



*Silviculture Prescription
Pine Barrens*

*Massachusetts Department of Conservation and Recreation
Bureau of Forestry*

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

Prepared by:

*Paul Gregory – Management Forester – Southeast District
William N. Hill, CF – Management Forestry Program Supervisor
Massachusetts Department of Conservation and Recreation
194 Cranberry Rd. – P.O. Box 66, South Carver, MA 02366
paul.gregory@state.ma.us – 508–866-2580 ext. 121*

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Approved by:

Management Forestry
Program Supervisor

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William N. Hill, CF

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 12,404 acres, and is the largest public recreation area in southeastern Massachusetts.

As a result of colonial wood utilization and wild fires, 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.

SITE DATA

Overview

There are approximately 576 acres of planted red pine (*Pinus resinosa*) stands located throughout Myles Standish State Forest. Many of these plantations were planted after large wildfires. The largest section of red pine plantations occur in the western portion of the forest, being planted after the 1957 fire. Norway spruce (*Picea abies*) and eastern white pine (*Pinus strobus*) plantations exist in MSSF as well. Norway spruce was also planted along side red pine in a few instances. Small rows of red pine are located along paved roads, forest roads, hiking trails, or paved bike paths. The trees in the plantations range from 45 to 80 feet tall. In some red pine plantations Norway spruce or white pine has seeded in from adjacent plantations and are a part of the forest overstory and understory.

The majority of the red pine in Myles Standish State Forest are showing signs of infection by red pine scale, (*Matsucoccus resinosa*), as well as with diplodia blight, (*Diplodia pinea*). Outward signs of the combined insect and fungus attack are discolored and brown needles and in some plantations, complete tree mortality. In some cases, these two biological agents have killed entire red pine plantations/stands. Many of the plantations are declining rapidly, going from no noticeable decline to dying in a matter of less than two years. Although some plantations show very little signs of pine scale and diplodia, all of them have at least minor damage.

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

Most of the soils of MSSF are sandy and excessively well-drained with little organic matter. Rain percolates too rapidly through the sandy soils to be fully available to plants. MSSF is primarily comprised of Carver coarse sandy soils that are well-drained (DEM, 1987). The glacial deposit for Carver soil series is from 40 to 160 feet thick with a seasonal high water table no closer than five feet from the surface (USDA, 1969). The thin layer of organic topsoil in the Carver soil series 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.

Carver loamy coarse sand soil is usually underlain with a deep deposit of pebbly sand and is found in small isolated areas near the southwestern and southeastern boundaries of MSSF. Carver-Gloucester soils are composed of two-thirds sandy Carver soil and one-third stony Gloucester soil derived from the glacial till deposits of the moraines located in the northwestern portion of MSSF. There is more organic matter in the Carver-Gloucester soil type, which supports native white pine forests.

The Carver and Carver-Gloucester sandy soils are easily graded for roads or trails, but the lack of organic top soil makes it very difficult to establish vegetation. The sands of both soil types are highly permeable and allow for very rapid percolation. As a result, the potential for groundwater contamination is great, as harmful chemicals do not have adequate time to leach out before reaching the groundwater.

Peat, muck and sanded muck also occur in isolated wetland areas. Sanded muck represents poorly drained soils that have been developed for cranberry production by covering the organic matter with a foot of coarse sand and developing a system of ditches to control the water level (DEM, 1987).

Hydrology and Wetlands:

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). Although a number of the ponds are in close proximity to the red pine plantations, there are no ponds within them.

The proposed project has one certified vernal pool as noted on the Project Map. It has been delimited with a 50 foot filter strip where no harvesting will occur. Additionally a few small isolated wetlands exist within the limits of the proposed project (note Project Map) which have also been delineated and provided a 50 foot buffer strip. No harvesting will be permitted within the 50 foot buffer strip unless the trees pose a safety concern. These trees will be cut in place to remain on site.

The retention of the filter strips will provide protection to these important water resources and retain dead standing red pine as snags which will be used by a variety of birds and wildlife as habitat and food sources.

Potential Vegetation

The red pine plantations are populated with the native forest species of southeastern Massachusetts. Eastern white pine, pitch pine (*Pinus rigida*), black oak (*Quercus velutina*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*) and black cherry (*Prunus serotina*) are the most common tree species within the red pine overstory. The majority of existing shrub species present in the plantations are scrub oak (*Quercus ilicifolia*), black huckleberry (*Gaylussacia baccata*), and low bush blueberry (*Vaccinium angustifolium*).

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 1/2 of the productivity scale created from the analysis.

Cultural and Archeological Resources

As a part of the preparation of this project the DCR Archeologist prepared comments and conducted a field visit to the plantation sites. Specific recommendations made by the archeologist were:

- Avoid stone walls and other cultural resources like charcoal pits, wells and foundations
- Flag and clearly mark all cultural resources

- Avoid **any** ground disturbing activity in the College Pond Road, Federal Hill, Shady Acre Campground, and Cranberry Road areas.

Landing locations will be reviewed by the state archeologist to insure protection of cultural resources. Landings may be moved if deemed necessary. Seventy seven (77) historical charcoal sites have been identified within or in close proximity to the red pine plantations. Their locations have been mapped and will be provided to the state archeologist for her records as many have never been recorded before. Trees within the charcoal sites will be marked as leave trees, will not have machinery pass over them, and as such will provide areas for snags to be retained.

STAND DATA

Forest Stand Attributes

The Pine Barrens Restoration project is composed of 125 polygons/stands of red pine plantations covering approximately 513 acres dominated by red pine. Approximately 131 acres of the plantations have had previous silvicultural treatments that were intended to improve the growth on remaining red pine. Also, 63 acres of red pine plantations were removed from the original project proposal due to their very small size and remote locations.

Stand exam inventory of the red pine plantations indicates an overstory composed of 75% red pine, 12 % pitch pine, 9% eastern white pine, 2% Norway spruce, 1% black oak, and 1% of a combination of white oak, scarlet oak and black cherry. There are a total of 397 overstory trees per acre of which 231 are red pine (Table 1 and Figure 1). Much of the oak species can be considered mid-story as they reside below major canopy of the red pine plantation. Although the red pine dominates the plantation settings it is obvious that the native species have competed well for growing space and will probably flourish if provided the opportunity.

Table 1 - Stocking Diagnostics

BA = Basal Area in ft²/acre; QMD = Quadratic Mean Diameter

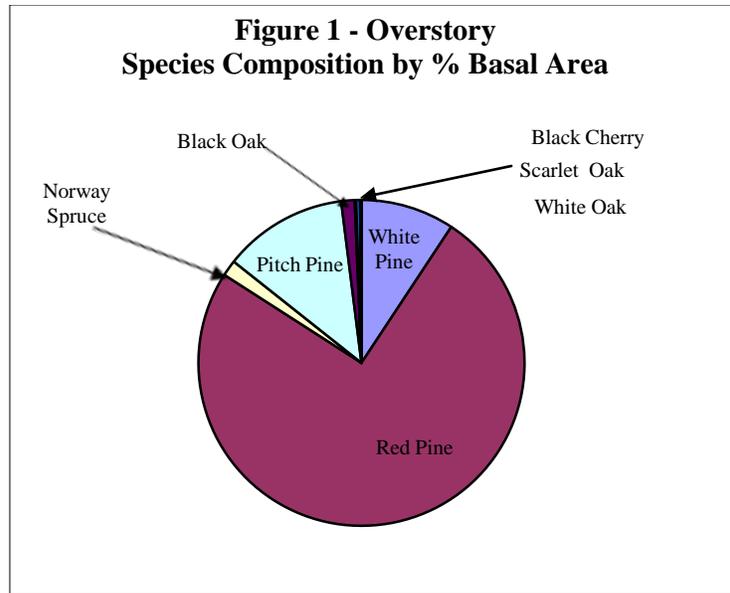
Species	Total Trees/Acre	Total BA/Acre	% BA by Species	QMD	Relative Density
White Pine	74.3	12.2	9%	5.5	6.2
Red Pine	230.6	98.1	75%	8.8	50.6
Norway Spruce	9.2	2.1	2%	6.4	1.1
Pitch Pine	72.1	16.2	12%	6.4	21.4
Black Oak	8.7	1.7	1%	6.1	1.7
White Oak	0.2	0.2	0.1%	14.4	0.1
Scarlet Oak	1.1	0.5	0.4%	9.3	0.5
Black Cherry	0.7	0.2	0.1%	6.9	0.0
Total	396.7	131.1	100%	7.8	82

Median Stand

Diameter ->>

10.5

82



The stand exam inventory conducted in August of 2013 also indicated that due to the red pine scale and diplodia blight, 23% of the red pine trees are dead, 67% are in various states of dying (some sign of disease to nearly dead) and 10% show no sign of insect and disease damage.

Inventoried shrub and non-tree ground cover vegetation of the red pine plantations consists of 49% black huckleberry (*Gaylussacia baccata*), 45% low bush blueberry (*Vaccinium angustifolium*), 30% scrub oak (*Quercus ilicifolia*), 9% wintergreen (*Gaultheria procumbens*), 4% bracken fern (*Pteridium aquilinum*), and 1.5% sheep laurel (*Kalmia angustifolia*).

Bearberry, cow wheat, dewberry, false wild indigo, dwarf chinquapin, grass sp., Highbush blueberry, lady slipper, mayflower, moss, reindeer lichen, shadbush, sweet fern, and viburnum sp., were also found with each less than 1%.

The only considerable amount of tree seedlings found were from white pine that had an average of 458 stems per acre, with over half of these less than 6 inches in height. Other sparse tree seedlings found were beech, black cherry, black oak, pitch pine, red maple, red oak, red pine, scarlet oak, and white oak.

Rare and Endangered Species and Wildlife

Most of the Myles Standish State Forest is within NHESP priority habitats of rare species. Most of the red pine plantations are within priority habitats of rare species, but most are out of the estimated habitat of rare wildlife. The pitch pine-scrub oak barrens within MSSF provide habitat for a diversity of state-listed animals and plants, including 15 species of moths and butterflies: Coastal Heathland Cutworm (*Abagrotis nefascia*), Barrens Daggermoth (*Acronicta albarufa*), Frosted Elfin (*Callophrys irus*), Gerhard's Underwing Moth (*Catocala herodias Gerhard*), Waxed Sallow Moth (*Chaetagnaea cerata*), Melsheimer's Sack Bearer (*Cicinnus melsheimer*), Slender Clearwing Sphinx Moth (*Hemaris gracilis*), Buckmoth (*Hemileuca maia*), Buchholz's

Gray (*Hypomecis buchholzaria*), Pine Barrens Itame (*Itame* sp. 1 nr. *Inextricata*), Coastal Swamp Metarranthis Moth (*Metarranthis pilosaria*), Pink Sallow Moth (*Psectraglaea carnosae*), Pine Barrens Zale (*Zale* sp. 1 nr. *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 three species of plants: Reed Bentgrass (*Calamagrostis pickeringii*), Broom Crowberry (*Corema conradii*), and New England Blazing Star (*Liatris scariosa* var. *novaeanglia*). * Natural Heritage and Endangered Species Program 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, plantation removal of non-native species is the highest priority recommendation for pine barrens management.

Many of the state-listed species would benefit from areas with open exposed, sandy soils (scarification areas). DCR will work with NHESP personnel to undertake intentional soil scarification. NHESP will provide additional consultation to determine the location and size of the areas to be scarified.

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.

Recreation and Aesthetic Resources

Boating, biking, birding, camping, cross-country skiing, fishing, geocaching, hiking, horseback riding, hunting, picnicking, snowmobiling, snowshoeing, and swimming occur in Myles Standish State Forest throughout the year.

Several paved roads, forest roads, hiking trails, paved bike paths, and illegal trails are abutting or located within the proposed project area. These trails will be closed during harvesting activity. Legal trails will be reestablished once the project is completed. Given the objective to enhance public safety, there will be no road or trail buffers retained so as to reduce the future risk of injury from falling dead trees or limbs. The 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 Scientific 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 action.

As whole tree removal will occur, the resulting landscape will have a dramatic change in appearance as large clearings will occur. The removal of the trees will reduce the fuel load and any hazardous trees to minimize the risk to public safety. It is expected that only a small amount of slash will remain on site as the trees are removed. Paved roads, forest roads, hiking trails, and paved bike paths adjacent to red pine plantations will be cleared of all debris following operations. Given the objective to enhance public safety, there will be no retention of road or trail buffers so as to reduce the risk of injury from falling future dead trees or limbs. Visuals in the trail areas where harvest occurs will change from a forest canopy to an open shrubland savannah. Because red pines will be removed to promote native species of pitch pine, scrub oak, and shrubland species the landscape view will change from a single species monoculture to a more diverse, multi structured canopy.

Invasive Species

During the course of the stand inventory and subsequent visits to the red pine plantations and other areas of the state forest, the amount of area with invasive species was found to be larger than first anticipated. The Barrett Pond campground and the College Pond recreational area were found to have invasive species not previously mapped. Due to the extent of invasive plants found, DCR is currently developing an invasive species plan to address this issue. At this writing, the plan is to use revenues from the harvest to begin invasive plant species control in former red pine plantations.

EVALUATION OF DATA AND PROJECTED RESULTS

Objectives

The objective is to complete an ecological restoration to create natural communities of pitch pine and scrub oak. Many plantations were established on former pine barrens habitat or are adjacent to existing pine barrens. The project also will protect and enhance public safety through the removal of red pine trees and the reduction of fuels to reduce the risk of wildfire. The Myles Standish State Forest ecological restoration 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 NHESP.
- Red pine scale and diplodia blight have infected many of the red pine plantations.
- The red pine in the plantations is beginning to die rapidly, and in some cases entire stands are dead.

The Myles Standish State Forest ecological restoration project endeavors to:

- Restore native pitch pine-scrub oak barrens, pine barrens, to provide habitat for a diversity of endangered species.
- Protect public safety through the proactive removal of red pine trees along roads, forest roads, hiking trails, paved bike paths.
- Reduce wildfire danger and provide safe access to firefighters and fire apparatus.

- 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

Red pine and Norway spruce overstory trees greater than 3" diameter breast height (d.b.h.) will be cut from the plantation locations shown on the Project Map with the exception of those wetland areas excluded from the harvest activity. The overstory removal of the non-native spruce and red pine will convert the forest composition to that of primarily native species. The removal of the red pine and Norway spruce 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 establish 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. Planning and funding for these operations will be needed.

Desired and Expected Results

Immediately post harvest the former red pine plantations will be composed of an overstory of widely spaced pitch pine, white pine, white oak, black oak, scarlet oak, and black cherry. Refer to figures 2a and 2b for pre harvest and post harvest comparison. Estimated trees per acre and basal area amounts post harvest are shown in Table 2. Note that the trees per acre will be reduced by about 2/3 and the absolute density of the overstory will be reduced by approximately 100 ft² of basal area per acre providing growing space to the desirable native species.

Table 2 - Immediate Post Harvest Estimated Stocking			
Species	Total Trees/Acre	Total BA/Acre	% BA by Species
White Pine	70.6	11.6	38%
Pitch Pine	71.3	16.0	53%
Black Oak	8.6	1.7	6%
White Oak	0.2	0.2	0.6%
Scarlet Oak	1.1	0.5	1.7%
Black Cherry	0.7	0.2	0.6%
Total	152.4	30.16	100%



Figure 2a – Pre harvest example



Figure 2b - Maintained Pine Barrens Forest Structure, immediate post harvest

Understory composition of scrub oak, huckleberry and blueberry will be significantly disturbed from harvesting activity reducing the density of shrub and small tree species by approximately 50%. When maintained with prescribed fire the incidence of thinned barked white pine will also be significantly reduced and the forest structure will resemble that shown in Figure 3.



Figure 3 - Maintained Pine Barrens Forest Structure – Immediate Post Burn

In the absence of disturbance, fire or mechanical, the vegetation components will rapidly move through succession, particularly the understory of scrub oak, huckleberry and blueberry. Perhaps within 10 years that component of the forest structure will become very dense and particularly flammable (Figure 4). Where white pine is present it may compete with pitch pine for growing space and eventually after many years dominate the site. This would be an undesirable condition as the objective of this project is to return the rare Pine Barrens habitat and maintain it to provide for the rare flora and fauna that exist within it.



Figure 4 - Very Dense Scrub Oak and Huckleberry Structure – Result of Minimal Disturbance

Sale Layout and Logging System

The method to remove the red pine plantations will be 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.”

The harvest will begin in late 2013 / early 2014 and ideally be completed before the recreation season begins in late May of 2014. The continued mortality and degradation of the red pine trees are lessening the value of the forest products where the cost of removing the dead trees may already exceed the value of the products. To not incur a cost to the taxpayers, or lessen the cost if indeed the cost of removal exceeds the value, it will be necessary to complete the harvest before the end of spring 2014.

The project will have multiple landings which are indicated on the Project Map. Signs will be displayed to close the sale area during timber harvesting operations. Roads will be graded if damage, e.g. ruts, has occurred from timber harvesting operations. The state forest has an excellent network of paved and unpaved public and forest roads to easily enable access for this project.

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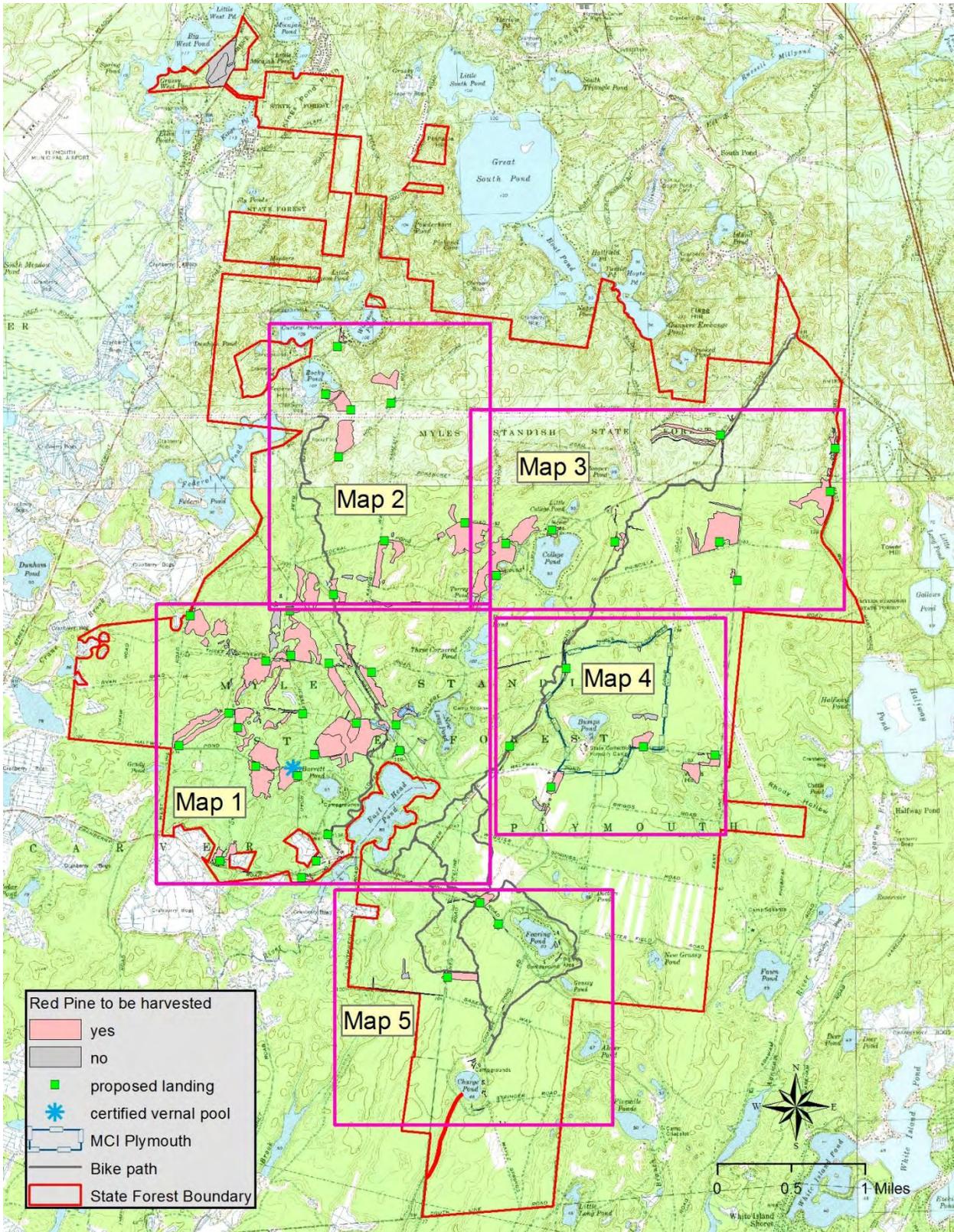
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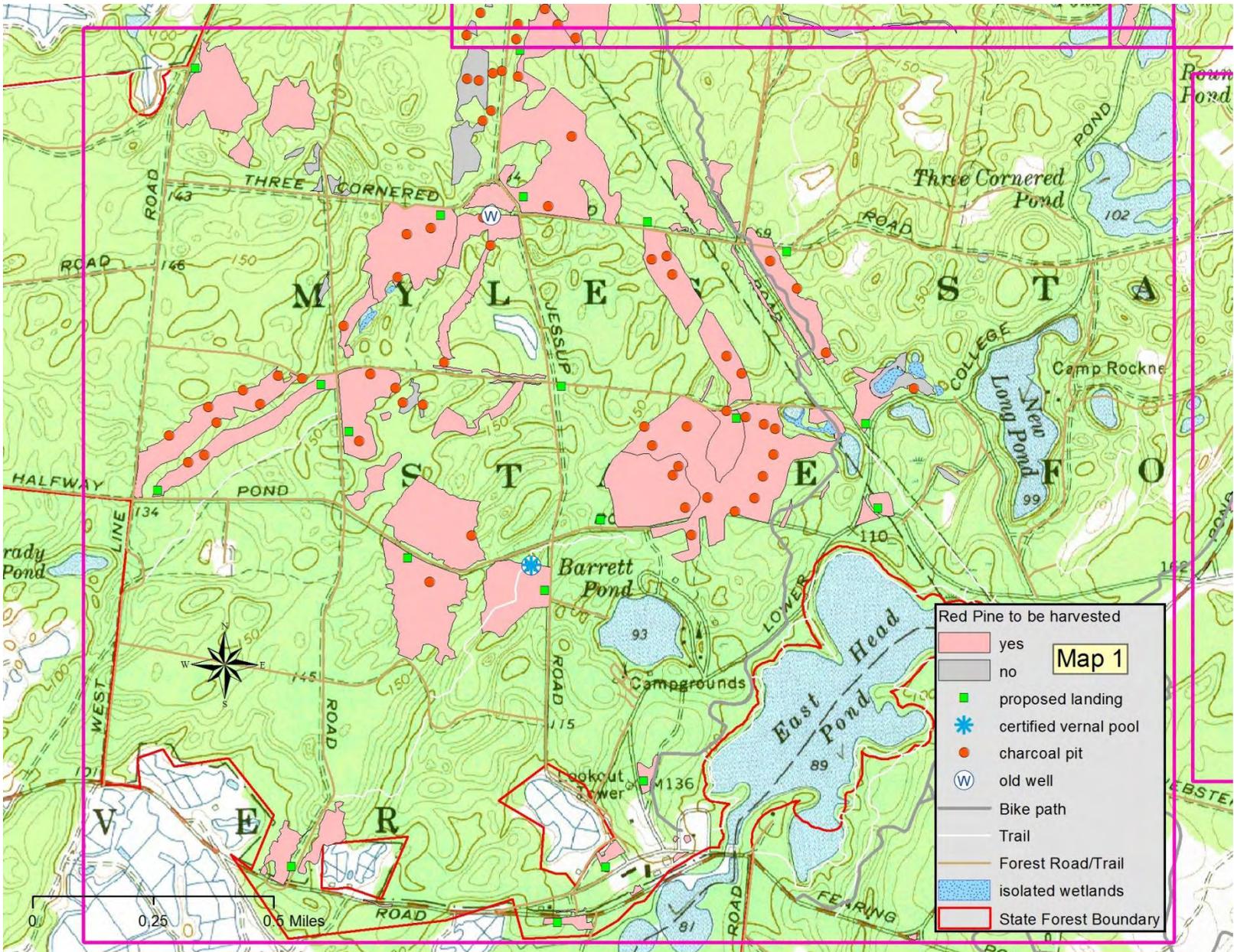
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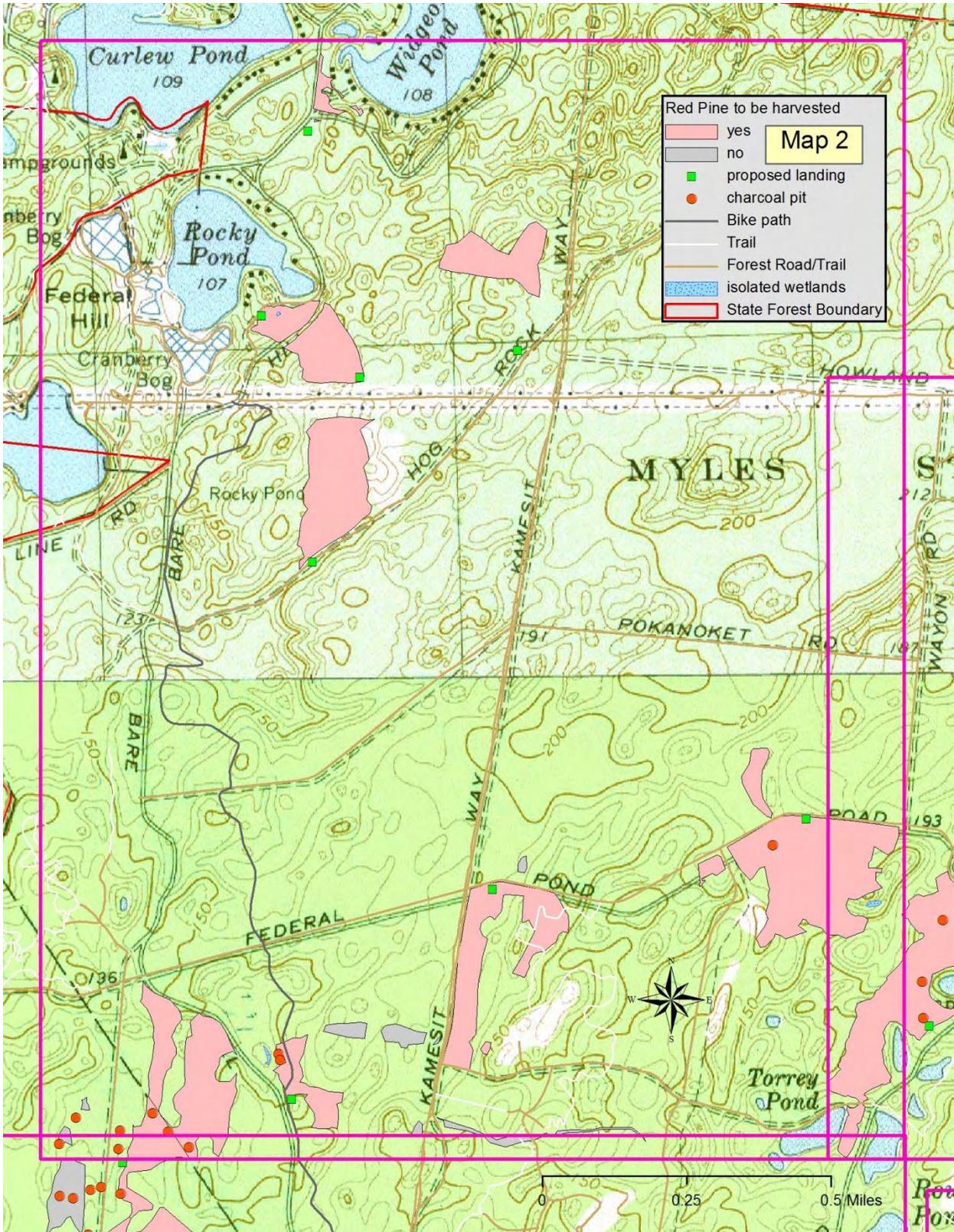
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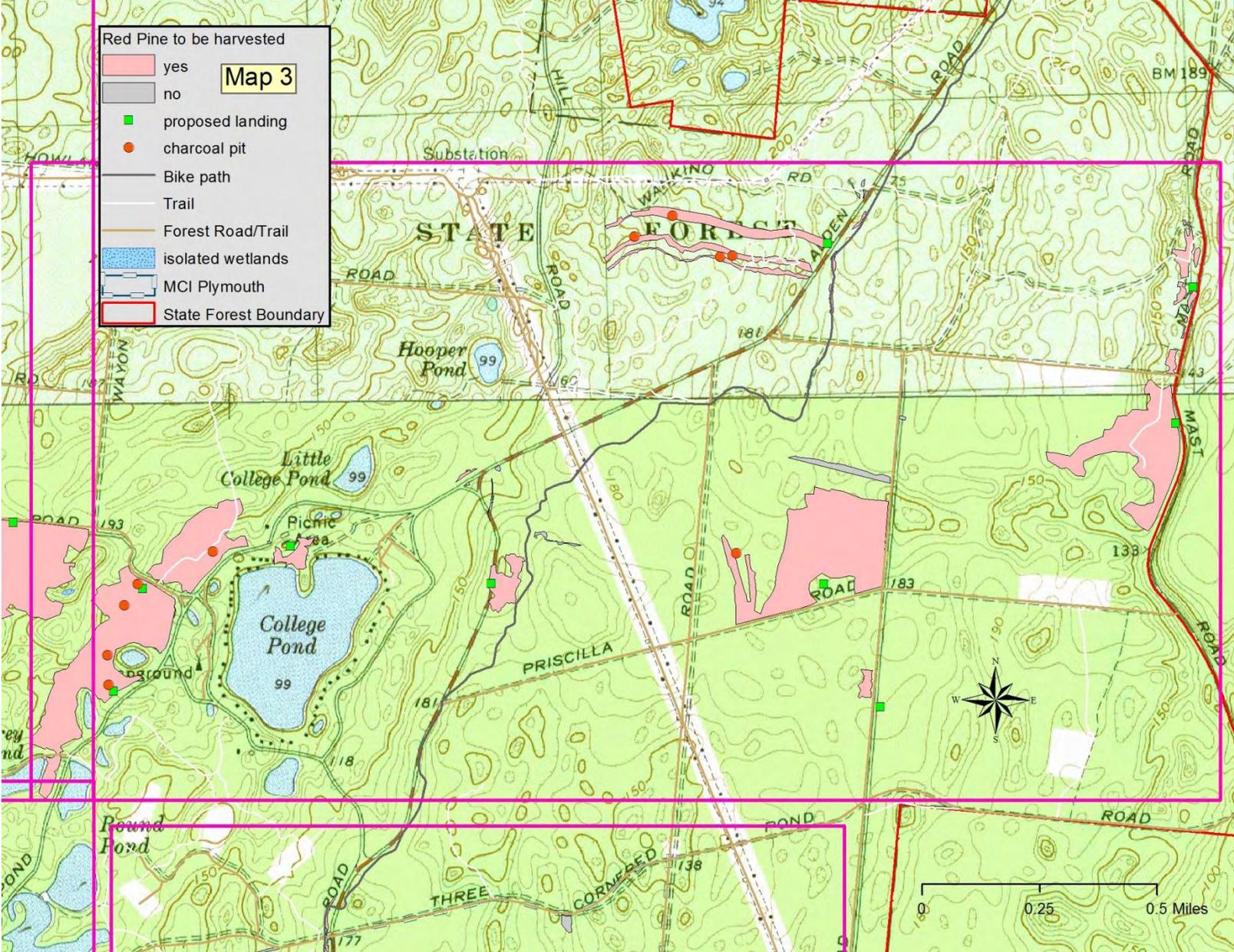


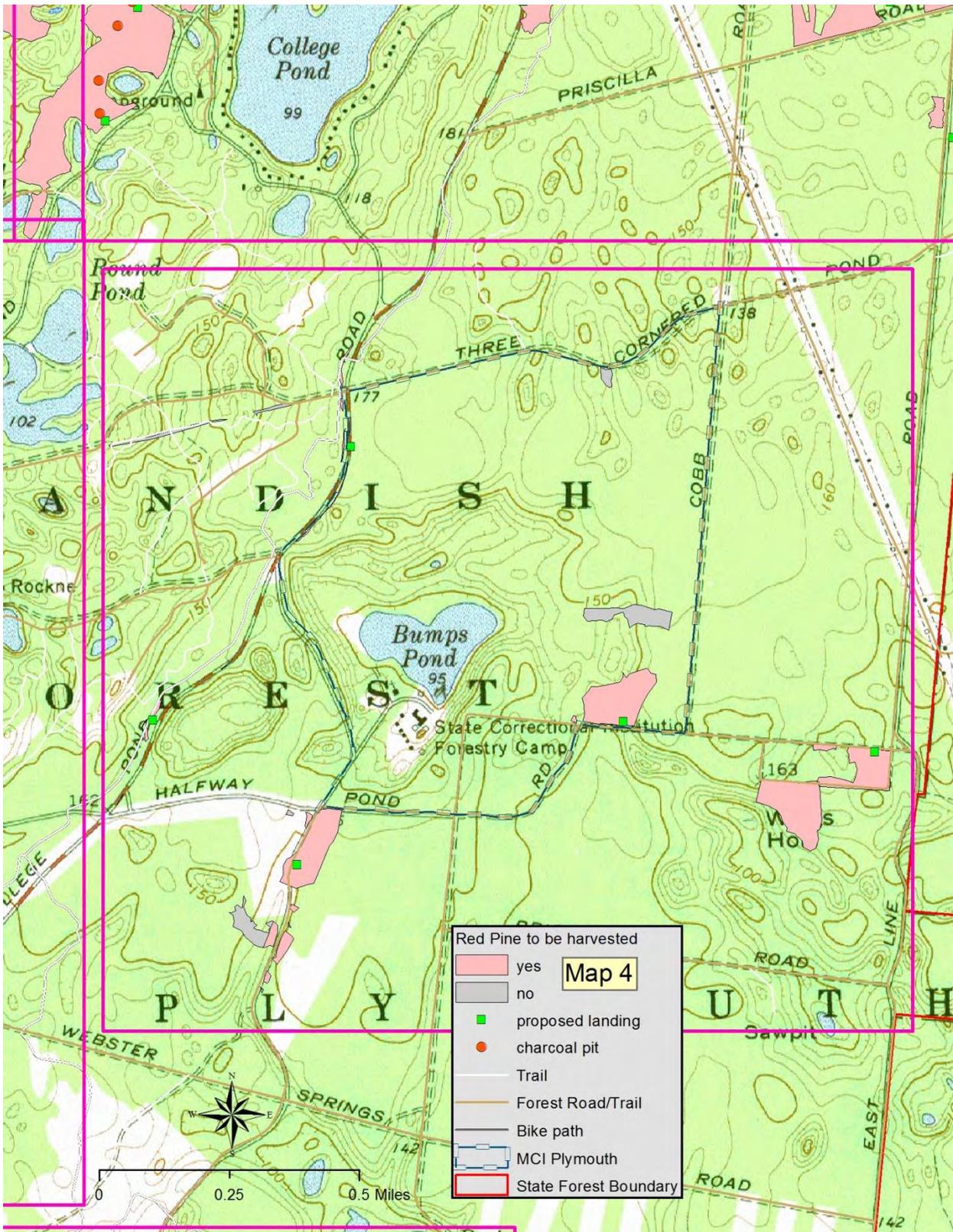




Map 3

- Red Pine to be harvested
 - yes
 - no
- proposed landing
- charcoal pit
- Bike path
- Trail
- Forest Road/Trail
- isolated wetlands
- MCI Plymouth
- State Forest Boundary





Map 4

Red Pine to be harvested

- yes
- no
- proposed landing
- charcoal pit
- Trail
- Forest Road/Trail
- Bike path
- MCI Plymouth
- State Forest Boundary

