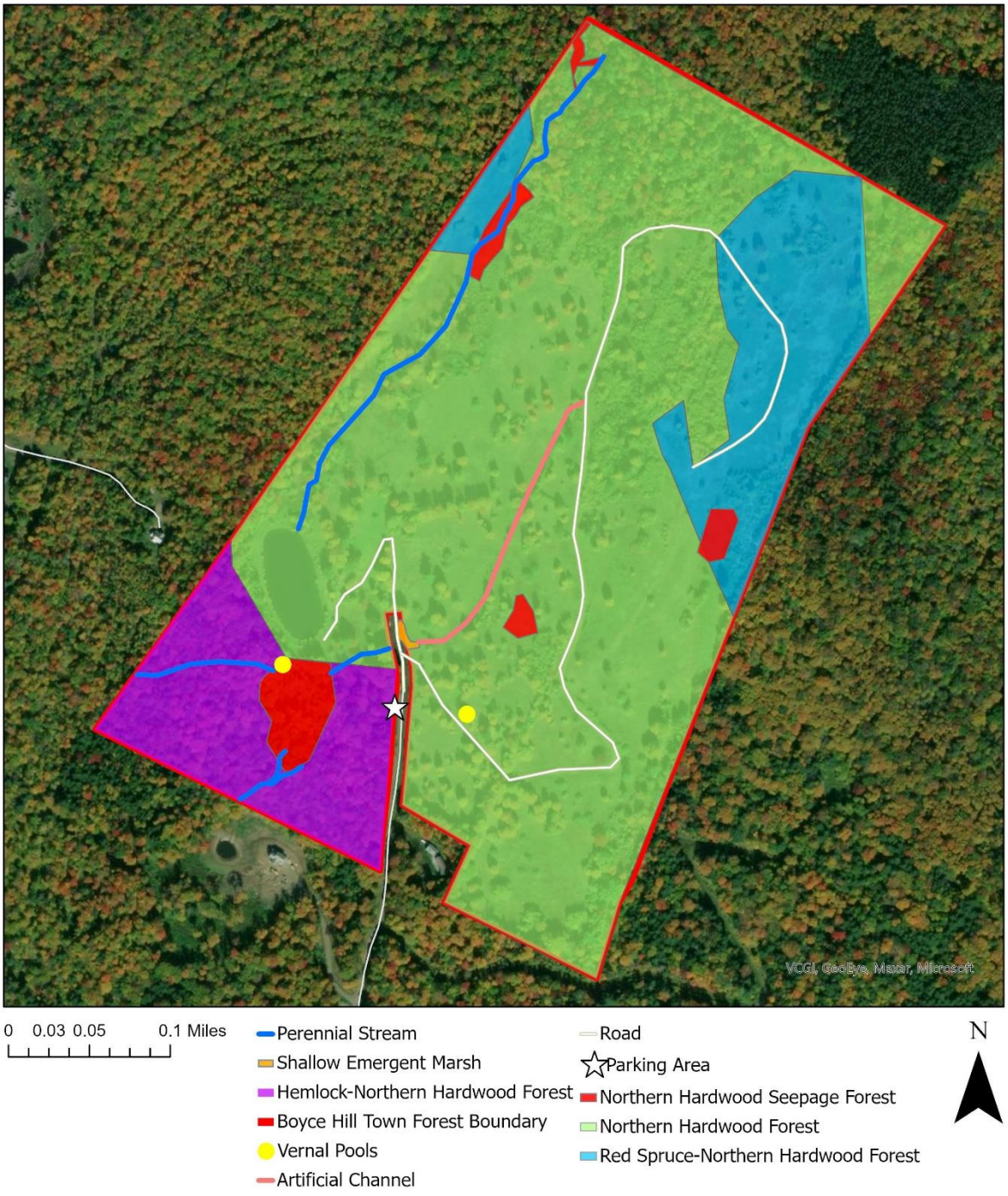
Natural communities are the distinct assemblages of plants, animals, and abiotic factors that form patterns across the landscape. Though the mosaic of natural communities is largely disturbed at Boyce Hill, thoughtful management planning can ensure that parts of the parcel return to a more natural state.

Depending on desired outcomes for wildlife and people alike, a variety of management practices may be considered valuable at Boyce Hill. When considering management practices, it may be useful to speculate about the natural communities that will eventually become established on the parcel (Map 3). These are merely predictions and based on a passive management plan that allows for natural succession to unfold on the property.

It is likely that the parcel's sedge meadows and shallow emergent marsh are former seepage forests that were converted to other wetland types by canopy removal. It would be interesting to observe the succession of these wetlands—including possible shifts in hydrologic regime—if their buffers are allowed to revegetate naturally. These wetlands may eventually become Northern Hardwood Seepage Forests. Allowing a wide vegetated buffer to mature beside the parcel's wetlands and streams will likely prevent soil erosion and sedimentation, improve nutrient retention, and provide corridors through which wildlife such as mink and bobcat can move throughout the property.

The parcel's old fields and young forest will likely succeed into a mix of Northern Hardwood Forest and Red Spruce-Northern Hardwood Forest. These two matrix forest types are mapped according to the regenerating saplings observed during this study: red spruce—though stunted by repeated mowing—is abundant in the parcel's Goldenrod-Reindeer Lichen Rocky Barrens, while white pine, red maple, and white ash are the dominant saplings in the parcel's old fields. An abundance of old black cherry, sugar maple, red spruce, white pine, and white ash stand scattered throughout the parcel as seed trees. Goldenrod-Reindeer Lichen Rocky Barrens will be slower to succeed to forest, perhaps lingering as stunted woodlands dominated by birch, red spruce, and white pine, punctuated by open expanses of dense hay-scented fern and shrubby patches of blackberry and raspberry.

Map 3. Projected natural communities on Boyce Hill Town Forest under passive management



Rare and Uncommon Species in the Boyce Hill Town Forest

Three uncommon plant species were observed during the course of field work. A population of yellow nodding ladies' tresses (*Spiranthes ochroleuca*) was found on a dry, south-facing slope at the northwest corner of the parcel. Seven individual plants were observed. This species, which is uncommon in Vermont (S3), is identified fairly readily by the yellow splotch on the underside of the flower's lower lip.

Yellow nodding ladies' tresses (S3)

Leathery grapefern (*Sceptridium multifidum)* was seen on a dry, mowed slope just above the parking lot. This uncommon (S3) fern often colonizes disturbed, bare ground. Only one individual was observed at Boyce Hill, where the more common dissected grapefern (*Sceptridium dissectum*) can be seen scattered throughout old fields.

Narrow-leaved gentian was found in two locations on the parcel: in the seepage wetland and in a ditch alongside the mowed trail. This species, which is uncommon to fairly widespread (S3S4) grows alongside our more common bottle gentian (*Gentiana clausa*) in both locations on Boyce Hill.

Narrow-leaved gentian (S3S4)

Management Recommendations

- Yellow nodding ladies' tresses and leathery grapefern have apparently thrived under the intensive disturbance regime at Boyce Hill over the past several decades, and without some continued disturbance these species will likely suffer population decline. If management goals include conservation of uncommon plant species, maintain areas around yellow nodding ladies' tresses and leathery grapefern in an open condition. Management to prevent canopy closure in these small areas would be relatively minor.

Wildlife Habitat at Boyce Hill

Boyce Hill provides the cover, food, and water necessary for a diversity of wildlife—from dragonflies to deer—to persist on the landscape. Some parts of the parcel, such as its seepage wetlands, are considered wildlife hotspots because of their ability to support a high diversity of species and relative lack of human disturbance. Under a reduced mowing regime, parts of the parcel would return to a more naturally vegetated state similar to the Northern Hardwood Forest in the surrounding forest block, rich in bear-clawed beech trees, buffered vernal pools full of frog and salamander eggs, and large trees home to cavity-nesting birds.

In its current state, the parcel offers refuge to species that require early successional habitat, including shrubland-nesting birds that are in decline due to a loss of open habitat types in Vermont. It also offers soft mast food sources—such as blackberries and apples— to animals traversing the landscape between larger core areas. However, since the parcel was cleared in the 1970s, yearly mowing has likely reduced value to wildlife by preventing the establishment of dense shrub thickets and young forest rich in food sources. Mowing has also prevented establishment of vegetated buffers around vernal pools and wetlands and along streams—these buffers provide valued cover for wildlife and allow them to travel freely across the landscape.

Nevertheless, the parcel is used seasonally by large mammals, as evidenced by bear scratches on the parcel's largest beech tree, deer beds in its sedge meadows, and moose scrapings on striped maple saplings. Wild turkeys and ruffed grouse were seen poking about for food in the forested seeps, and clouds of butterflies were observed drifting between wildflowers blooming in the old fields. Connectivity to core habitat, maintenance of young forest, and development of structurally complex mature forest on Boyce Hill will help ensure that all of these species can persist on an ecologically functional landscape into the future.

Conclusions

Boyce Hill Town Forest is a place of dramatic contrasts: young and maturing forest, shrub thicket and shady hemlock grove, mucky wetland and dry rocky barren. It sits on the flanks of an interior forest block, adding physical diversity to the landscape in the form of shrubland and young forest. Maintaining some of these early successional habitat types will ensure the persistence of this physical diversity of wildlife habitat. At the same time, Vermont Conservation Design's goals for early successional habitat are being met in Fayston and Waitsfield, suggesting that the benefit of allowing parts of Boyce Hill—particularly its steeper slopes—to succeed to a more natural forested state outweigh the benefits of maintaining them as open. The benefits of allowing these areas to revegetate include reduced erosion and sedimentation as well as climate change mitigation.

The protection of water resources on this parcel should be a priority, especially considering the parcel's steep slopes. Sedimentation and water quality are known concerns in the Mad River Valley (Stone

Environmental, 2016); less intensive mowing regimes and wider vegetated buffers would reduce sedimentation and improve water quality. Allowing buffers to develop around vernal pools and wetlands will also provide benefits to a suite of species that rely on them for food, cover, and breeding.

In the Boyce Hill Town Forest, young forest as well as patches of Northern Hardwood Forest and Hemlock-Northern Hardwood Forest in the northwest and southwest corners of the parcel forest provide a stage for the development of structurally complex mature forest. The parcel's old fields provide potential for the succession of more valuable habitat types, such as raspberry-goldenrods thickets and young forest, to develop with discontinued or less frequent mowing. Thoughtful management of these varied habitat types will ensure that physical diversity is maintained on the parcel while its more fragile resources—such as seepage wetlands and steep erosion-prone slopes—are protected.

References

Arrowwood Environmental. 2007. Natural Heritage Element Inventory and Assessment of Waitsfield and Fayston, VT. Arrowwood Environmental, Huntington, Vermont.

Audubon Vermont and the Vermont Department of Forests, Parks, and Recreation. 2011. *Silviculture with Birds in Mind: Options for Integrating Timber and Songbird Habitat Management in Northern Hardwood Stands in Vermont.*

Cretaz, A. L. & Kelty, M.J. 2006. *Control of hay-scented fern by mowing.* Journal of Applied Forestry 23(3): 149-154.

Degraaf, R.M. et al. 1992. *New England Wildlife: Management of Forested Habitats.* General Technical Report NE-144. Amherst, MA. U.S.D.A., Forest Service.

Hagenbuch, S. November 2017. Forest Bird Habitat Assessment and Management Recommendations. Huntington, Vermont: Audubon Vermont.

Marchand, M. 2016. Identifying and documenting vernal pools in New Hampshire: third edition. New Hampshire Fish and Game Department, Nongame and Endangered Wildlife Program. Retrieved from https://wildlife.state.nh.us/nongame/documents/vernal-pool-manual.pdf

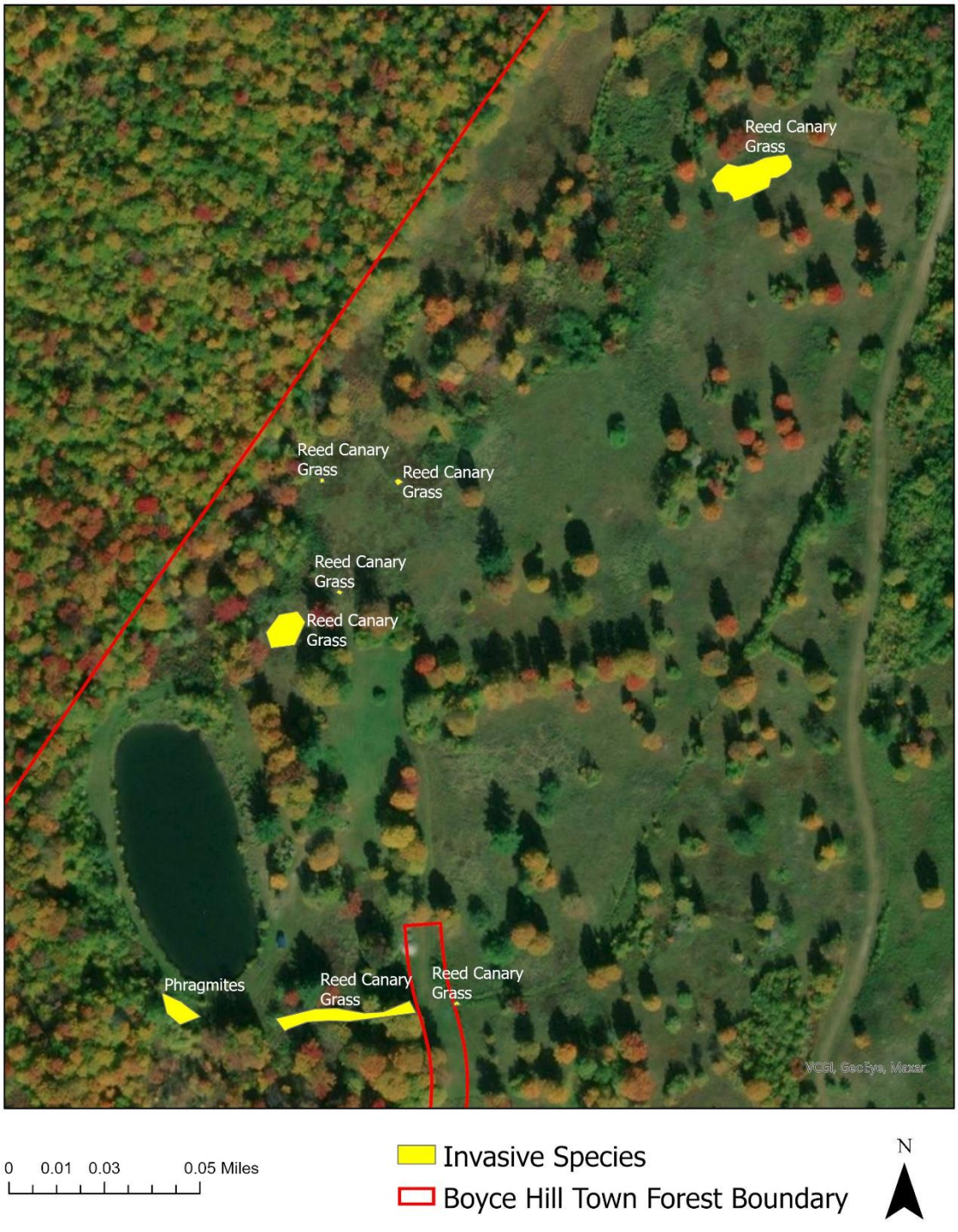
Hawes, Ellen and Markelle Smith. April 2005. Riparian Buffer Zones: Functions and Recommended Widths. Yale School of Forestry and Environmental Studies.

Stone Environmental. May 2016. A Framework for Action on Stormwater: Ridge to River Phase 1 Final Report.

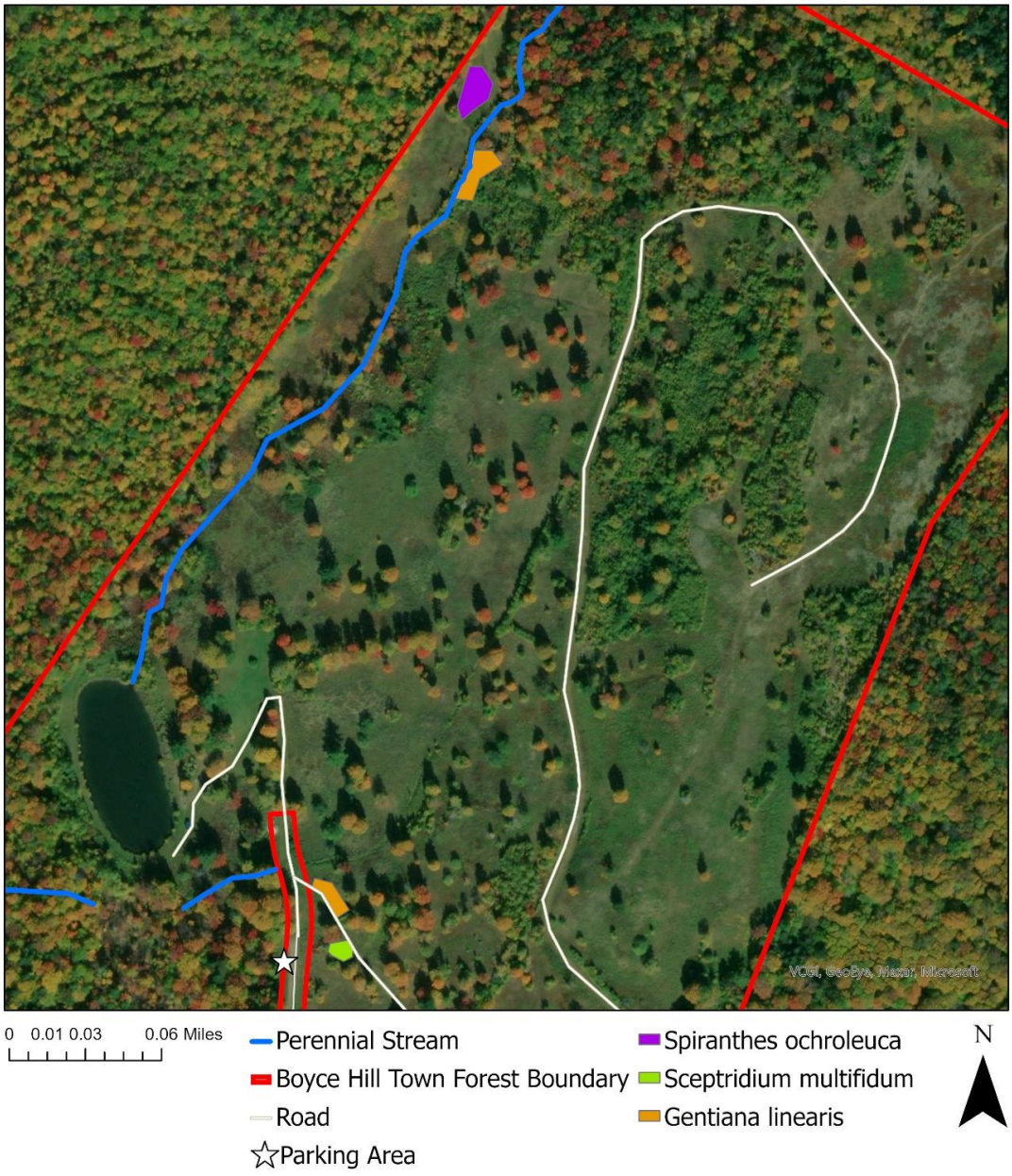
Thompson, E.H. & Sorenson, E.R. 2019. Wetland, Woodland, Wildland – A Guide to the Natural Communities of Vermont. Vermont Department of Fish and Wildlife, Vermont Land Trust, and The Nature Conservancy. University Press of New England, Hanover and London.

Vermont Conservation Design. February 2018. Vermont Fish & Wildlife and Vermont Agency of Natural Resources.

Appendix I. Invasive Species Mapped on Boyce Hill Town Forest. Note that scattered reed canary grass does exist elsewhere on the parcel, particularly in the lower fields in the southern portion, but thorough mapping was not possible due to time constraints. Shapefiles will be provided along with the final report.



Appendix II. Rare plants at the Boyce Hill Town Forest. Shapefiles will be provided along with the final version of this report.

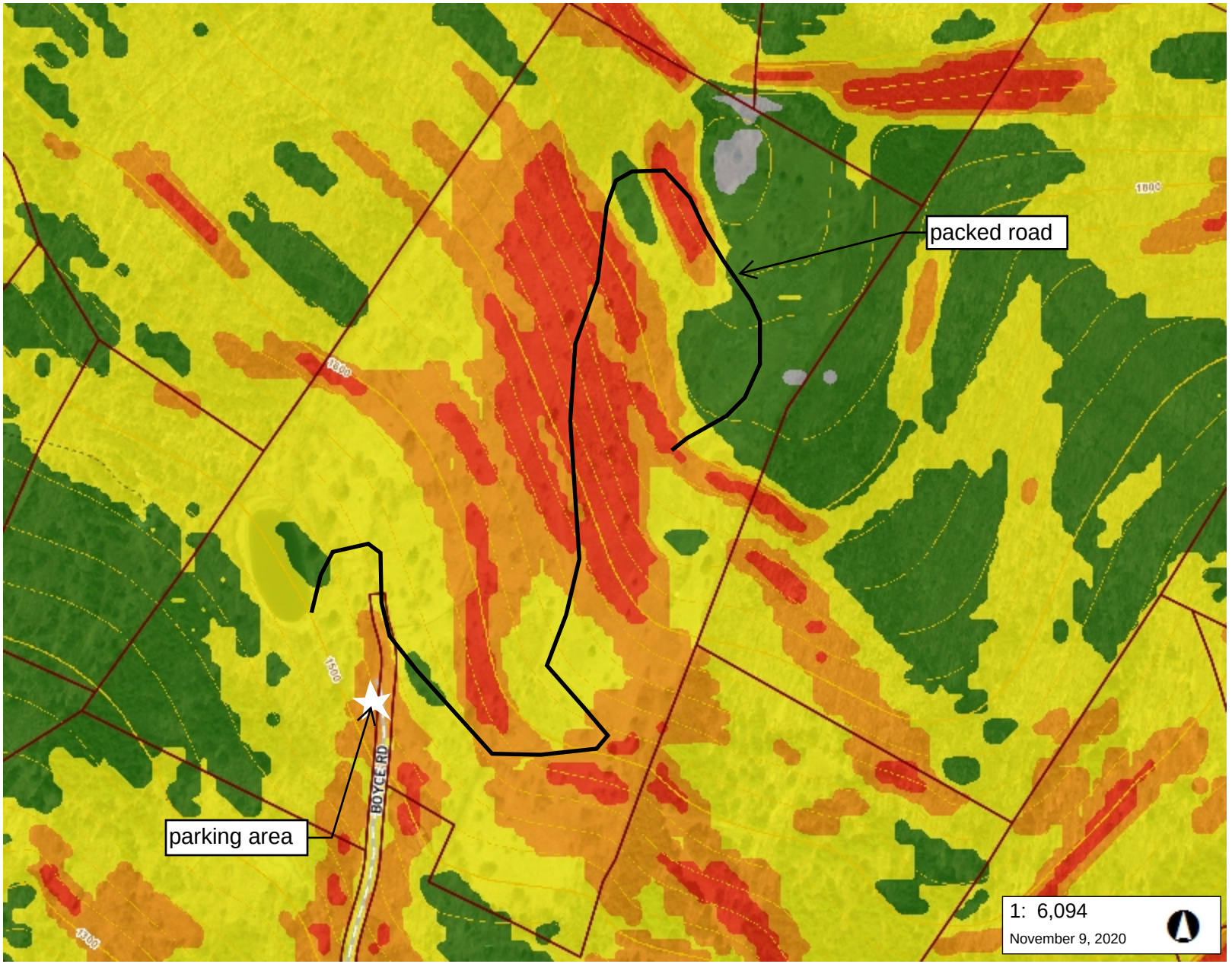


VERMONT

Slope at Boyce Hill

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- Parcels (standardized)
- Roads
  - Interstate
  - US Highway; 1
  - State Highway
  - Town Highway (Class 1)
  - Town Highway (Class 2,3)
  - Town Highway (Class 4)
  - State Forest Trail
  - National Forest Trail
  - Legal Trail
  - Private Road/Driveway
  - Proposed Roads
- Slope
  - <5%
  - 5-15%
  - 15-20%
  - 20-25%
  - >25%

NOTES

Map created using ANR's Natural Resources Atlas

310.0 0 155.00 310.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 508 Ft. 1cm = 61 Meters

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