

*Silviculture Prescription
Norway Spruce Removal / Pine Barrens Restoration*

*Massachusetts Department of Conservation and Recreation
Bureau of Forestry*

*Southeast District
Myles Standish State Forest
Carver & Plymouth, MA*

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Background

In 1914, the State Forest Commission was formed to acquire and restore unproductive waste lands to commercial forests, to protect the soil, and regulate water flow. In 1916 the State Forest Commission purchased the 5,700-acre Game Sanctuary Association property, creating Myles Standish State Forest (MSSF). By the end of the 1920s, the state had purchased the majority of the land we now know as MSSF. Today, MSSF has approximately 12,437 acres, and is the largest public recreation area in southeastern Massachusetts.

As a result of colonial wood utilization and wildfires, most of the original forest was cleared and burnt over by the mid-1800s. The Massachusetts Game Sanctuary Association initiated reforestation efforts in 1912 by planting 30,000 white pines around Barrett Pond and East Head Reservoir (Rothman, 1996).

After acquiring the land the state continued the reforestation program over the next 40 years. With the help of state unemployed crews and Civilian Conservation Corps crews in the 1930s, approximately 1.9 million white, red, Austrian, jack and Scots pines, spruce and other species were planted in the forest between 1916 and 1937. After the 1957 fire, several stands of red pine, white pine and Norway spruce were planted in the western portion of MSSF in an effort to reforest the area. The Norway spruce plantations of this project were planted after the 1957 wildfire. Over 50% of MSSF has seen a wildfire since becoming a state forest in 1916.

Site Data

Geology and Landforms

The project area, like most of the state forest, consists mainly of glacial outwash sands. The project area is flat to rolling terrain.

Myles Standish State Forest is located in Cape Cod Coastal Lowland & Islands Ecoregion. This region was formed by three advances and retreats of the Laurentide ice sheet. The resulting terminal moraines, outwash plains, and coastal deposits characterize the area with their sandy beaches, grassy dunes, bays, marshes, and scrubby oak-pine forests. There are numerous kettle hole ponds, swamps, and bogs. Much of the surface water is highly acidic.

Climate

The climate of MSSF is more moderate than inland areas because of its proximity to Cape Cod Bay and Buzzards Bay. Spring and summer temperatures are somewhat cooler than inland areas, favoring outdoor recreation. Winter temperatures are slightly warmer with less snow accumulation as the ocean slowly cools in autumn. Average monthly temperatures range from approximately 32.0°F in January to 68.9°F in July (Aizen and Patterson, 1995). In general, annual precipitation ranges from 42 to 50 inches, with peaks typically in early spring and mid to late fall. Variations in precipitation from year to year can cause drought or flooding with as much as a five-foot variation in the water table level. The growing season ranges from 146 to 174 days,

but within topographic depressions (i.e., frost pockets) frost can occur throughout the year (Epsilon, 2001).

Soils

Soils are excessively to moderately well drained coarse and loamy sands. Rain percolates too rapidly through the sandy soils to be fully available to plants. The soils were derived from the outwash plain from the Laurentide ice sheet. The thin layer of organic topsoil in the coarse sand is a limitation to the number and type of plant species that will grow in this area. However, there are specialized plants well adapted to this dry, sandy substrate.

Hydrology and watershed

The water resources of Myles Standish State Forest are dominated by groundwater-related features such as kettle hole ponds and vegetated wetlands. Rainfall is rapidly absorbed into the sandy soil, contributing to the underlying aquifer, and relatively little water results in surface runoff. The groundwater table can be seen in the various kettle hole ponds that intersect the aquifer within the forest. Fifty-eight kettle hole ponds ranging in size from approximately one to 86 acres are located within MSSF. Twenty-one of these ponds are named and 37 ponds are unnamed and relatively small in size (typically less than three acres) (DCR, 2011).

Potential Vegetation

The project area is populated with non-native and the native forest species. Norway spruce (*Picea abies*), pitch pine (*Pinus rigida*), eastern white pine (*Pinus strobus*), and white oak (*Quercus alba*) were found. The majority of existing shrub species are low bush blueberry (*Vaccinium angustifolium*), black huckleberry (*Gaylussacia baccata*), and scrub oak (*Quercus ilicifolia*).

Site Productivity

The sandy, excessively well drained soils as described above have very low productivity. The extraction of timber from the MSSF area for ship building, fuelwood, and charcoal with repeated burning of the landscape for nearly 3 centuries reduced the forest cover to pitch pine and scrub oak which significantly reduced the ability of the forest to build soil “capital”.

An analysis was conducted across all properties managed by the Bureau of Forestry to assess site productivity and complexity using Geographic Information System (GIS) data layers of Prime Forest Soils, Potential Vegetation Complexity, Late Successional potential, Forest Diversity, Early Successional potential, CFI Site Index, and CFI Stand Structure (Goodwin, Hill, 2012). This analysis found that 53% of the Myles Standish ranks in the lower 1/3 and 82% ranks in the lower ½ of the productivity scale created from the analysis.

Cultural and Archeological Analysis

A review by the DCR office of Cultural Resources was conducted prior to this prescription process. It was reported by the DCR Staff Archeologist that there are no known or significant historic or archaeological resources in the proposed project.

Historical charcoal sites have been identified within the project area. Charcoal sites will be marked to exclude equipment. Trees along the edges of charcoal sites will be removed. Trees within the interior of charcoal sites will be girdled to eliminate seeding and to provide snags for a variety of wildlife.

Stand Data

Forest Stand Attributes

There are two Norway spruce stands and isolated pockets of Norway spruce totaling approximately 62 acres. The density of Norway spruce is highly variable across the plantations. Some areas have a high density of Norway spruce with little else growing, whereas other areas have scattered Norway spruce among pitch pine and highly scattered white pine and white oak. Tree planter plough marks can still be seen from the planting of the Norway spruce.

For the proposed project area (Table 1) there are a total of 261 overstory trees per acre of which 131 are Norway spruce. The following tables illustrate the stand structure, composition, relative density, quadratic mean-stand diameter (QMD), regeneration, and understory vegetation. There is approximately 19.1 cubic feet per acre of coarse woody material.

Table 1 – Stocking diagnostics for the project area

Species	Total trees/acre	Total BA/acre	% BA/acre by species	QMD	Relative density
Norway spruce	131.2	62.8	53%	9.4	25.9
Pitch pine	121.3	46.1	39%	8.3	57.1
White pine	6.6	8.9	8%	15.7	3.2
White oak	1.9	0.6	0%	7.2	0.5
Total	261	118.4	100%	9.1	86.7

Table 2 – Volume diagnostics for the project area

Species	Sawlog Bf/Acre	Pulp Cords/Acre	Sawtimber Mean Ht (logs)	Total Bf (Stand)	Total Cords (Stand)	Topwood Cords (stand)
Norway spruce	1,745	14.21	2.0	108,217	881.0	48
White pine	180	1.29	0.5	11,190	79.7	29
Pitch pine	43	12.95	1.0	2,648	803.2	4
White oak	0	0.14		0	8.6	

Table 3 – Stand advanced regeneration (stems per acre)

Species	< 1'	1'-4.5'	4.5' to 1" dbh	> 1" DBH	total
white pine	33	0	25	17	75
Norway spruce	0	0	0	42	42
pitch pine	0	0	0	25	25
black cherry	0	17	0	0	17
white oak	0	8	0	0	8
total	33	25	25	83	167

Table 4 – Ground cover (percent cover)

Species	Percent cover
lowbush blueberry	46
huckleberry	43
scrub oak	11
wintergreen	4
bracken fern	3
moss	2
lichen	< 1
serviceberry	< 1
sheep laurel	< 1

Rare and Endangered Species and Wildlife Habitat

The proposed project is within priority habitats of rare species. The pitch pine-scrub oak barrens within MSSF provide habitat for a diversity of state-listed animals and plants, including 13 species of moths and butterflies: [Barrens Daggermoth](#) (*Acronicta albarufa*), [Frosted Elfin](#) (*Callophrys irus*), [Gerhard's Underwing Moth](#) (*Catocala herodias* Gerhard), [Melsheimer's Sack Bearer](#) (*Cicinnus melsheimer*), [Slender Clearwing Sphinx Moth](#) (*Hemaris gracilis*), [Barrens Buckmoth](#) (*Hemileuca maia*), [Buchholz's Gray](#) (*Hypomecis buchholzaria*), [Coastal Swamp Metarranthis Moth](#) (*Metarranthis pilosaria*), [Pink Sallow Moth](#) (*Psectraglaea carnosae*), [Pine Barrens Speranza](#) (*Speranza exonerata*), [Pine Barrens Zale](#) (*Zale lunifera*), [Pine Barrens Zanclognatha](#) (*Zanclognatha martha*) and one other moth species*; two tiger beetle species: [Purple Tiger Beetle](#) (*Cicindela purpurea*), and one other tiger beetle species*; and two species of plant: [Reed Bentgrass](#) (*Calamagrostis pickeringii*) and [New England Blazing Star](#) (*Liatris scariosa* var. *novaeanglia*). * Natural Heritage and Endangered Species Program (NHESP) does not publicly reveal the name or location of this species in property-specific documents.

Most of these barrens species rely on habitat with an open vegetation structure, such as scrub oak shrublands and heathlands. A few of the “barrens” species prefer even more open habitat, perhaps more accurately described as savanna or sandplain grassland. Per the 2007

Biodiversity of Myles Standish State Forest report from NHESP, pine barrens management it is a high priority to improve and maintain habitat quality for pine barrens species, and to reduce the potential for wildfire.

Myles Standish State Forest is also an Important Bird Area as designated by Mass Audubon. An Important Bird Area is a site providing essential habitat to one or more species of breeding, wintering, and/or migrating birds. The state forest is a significant breeding site for the regional high conservation priority species such as: Whip-poor-will, Brown Thrasher, Prairie Warbler, Eastern Towhee, and Field Sparrow, all of which will benefit from the prescribed treatment.

Refer to pages 165 to 179 of the Massachusetts Wildlife Action plan at: <https://www.mass.gov/service-details/state-wildlife-action-plan-swap>. This document provides detailed description of animals found in pitch pine-oak upland forests.

Water Resources

All required BMP's set forth in the most recent edition of the "Massachusetts Forestry: Best Management Practices Manual" will be implemented across the project area. No wetland resources occur in the project area. A shrub swamp (an abandoned cranberry bog) exists south of the most southern parcel located on the west side of Jessup Road. A shrub swamp and an adjacent shallow marsh meadow also exists southeast of the project to the south of Musquash Road. The proposed timber harvest area is not within 100 feet of a certified vernal pool according to the Natural Heritage & Endangered Species Program (NHESP) datalayer downloaded June 18, 2020 available from MassGIS.

Recreational and Aesthetic Resources

Basketball, bicycling, boating, canoeing/kayaking, dog walking, fishing, geocaching, hiking, horseback riding, hunting, nature study, picnicking, running/jogging, skiing- cross-country, snowmobiling, snowshoeing, swimming, and volleyball occur in Myles Standish State Forest throughout the year.

Bare Hill Road is near, but not directly abutting, the proposed project area. Three Cornered Pond Road, Jessup Road, and Musquash Road directly abut the proposed project area. A small section of the paved bike path abuts the proposed project area. No trails are abutting or within the proposed project area, but one illegal trail is within the western most parcel. A small dirt parking lot is just north of the project area. The bike path and the parking lot will be closed during harvesting activity. DCR Management Guidelines of 2012 state that all trails that interface with forest management will include a 50 foot wide corridor on each side of the road or trail. However, the Guidelines also state that if deemed appropriate by DCR and reviewed by the Forest Reserves Science Advisory Committee (FRSAC), removal of hazardous trees directly adjacent to official DCR trails and abutting properties may be allowed. The FRSAC has reviewed and approved this project.

Tree density will be significantly reduced to promote native pitch pine, scrub oak, and shrubs. As removing a considerable portion of the forest canopy will occur, the resulting landscape will have a dramatic change in appearance from a high density forest to a more open woodland and shrubland savanna.

To minimize adverse aesthetic impact to recreational users of the area, all forest roads and the paved bike path will be cleared of all debris following operations. Given the objective to reduce most of the tree canopy there will be no retention of road or trail buffers. The paved bike path will be protected during machine crossings.

Evaluation of Data and Projected Results

Objectives

The principal objective is to complete an ecological restoration of open pitch pine and scrub oak communities, which are often referred to as ‘pine barrens’. Pine barrens are globally rare, fire-dependent, shrub dominated communities with scattered trees and occasional openings, occurring on dry, poor, sandy soils. They provide habitat for many rare species. Human effort to exclude fire in these pine barrens areas over the past half-century have favored growth of Norway spruce over pitch pine and scrub oak. Many plantations of exotic softwood trees were established on former pine barrens habitat or are adjacent to existing pine barrens.

The project was selected for forest management at this time because:

- Non-native plantation removal is a high priority for pine barrens management in the 2011 resource management plan for the Myles Standish planning unit as well as in the 2007 Biodiversity of Myles Standish State Forest report from Natural Heritage and Endangered Species Program (NHESP).
- The existing non-native plantations are generally low in species diversity.
- The project builds upon adjacent non-native plantation removal / pine barrens restoration work.

The project endeavors to:

- Restore native pitch pine-scrub oak barrens, pine barrens, to provide habitat for a diversity of endangered species as well as common species.
- Demonstrate harvesting techniques and silvicultural operations that restore native communities.
- Fulfill management approaches for Reserves as directed by the Forest Futures Visioning Process (2010) and subsequent Management Guidelines (2012). From page 20 of the Guidelines “... some situations may call for ecological restoration and vegetation management. Situations where some management may be appropriate include the removal of invasive species or for the protection of existing rare species. Fire adapted Reserves in Southeastern Massachusetts may require active restoration and management

to maintain habitat for rare species and reduce the risk of catastrophic wildfire that can threaten human health and safety.”

Silvicultural Prescription

Primary and secondary goals: The primary silvicultural goal is to establish native pitch pine and scrub oak regeneration in areas lacking such species, and to release these native species currently under Norway spruce. A secondary goal is to increase the structural and native species diversity of the forest. Achieving these goals will provide habitat and food for rare and common wildlife species.

Silvicultural Method: The silviculture applied in this project will be to convert the artificial plantation to an ecologically functioning pine barrens. This is termed ecological rehabilitation or restoration (Ashton and Kelty, 2018, page 566). Norway spruce will be removed using whole-tree harvesting and chipping, with all chips removed from the site to allow for future use of prescribed fire and/or mowing in maintaining the pine barrens habitat. From page 65 of the Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines (2012) “On DCR harvests this tool [Whole Tree Harvesting and Woody Biomass Removal] may be used in limited circumstances in order to:…Intentionally impoverish site conditions and reduce fuel loads when converting plantations on sand-plain ecosystems to native scrub oak, tree oak and pitch pine vegetation communities.” White pine interspersed within the plantations will be removed as well as white pine is not a species sustained in a pine barrens habitat.

In addition, from page 22 of the Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines (2012), “Habitat manipulation, silvicultural treatments and commercial harvesting operations are not permitted in Reserves. However, if deemed appropriate by DCR and reviewed by the Forest Reserves Science Advisory Committee (FRSAC), the following exceptions may be allowed: a) Implementation of NHESP recommendations to restore, maintain or enhance habitat for rare and endangered species and exemplary natural or rare communities.” The FRSAC has reviewed and approved this action.

Specifications

Any and all Norway spruce and white pine trees greater or equal to 5” in diameter at breast height (dbh) will be removed. The canopy will be thinned in some areas, to complete overstory removal in other areas depending on the density of the Norway spruce and white pine.

The overstory removal of the white pine and non-native spruce will convert the forest composition to that of native pine barren species. The removal of the plantation trees will release the native overstory pitch pine and oak species and the understory scrub oaks, huckleberry and blueberry.

Future silvicultural treatments will be prescribed burning, mowing, and a combination thereof to kill white pines that typically reseed in such areas and to stimulate sprouting and growth of native shrubs. Active management using these methods will be planned in coordination with NHESP and done at variable frequencies and intensities to encourage a mosaic of pine barrens, shrublands, and woodland communities.

Desired and Expected Results

The desired future condition is an open canopy of pitch pine and tree oaks above a dense understory of scrub oak, heath, and other native shrubs and plants. This will allow for the safe application of prescribed fire. Existing patches of native species will be free to grow.



Figure 2a – Existing plantation (pre-harvest) example



Figure 2b - Post timber harvest example

Anticipated Future Treatments:

Short Term

The objective is to convert these stands to native open woodlands or shrublands characterized by pitch pine, tree oaks, scrub oak and associated native shrubs. Portions of the Norway spruce plantations have pitch pine scattered within the canopy and scrub oak, and native shrubland species underneath. Removing the Norway spruce will result in an open shrubland habitat in some areas, and an open pitch pine woodland in other areas. Both will provide a benefit to a variety of rare, declining, and common species. White pine interspersed within the plantations will be removed as well. Approval from the DCR Commissioner will be required for openings above 1/3 acre that harvest all merchantable trees.

Long Term

Future silvicultural treatments will be prescribed burning, mowing, and a combination thereof to kill white pines that typically sprout in such areas and to stimulate sprouting and growth of native shrubs. Active management using these methods will be planned in coordination with NHESP and done at variable frequencies and intensities to encourage a mosaic of pine barrens, shrublands, and woodland communities.

Logging System Requirements

The method to remove the Norway spruce and white pine will be whole tree harvesting and chipping, with all chips removed from the site to allow for future use of mowing/mulching and prescribed fire in maintaining the pine barrens habitat. Skidding will be permitted to provide scarification for pitch pine and scrub oak regeneration. The harvest will begin at the earliest in the summer of 2020.

The project will have two landings on Three Cornered Pond Road with an option for a third landing on Musquash Road (see map). If the landing on Musquash Road is utilized approximately 48 Norway spruce to south of Musquash Road and to the east of the shrub swamp/shallow marsh meadow should be included in the project to further remove non-native species. Access to the project will be from Bare Hill Road and/or Musquash Road depending on the use of the optional landing. No skidding should occur to the east of the project area as an underground gas line is present. Skidding will take place between the two larger plantations where dead red pine was removed in 2014.

A steel plate will be necessary for crossing the paved bike path. Signs will be displayed to close the sale area during timber harvesting operations.

Portions of existing forest roads will be utilized as skid roads. Portions of existing forest roads will require gravel to stabilize uneven or soft sandy areas for equipment and log and chip trucks. As this project involves restoring disturbance dependent natural communities there will be no set skid roads, but rather a directive to broadcast travelled routes throughout the project area.

Excluded areas: Charcoal sites will be marked to exclude equipment. Trees along the edges of charcoal sites will be removed and will be cut so as to not damage the interior portion of the charcoal site. Trees within the interior of charcoal sites will be girdled to eliminate seeding and to provide snags for a variety of wildlife.

In-kind Services: Three Cornered Pond Road from Bare Hill Road west to the DCR gate is in need of maintenance and repair. Services may include gravel and grading where needed.

Upon completion of harvest activity all forest roads, skid roads, and skid trails and landings will be stabilized with water bars to the recommendations found in the Massachusetts Forestry: Best Management Practices Manual.

Prescription Documentation **Timber Marking Guidelines**

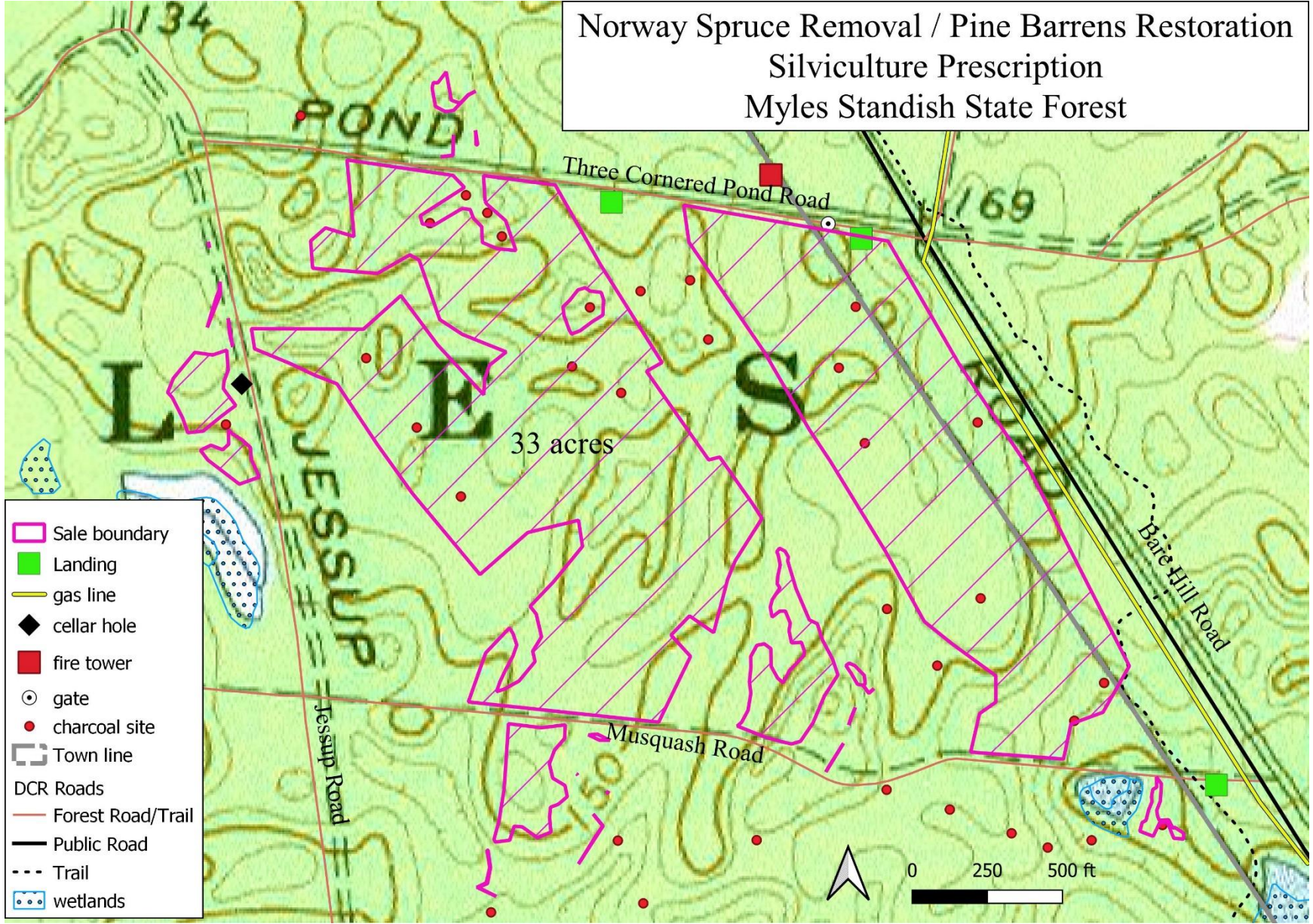
As all Norway spruce and white pine trees greater than or equal to 5" in dbh will be removed, only the sale boundary will be marked with the exception of trees along the edges of the charcoal sites. The boundary will be marked by three diagonal stripes in blue paint. Boundary trees will be cut. Standing dead trees within a tree length of any road or the bike path will be removed. Trees on the edge of charcoal sites will be marked with a single diagonal stripe in a color different than the sale boundary and interior charcoal site trees will be double flagged and will not be cut. Wetlands will be flagged.

Alternative project scope

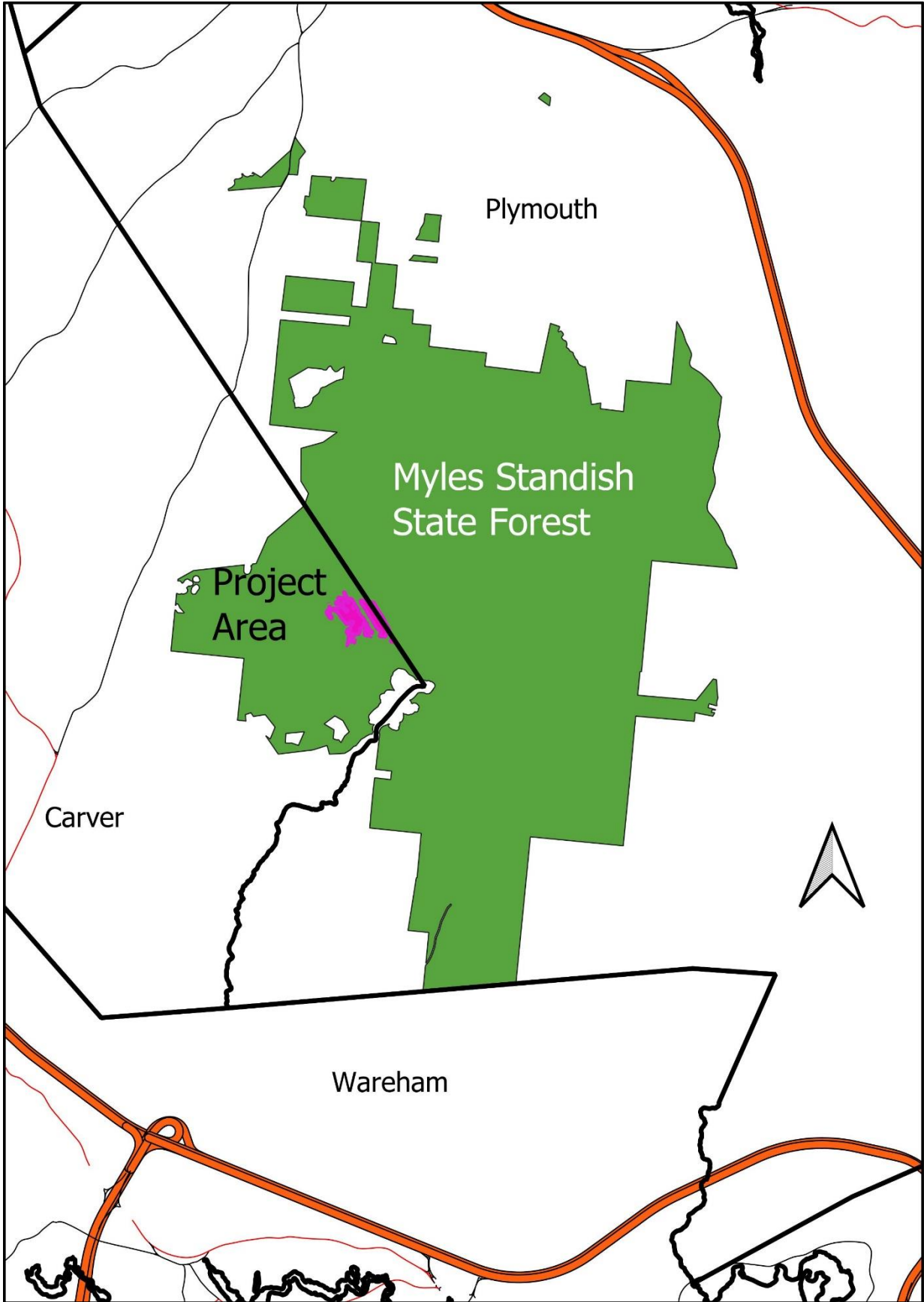
The 33 acre sub unit (see map) contains approximately 90% of the board feet of the entire 62 acre project area. To not incur a cost to the taxpayers, or lessen the cost if indeed the cost of

removal exceeds the value, it may be prudent to consider only harvesting the 33 acre sub unit and harvest the remaining acreage through grant opportunities as they become available.

Norway Spruce Removal / Pine Barrens Restoration Silviculture Prescription Myles Standish State Forest



- Sale boundary
- Landing
- gas line
- cellar hole
- fire tower
- gate
- charcoal site
- Town line
- DCR Roads
- Forest Road/Trail
- Public Road
- Trail
- wetlands



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