

Silviculture Prescription Wendell State Forest – Brook Road

Massachusetts Department of Conservation and Recreation Bureau of Forestry

Eastern Connecticut Valley District Wendell State Forest Wendell, MA

Prepared by:

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Approved by:

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Project Overview/Summary

Location: Wendell State Forest, Brook Road; west of Wicket Pond

Approximate Size: 128.7 Acres

Management Goals:

- Release advanced regeneration established through prior forest management operations.
- Establish early successional habitat through forest management.
- Increase structural complexity and species diversity.
- Encourage the regeneration of native species and establishment of a new age class.
- Improve/maintain forest infrastructure with the utilization of in-kind services.

Silvicultural Systems:

- Even Aged
 - Partial overstory removal Overstory removal is commonly the final stage of the traditional shelterwood system, where the majority of the overstory is removed, allowing for an increase in resource availability to advanced regeneration present. A partial overstory removal will be implemented, where only select portions of the overstory will be removed.
 - Clearcuts with reserves (<5 acres) Complete removal of overstory trees in a given area, with the exception of designated reserve trees.
- Uneven Aged
 - Expanding gap irregular shelterwood A variation of group selection, where 1/3 acre openings in the overstory are established, and expanded upon in future entries; resulting in multiple age classes over multiple entries.

Inventory Specifications:

A systematic grid of sample plots was established using ArcGIS which encompassed the entire 128.7 acres on the basis of 1 plot per 3 acres; resulting in 41 variable radius plots (additional plots were added in under represented stands). Each plot included the measurement of overstory trees, regeneration and coarse woody debris (CWD). The Big BAF sampling method was utilized for overstory estimates, with the two angle gauges used being 20 factors and 80 factor. Regeneration and ground cover data was gathered by establishing a 1/300 acre plot, at the center of each overstory plot. The size classes utilized in regards to regeneration are as follows; size class 1 = 0-1' in height, size class 2 = 1' - 4.5' in height, size class 3 = 4.5' tall -1'' dbh, and size class 4 = 1'' dbh -5'' dbh. CWD estimates are a result of a 100' transect at each plot. Programs utilized to interpret data recorded in the field include, NH Fox DS Cruiser for overstory data and a series of calculations completed within Microsoft Excel for ground cover, regeneration, and CWD.

Geology/soils/landforms

The project area lies at approximately 1,100' in elevation, with a maximum elevation of approximately 1,200'. Topography is generally mild, with some slight to moderate slopes located in stand 3, not exceeding 15% (derived using USGS topographical map). Soils present include Pillsbury fine sandy loam, Millsite-Woodstock complex, Agawam fine sandy loam, Henniker sandy loam, Canton fine sandy loam, and Chichester fine sandy loam. The majority of the soils present on site (covering approximately 93% of proposed harvest area) are described by the NRCS Soil Survey to be "moderately suited" for timber harvest operability. All of the above listed soils are classified as well drained or somewhat excessively well drained, with the exception of Pillsbury fine sandy loam which is described as being poorly drained. See Table 1 in Appendix for more information regarding site index.



Climate

This region, specifically central Massachusetts, receives an average of 44.83" of precipitation annually. The highest average precipitation occurs in the month of March, with totals reaching 3.91"; with the least amount of precipitation falling in the month of February reaching a total of 3.17". The average annual temperature is estimated at 47.1 degrees Fahrenheit, with the maximum average temperature falling in the month of July at 81.9 degrees Fahrenheit and the minimum average temperature falling in the month of January at 14.0 degrees Fahrenheit. This data was obtained from the National Oceanic and Atmospheric Association (NOAA) and is specific to central Massachusetts. Averages are based on over 100 years of recorded data for this region.

Hydrology

Several wetland resources are located in the immediate vicinity of the project area, including Wickett Pond, Ruggles Pond, and potentially a variety of intermittent streams, forested wetlands, and vernal pools. The project area lies within the Millers River watershed, which encompasses a large portion of north central Massachusetts (approximately 310 square miles). The headwaters of the Millers River are located in Ashburnham, MA, and continue to flow in a westerly direction until reaching the Connecticut River near the tri-town line of Montague, Gill, and Erving. The current DEP wetlands layer shows an array of wetland resources in the vicinity of proposed management, with only a small (< 0.5 acre) wooded deciduous swamp being within the bounds of the proposed harvest. Two potential vernal pools were identified during preliminary inventory, these were both located along the north eastern edge of the red pine stand (stand 1). Variable width filter strips will be implemented along all regulated streams and wetland resources and all potential vernal pools will be treated as certified vernal pools. Operations which will impact wetland resources such as stream crossings and wetland crossings will be kept to a minimum and shall comply with current Massachusetts BMP's.

Site Productivity



The DCR Management Guidelines of 2012 state that forest stands will be "classed... and considered for silvicultural treatments that generally fit their productivity, structural complexity (or potential thereof) and diversity". Analysis of the project area using the Forest Productivity and Stand Complexity Model (Goodwin, Hill, 2012), indicates that approximately 47% of the project area is classed as having "Medium" forest productivity and complexity, 45% of the project area is classed as having "High" forest productivity and complexity, and the remaining 8% is classified as "Low". The variety of potential forest productivity and stand complexity allow for the implementation of both uneven and even aged silvicultural systems. This model takes into consideration an array of GIS information and data, including stand type, stocking levels, and site index (obtained from CFI database), among others.

Forest Productivity and Complexity Stand level data:

	Red	Pine (Stand 1)	White Pine (Stand 2)		Red Oak (Stand 3)		
	Acres	% of Stand	Acres	% of Stand	Acres	% of Stand	
High	16.4	65.6%	1.7	11.0%	39.7	44.9%	
Medium	8.3	33.2%	12.4	80.0%	40.3	45.6%	
Low	0.3	1.2%	1.4	9.0%	8.4	9.5%	
Total	25	100.0%	15.5	100.0%	88.4	100.0%	

Soil productivity varies throughout the project area, with the majority of soil types being suitable for the growth of upland species. See Table 1 in appendix for specific site index information in regards to each soil type present within the project area. All information pertaining to soils was obtained from the NRCS Soil Survey – Franklin County.

<u>Cultural</u>

There is potential for the occurrence of stonewalls and possibly foundations throughout the forest management project area. A stonewall as well as a foundation were indicated on prior harvest maps just west of stand 1, south of Montague Road, but are located outside of the proposed management area. DCR Archeology has reviewed the proposed forest management project and stated "No precontact sites recorded within, adjacent or near the proposed project area. No historic period or archaeological resources documented within, adjacent or near the proposed project area." Any cultural resources identified during further field work will be GPS'd and documented.

This particular portion of Wendell State Forest was acquired by the Commonwealth of Massachusetts in 1920's. In the 1933 Civilian Conservations Corps (C.C.C.) camp S-62 was established within Wendell State Forest and was disbanded in 1937. The C.C.C. was responsible for much of the infrastructure that exists within Wendell State Forest today, including but not limited to fire ponds, roads and road drainage features, and forest plantations. Early forest stand maps (1927) indicate that much of the project area consisted of a mix of oak and early successional species averaging 2 inches in diameter. As typical with much of central Massachusetts, this young forest was most likely a result of agricultural abandonment. It appears that the Red Oak stand (stand 2) is a direct result of the maturation of this earlier recorded forest type, where as the other two stands were cut over and planted by the C.C.C. during their tenure.

Recreation

Wendell State Forest is home to miles of trails and roads which are utilized year round by hikers, skiers, snowmobiles, hunters, birders and more. Consideration will be given to minimize conflict with recreational users. During winter months some interior roads will be cleared of snow to allow for truck traffic. Local snowmobile clubs will be notified prior to the start of operations. This area will be temporarily closed during active harvest operations to protect the safety of the public; signs will be posted along main roads and trails indicating closed areas.

Wildlife/NHESP

According to the most recent Natural Heritage and Endangered Species Program (NHESP) layer available at <u>www.mass.gov/mgis</u>, there are currently no priority or estimated rare species habitats associated with this proposed forest management area. There are two areas indicated as priority habitat in the vicinity, one surrounding Wickett Pond and the other being located in a forested wetland north of the project area.

The stands proposed for management are currently classified as non-priority natural communities in the state of Massachusetts according to Massachusetts Division of Fish and Wildlife's State Wildlife Action Plan. Minimal sign of wildlife was observed during the early phases of reconnaissance including visual evidence of deer, squirrels, chipmunks, pileated woodpecker, and wild turkey. Despite deer presence observed and the potential for moose presence the current state of regeneration is adequate and minimal browsing damage was observed at this time. In accordance to provision set forth in DCR's Management Guidelines document the following wildlife habitat considerations will be implemented:

- Retention of at least 1 to 3 large diameter trees (where possible >18" dbh) and 4 live 10"-12" dbh trees per acre that have the potential to serve as cavity and den trees and future snags.
- Retention of all dead snags and stubs in harvest area as safe operating conditions allow.
- Retention of an average of one of the oldest, largest diameter, well-formed dominant trees (where possible > 18" dbh) per acre in harvest area to serve as legacy trees.
- Maintain a minimum of 256 cubic feet per acre of coarse woody material within the harvest area.

In 2007, a tornado crossed through this particular section of Wendell State Forest (just north of the project area) and was subsequently salvaged. This allowed for the establishment of several acres of early successional habitat. Much of this early successional habitat created by these disturbances is now

reaching heights of 15'-20' in height, at which point some of the niche habitat benefits will begin to decline for some species which require early successional habitat(DeGraaf, Yamasaki; 2003). During the internal review of the forest management proposal for this area Massachusetts Division of Fish and Wildlife (DFW) noted that early successional bird species have been using the area particularly the Eastern whip-poor-will (*Caprimulgus vociferus*), a MA species of concern.

Stand Data

Red Pine (Stand 1)

This approximately 25 acre stand is located on both the north and south side of Montague road, just south of the Wendell State Forest Headquarters building. It is a result of C.C.C. planting done between 1933 and 1937, making this stand approximately 85-90 years old. This particular stand has been actively managed in the past, with the last two entries occurring in 1990 (shelterwood preparation cut) and 2008 (shelterwood regeneration cut).

Being a planted monoculture, the overstory is almost exclusively dominated by red pine (*Pinus resinosa*), with scattered occurrences of eastern white pine (*Pinus strobus*) and northern red oak (*Quercus rubra*). The estimated basal area throughout this stand is approximately 107 ft^2/acre, total stems per acre (including all overstory species present) is estimated at 107, and the estimated quadratic mean diameter is 13.6" at breast height (See Table 2 in Appendix). These numbers indicate that this is a moderately stocked stand (slightly above the "B line"); extreme competition between overstory trees is not a concern due to previous forest management (Benzie, 1977). There was some variation in stocking levels observed in this stand north and south of the road, it is evident that portions of the red pine stand north of Montague Road were not cut as heavily as portions south of the road in the 2008 entry. The average basal area south of Montague Road is estimated at approximately 70 square feet per acre, while north of the road estimates are higher (approximately 180 – 210 square feet per acre).

Regeneration is abundant throughout the stand and is a direct result of previous harvesting operations. Species present include, white pine, red oak, grey birch (*Betula populifolia*), pin cherry (*Prunus pensylvanicum*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), white oak (*Quercus alba*), black birch (*Betula lenta*), and scattered red pine. The most prominent of these is white pine with an estimated 1,612 stems per acre across all size classes, with the large majority (approximately 54%) of which being size class 2 (1'-4.5' in height); total stems per acre for all species was estimated at 4,837 (See Table 3 in appendix). Understory plants observed include mountain laurel (*Kalmia latifolia*), sheep laurel (*Kalmia angustifolia*), highbush (*Vaccinium corymbosum*) and lowbush blueberry (*Vaccinium angustigolium*), pink lady slipper (*Cypripedium acaule*), northern wild raisin (with-rod) (*Viburnum cassinoides*), wintergreen (*Gaultheria procumbens*), tree clubmoss (*Lycopodium obscurum*), and assortments of grass and fern species (See Table 4 in appendix). One invasive species was identified within this stand, Morrow's honeysuckle (*Lonicera morrowii*); although not widespread throughout the stand its presence warrants extra precautions in the attempt to limit further spread. CWD was estimated at approximately 255 cubic feet per acre, with a large percentage of which being larger than 6" diameter.

White Pine (Stand 2)

This 15.5 acre stand is located in the most northern portion of the project area, along the east side of Brook Road and just west of Wicket Pond. As with the red pine stand, this white pine plantation is the direct result of C.C.C. planting during their tenure in the 1930's. A small pulpwood sale occurred in this stand in 1991, which also included a 3.5 acre clearcut on the west side of Brook Road. Just to the north of this stand lies the swath of destruction left by the 2007 tornado, which was salvaged in 2008.

This plantation is approximately 85-90 years old and a monoculture of white pine. The estimated basal area throughout this stand is approximately 147 ft^2/acre, total stems per acre (including all overstory species present) is estimated at 120, and the estimated quadratic mean diameter is 14.9" (See Table 5 in Appendix). This stand currently possesses a moderate stocking level primarily due to previous forest management (Leak, Lamson; 1999). In stands with moderate stocking densities overstory trees generally have some room to grow and the risk of stagnation due to competition is not of great concern.

Regeneration is abundant throughout the stand and is a direct result of previous harvesting operations. Species present include, black birch, red maple, red oak, sugar maple (*Acer saccharum*), and white pine. The most prominent of these is red maple with an estimated 825 stems per acre across all size classes, with the large majority (approximately 39%) of which being size class 1 (<1' in height); total stems per acre for all species was estimated at 2,100 (See Table 6 in Appendix). Understory plants observed include lowbush blueberry, wintergreen, partridgeberry (*Mitchella repens*), Indian cucumber root (*Medeola virginiana*), sheep laurel, starflower (*Triantalis borealis*), maple leaved viburnum (*Viburnum acerifolia*), wild sarsaparilla (*Aralis nudicalis*), and assortments of grass and fern species (See Table 6 in Appendix). CWD was estimated at approximately 702 cubic feet per acre, with approximately half of the observations being larger than 6" diameter.

Red Oak (Stand 3)

This approximately 88 acre stand appears to be the result of natural regeneration established post agricultural abandonment. Forest stand maps dated 1927 indicate that the majority of this stand consisted of a mix of oak, birch, red maple, and black cherry (*Prunus serotina*); ranging in an average diameter of 2"-3". It is assumed that much of this stand was once cleared for agriculture (specifically pasture due to the abundance of surface stones present on the forest floor) and was approximately 20 years old when it was first inventoried and mapped; resulting in an approximately 110 year old stand.

As the forest matured, much of the short lived species such as grey and white birch (*Betula papyrifera*) have started to naturally decline, leaving an overstory of predominantly oak with occurrences of white pine. In its current state, the total basal area of this stand was estimated at 128 ft^2/acre, total stems per acre (including all overstory species present) is estimated at 216, with an estimated quadratic mean diameter of 10.4" (See Table 9 in Appendix). Northern red oak consists of nearly 50% of the total basal area and 70% of the total volume recorded throughout the stand and has a quadratic mean diameter of 13.6". This stand is currently overstocked, meaning that overstory trees growth rates are limited due to competition. Stands which are considered overstocked generally exhibit slower growth in overstory trees as well as limited resource availability for regeneration and understory plants due to a predominately closed canopy.

Regeneration is present and varies throughout the stand; pockets of abundant regeneration currently occur where natural mortality has allowed for in an increase of light to the forest floor, while areas of dense canopy cover (specifically hemlock) are virtually devoid of regeneration. The species present include, red maple, white pine, red oak, American beech, American chestnut (*Castenae dentata*), black birch, striped maple (*Acer pensylvanicum*), eastern hemlock (*Tsugas canadensis*), white oak, and black cherry. The most prominent is white pine with approximately 364 stems per acre (across all size classes), followed by red maple with approximately 353 stems per acre (across all size classes). The total number of stems per acre across all species was estimated at approximately 1,885 (See Table 10 in Appendix). Understory plants observed include mountain laurel, lowbush blueberry, highbush blueberry, witch hazel (Hammemelis virginiana), goldthread (*Coptis trifolia*), wintergreen, partridgeberry, Indian cucumber root, sheep laurel, starflower, maple leaved viburnum, wild sarsaparilla, and assortments of grass and fern species, among others (See Table 11 in Appendix). CWD was estimated at approximately 640 cubic feet per acre.

Prescribed Management and Intended Goals

Red Pine (Stand 1)

This stand has a history of active forest management, from the initial planting of the red pine to multiple entries intended to increase yields and promote regeneration. The management strategy implemented over the past three decades mimic that of a traditional three stage shelterwood, with the first entry in 1990 acting as the preparation cut and the second entry in 2008 acting as the regeneration cut. Generally, the regeneration cut is followed by an overstory removal, which aims to release the regeneration established in the previous entry.

Prescribed management for this stand will continue upon the even-aged silvicultural system which has been implemented over the past several decades. This entry will act as the final stage of the three stage shelterwood system and will entail a partial overstory removal. The focus will be on the removal of a large majority of red pine in the overstory, while maintaining several legacy trees per acre in accordance with DCR Management Guidelines.

Basal area estimates as well as the presence of adequate regeneration will determine the level of overstory removal in any given portion of the stand. In areas where overstory basal area is below 90 square feet per acre and regeneration is deemed adequate, 80%-100% of the current overstory will be removed. Areas where overstory basal area is greater than 90 square feet per acre and/or regeneration observed is less than approximately 25% of the average density of the entire stand, 60% of the current overstory will be removed.

The intent is to release established regeneration, while also removing the large portions of the planted red pine. With the current mix of regeneration it is anticipated that this stand after harvest will have an overstory dominated by a mix of hardwoods and white pine. As the canopy begins to close it is expected that the more shade intolerant species, such as raspberry, pin cherry, and paper birch, will be less of a component in the understory. Short lived overstory trees such as paper birch, grey birch, and pin cherry will eventually fall out of the canopy as well. This method will establish a relatively even aged forest, but will encourage a more diverse mix of native species overtime. Future management will focus on increasing structural diversity and forest complexity, by implementing uneven-aged management strategies. A future entry into this stand will not occur for at least 20 to 30 years.

White Pine (Stand 2)

This white pine plantation will be managed using two even-aged silvicultural systems; the traditional 3 stage shelterwood and clearcuts not to exceed 5 acres in size.

Clearcuts (no greater than 5 acres) will be implemented within the white pine stand with the goal of creating small patches of early successional habitat. This silvicultural prescription was suggested by officials from the Massachusetts Department of Fish and Wildlife (DFW) during internal review of the forest management proposal due to the presence of whip-poor-will as well as the close proximity to the forest openings created by the 2007 tornado. The clearcuts will allow for the establishment of early successional habitat, which has been in decline throughout Massachusetts for a number of years (Alerich, 2000), subsequently resulting in a decline in specialist wildlife species which depend on this habitat type. These areas will be strategically located with the intent of maximizing wildlife benefits, as well as to allow for adequate regeneration throughout. The shelterwood treatment will be the second entry (regeneration cut) of a three stage shelterwood. Areas subject to this treatment will be thinned with the intent of increasing sunlight to the forest floor, encouraging regeneration and preparing these areas for future management, while also allowing for the residual trees to expand their crowns and provide a seed source for a new generation of trees.

The shelterwood treatment will occur on approximately 60% of the stand (approximately 9.3 acres) and will focus on the removal of poorly formed, less vigorous trees. Approximately 50% of current stocking levels will be removed, bringing the current 120 square feet of basal area per acre to about 60 square feet per acre. Clearcuts will occur on the remaining 40% of the 15.5 acres of this stand, resulting in 6.2 acres to be treated with this prescription and will maintain a minimum of "1 to 3 live, large diameter (where possible < 18" dbh) trees per acre and 4 live, 12" to 18" dbh trees per acre..." as well as the retention of all snags which lie within the clearcut area is required (Commonwealth of Massachusetts, 2012).

Future entries will focus on the further removal of the overstory plantation white pine, while continuing efforts to regenerate a diverse mix of native species. Future conditions are expected to fall in line with the adjacent tornado salvage areas, with an abundance of regeneration comprised of an array of native species. In approximately 10 years, the remaining white pine overstory will be removed with the intent of releasing regeneration established through this entry.

Red Oak (Stand 3)

The silvicultural prescription that will be implemented in this stand is the expanding gap, irregular shelterwood method of regeneration. This method entails the creation of several openings or gaps scattered throughout the stand. These 'expanding' gaps will allow for the creation of several different age classes with each entry, resulting in a more structurally complex and resilient stand. The goal is to naturally regenerate a native mix of species, while improving the growth of overstory trees by incorporating an intermediate thinning between gaps. The majority of the anticipated regeneration will be a result of these newly created gaps, with lower amounts of regeneration anticipated where only thinning occurs. With this system of management, future entries will focus on the expansion of previously established gaps effectively creating new age classes with every entry.

During this entry approximately 20% of the total stand area will be regenerated utilizing 1/3 acre openings, resulting in a total of 52 openings encompassing a total of 17.6 acres. The thinning between gaps will occur across all size classes and species and will focus on the removal of poorly formed, less vigorous individuals and will maintain a minimum of 70 ft^2/acre of residual basal area. The anticipated result of this management is to regenerate a mix of native species, while also providing an increase in resource availability to residual trees. The 1/3 acre openings in conjunction with the thinning will allow for in an increase in available sunlight to the forest floor, providing for more favorable conditions for the establishment of regeneration. It is anticipated that shade tolerant species will comprise the majority of regeneration in the areas that are thinned between gaps, with an increase in mid shade tolerant species located within the 1/3 acre openings. Future entries will mimic this one and will occur at approximately 20 year intervals.

Operational Information

Logging Requirements

All primary and secondary skid roads will require the implementation of erosion control measures, including but not limited to, the construction of water bars, installation of culverts, and slashing of roads. Culturally sensitive areas (C.C.C. structures, stone walls, etc...) will be protected and minimal disturbance will be tolerated in and around these areas.

Harvesting will be permitted year round, as long as ground conditions are stable and allow for harvesting operations. There are currently no NHESP restrictions to this site. Some interior forest roads will require plowing, therefore impacting snowmobile and other winter recreation opportunities. This will only affect a small portion of the state forest and will persist for no more than 2 winter seasons. During hours of operation, this portion of the state forest will be closed for recreational use due to hazards pertaining to harvest operations. Notifications will be sent to local snowmobile clubs to inform users of these temporary access restrictions.

General Guidelines

All wetland resources will be subject to variable width filter strips and all potential vernal pools will be treated as 'certified' vernal pools. A 50' buffer will be implemented along Montague Road, where no more than 50% basal area will be removed. All operations throughout this sale will adhere to the guidelines and restrictions set forth in the Massachusetts Best Management Practices Manual (2013).

Timber Marking Guidelines

Marking guidelines are as follows:

- Trees marked with a single blue stripe will be removed for harvest
 - Horizontal stripe indicates sawtimber
 - o Vertical stripe indicates pulp or cordwood
 - "X" indicates cull tree to be cut and left on site (no tally)
- Skid roads will be painted in red, all trees marked with red paint are to be cut and removed (the same marking scheme mentioned above applies to skid trail marking).

• Filter strips, vernal pool and wetland buffers and harvest boundaries will be marked with three horizontal blue stripes, indicating an area where cutting is prohibited; these trees will remain uncut.

<u>Appendix</u>

Table 1. – Soil Site Index Information

Soil Type	Common Trees	Site Index
75—Pillsbury fine sandy loam		
	Balsam fir	51
Pillsbury, very stony 129—Millsite-Woodstock complex Millsite, very rocky Woodstock, very rocky 275—Agawam fine sandy loam	Eastern white pine	60
Pillsbury, very stony	Northern red oak	60
	Red spruce	47
	Sugar maple	55
129—Millsite-Woodstock complex		
	Northern red oak	60
Millsite, very rocky	Sugar maple	73
	White ash	75
	Eastern white pine	55
Woodstock, very rocky	Northern red oak	47
	Sugar maple	56
275—Agawam fine sandy loam		
	Bigtooth aspen	74
	Black cherry	93
	Black oak	60
	Eastern white pine	70
Agawam	Northern red oak	83
	Paper birch	73
	Sugar maple	65
	Sweet birch	66
	White ash	76
349—Henniker sandy loam		
	Eastern white pine	75
Henniker, very stony	Northern red oak	60
	Sugar maple	65
421—Canton fine sandy loam		
Canton yony stony	Eastern white pine	58
Canton, very stony	Northern red oak	52
444B—Chichester fine sandy loam		
	Eastern white pine	65
Chichester	Northern red oak	55
	Sugar maple	55

Red Pine (Stand 1) Data

Table 2. – Red Pine (Stand 1) Overstory Data

Species	Trees/Acre	BA/Acre	BF/Acre	QMD	Avg. Ht (logs)	Total BF (Stand)
Red Pine (<i>Pinus resinosa</i>)	107.5	107.7	18,526	13.6	2.9	463,144
-	-	-	-	-	-	-
Total	107.5	107.7	18,526	13.6	2.9	463,144

 Table 3. – Red Pine(Stand 1) Regeneration Tree Data

Represented in Trees Per Acre (TPA)	Size Class				
SPECIES	1	2	3	4	TOTAL
Red Oak (Quercus rubra)	450	37.5	150	300	937.5
White Pine (Pinus strobus)	300	862.5	300	150	1,612.5
Grey Birch (<i>Betula populifolia</i>)	0	112.5	0	0	112.5
American Beech (Fagus grandifolia)	37.5	0	0	0	37.5
Black Birch(<i>Betula lenta</i>)	0	37.5	0	0	37.5
White Oak (Quercus alba)	0	0	37.5	0	37.5
Red Maple (Acer rubrum)	525	300	562.5	412.5	1,800
Red Pine (Pinus resinosa)	75	150	0	0	225
Pin Cherry (Prunus pensylvanica)	0	0	0	37.5	37.5
TOTAL	1,387.5	1,500	1,050	900	4,837.5

Table 4. – Red Pine (Stand 1) Understory Shrub/Herbaceous Data

SPECIES	Avg. % Cover	# Plots Observed	% of Plots Observed
Assorted Fern Species	6.25	5	62.5
Assorted Grass Species	3.75	1	12.5
Black Huckleberry (Gaylussacia baccata)	2.50	1	12.5
Canada Mayflower (Maianthemum canadense)	5.00	4	50.0
Dewberry (<i>Rubus spp.</i>)	2.50	2	25.0
Highbush Blueberry (Vaccinium corymbosum)	8.75	2	25.0
Lowbush Blueberry (Vaccinium angustifolium)	23.75	7	87.5
Morrow's Honeysuckle (Lonicera morrowii)	1.25	1	12.5
Mountain Laurel (Kalmia latifolia)	13.75	3	37.5
Northern Wild Raisin (Viburnum cassinoides)	1.25	1	12.5
Pink Lady Slipper (Cypripedium acaule)	1.25	1	12.5
Sessile Bellwort (Uvularia sessilifolia)	1.25	1	12.5
Sheep Laurel (Kalmia anfustifolia)	1.25	1	12.5
Starflower (Triantalis borealis)	1.25	1	12.5
Tree Clubmoss (Lycopodium obscurum)	1.25	1	12.5
Wild Sarsparilla (Aralia nudicaulis)	5.00	4	50.0
Winter Green (Gaultheria procumbens)	6.25	4	50.0
Witch Hazel (Hammamelis virginiana)	1.25	1	12.5

White Pine (Stand 2) Data

Table 5. White Pine (Stand 2) Overstory Data

Species	Trees/Acre	BA/Acre	BF/Acre	QMD	Avg. Ht (logs)	Total BF (Stand)
White Pine (<i>Pinus strobus)</i>	118.23	145	17,893.66	14.9	2.0	277,351.77
Red Maple (Acer rubrum)	2.04	2.5	337.62	14.9	-	5,233.05
Total	120.27	147.5	18,231.28	14.9	2.9	282,584.82

Table 6. White Pine (Stand 2) Regeneration Tree Data (TPA)

SPECIES	1	2	3	4	TOTAL
Black Birch (<i>Betula lenta</i>)	300	0	0	0	300
Red Maple (Acer rubrum)	600	0	225	0	825
Red Oak (Quercus rubra)	0	0	0	75	75
Sugar Maple (Acer saccharum)	300	0	0	0	300
White Pine (Pinus strobus)	150	0	225	225	600
TOTAL	1,350	0	450	300	2,100

Table 7. White Pine (Stand 2) Understory Shrub/Herbaceous Data

SPECIES	Avg. % Cover	# of Plots Observed	% of Plots Observed
Assorted Fern Species	5%	2	50%
Assorted Grass Species	2.50%	1	25%
Canada Mayflower (Maianthemum canadense)	5%	2	50%
Indian Cucumber Root (Medeola virginiana)	2.50%	1	25%
Lowbush Blueberry (Vaccinium angustifolium)	20%	4	100%
Maple Leaved Viburnum (Viburnum acerifolia)	2.50%	1	25%
Partridgeberry (Mitchella repens)	2.50%	1	25%
Sheep laurel (Kalmia angustifolium)	7.50%	3	75%
Starflower (Triantalis borealis)	2.50%	1	25%
Wild Sarsaparilla (Aralia nudicaulis)	7.50%	3	75%
Wintergreen (Gaultheria procumbens)	10%	4	100%

Red Oak (Stand 3) Data

Table 8. Red Oak (Stand 3) Overstory Data

Species	Trees/Acre	BA/Acre	BF/Acre	Cds/ Acre	QMD	Avg. Ht (logs)	Total BF (Stand)	Total Cords (Stand)
White Pine (Pinus strobus)	45.8	21.3	1,000.2	3.6	9.2	1.9	80,016.6	284.4
Eastern Hemlock (Tsugas								
canadensis)	36.2	14.7	968.7	1.3	8.6	1.4	77,494.2	107.1
Sugar Maple (<i>Acer</i>								
saccharum)	1.4	0.7	0.0	0.2	9.4		0.0	14.9
Red Maple (Acer rubrum)	30.2	8.0	71.2	1.4	7.0		5,696.7	115.4
Paper Birch (<i>Betula</i>								
papyrifera)	19.1	10.7	50.6	2.6	10.1	1.0	4,051.4	204.6
Black Birch (<i>Betula lenta</i>)	7.1	4.0	142.4		10.1		11,393.4	
American Beech (Fagus								
grandifolia)	7.1	4.0	71.2		10.1		5,696.7	
Red Oak (Quercus rubra)	63.0	60.0	5984.8	1.1	13.2	1.5	478,787.1	91.9
White Oak (Quercus alba)	6.5	4.7	255.9		11.5	1.0	20,470.5	
Total	216.3	128.0	8,545.1	10.2	10.4		683,606.8	818.2

Table 9. Red Oak (Stand 3) Regeneration Tree Data (TPA)

SPECIES	1	2	3	4	TOTAL
Red Maple (Acer rubrum)	235.71	64.29	32.14	21.43	353.57
White Pine (Pinus strobus)	235.71	96.43	21.43	10.71	364.29
Red Oak (Quercus rubra)	160.71	75.00	10.71	10.71	257.14
American Beech (Fagus grandifolia)	139.29	150.00	42.86	0.00	332.14
American Chestnut (Castanea dentata)	42.86	32.14	21.43	0.00	96.43
Black Birch (Betula lenta)	32.14	0.00	0.00	0.00	32.14
Striped Maple (Acer pensylvanicum)	107.14	0.00	32.14	0.00	139.29
Eastern Hemlock (Tsuga canadensis)	192.86	0.00	0.00	0.00	192.86
White Oak (Quercus alba)	75.00	21.43	0.00	0.00	96.43
Black Cherry (Prunus serotina)	21.43	0.00	0.00	0.00	21.43
TOTAL	1242.86	439.29	160.71	42.86	1,885.71

Table 10. Red Oak (Stand 3) Understory Shrub/Herbaceous Data

SPECIES	Avg. % Cover	# of Plots Observed	% of Plots Observed
Mountain Laurel (<i>Kalmia latifolia</i>)	19.00%	14	46.67%
Wintergreen (Gaultheria procumbens)	11.33%	24	80.00%
Lowbush Blueberry (Vaccinium angustifolium)	12.00%	24	80.00%
Black Huckleberry (<i>Gaylussacia baccata</i>)	3.67%	4	13.33%
Tree Clubmoss (Lycopodium obscurum)	5.00%	14	46.67%
Highbush Blueberry (Vaccinium crymbosum)	0.67%	2	6.67%
Sheep Laurel (Kalmia angustifolia)	1.33%	4	13.33%
Witch Hazel (Hammamelis virginiana)	1.00%	3	10.00%
Assorted Fern Species	5.33%	13	43.33%
Northern Wild Raisin (Viburnum cassinoides)	2.00%	6	20.00%
Starflower (Triantalis borealis)	3.00%	9	30.00%
Goldthread (Coptis trifolia)	0.33%	1	3.33%
Partridgeberry (Mitchella repens)	3.00%	9	30.00%
Indian Cucumber Root (Medeola Virginiana)	1.67%	5	16.67%
Wild Sarsaparilla (Aralia nudicaulis)	2.00%	6	20.00%
Sessile Bellwort (Uvularia sessilifolia)	0.33%	1	3.33%
Maple Leaved Viburnum (Viburnum acerifolia)	0.67%	2	6.67%
Ground Cedar(Diphasiastrum digitatum)	0.33%	1	3.33%
Assorted Grass Species	1.67%	4	13.33%
Dewberry (<i>Rubus spp.</i>)	0.33%	1	3.33%





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