dcr | Massachusetts Department of Conservation and Recreation

Silviculture Prescription
Hansen Lot

Massachusetts Department of Conservation and Recreation
Bureau of Forestry

Northeast District
Marlborough-Sudbury State Forest
Marlborough, MA

Prepared by:

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Approved by:

Management Forestry
Program Supervisor  Date: June 8, 2016

William N. Hill, CF

Site Data:

Cultural and Historical:

The Hansen Lot project is located in the Sudbury State Forest, part of the "Desert Natural Area", in the Town of Marlborough Massachusetts (Figure 1 & Exhibit 1). The Hansen Lot is approximately 100 acres located within the larger 900 acre Desert Natural Area in the Towns of Marlborough and Sudbury. The Marlboro-Sudbury State Forest is located within the suburbs of the metropolitan Boston area, and is part of an area of approximately 4000 acres of protected conservation land across several ownerships and municipalities (Exhibit 2).

The Desert Natural Area is an ecosystem that contains disturbance and fire dependant communities of plants and animals. This increasingly rare and declining habitat type is typified by an open savanna Pitch Pine (*Pinus rigida*), Scrub-Oak (*Querqus ilicifolia*) dominated forest with a diverse understory of shrubs and ground cover species. This rare forest type is designated a Priority Natural Community by the Massachusetts Natural Heritage and Endangered Species Program (N.H.E.S.P.). There is approximately 28 acres of Pitch Pine-Scrub-Oak forest type located in the project area.

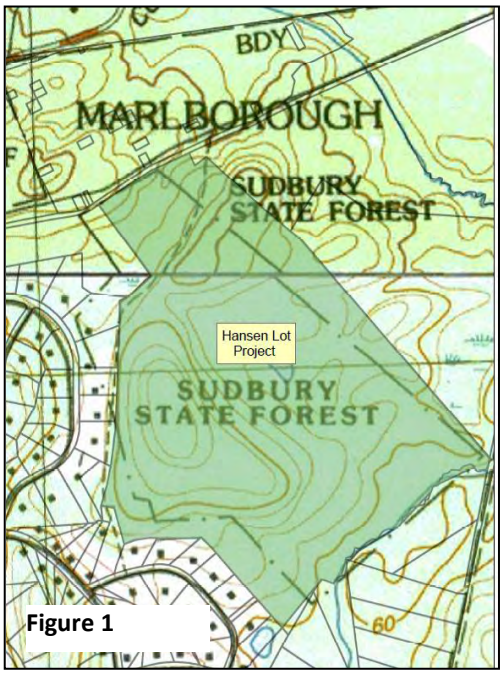

Figure 1

The Hansen Lot is bounded to the north by Old Concord Road. The eastern boundary abuts the Town of Marlboro and Sudbury Valley Trustees properties. The southern boundary is made up of the Town of Marlborough and numerous private property owners along Red Oak Drive. Lastly, the western boundary is made up by numerous private property owners along Minehan Lane and Turner Ridge Road respectively.

The Hansen lot was acquired in 1915. The Commonwealth of Massachusetts purchased many acres of abandoned farmland during this period and set about planting these fallow acres to forest by way of the state reforestation efforts in the early part of the 20th century, and later by the Civilian Conservation Corps (CCC). These camps were located in the nearby towns of Upton, Douglas and Leominster. Many acres of red pine (*Pinus resinosa*), Scots Pine (*Pinus sylvestris*), Norway Spruce (*Picea abies*), and white pine (*Pinus strobus*) were planted and this landscape bears the results of their hard labor. There are approximately 30 acres of plantation pine located in the project area.

When the state took possession of the property back in 1915 the land was in an open non-forested condition. Documents discovered during the course of researching the project

area found that after the Commonwealth took title to the property in 1915 the State took to replanting this lot at least two times. According to records, the first such planting took place in 1915 with plantations of red, white, and Scots pine. There was a wildfire on the property around 1924 that burned all but fifteen acres of the parcel. The property was planted again in 1925, but documents state the planting "did not take well". The property had another burn in early 1955 that covered approximately 40 acres in the Northeast portion of the parcel. No records were discovered noting any additional reforestation after the second planting effort in 1925.[1] The logical inference can be that the non plantation forests in the project area are those that derived from the natural seed bank from adjacent forested stands and trees that were left untouched by previous forest fires.

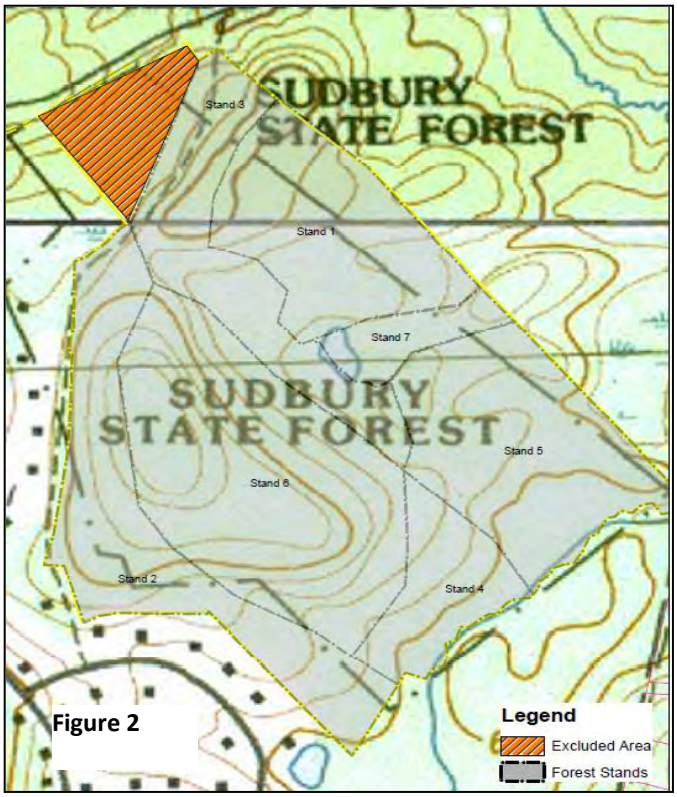

Figure 2

There are several hundred feet of stone walls located along the boundaries of the project area along with two shallow hand dug trench lines along the northern property line. There are numerous breaks in the walls surrounding the project area. Three internal stone walls were discovered during site examination and have been mapped. There were no cellar holes or other evidence of previous human dwellings discovered during site examination of the project area.

A small commercial timber harvest was conducted on approximately 21 acres of the Hansen Lot in the early 1980's. That operation was conducted mainly on the western portions of the site in stands 2, 3, and 6, where planted red pine, white pine, scots pine and Norway spruce are located. Some hardwood trees in stand 6 were harvested about this time also. Evidence of the previous harvest can be found where some logging debris is still visible on the landing area along with evidence of old skid trails. No records of any additional commercial harvests were found during research.[2]

[1] Survey by Cook, Reforestation Lot No.124, Hansen Lot, Marlboro, 1915

[2] EM-1-82-T

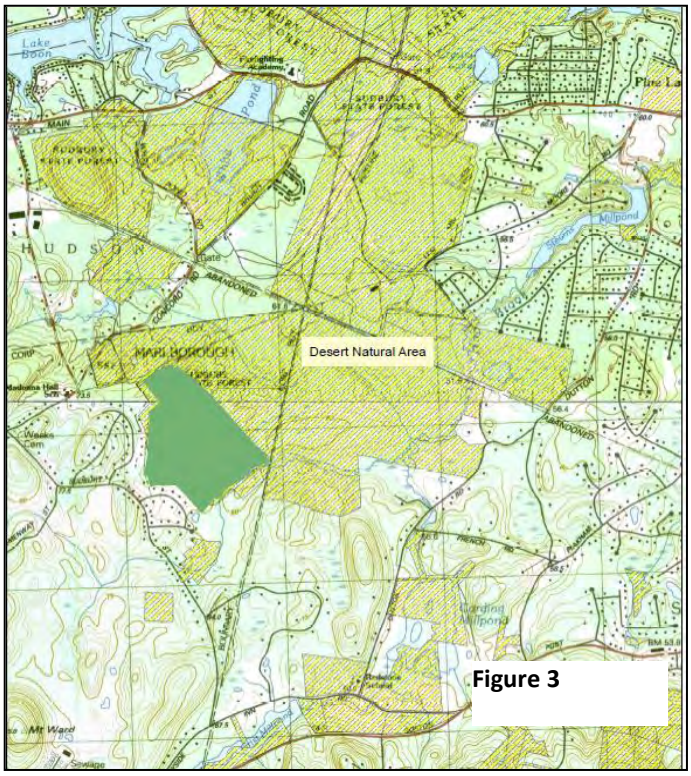

Figure 3

A small portion of the Hansen lot to the northwest of stands 1 and 3 towards Old Concord Road is excluded from this prescription. This is a small stand containing wetland species of trees and shrubs and is not part of the project area. Natural process will be allowed to dictate future forest conditions here (Figure 2)

Over the past several decades this area has seen pronounced urbanization and development of areas that were previously open space. This development has caused loss of native forest canopy giving way to impervious surfaces and urban landscapes with associated pests and invasive species within this region. Development pressures in this and surrounding communities highlight the value of this area, the species that live there, and the importance of protecting and promoting its ecosystem services (Figure 3).

Climate:

Weather patterns in New England vary greatly from season to season. From cold weather fronts that typically originate from the north and northwest during the winter season, to warm weather fronts originating from the south and southwest during summer periods, wind is the major factor driving weather patterns in New England. These seasonal winds can vary greatly from gentle breezes to hurricane force winds causing great damage to property and the surrounding landscape. The National Oceanic and Atmospheric Administration (NOAA) reports an annual average precipitation of 49.48" with an average winter temperature of 17.6^{o} F and average summer temperature of 70.2^{o} F for this area.

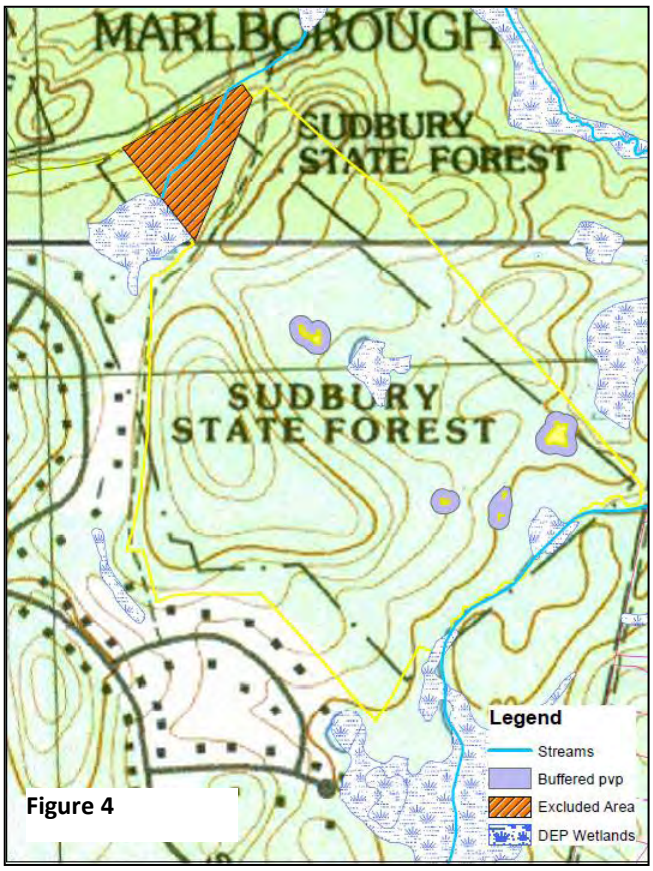

Figure 4

Major weather events (i.e. hurricanes, ice, etc.) are a contributing factor to forest development in New England and the Hansen Lot is no exception. While this area has been spared from any major catastrophic events over the past decades, the Hansen Lot bears witness to several smaller events. The last significant event to affect the site was the December 2008 ice storm, and October 2011 snow storm that caused damage to portions of the project area. Damage ranges from insignificant (broken branch's) to extensive (broken tops). Damage is more prevalent in hardwood dominated areas with less damage occurring in forest stands containing a majority softwood component that could more readily shed ice and snow events due to their conical structure.

Hydrology and Watershed:

There are several significant wetland resources within the project area and adjacent properties (Figure 4). The major resource areas within the project consist of six potential vernal pools (pvp), a small pond and wetland centrally located on the project with a small intermittent stream that drains this area to the east, and two streams with associated wetlands. One intermittent stream is to the north that drains out of the wetlands adjacent to Old Concord Road and the second being Trout Brook that flows along the southern border of the property. Both streams flow into Hop Brook to the east. All potential vernal pools within the Hansen Lot will be treated as certified as they pertain to this silvicultural prescription. Streams will be protected by variable width filter strips (minimum 50 feet wide) where no equipment will be allowed to operate and no harvesting will occur. There will be no harvesting in wetlands associated with this project.

The Hansen Lot is located in the Concord Watershed within five miles of the Assabet River and Assabet River National Wildlife Refuge. The Sudbury Reservoir managed by the Department of Conservation and Recreation Division of Water Supply and Protection lies approximately three miles to the southwest of the project area.

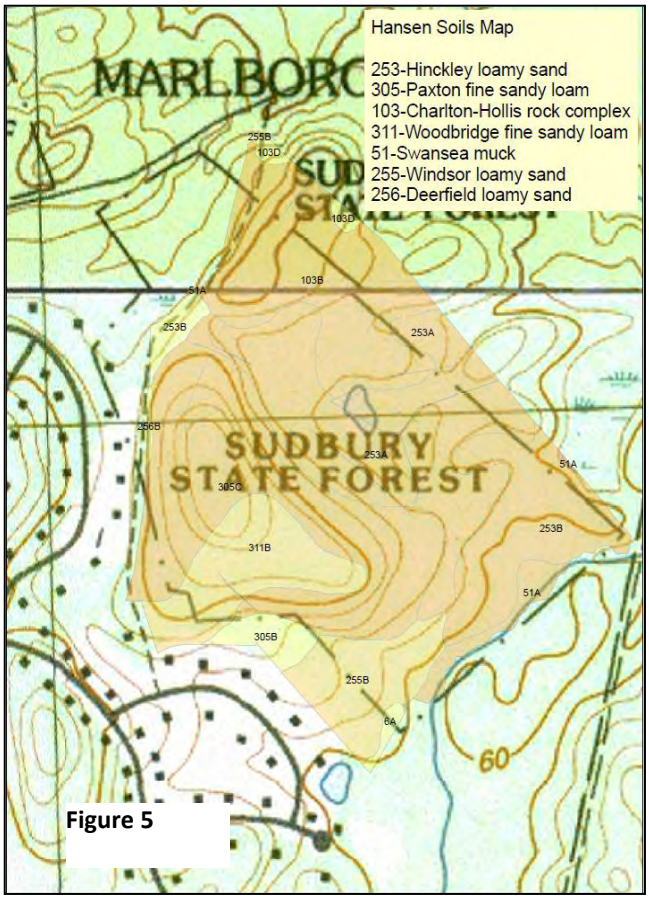

Figure 5

Geology and Soils:

The Hansen Lot project is in an area that has variable slopes from 0% to 20% on an outwash plain (Figure 5). There are seven different soil types found in the project from most to least prevalent being Hinckley loamy sand, Paxton fine sandy loam, Charlton-Hollis rock complex, Woodbridge fine sandy loam, Swansea muck, Windsor loamy sand, and Deerfield loamy sand.[3] The soils in this area can be characterized by their tendency towards droughtiness with a sandy-stony nature, other than the muck type soils which have a much higher organic matter content and saturated nature.

The major soil type is Hinckley loamy sand covering 31.5% of the project area with slopes ranging from 0-8%. This is the major soil type in stands 1, 3, 5 and 7. This soil originates from sandy and gravelly glaciofluvial deposits derived from gneiss, granite, or schist and is excessively drained. The second most prevalent soil type is Paxton fine sandy loam covering 27.7% of the project area with slopes ranging from 3-15%. This soil type is found in stands 2 and 6 respectively that is derived from gneiss, granite or schist and is considered well drained. The third soil type is Charlton-Hollis Rock outcrop complex covering 18.6% of the project area with slopes ranging from 3-25% and is well drained. This is the soil type is found in stand 1 and is derived from granite and gneiss. The fourth soil type in the project is Woodbridge fine sandy loam covering 9.7% of the project area with slopes from 0-8% found in stands 2 and 6 and is derived from gneiss, granite and schist and is moderately well drained. Fifth on the soil type list is Swansea muck covering 6.0% of the project area with slopes from 0-1%. This is a wetland soil type found along the riparian areas of stands 4 and 5 derived from decomposed organic material over loose sand and gravelly glaciofluvial deposits and is very poorly drained. The second to last type of soil found in the project area is a Windsor loamy sand 3-8% slope, located in stand 2. This soil is formed from sandy and gravelly glaciofluvial deposits derived from gneiss, granite, or schist and is excessively drained. The final soil type is a Deerfield loamy sand covering a mere 0.4% of the project area in a portion of stand 2 with a

[3] United States Department of Agriculture-Natural Resource Conservation Service, Web Soil Survey, generated 11/30/15.

slope of 3-8%. This soil is derived from loose sand glaciofluvial deposits and is considered moderately well drained.

According to the Natural Resource Conservation Service information available for the project area the majority of the soil types are suitable for forestry operations with the exception of the Swansea muck type soils in parts of stands 4 and 5. This soil type is part of the buffer strip along Trout Brook and will be excluded from project activities when implemented.

Site Productivity:

Site productivity is a function of the underlying soil types found within the project area as discussed in the previous section. Nearly 59% of the project area is dominated by two major soil types (Hinckley loamy sand and Paxton fine sandy loam). These soils being excessively and well drained, respectively, lead to oak and pine species dominating the forest type as they are more adapted to xeric soil conditions. The site indexes for these two soil types range from 61 for eastern white pine and 49 for northern red oak on the Hinckley series to a site index of 72 for eastern white pine and 68 for northern red oak for the Paxton series of soils.

DCR Management Guidelines of 2012 state that "*Forests stands will be classed on a continuum and considered for silvicultural treatments that generally fit their productivity, structural complexity (or potential thereof) and diversity."* [4] Analyzing stands 1-7 site history (land use; agriculture/ logging) and other site conditions (soil types, productivity; vegetation cover) suggests that stands dominated by low complexity soils lend themselves to even age management.

Current Vegetation:

The overall condition of the forest on this project is a function of its history of, naturally occurring disturbances (fire, hurricanes, etc), pre-colonial use by native people, clearing of forests for agricultural use, large scale farm abandonment, and the reforestation and management efforts by the Commonwealth over the past 100 years. These natural disturbances and anthropogenic management have shaped the forest structure as it currently stands into four general types in the project area. A red maple (*Acer rubrum*) swamp type (Stand 7, along with southern portions of stands 4 and 5), pitch pine-scrub oak type (Stands 4 and 5), an oak-pine type (Stands 1 and 6), and lastly a pine plantation type (Stands 2 and 3).

Red Maple swamp forests are typified by the tendency to have saturated soils, shallow water tables with associated wetland vegetation of shrubs and trees, such as Skunk Cabbage

[4] Commonwealth of Massachusetts, Department of Conservation and Recreation, Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines, March 2012

(*Symplocarpus foetidus*), speckled alder (*Alnus rugosa*), silver maple (*Acer sacharinum),* swamp white oak (*Quercus bicolor*) and others. There is evidence of beaver (*Castor canadensis*) activity in this forest type along Trout Brook. This forest type is also found along Old Concord Road to the northwest outside of the project area, and centrally near the small pond.

Pitch pine-scrub oak type forests found on this site are part of a rare and declining habitat type found in the New England region. These forest types have an early successional structure composed of a scattered canopy of trees and a diverse and abundant ground cover and herbaceous layer. Periodic fires are a feature in this forest type and have molded the development and structure of the forest canopy and understory vegetation. These fires range from small to large scale anthropogenic caused fires (pre-settlement burning to improve hunting grounds, runaway campfires and locomotives), to natural occurring events such as those caused by lightning strikes. This variable disturbance regime leads to a mosaic of age and size classes and an open "savannah" look to the forest.

Fire suppression and passive management over many decades have been a detriment to these communities dependant on periodic disturbance and fire. This has changed the forest structure from one of an early successional nature to more of a maturing closed canopy forest becoming dominated by white pine, white oak (*Quercus alba*), and black oak (*Quercus velutina*).

The oak-pine forest type is centrally located in the project area on a hill top. The overstory canopy is dominated by oak species and scattered white pine. There are many American chestnut (*Castanea dentata*) sprouts found throughout the understory, and chestnut was obviously a significant component of the forest in this area before Chestnut blight (*Cryphonectria parasitica*) decimated the population. Understory vegetation in this forest type consists mainly of low bush blueberry (*Vaccinium angustifolium*), huckleberry (*Gaylussacia baccata*) and scattered white pine seedlings.

Pine plantations have been discussed briefly in the cultural and historical portion of this prescription and are characterized by monocultures of human planted Norway spruce, white, red and Scots pine. These plantations generally have a limited diversity of tree species, less vigorous growth, and are experiencing some mortality due to an overstocked condition. The understory consists of white pine seedlings, black birch (*Betula lenta*) saplings, patches of various oak species, low bush blueberry and Canada mayflower (*Maianthemum canadense*).

Plantation forest types are not problematic in general when they are properly managed throughout their life cycle to maintain vigor and promote diversity. Unfortunately, the red pine plantations found on this site are susceptible to the fungal pathogen diplodia blight (*Diplodia*

pinea), and red pine scale (*Matsucoccus resinosae*). Red pine infected by these pathogens can experience rapid decline in vigor leading to extensive mortality.[5] [6]

Invasive Species:

During the course of gathering field data for use in the development of this prescription several small populations of invasive plant species were observed. The most common of these invasive species is Glossy Buckthorn (*Frangula alnus*) along with scattered Japanese Barberry (*Berberis thunbergii).* If left unchecked these invasive plants can outcompete native vegetation and alter the dynamics of natural processes.

Pretreatment of these invasive plants will be done prior to project implementation by physically removing them. This will be done at the same time as trees are marked for harvest. A monitoring program will be established to track these invasive species, and if post treatment is necessary Forest Product Trust Fund monies will be used for further curtail these populations.

Recreation:

The Hansen Lot being located within the larger Desert Natural Area and other conservation parcels is part of a unique open space in an otherwise urban forest. Walking, running and other forms of passive recreation are the most frequent users of the forest. Illegal ATV use has been a reoccurring issue in this area and adequate regulatory controls are not available to prevent these users from impacting the site. Some erosion associated with this use is found throughout the area.

Implementing this prescription will have limited impacts on recreational users of this forest. Seasonally restricting this operation to winter months, and closing the forest during hours that active harvesting operations are taking place will help mitigate issues with recreation. All legal trails will be treated utilizing the standards contained within the DCR Management Guidelines document pertaining to forest management within trail corridors.

Major skid trails will not be located on walking trails to minimize impacts, crossings will occur at right angles, and trails will be left in a passable condition at all times. The only exception to this standard is the use of Old Concord Road for access by trucks and equipment when the project is implemented. Where skid trails cross recreation trails signage will be posted to warn the public of this interface.

[5] http://na.fs.fed.us/spfo/pubs/fidls/diplodia/diplodiafidl.htm

[6] http://www.nhstateparks.org/uploads/pdf/RP_pestalert.pdf

Wildlife, Rare and Endangered Species:

The Hansen Lot is used by a variety of native wildlife species found in the area. Deer and a variety of other small mammals utilize this area for foraging and rearing of young. A variety of avian species use this area for nesting and foraging. Amphibians and invertebrates utilize the wetland areas and potential vernal pools for their life cycles.

The thinning of stands will result in increased sunlight penetrating to the forest floor, stimulating regeneration of trees species while also increasing the amount of shrub and herbaceous vegetation that is beneficial to wildlife. Vertical complexity will increase due to a new cohort of trees being established. This will provide nesting and perching opportunities to species that utilize them. Large mast producing trees will be retained and released to provide sources of food for wildlife species dependant on them. Retention of known cavity trees, standing snags, and coarse woody material will benefit species of wildlife that depend on them for a portion or all of their life cycles. Tree marking will follow "Guidelines to Wildlife Tree Management in New England Northern Hardwoods."[7] Potential vernal pools will be protected with a 50 foot no cut buffer.

The southern portion of the Hansen Lot is mapped as a Natural Heritage Endangered Species Program (NHESP) priority habitat. The pitch pine-scrub oak barrens that lie within the Hansen Lot also provide the potential opportunity to provide habitat for a diversity of state listed animals and plants.

[7] Tubbs, DeGraff, Yamasaki, & Healey: Guide to Wildlife Tree Management in New England Northern Hardwoods, USFS General Technical Report NE-118

Stand Data:

Methodology:

An inventory grid was developed using GIS software to collect data used in this prescription. Forty five inventory plots were established on this grid to collect field data. Double point or "Big BAF" sampling was conducted on these plots using different angle gauges for count and measure trees. NH Fox DS Cruiser was used to process this data for incorporation into this prescription.

Coarse woody material (CWM) transects were collected for 100 feet from plot centers to estimate volume of down material on forest floor and standing snag observations. Ground species and regeneration data was collected utilizing a 6 foot radius standard. Regeneration data was collected utilizing the standards set forth in the 2014 DCR Manual for Continuous Forest Inventory Field Procedures. CWM, regeneration, and ground cover data was entered into NED-3 for processing and incorporation into this prescription.

This data, as it relates to this document, was compared to stocking tables located in "A Silvicultural Guide for White Pine in the Northeast"[8], "Silivicultural Guide for Northern Hardwoods in the Northeast"[9] and "A Management Guideline for Oak in New England"[10] to provide a roadmap for marking and residual stocking levels. The DCR Management document was also consulted to ensure that guidelines, as they pertain to properties within the "Woodlands Designation", were followed.

Evaluating data gathered during stand examination helps inform the decision making process and provides a basis to guide vegetation management. Foresters use basal area, relative density, trees per acre and other data to recommend a course of action (prescription) for forested landscapes.

Stocking charts developed over many years of research help foresters determine if forest stands are over stocked (A-Level), fully stocked (B-Level), or under stocked (C-Level) by graphically comparing the variables: basal area per acre, trees per acre, and mean stand diameter. The use of relative density is helpful as it describes where current stands fall within these stocking guidelines. I.e. relative density of 75% means a forest stand is stocked within 75% of the A-Level.

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[8] Lancaster and Leak: A Sivicultural Guide for White Pine in the Northeast, USFS General Technical Report NE-41 1978

[9] Leak, Yamasaki, & Holleran: A Silvicultural Guide for Northern Hardwoods in the Northeast, USFS General Technical Report NRS-132

[10] Hibbs and Bentley: A Management Guideline for Oak in New England, University of Connecticut, Cooperative Extension Service, College of Agriculture and Natural Resources, Publication Number 18647-300-50-5/01-10.5-C.R.

Stand 1 Data:

Stand 1 is approximately a 14 acre even aged mixed oak-pine stand. The trees in this stand are approximately 70 to 80 years old and have been treated previously with a fuelwood cutting back in the early 1980's.

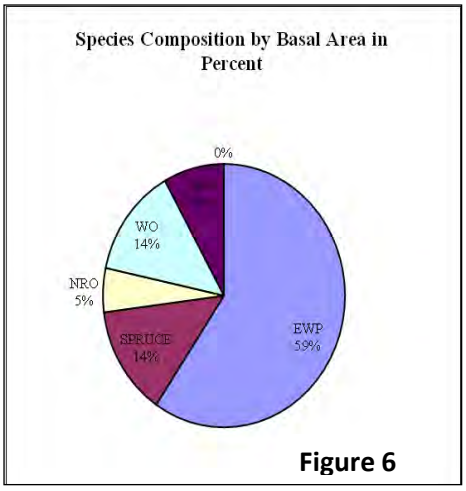

Figure 6

There is 148 square feet of basal per acre in this stand, 146 trees per acre, an estimated relative density of 66%, and a quadratic mean diameter of 13.6 inches. The stand contains an estimated 14,316 board feet of sawtimber sized trees per acre and approximately 7.0 cords of pulpwood sized trees per acre (Appendix Table 1).

White pine dominates the overstory species composition of this stand at 59%, followed by white oak and spruce, tied at 14% each, with black oak 8%, and northern red oak 5% rounding out the composition of the overstory (Figure 6).

The regeneration and potential vegetation in this stand consists of seedlings and sapling sized trees with species consisting of eastern white pine, white oak, red oak and gray birch. The understroy consists of low bush blueberry and a small collection of unidentified grasses and shrubs. White pine is the most prevelant tree found in the rengeneration layer with an estimated 333 stems per acre, followed by white oak, 41 stems per acre , red oak, 16 stems per acre and gray birch, 16 stems per acre (Appendix Table 2). Lowbush blueberry is the dominant shrub cover covering an estimated 11.3% of the stand (Appendix Table 3).

Coarse woody material is found throughout this stand and is estimated at 265.9 cubic feet per acre. The majority of this material is derived from black oak and white pine. All observations were of material less than 12 inches in diameter and consiting of both hard (sound) and soft (decayed) type. Management guidelines recommend a minimum of 256 cubic feet of course woody material per acre be left in the forest to provide habitat for wildlife and nutrient cycling. Standing snags were observed, but not sampled during inventory.

Anylyzing the data of Stand 1 points to a condition where the trees are experiencing slow to moderate growth due to competition for scarce resources (light, soil moisture, and nutrietnts) and some mortality. The present basal area of 148 ft^2 and relative density of 66% shows a slightly overstocked condition when compared to stocking charts for white pine and oak forest types. A thinning would be a prudant course of action to increase tree vigor by reducing the basal area approximately 20-40% .

Stand 2 Data:

Stand 2 is a 19 acre mixed pine plantation consisting of white pine, red pine, scots pine and Norway spruce along with mixed hardwood species with an age of 80-90 years. There are scattered black birch saplings in the understory that established themselves after a commercial timber harvest in this stand in the early 1980's with very little additional regeneration of other species observed.

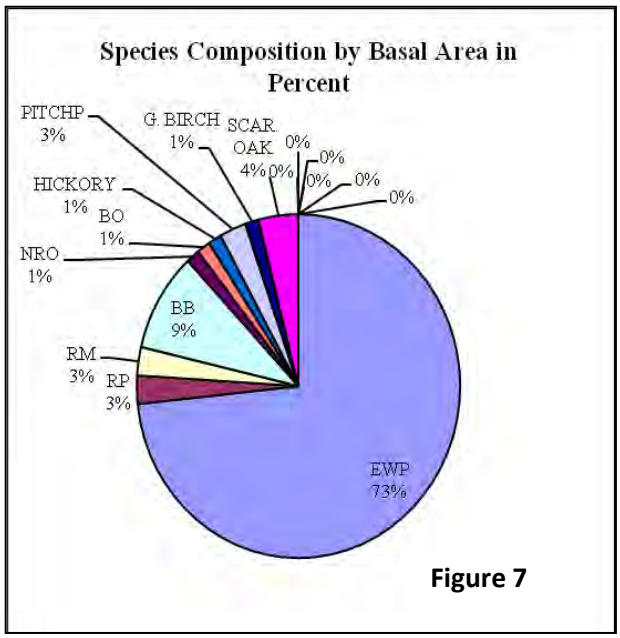

Figure 7

There is an estimated 187.5 square feet of basal area in this stand, 139 trees per acre, a relative density of approximately 58%, and a quadratic mean diameter of 15.7". The stand contains an estimated 23,201 board feet of sawtimber of all species and an estimated 9.50 cords of pulpwood sized trees per acre (Appendix Table 4).

White pine is the most prevelant overstory species found in this stand, comprising approximatly 73% of the stand. Black birch and scarlet oak (*Quercus coccinea)* are also frequently found in this stand comprising 13% and 9% respectively (Figure 7).

The regeneration and potential vegetation in this stand is composed of a variety of tree species consisting mainly of white oak and eastern white pine, with lesser amounts of black cherry, gray birch, red maple and oak species. White oak has and estimated 140 stems per acre with eastern white pine having an estimated 100 stems per acre (Appendix Table 5). The majority of the understory is comprised of low bush blueberry and bracken fern (*Pteridium)* being the most numerous species present (Appendix Table 6).

Coarse woody material is found throughout this stand and is estimated at 173.3 cubic feet per acre. The majority of this material is derived from black oak and white pine. All observations were of material beteween 1 and 12 inches in diameter and consiting of both hard (sound) and soft (decayed) type. Additional woody material will be left within this stand to meet the minimum threshold of 256 cubic feet per acre. Standing snags were observed, but not sampled during inventory.

Analysis of Stand 2 data shows an overstocked condition (above the B line) within the pine stands. A thinning to reduce the current basal area from 187.5 ft^2 to between 100 ft^2 to 150ft^2 will reduce competition within the stand to improve vigor, allow expansion of tree canopies, while increasing sunlight penetration to the forest floor stimulating regeneration and herbacious growth.

Stand 3 Data;

Stand 3 is a 14 acre white pine and red pine plantation with a red and white oak component. The trees are approximately 70 years old. Part of the northwest section of the stand was harvested in the early 1980's during a commercial operation, however the majority of this stand was not treated during the harvesting operation.

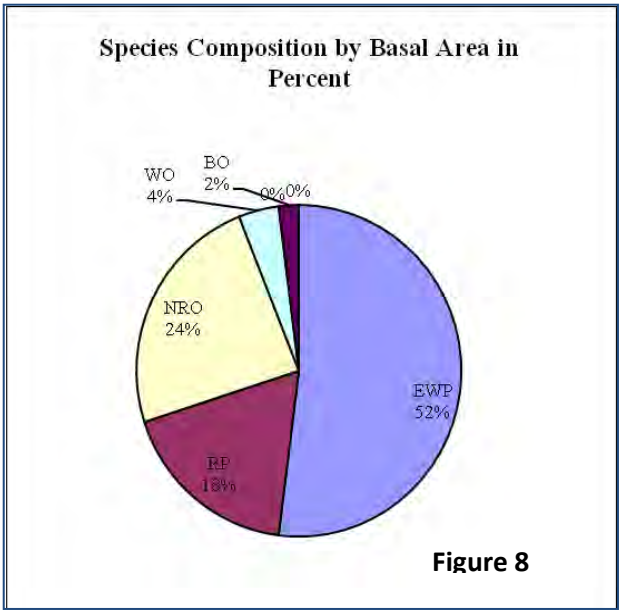

Figure 8

There is an estimated 166.7 square feet of basal area in this stand, 196 trees per acre, a relative density of of 92%, and a quadratic mean diamter of 12.5". The stand contains an estimated 17,285 board feet of sawtimber of all species and an estimated 7.3 cords of pulpwood sized trees per acre (Appendix Table 7).

Eastern white pine is the most abudent species found in this stand comprising 52% of the overstory trees, followed by northern red oak, 24%, and red pine, 18%, with lesser amounts of white and black oak throughout the stand (Figure 8).

The regeneration and potential vegetation portion of this stand is composed mainly of white oak and eastern white pine species, with a lesser amount of gray birch (*Betula populifolia)*, black cherry (*Prunus serontia)*, northern red oak, red maple and swamp white oak (*Quercus bicolor)*. White oak has an estimated 140 stems per acrea with eastern white pine at an estimated 100 stems per acre (Appendix Table 8). The most numerous species found in the understory is lowbush blueberry along with Canada mayflower(*Maianthemem canadense)* (Appendix Table 9).

Coarse woody material is estimated at 158.2 cubic feet per acre. The majority of this material is derived from eastern white pine and white oak species. All observations were of material between 1 and 12 inches in diameter and consists of both sound and decayed types. Additional woody material will be left within this stand to meet the minimum threshold of 256 cubic feet per acre. No snags were sampled, but were noted within the stand.

Reviewing the Stand 3 data shows this stand is currently approaching an overstocked condition with a relative density of 92%. Forest stands that have relative densities over 100% start to experience significant mortality due to overcrowding. Thinning this stand to reduce relative density by approximately 30% will ease competition induced mortality, allow for crown expansion, and promote diverse, native vegetation.

Stand 4 Data:

Stand 4 is a 7 acre pitch pine and white pine stand with a hardwood component. The trees are approximatley 80 years old. This stand has not had any harvesting treatments since aqusition by the state.

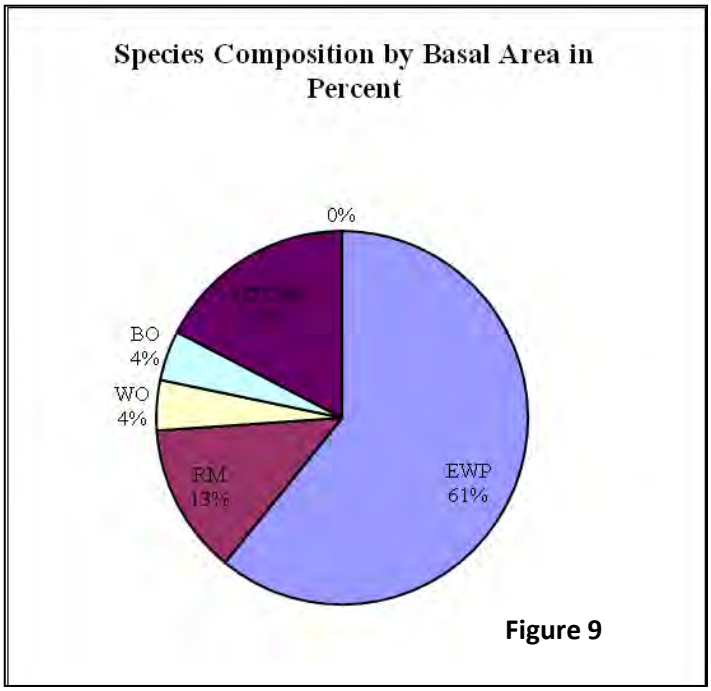

Figure 9

There are an estimated 153.3 square feet of basal area in this stand, 157 trees per acre a relative density of 81%, and a quadratic mean diameter of 13.3". The stand contains an estimated 12,508 board feet of sawtimber sized trees of all speciea and an estimated 5.82 cords of pulpwood of all species per acre (Appendix Table 10).

White pine is the most common tree found in this stand and comprises approximatlely 61% of the overstory canopy. Pitch pine is the second most dominanat canopy tree at 17%, followed by red maple at 13%. Lesser amounts of black and white oak are also found in this stand (Figure 9).

The regeneration and potential vegetation portion of this stand is composed of white oak, white pine, red maple and gray birch, with no pitch pine noted in the regeneration plots. White oak is the most commonly found species in the regeneration plots at an estimated 222 stems per acre followed by white pine at 155 stems per acre (Appendix Table 11). The understory is composed of equal amounts of lowbush blueberry and bracken fern species at an estimated 3.3% cover (Appendix Table 12).

Coarse woody material found throughout this stand is estimated at 160.5 cubic feet per acre. The majority of this material is derived from oak species and all observations were of material less than 12 inches in diameter and consists of both sound and decayed types. No additional wood material will be added in this stand as the intention is to impoverish this area to restore barrens habibtat. No standing snags were sampled, but were noted in the stand.

Anylasis of Stand 4 data demonstrates a stand that is approching an overstocked condition with a relative density of 81%, and 153.3 ft^2 of basal area. If left unchecked this will result in a loss of potential pine barrens habitat as pitch pine gets outcompeted by more shade tolerant species such as white pine and oak species. Reduction of the stand density by as much as 60% will allow barrens adapted species such as huckleberry, lowbush blueberry, and pitch pine to perpetuate.

Stand 5 Data:

Stand 5 is a 16 acre pitch pine scrub oak stand, with lesser amounts of eastern white pine, and white and black oak species. The stand is approximately 80 years old and has not had any silvicultural treatments since aqusition by the State.

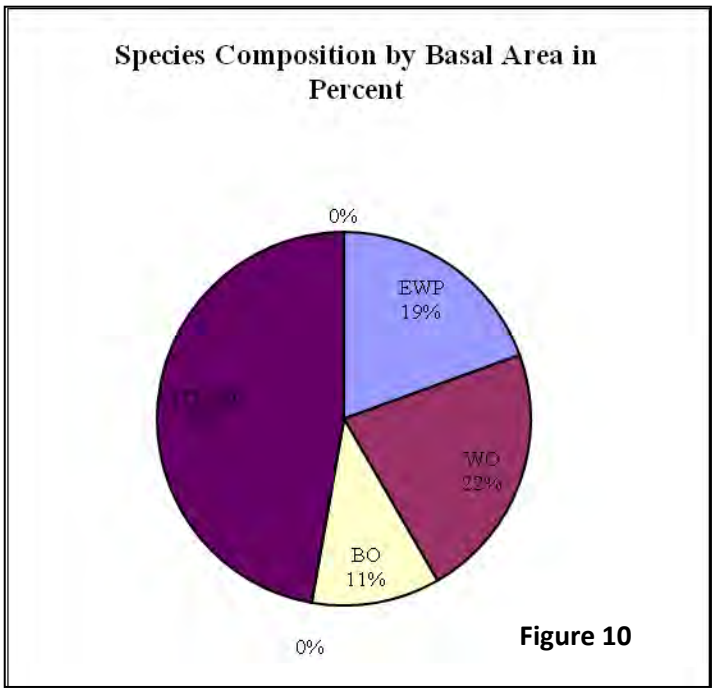

Figure 10

There is an estimated 120.0 square feet of basal area in this stand, 129 trees per acre, a relative density of approximately 101%, and a quadratic mean diamter of 13.0". The stand contains an estimated 7,313 board feet per acre of sawlog sized trees along with approximately 9.6 cords of pulpwood sized trees per acre (Appendix Table 13).

Pitch pine is the most common trees species found in this stand and comprises aproximately 47% of the overstory followed by white oak at 22%, eastern white pine at 19%, and black oak at 11% (Figure 10).

The regeneration and potential vegetation associated with this stand is composed mostly of hardwood species mainly white oak, estimated 38 stems per acre, and red oak at and estimated 22 stems per acre, with lesser amounts of white pine, red maple, black cherry and gray birch (Appendix Table 14). It should be noted that no pitch pine were observed in the regeneration plots within this stand. Pitch pine does not readily regenerate under a closed canopy due to the species degree of shade intolerance. The ground cover is composed of a mostly lowbush blueberry and brackenfern, at an estimated 10% and 4.3%, with lesser amounts of Canada mayflower, huckleberry (*Gaylussacia*) and unidentified grasses (Appendix Table 15).

Coarse woody transects were run within this stand, but no observations were recoded of material greater than 1" in diameter within the transects. No additional woody material will be added in this stand as the intention is to impoverish this area to restore barrens habibtat. Also, there were no observations of snags within the transects, however snags were observed within the stand.

Reviewing the Stand 5 data shows this stand is currently in an overstocked condition with a relative density of 101%. Without treatment the stand will convert to a white pine-oak forest type with resulting loss of barrens habitat as noted in Stand 4 above.

Stand 6 Data:

Stand 6 is an approximately 27 acre oak hardwood stand with scattered white pine, scots pine, Norway spruce throughout the stand. Some scattered red pine are also found in this stand near the transition between stand 3 and stand 6. The trees are approximately 80 years old and part of the stand was partially treated during the 1980's commercial project along the western portions of the stand.

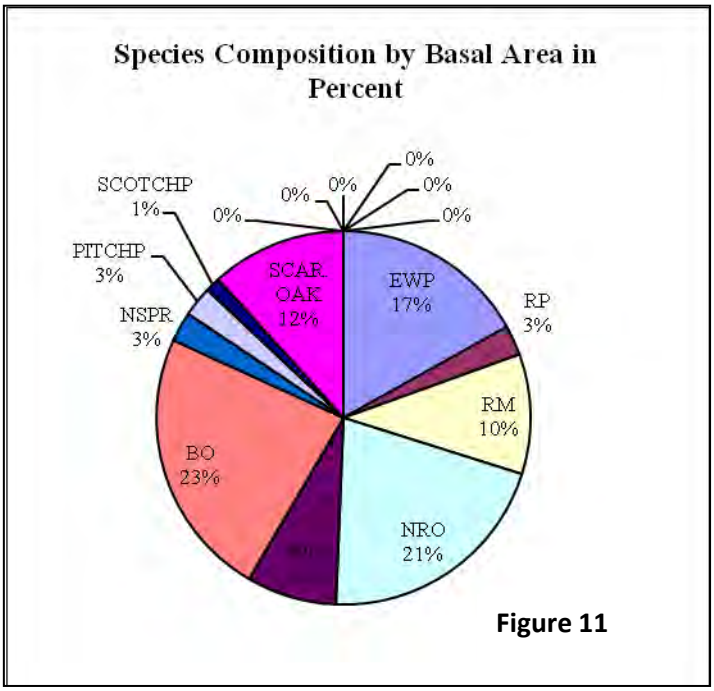

Figure 11

There is an estimated 118.4 square feet of basal area found in this stand, 104 trees per acre, a relative density of 84.2%, and a quadratic mean diameter of 14.4 inches. The stand contains and estimated 9,305 board feet per acre of sawtimber sized trees and an estimated 7.4 cords of pulpwood sized trees per acre (Appendix Table 16).

The species composition of this stand is dominated by oak species with black oak, northern red oak, scarlet and white oak comprising the majority of the overstory trees. Conifers are represented by eastern white pine, red pine, norway spruce, pitch pine and scots pine (Figure 11).

Regeneration and potential vegetation in this stand is comprised of several different species dominated by eastern white pine, red maple and white oak, estimated at 179, 71 and 59 stems per acre repectively. Other species noted in the understroy northern red oak, gray birch, norway spruce, chestnut oak, and black cherry (Appendix Table 17). Ground cover species include lowbush blueberry, huckleberry, eastern poison ivey, Canada mayflower, along with lesser amounts of brackenfern, Solomon's seal (*Polygonatum*), northern dewberry (*Rubus flagellaris*), mountian laurel (*Kalmia latifolia*) and unidentified grasses and forbes (Appendix Table 18).

Coarse woody material is estimated at 490.9 cubic feet per acre. Material is comprised of both sound and decayed material and ranges from 1" to 24" in diameter. The majority of this material is derived from white pine and oak species. This stand exceeds the 256 cubic foot standard for course woody material. Standing snags were observed, but not sampled during inventory.

Reviewing the Stand 6 data shows this stand is currently approaching an overstocked condition with a relative density of 84.2% and 118.4 ft^2 of basal area. Thinning this stand to a residul basal area of approximatley 80ft^2 will improve the quality of the residual trees by removing poorly formed and suppressed stems, concentrating growth on large diameter specimens of greater value to wildlife and timber.

Stand 7 Data:

Stand 7 is a 3 acre red maple swamp forest that consists of a small pond and associated wetland. There is a small seasonal stream that drains the area towards the east and Hop Brook. Associated species such as white pine, red pine and Norway spruce are also found within this stand. This stand has never seen any treatment during the time of state ownership and the trees are approximately 80 years old.

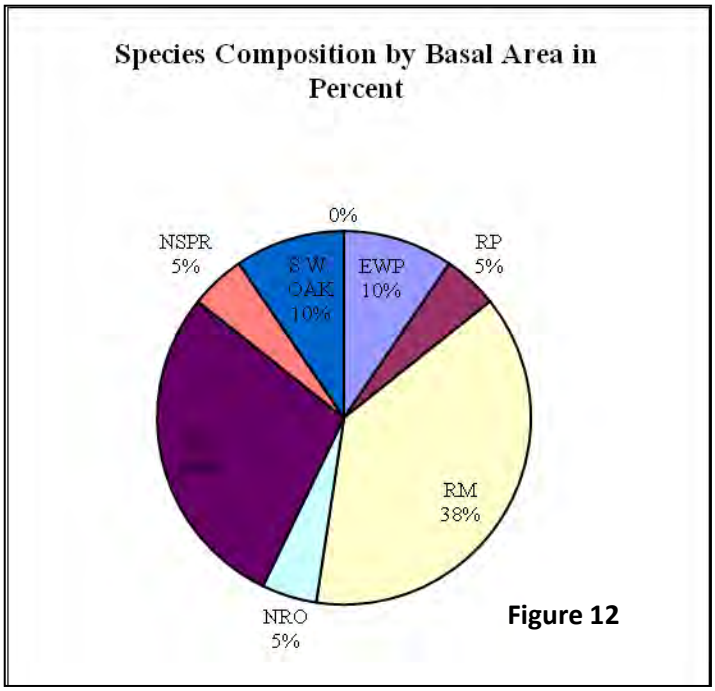

Figure 12

There is an estimated 210.0 square feet of basal area, 345.5 trees per acre, a relative density of 139.1%, and quadratic mean diameter of 10.6". The stand contains and estimated 8923 board feet of sawlog and 27.6 cords of pulpwood sized trees per acre respectively (Appendix Table 19).

Red maple is the most commonly found tree within this stand comprising approximately 38.1% of the basal area, followed by white oak, 28.5%, and swamp white and white pine tied at 10% of the basal area (Figure 12.) There are scattered northern red oak, red pine and Norway spruce that also make up this stand and are found along the periphery.

The regeneration and potential vegetation found within this stand is composed of species that would be associated with a wetland forest type. Eastern white pine is the most commonly found tree found in the regeneration portion of this stand with an estimated 13 trees per acre of all size classes, followed by white oak, 7 trees per acre, red maple, 3 trees per acre, and lastly red oak at 2 trees per acre (Appendix Table 20). The understory vegetation is composed lowbush blueberry and Canada mayflower (Appendix Table 21).

Coarse woody material found within this stand is estimated at 927.4 cubic feet per acre and is composed of material in both the sound and decayed types. The species are composed of a majority white pine with observations of material ranging in diameter from 1" to 24", followed by black oak, red maple and unidentified species. This stand well exceeds the standards for down woody material. Standing snags were observed, but not sampled during

inventory.

This stand is currently overstocked with a relative density of 139.1% and 210 ft^2 of basal area. As noted earlier with relative densities above 100%, stands of trees start to experience significant mortality due to competition. However, this stand has significant value to wetland dependant species of plants and wildlife and very little value from a commercial perspective and recommending treatment would diminish those important values.

Silvicultural Prescription:

Stand prescriptions were devised using The New Hampshire Fox DS cruiser software version 2007.2 that takes inventory data gathered during stand examination to formulate residual stocking levels.

Guidelines set forth in the DCR's Management Guidelines publication approach to woodlands will be applied to individual stands. Examples include:

- Ecological restoration of degraded natural communities
- Positive benefits to wildlife
- Sustainable forestry practices, biologically and economically
- Examples of model forestry on DCR lands
- Opportunities to contribute to DCR's recreational goals

Stands 1, 2, 3 and 6:

These stands will be treated with a commercial thinning. Trees will be individually marked for removal (cut tree marked) using DCR standard marking regime and following guidelines found in Appendix Tables 22, 23, 24, and 25. Cutting boundaries will be triple marked with 45 degree slashes to denote cutting area. A fifty foot no cut buffer will be provided along the western portion of stand 2 due to the perimeter trail and abutting landowners. Potential vernal pools will be protected by a 50 foot no cut buffer marked with paint and flagging. All standing snags, cavity trees, and wildlife trees will be retained, with the exception of any of those that present a danger to public safety near trails. If snags need to be cut, trees will remain onsite as course woody material.

Goals associated within these stands are:

- Short Term
    - Remove poorly formed, suppressed, low vigor trees.
    - Retain superior dominant trees as a legacy source and also a source of seed for the future forest.
    - Focus removals in pine plantations on non-native species susceptible to disease and insect infestations.

    - Remove hazard trees located along trails.
- Long Term
    - Introduce a new cohort of native species to promote diversity in both species and age class.
    - Promote structure (vertical and horizontal) within forest stands.
    - Provide wildlife habitat.
    - Improved growth and vigor of all residual trees regardless of species.

Expected Results – Stands 1, 2, 3, and 6:

Following treatment there will be obvious changes within these four stands. Light penetration to the forest floor will have increased due to the reduction in the forest canopy. The increased sunlight will stimulate established regeneration present within these stands allowing these trees to increase in caliper and height by freeing up scarce resources of light and soil moisture. Herbaceous vegetation will increase in abundance also due to increased sunlight. In areas within these stands lacking established regeneration it is anticipated that mid shade tolerant species (white pine / oak) will begin to readily occupy the site within two to five years. There will be a reduction in the relative density of these stands, and the stands will have a more open appearance containing fewer larger diameter trees of dominant and co-dominant size classes. Non-native species will still be present within these stands, but will account for less of the residual stocking following treatment.

It is expected within fifteen years (2031) that these stands should be considered for follow up treatment. Basal area within these stands will have increased, mean stand diameter for all species will have improved, and relative density will have increased to a point where another treatment should be considered. Regeneration that was present and released during thinning in 2016 will have increased in height and diameter to a point where they may be further released to occupy an overstory position within the forest.

At that time consideration of regeneration techniques (Irregular Shelterwood) concentrating on parts of those stands that still contain non-native species should be considered. This type of approach will create a mosaic of age and species across these stands mimicking the episodic weather events that drive forest ecosystems in the Northeast fulfilling recommendations found in the DCR Management guidelines document.

Stands 4 and 5:

These stands will be treated to restore native habitat made up of pitch pine, scrub oak, dwarf chestnut oak, and shrubs such as black huckleberry. Trees will be marked for retention with paint (leave tree marked) using DCR standard marking regime and following guidelines found in Appendix Tables 26 and 27. Potential vernal pools, wetland and streams will be protected with a 50 foot not cut buffer. Commissioner approval has been received for openings greater than 1/3 of an acre where the majority of the overstory and mid-story trees will be removed. Occasional white oak, red oak and white pine legacy trees will be retained to provide wildlife benefits.

Goals associated within these stands are:

- Short Term
    - Stimulate growth of herbaceous vegetation found in barrens habitat to benefit wildlife
    - Reduce stocking and fuel loads to impoverish the site in advance of reintroducing fire into the landscape
- Long Term
    - Restore rare and declining pitch pine-scrub oak forest type
    - Provide habitat to rare plant and animal communities
    - Protect and enhance significant natural features (streams, wetlands, potential vernal pools, barrens habitat) and the ecological services they provide.

Expected Results: Stands 4 and 5:

Following treatment there will be a dramatic change in these stands. Residual basal area, relative density, and tree species composition will have been reduced to low levels (Appendix Tables 26 and 27) and these stands will have an open "savannah" look to them. Trees will be widely spaced and be composed of pitch pine, white pine and oak species.

Understory vegetation and small trees will also be dramatically reduced in density as a result of harvesting activity. Without direct intervention, either by mowing or prescribed fire, the increased sunlight and moisture available will result in these stands being rapidly colonized by shade intolerant tree species such as aspen, cherry, and birch, along with mid shade tolerant white pine and oak seedlings that can outcompete and eventually overtop desirable barrens species such as scrub oak, huckleberry and pitch pine within 10 years. Maintaining this forest type long term will require planning and funding.

Stand 7:

This stand is excluded from treatment. Natural process will be allowed to occur and no future treatments are proposed. This stand will continue to accumulate biomass, provide long term carbon storage, and develop old growth characteristics of this forest type.

Harvesting System and Project Layout:

A whole tree mechanical harvesting system will be employed. This type of system will allow for utilization of portions of trees that would otherwise be left in the woods to decompose naturally. Retention guidelines for coarse woody material in Stand 1 and 6 will be followed (minimum 256 cubic feet per acre). Additional woody material will be allocated to stands 2 and 3 since they are under the recommended guideline. This will be accomplished by scattering woody material from stands 4 and 5 that are to be intentionally impoverished. This

type of system will allow for minimal visual impact as “slash” is greatly reduced and tree utilization is exceptionally good.

Utilizing this type of whole tree system is preferred in restoration of pine barren habitats as noted in DCR Management guidelines document 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*”. Utilizing this type of system will allow for plant communities found in barrens habitat to dominate, while reducing fuel loads for future treatments such as prescribed fire.

Principal skid trails will be laid out, painted and flagged prior to operations. Skid trails will not be located on existing walking trails, trail crossings will be made at right angles wherever possible (Exhibit 1) and signage will be affixed at crossings to alert users. The project area will be closed during the hours of harvesting operations to protect public safety, and operations will be restricted to winter season when recreational use is low. The anticipation is that this project may proceed as part of a larger venture that may also include the Town of Marlboro and Sudbury Valley Trustees conservation projects. If the opportunity to work collaboratively with these organizations exists, than utilizing a possible landing area on Town of Marlboro property (with appropriate permissions from governing authorities) would be ideal as this would minimize impact to recreational users, and reduce the need to clear multiple landings for forestry operators.

A MGL Ch 132 Forest Cutting Plan will be filed with the Massachusetts Department of Conservation and Recreation Service Forestry Division prior to harvesting operations. Mandatory best management practices, as required by law, will be implemented to safeguard important ecological features. Review of this plan by N.H.E.S.P. will be mandatory due to the presence of priority habitat in the project area. Specific operating recommendations will be incorporated into the Forest Cutting Plan to avoid negative impacts to state listed species and their habitats.

"Hansen Lot"
Marlboro-Sudbury State Forest
Marlboro

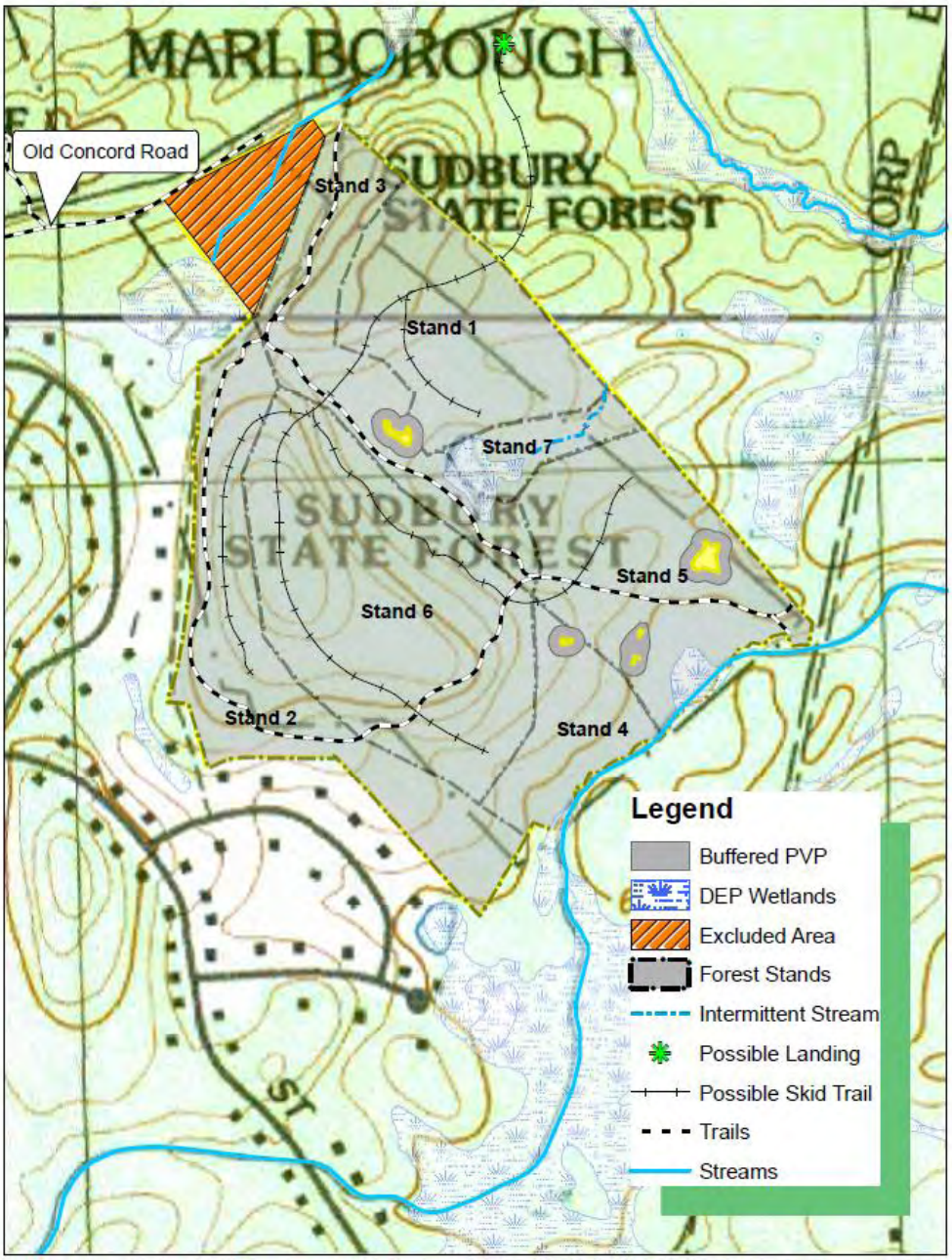

Exhibit 1

MJW12515

"Hansen Lot"
Locus Map
Marlboro-Sudbury State Forest
Marlboro

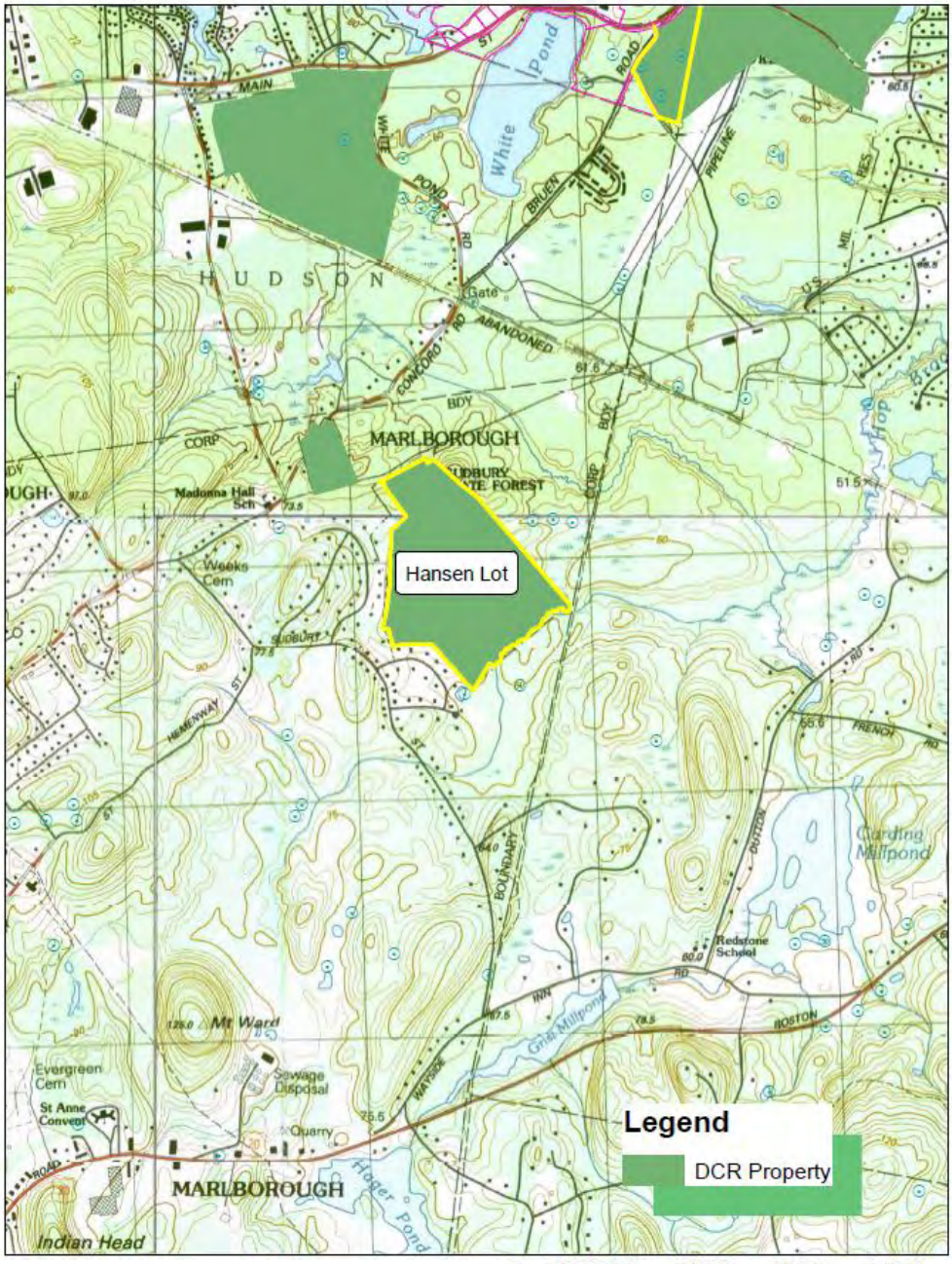

Exhibit 2

MJW12515

List of trees and shrubs

Name	Latin
black cherry	*Prunus serotina*
black oak	*Quercus velutina*
brackenfern	*Pteridium*
Canada mayflower	*Maianthemum canadense*
chestnut oak	*Quercus prinus*
eastern poison ivy	*Toxicodendron radicans*
eastern white pine	*Pinus strobus*
gray birch	*Betula populifolia*
highbush blueberry	*Vaccinium corymbosum*
huckleberry	*Gaylussacia*
jewelweed	*Impatiens capensis*
lowbush blueberry	*Vaccinium angustifolium*
mountain laurel	*Kalmia latifolia*
northern dewberry	*Rubus flagellaris*
northern red oak	*Quercus rubra*
Norway spruce	*Picea abies*
oak	*Quercus*
pitch pine	*Pinus rigida*
red maple	*Acer rubrum*
scarlet oak	*Quercus coccinea*
Scots pine	*Pinus sylvestris*
Solomon's seal	*Polygonatum*
starflower	*Trientalis*
swamp white oak	*Quercus bicolor*
sweet birch	*Betula lenta*
white oak	*Quercus alba*

Appendix

Table 1. Stand 1 Overstory Data (NH Fox Cruiser):

Species	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	BA/Acre %	QMD	Relative Density
Eastern white pine	11086	1.9	80.9	88.0	59.0 %	14.1	32.6
Norway Spruce	962	No tally	22.5	20.0	14.0 %	12.8	7.0
Northern Red	447	No tally	7.7	8.0	5.0 %	13.8	0.0
White Oak	895	5.1	26.7	20.0	14.0 %	11.7	16.8
Black Oak	926	No tally	8.4	12.0	8.0%	16.1	9.5
Total	**14,316**	**7.0**	**146.4**	**148.0**	**100**	**13.6**	**66.0**

Table 2. Stand 1 Regeneration Data (Stems Per Acre, NED3)

		Size Class			
Name	**1**	**2**	**3**	**4**	**Total**
Eastern white pine	183	113	29	8	**333**
White oak	42	0	0	0	**42**
Northern red oak	17	0	0	4	**21**
Gray birch	17	0	0	0	**17**
Unidentified species	8	0	0	0	**8**
Lowbush blueberry	0	0	0	0	**0**
Total	**267**	**113**	**29**	**13**	**421**

Table 3. Stand 1 Understory data (Percent Cover, NED 3)

Species	% Cover
Lowbush blueberry	11.3
Unidentified species	1.3
Totals	12.6

Table 4. Stand 2 Overstory Data (NH Fox Cruiser):

Species	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	BA/Acre%	QMD	Relative Density
Eastern white pine	20246.5	9.5	97.8	137.5	73.33%	16.1	48.9
Red pine	0.0	No tally	3.7	5.0	2.67%	15.7	0.0
Red maple	725.0	No tally	3.7	5.0	2.67%	15.7	0.0
Black birch	0.0	No tally	13.0	17.5	9.33%	15.7	0.0
Northern red oak	362.5	No tally	1.9	2.5	1.33%	15.7	0.0
Black oak	269.4	No tally	2.1	2.5	1.33%	14.6	2.0
Hickory	362.5	No tally	1.9	2.5	1.33%	15.7	0.0
Pitch pine	725.0	No tally	3.7	5.0	2.67%	15.7	0.0
Gray birch	0.0	No tally	1.9	2.5	1.33%	15.7	0.0
Scarlet oak	509.8	No tally	9.7	7.5	4.00%	11.9	6.7
Total	**23200.7**	**9.5**	**139.3**	**187.5**	**100.00%**	**15.7**	**57.6**

Table 5. Stand 2 Regeneration Data (Stems Per Acre NED 3):

		Size Class			
Name	**1**	**2**	**3**	**4**	**Total**
White oak	130	11	0	0	**141**
Eastern white pine	52	41	4	4	**100**
Gray birch	11	4	0	0	**15**
Black cherry	15	0	0	0	**15**
Red maple	4	0	4	0	**7**
Northern red oak	7	0	0	0	**7**
Black oak	0	7	0	0	**7**
Swamp white oak	4	0	0	0	**4**
Total	**222**	**63**	**7**	**4**	**296**

Table 6. Stand 2 Understory Data (Percent Cover, NED 3):

Species	% Cover
Canada mayflower	1.1
Brackenfern	3.3
Eastern poison ivy	1.1
Jewelweed	1.1
Lowbush blueberry	6.7
Northern dewberry	1.1
Starflower	0.6
Total	**15.0**

Table 7. Stand 3 Overstory Data (NH Fox Cruiser):

	Sawlog	Pulp	Total	Total	BA/ac		
Species	**Bf/Acre**	**Cords/Acre**	**Trees/Acre**	**BA/Acre**	**by Spp**	**QMD**	**Relative Density**
Eastern white pine	10115.4	5.4	116.4	86.7	52.0%	11.7	33.8
Red pine	3516.8	No tally	30.5	30.0	18.0%	13.4	14.1
Northern red oak	3287.1	No tally	32.1	40.0	24.0%	15.1	35.1
White oak	No tally	1.8	14.4	6.7	4.0%	9.2	5.9
Black oak	365.2	No tally	2.7	3.3	2.0%	15.2	2.6
Total	**17284.5**	**7.3**	**196.1**	**166.7**	**100%**	**12.5**	**91.6**

Table 8. Stand 3 Regeneration Data (Stems Per Acre NED 3):

		Size	Class		
Species	**1**	**2**	**3**	**4**	**Total**
White oak	130	11	0	0	**141**
Eastern white pine	52	41	4	4	**100**
Gray birch	11	4	0	0	**15**
Black cherry	15	0	0	0	**15**
Red maple	4	0	4	0	**7**
Northern red oak	7	0	0	0	**7**
Black oak	0	7	0	0	**7**
Swamp white oak	4	0	0	0	**4**
Total	**222**	**63**	**7**	**4**	**296**

Table 9. Stand 3 Understory Data (Percent Cover NED3):

Species	**Percent Cover**
Canada mayflower	4.0
Highbush blueberry	1.0
Lowbush blueberry	8.0
Unidentified species	0.2
Total	**13.2**

Table 10. Stand 4 Overstory Data (NH Fox Cruiser):

	Sawlog	Pulp	Total	Total	BA/ac		
Species	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	by Spp	QMD	Rel Density
Eastern white pine	7991.9	No tally	85.8	93.3	60	14.1	33.7
Red maple	703.2	3.0	29.2	20.0	10	11.2	16.2
White oak	No tally	2.8	20.7	6.7	0	7.7	6.1
Black oak	781.7	No tally	8.2	6.7	0	12.2	0.0
Pitch pine	3031.0	No tally	13.9	26.7	20	18.8	25.3
Total	**12507.9**	**5.8**	**157.7**	**153.3**	**100**	**13.4**	**81.3**

Table 11. Stand 4 Regeneration Data (Stems Per Acre NED 3):

		Size	Class		
Name	1	2	3	4	Total
White oak	200	22	0	0	**222**
Eastern white pine	78	78	0	0	**156**
Red maple	89	0	0	0	**89**
Gray birch	11	0	0	0	**11**
Total	**378**	**100**	**0**	**0**	**478**

Table 12. Stand 4 Understory Data (Percent Cover NED3):

Species	% Cover
Lowbush blueberry	3.3
Brackenfern	3.3
Totals	6.6

Table 13. Stand 5 Overstory Data (NH Fox Cruiser):

	Sawlog	Pulp	Total	Total	BA/ac		
Species	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	by Spp	QMD	Rel Density
Eastern white pine	1537.2	No tally	9.5	23.3	19.4%	21.2	7.7
White oak	318.0	4.0	37.4	26.7	22.2%	11.4	22.4
Black oak	954.0	0.5	10.7	13.3	11.1%	15.1	10.6
Pitch pine	4504.6	5.0	71.7	56.7	47.2%	12.0	60.8
Total	**7313.7**	**9.6**	**129.3**	**120.0**	**100.0%**	**13.0**	**101.4**

Table 14. Stand 5 Regeneration Data (Stems Per Acre NED3):

		Size	Class		
Name	1	2	3	4	Total
White oak	37	1	0	0	**38**
Northern red oak	19	4	0	0	**23**
Eastern white pine	2	1	2	0	**5**
Red maple	2	0	0	0	**2**
Black cherry	1	0	0	0	**1**
Gray birch	0	0	0	0	**1**
Total	**62**	**7**	**2**	**0**	**72**

Table 15. Stand 5 Understory Data (Percent Cover NED3):

Species	% Cover
Lowbush blueberry	10.0
Brackenfern	4.3
Canada mayflower	2.9
Huckleberry	2.9
Unidentified species	1.4
Totals	21.5

Table 16. Stand 6 Overstory Data (NH Fox Cruiser):

Species	Sawlog Bf/Acre	Pulp Cords/Acre	Total Trees/Acre	Total BA/Acre	BA/ac by Spp	QMD	Rel Density
Eastern white pine	2201.8	0.9	19.7	20.0	16.9%	13.7	7.5
Red pine	504.7	No tally	2.6	3.1	2.6%	14.7	1.4
Red maple	0.0	2.7	13.7	12.3	10.4%	12.8	9.9
Northern red oak	2325.7	0.7	15.2	24.6	20.8%	17.2	21.3
White oak	250.9	0.7	9.0	9.2	7.8%	13.7	7.4
Black oak	2141.9	2.4	25.0	27.7	23.4%	14.2	22.2
Norway spruce	546.7	No tally	1.3	3.1	2.6%	20.5	0.7
Pitch pine	182.5	No tally	2.7	3.1	2.6%	14.4	0.0
Scots pine	131.1	No tally	1.1	1.5	1.3%	16.2	1.5
Scarlet oak	1020.0	No tally	13.3	13.8	11.7%	13.8	12.2
Total	**9305.4**	**7.4**	**103.6**	**118.5**	**100.0%**	**14.5**	**84.2**

Table 17. Stand 6 Regeneration Data (Stems Per Acre NED3):

		Size Class			
Name	**1**	**2**	**3**	**4**	**Total**
Eastern white pine	28	77	64	10	**179**
Red maple	69	0	0	3	**72**
White oak	56	0	3	0	**59**
Northern red oak	10	0	0	0	**10**
Gray birch	8	0	0	0	**8**
Norway spruce	3	0	0	0	**3**
Chestnut oak	0	0	3	0	**3**
Black cherry	3	0	0	0	**3**
Total	**177**	**77**	**69**	**13**	**336**

Table 18. Stand 6 Understory Data (Percent Cover NED3):

Species	% Cover
Lowbush blueberry	7.7
Huckleberry	3.1
Eastern poison ivy	1.5
Canada mayflower	1.5
Brackenfern	0.8
Solomon's seal	0.8
Northern dewberry	0.8
Mountain laurel	0.8
Unidentified species	0.8
Totals	17.8

Table 19. Stand 7 Overstory Data (NH Fox Cruiser):

Species	Sawlog Bf/Acre	Pulp Cords/Acre	Total Trees/Acre	Total BA/Acre	BA/ac by Spp	QMD	Rel Density
Eastern white pine	892.3	No Tally	38.7	20	9.5%	9.7	0.0
Red pine	892.3	No Tally	19.4	10	4.8%	9.7	0.0
Red maple	No Tally	24.8	183.4	80	38.1%	8.9	66.8
Northern red oak	1851.2	No Tally	6.1	10	4.7%	17.3	8.6
White oak	4395.0	No Tally	42.8	60	28.7	16.0	46.6
Norway spruce	No Tally	No Tally	19.4	10	4.7%	9.7	0.0
Swamp white oak	892.3	2.8	35.7	20	9.5%	10.1	17.0
Total	**8923.1**	**27.6**	**345.5**	**210**	**100.00%**	**10.6**	**139.1**

Table 20. Stand 7 Regeneration Data (Stems Per Acre NED3):

		Size	Class		
Species	**1**	**2**	**3**	**4**	**Total**
Eastern white pine	2	5	7	0	13
White oak	7	0	0	0	7
Red maple	2	0	0	2	3
Northern red oak	2	0	0	0	2
Total	12	5	7	2	25

Table 21. Stand 7 Understory Data (Percent Cover NED3):

Species	% Cover
Lowbush blueberry	10.0
Canada mayflower	5.0
Totals	15.0

Appendix Table 22. Stand 1 Thinning Guidelines Percent Cut (NH Fox Cruiser)

		Harvested			Residual			
Spp	% to cut	Sawtimber	Cords	RelDen	Sawtimber	Cords	RelDen	Basal Area
EWP	40	66,519	11	13	99,778	17.1	19.5	52.8
SPRUCE	40	5,774		3	8,661		4.2	12.0
NRO	25	1,678		0	5,033		0.0	6.0
WO	25	3,355	19	4	10,066	57.8	12.6	15.0
BO	25	3,471		2	10,412		7.1	9.0
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
Total		80,797	31	22	133,951	74.9		94.8

Appendix Table 23. Stand 2 Thinning Guidelines Percent Cut (NH Fox Cruiser)

		Harvested			Residual			
Spp	% to cut	Sawtimber	Cords	RelDen	Sawtimber	Cords	RelDen	Basal Area
EWP	30	115,405	54	15	269,278	126.3	34.2	96.3
RP	50	0		0	0		0.0	2.5
RM	50	6,888		0	6,888		0.0	2.5
BB	100	0		0	0		0.0	0.0
NRO	30	2,066		0	4,821		0.0	1.8
BO	5	256		0	4,862		1.9	2.4
HICKORY	5	344		0	6,543		0.0	2.4
PITCHP	5	689		0	13,087		0.0	4.8
G. BIRCH	5	0		0	0		0.0	2.4
SCAR. OAK	30	2,906		2	6,780		4.7	5.3
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
Total		128,554	54	17	312,260	126.3		120.1

Appendix Table 24. Stand 3 Thinning Guidelines Percent Cut (NH Fox Cruiser)

		Harvested			Residual			
Spp	% to cut	Sawtimber	Cords	RelDen	Sawtimber	Cords	RelDen	Basal Area
EWP	40	56,646	30	14	84,970	45.5	20.3	52.0
RP	50	24,617		7	24,617		7.1	15.0
NRO	30	13,806		11	32,214		24.5	28.0
WO	30	0	8	2	0	18.1	4.2	4.7
BO	30	1,534		1	3,579		1.9	2.3
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
Total		96,604	38	34	145,380	63.6		102.0

Appendix Table 25. Stand 6 Thinning Guidelines Percent Cut (NH Fox Cruiser)

		Harvested			Residual			
Spp	% to cut	Sawtimber	Cords	RelDen	Sawtimber	Cords	RelDen	Basal Area
EWP	30	17,835	7	2	41,615	16.6	5.2	14.0
RP	50	6,814		1	6,814		0.7	1.5
RM	50	0	37	5	0	36.6	4.9	6.2
NRO	30	18,838	6	6	43,956	14.1	14.9	17.2
WO	30	2,032	6	2	4,742	13.3	5.2	6.5
BO	30	17,350	20	7	40,483	45.5	15.6	19.4
NSPR	5	738		0	14,022		0.7	2.9
PITCHP	5	246		0	4,680		0.0	2.9
SCOTCHP	100	3,540		2	0		0.0	0.0
SCAR. OAK	30	8,262		4	19,279		8.6	9.7
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
Total		75,655	75	28	175,591	126.1		80.3

Appendix Table 26. Stand 4 Thinning Guidelines Percent Cut (NH Fox Cruiser)

		Harvested			Residual			
Spp	% to cut	Sawtimber	Cords	RelDen	Sawtimber	Cords	RelDen	Basal Area
EWP	90	50,349		30	5,594		3.4	9.3
RM	100	4,923	21	16	0	0.0	0.0	0.0
WO	90	0	18	6	0	2.0	0.6	0.7
BO	90	4,925		0	547		0.0	0.7
PITCHP	30	6,365		8	14,852		17.7	18.7
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
Total		66,562	39	60	20,994	2.0		29.3

Appendix Table 27. Stand 5 Thinning Guidelines Percent Cut (NH Fox Cruiser)

		Harvested			Residual			
Spp	% to cut	Sawtimber	Cords	RelDen	Sawtimber	Cords	RelDen	Basal Area
EWP	90	22,135		7	2,459		0.8	2.3
WO	90	4,579	58	20	509	6.5	2.2	2.7
BO	90	13,737	8	10	1,526	0.9	1.1	1.3
	0	0			0			
PITCHP	30	21,622	24	18	50,452	56.3	42.6	39.7
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
	0	0			0			
Total		62,073	90	55	54,946	63.6		46.0