



*Silviculture Prescription  
Garnet Hill Lot*

*Massachusetts Department of Conservation and Recreation  
Bureau of Forestry*

*Central Berkshire District  
Peru State Forest  
Peru, MA*

*Prepared by:*

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Approved by:

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### **Overview:**

The Garnet Hill Lot Forest Management project is on the western portion of the Peru State Forest (see Locus Map) along Garnet Hill Road which is accessed from Curtin Road in the town of Peru is comprised of approximately two hundred and eighty acres of red pine plantation, red spruce plantation, northern hardwoods, hemlock-hardwood and wetlands.

### **The conditions that led to selecting this project for forest management are:**

- Significant portions of the project area have been affected by biotic (red pine scale) agents that are causing mortality in the overstory red pine trees.
- Portions of the project area have been affected by biotic agents such as beech bark disease, black knot and sugar maple borer causing structural defects in overstory trees in the northern hardwood stands.
- Significant portions of the project area have been affected by abiotic (ice) agents repeatedly, with major damage from the December 2008 ice storm.
- This project will provide an opportunity to repair drainage and erosion issues on Garnet Hill Road.
- Will provide an opportunity to demonstrate regeneration cuttings in both northern hardwoods and plantations.
- Desire to capture monetary value of offsite red pine trees prior to mortality of the entire stand.
- This project offers an opportunity to demonstrate and fulfill an ecosystem services approach to forest management on DCR Woodlands including the restoration of native vegetation communities.

### **The Garnet Hill Forest Management Project proposes to:**

- Remove/salvage an overstory of dying red pine stand and release an existing understory.
- Demonstrate several regeneration techniques in northern hardwood forest types.
- Remove/reduce the costs and safety concerns of the dying red pine stands along traveled roads.
- Demonstrate harvesting techniques and best management practices that protect forest productivity, soil and water resources.
- Repair drainage and erosion issues along portions of Garnet Hill Road.
- Create and provide ecosystem services from this Woodland as directed by the Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines (2012) including:
  - Ecological restoration of degraded natural community types
  - Provide locally grown forest products to the local economy
  - Create a more diverse forest structure that is resilient to disturbance
  - Sequester carbon in retained overstory trees, permanent forest products produced from the harvest, and in the vigorous regenerating forest.
  - Provide the conditions for early seral or regenerating forest that will support diverse species.

### **Site Data:**

**Stand Information:** The proposed project area consists of approximately 280 acres of red pine plantations, red spruce plantation and northern hardwoods forest types. Throughout the project area the

dominant tree species that were observed are red pine (*Pinus resinosa*), red spruce (*Picea rubens*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), white birch (*Betula papyrifera*), white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), American beech (*Fagus grandifolia*), quaking aspen (*Populus tremuloides*), white pine (*Pinus strobes*) and Hemlock (*Tsuga canadensis*).

There are three major forest types in this project area. They are red pine plantation, red spruce, and northern hardwoods.

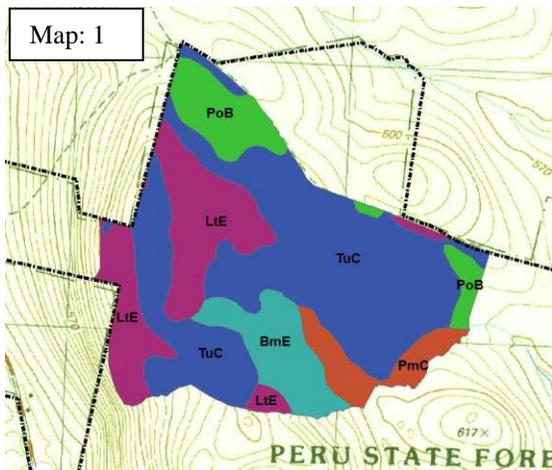
- Red Pine Plantation – There are approximately 58 acres of declining red pine plantation. These stands are approximately 95 years old and fully stocked. The soil types in these stands listed by dominance are Lyman-Turnbridge (LtE), Turnbridge-Lyman (TuC), and Pillsbury Loam (PoB) (see next section on soil description). These plantations are currently even-aged two story stands. The overstory which is dominated by red pine with small amounts of hardwood species is medium sized, or roughly an average of 12-14 inch diameters. The exotic red pine plantation portion of this project area has been shaped by rapid mortality in recent years caused by crown damage resulting from the 2008 ice storm ([http://www.weather.gov/media/box/officePrograms/science/December\\_2008\\_Ice\\_Storm.pdf](http://www.weather.gov/media/box/officePrograms/science/December_2008_Ice_Storm.pdf)) followed by a rapidly expanding infestation of red pine scale (*Matsucoccus resinosa*) ([http://www.nhstateparks.org/uploads/pdf/RP\\_pestalert.pdf](http://www.nhstateparks.org/uploads/pdf/RP_pestalert.pdf)). The understory is currently stocked with sugar maple, red maple, American beech, black cherry and other northern hardwoods in lower elevations. This young emerging stand is approximately 20 feet tall with an average diameter of 1-4 inches. Along the higher elevations and ridgeline of Garnet Hill the understory of these stands is shifting to a combination of low bush blue berry, high bush blue berry, red spruce, white pine, grey birch, and mountain ash.
- Red Spruce - There are approximately 3 acres of red spruce located within the project area, based on historic records it is not clear if this stand is planted or native. This stand is approximately 95 years old and fully stocked. The soil type in this stand is PoB (see next section on soil description). This plantation is currently even-aged and dominated by spruce with an occasional northern hardwood or white pine tree mixed. The stand is also composed of medium sized trees, or roughly an average diameter of 12-14 inches.
- Northern Hardwoods - The majority of the project area, approximately 205 acres, is in a mixed northern hardwood type. Past land use and weather events have had a negative effect on the quality and health of these stands. This forest type will be broken down into individual stands for management purposes based on dominant tree species, topography and soils to assist planning in proper management decisions. There are several inclusions up to 5 acres where hemlock and white pine are a component. The current size class in this forest type range from small to large diameter trees with an estimated average of 12 inches but ranging from 6-25 inches. The density of the northern hardwood stands is generally high but there are natural gaps in the forest canopy mostly caused by ice and wind damage. Throughout the project area white ash has been in decline for several years. It is anticipated that the emerald ash borer (EAB) will kill the remaining stressed trees upon its arrival. The stand age is approximately 80-100 years old.

**Geology and Landforms:** This proposed project area is located in the western portion of the Peru State Forest adjacent and South of Garnet Hill Road. The project is bounded by Garnet Hill Road to the north, state forest boundary to the west and intermittent streams, wetlands and forest type changes to the south and east. Both the western and eastern edges of the project area have an elevation of

approximately 1900'. From here the terrain rises to the middle portion of the project area to an elevation of 2175' at the peak of Garnet Hill.

Along with the stream and wetland along the southern boundary mentioned above there are additional streams and wetlands located throughout the project area. These are discussed in more detail in the "Hydrology and Watershed" section below.

The project area ranges from generally flat in the middle with gradual slopes to the east and more severe drops in elevation to the west. Just outside the project area to the west is extremely steep with exposed bedrock. Garnet Hill is also known for its views from the peak at the end of Garnet Hill Spur Road. Along the ridge line of Garnet Hill there are several exposed outcrops of bedrock as well as several areas of shallow soil supporting only fern and grass species.



**Soils:** There are five soil types associated with this project area ranging from very poorly drained flat bottom types to excessively drained upland soils (Map: 1). As with topography the forest composition changes with the soil types. The five types are described below (excerpts from "Soil Survey of Berkshire County Massachusetts", NRCS 1988).

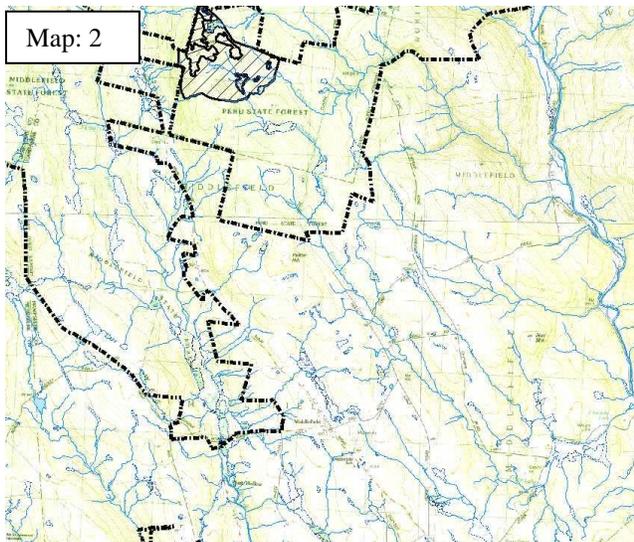
- PmC - Peru-Marlow Association: (17.2 ac) This map unit consist of very deep, moderately well drained Peru soils and very deep, well drained Marlow soils. Peru soils are typically on the lower parts of slopes or in slightly concave areas and Marlow soils are on the upper parts of slopes on in convex areas.
- BmE – Berkshire-Marlow Association: (27.4ac) This map unit consists of very deep, well drained Berkshire and Marlow soils. The soils are on the sides of hill and mountains.
- TuC – Tunbridge-Lyman Association: (148.0 ac) This map unit consists of moderately deep, well drained Tunbridge soils and shallow, somewhat excessively drained Lyman soils. These soils are on the sides and tops of hills and mountains.
- LtE – Lyman-Trunbridge Association: (60.9 ac) This map unit consists of shallow, somewhat excessively drained Lyman soils and moderately deep, well drained Tunbridge soils. These soils are on the mountainous uplands.
- PoB – Pillsbury Loam: (27.5 ac) This is a nearly level to gently sloping, very deep, poorly drained soil on foot slopes of drainage ways and in slightly concave areas of glacial till uplands.

**Climate:** The project location lies in an area of mild summers and moderate winters with year round precipitation possible. Winds generally come from the west. Although major weather events can happen in any given year, the chances of hurricanes, tornadoes, ice storms or other forest changing events are seldom but do occur. The figures below (Table 1) are excerpts from the National Weather Service 2012 Climatological Report for Pittsfield, MA. The climate period used to determine normal value is 1981 through 2010.

Table 1:

	2012 Annual	2011 Annual	Normal Annual Value	Normal Winter	Normal Spring	Normal Summer	Normal Fall
Annual Maximum Temp	58.4	56.5	55.3	31.7	54.3	76.7	57.9
Annual Minimum Temp	39.2	37.4	35.4	15.4	32.9	55	38
Annual Mean Temp	50	50.2	48.3	23.6	43.6	65.8	48
Total Precipitation (in)	36.36	59.46	45.38	8.6	11.44	12.74	12.6
Days with >= .01 Precipitation	144						
Average Wind Speed	6.1						

The most recent major weather event which damaged this project area was the ice storm of 2008. The ice storm event produced ice amounts of 0.5 – 1.5 inches thick on all surfaces causing extensive tree damage by breaking limbs and uprooting due to the ice’s weight. Effects of this event are seen by the damage still evident in the project area; many trees with more than 50% crown loss have not recovered and broken branches and downed trees remain on the ground.

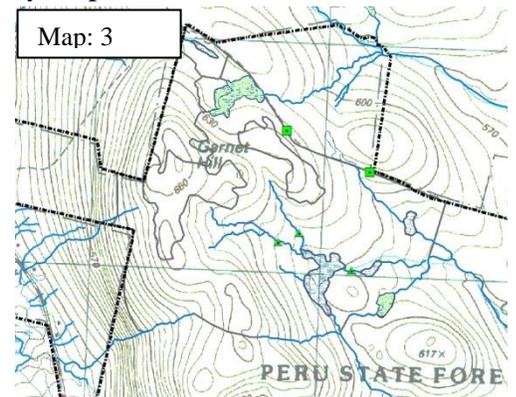


**Hydrology and Watershed:** The project area falls entirely within the Westfield Watershed. Rainfall within this project area drains into wetlands and intermittent or perennial streams which flow into Factory Brook, Tuttle Brook, Cone Brook, and Glendale Brook. From here the water flows to the Middle Branch (70%) and West Branch (30%) of the Westfield River.

Streams to the east of the project area generally flow through wetlands and beyond to Tuttle Brook, Cone Brook and Glendale Brook before crossing Curtin Road and eventually flowing to the Middle Branch of the Westfield River after crossing several more roads. The intermittent streams on the western portion of the project area generally flow across the skyline trail to Geer Brook then to Factory Brook which eventually empties into the West Branch of the Westfield River.

Within and adjacent the project area there are six known wetland areas, two larger systems and four smaller ones with associated connecting streams. There are also several intermittent streams. There will be no management within the wetlands and final layout of the project will follow guidance received from the Massachusetts Department of Fish and Wildlife (MA-DFW) At minimum there will be a 50’ filter strip along each stream.

There are no mapped certified or potential vernal pools by NHESP. During the pre-harvest inventory several areas with vernal pool features have been located throughout the project area. These areas as well any others found during the preparation of timber sales will be treated as wetlands and excluded from harvest.



**Disease and Insects:** There are current and potential threats to this project including red pine scale, beech bark disease, emerald ash borer, sugar maple borer and black knot.

- Red Pine Scale was first reported in Connecticut in 1946 and has spread through New England since. It is believed to have been introduced to the region on exotic pines planted in 1939 at the World's Fair in New York. In the United States this scale only attacks the Red Pine tree. Other pines species are not affected.

The scale is first detected by the presence of red/browning individual branches, followed by a rapid decline of the whole crown. As Red Pine Scale expands, feeding on the tree secondary pests such as turpentine beetles can enter and speed the mortality process. [http://www.nhstateparks.org/uploads/pdf/RP\\_pestalert.pdf](http://www.nhstateparks.org/uploads/pdf/RP_pestalert.pdf)

- Beech bark disease (BBD) was first found in Maine in the 1930s and has been spreading throughout the Northeast and beyond since then. It is believed to have come to the US from Europe through Nova Scotia. It has spread throughout the eastern United States and Canada.

BBD is a two stage insect/disease which starts when the beech scale insect attacks the bark leaving a pathway for the Nectria fungus to invade, eventually leading to the death of the tree. BBD can attract other insects and diseases to hasten the declining tree into death. BBD reduces nut production negatively affecting wildlife which depends on it as a source of food. This disease will continue to re-infect the root sucker regeneration creating a continuous state of diseased beech in the stand.

There is evidence of resistance to the BBD in some individual beech. This is evident in dense beech stands where one or several stems appear vigorous and free of BBD when all others are damaged. Potential resistant beech are generally maintained and promoted throughout the stand.

- Black Knot is a native fungus which causes enlarged black growths on the branches and stems of black cherry trees. This damage reduces the trees vigor, weakens the infected branch or stem and eventually may kill the tree. The galls caused by this fungus make the trees susceptible to other pathogens and weakens the mechanical structure of the tree. Infected trees should be removed during harvesting operation to prevent the continued spread of the fungus.



- The native sugar maple borer is a long horned wood boring beetle that generally attacks the lower bole of the tree leaving behind a linear open scar. The damage caused by this borer acts as a girdle around the tree, reducing vigor and weakening the structure of the tree. This borer attacks previously stressed trees, generally due to overcrowding, suppression or drought. Tree vigor should be maintained by reducing competition for resources to control sugar maple borer.

- Emerald Ash Borer (EAB) was first found in Michigan and Ontario in 2002. It was introduced from Asia and has few natural predators here to control populations. EAB has spread from Michigan and is now located throughout the northeastern part of the United States and Canada. This insect feeds exclusively on ash trees and has destroyed



millions of trees across its range already. EAB is generally attracted to trees which were previously weakened or stressed.

The EAB has a one year life cycle in which each female lays 30-60 eggs on average with maximum of 200 in some cases. After the eggs are deposited in bark the larvae chew into the tree and begin feeding on the phloem of the tree. The following year the adult will exit the tree through a D-shaped hole and begin feeding on foliage to continue the cycle.

The first infestation found in Massachusetts is located approximately 6.5 miles from this project area. It is generally accepted that there is no way to stop or economically control EAB in forested conditions.

**Wildlife Habitat Conditions:** It was noted during field visits with MA DFW staff that the ridge top portions of the red pine plantations have characteristics of two uncommon terrestrial community types; ridge top heathland and high elevation spruce – fir forest. For both of these community types removal of the existing red pine overstory will enhance and expand the presence of the two unique community types in the area. Upon completion of this project MA DFW will be consulted to determine if any further management options should be sought.

According to the NHESP “Massachusetts Natural Heritage Atlas 13<sup>th</sup> Edition” there is no priority or estimated habitats located in the proposed harvest area. Care will be taken to properly report and address the needs of any state-listed rare plant or wildlife species if found on the site.

No rare animals or critical habitat were noted site visits to the area. Large mammals noted through observed signs were deer and coyote. Small wildlife noted was turkey, squirrel and porcupine. It has been observed in previous forestry operations nearby that large herbivore pressure is not a concern. The proposed project area is a small portion of the total land in these forest types in the immediate vicinity.

Due to the deteriorating nature of the forest types within the red pine and northern hardwood stands there will be an abundance of large diameter coarse woody debris (CWD) as the dead trees fall down. As the Oak/Hardwoods stand matures more opportunity for large diameter CWD will accumulate. Within all stands small diameter CWD is abundant and will increase as a result of the prescribed harvest. There were also a large amount of live wildlife trees observed in the field. These included large trees of various species with large cavities, rotten portions, large dead branches and broken tops.

**Roads, Trails and Recreation:** Garnet Hill Road and the Garnet Hill Spur Road are unmaintained roads within the Peru State Forest. Garnet Hill Road leaves Curtain Road and travels west through the state forest and adjacent private land and exits into a private lake community located off of Smith Road in Peru. Garnet Hill Spur Road leaves Garnet Hill Road and ends at the overlook on Garnet Peak. There are no private dwellings located along Garnet Hill Road or the Spur Road, however there are several fire water holes, foundations and adjacent stonewalls.

Both roads are currently in poor condition and only accessible by high clearance 4x4 vehicles or by foot due to holes and rocks. Many water control features of the road have failed due to lack of maintenance causing erosion.

As per the “Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines”, there will be a 50 foot buffer along these two roads where no more than 50% of live basal area will be harvested and no slash within 25’ of the road will remain. Where red pine plantations come to the road more than 50% of the live basal area may be harvested, an exemption for public safety

will be sought within the Forest Cutting Practices Act in these portions. The Massachusetts Slash Law will be observed beyond the 25' no slash zone.

Peru SF is open to all legal passive recreation activities that are allowed on DCR properties including hunting, fishing, snowshoeing, hiking and birding. Although there is no formal recreation areas located within the Peru State Forest there are several sites commonly used by the public. These sites are currently not maintained by the DCR.

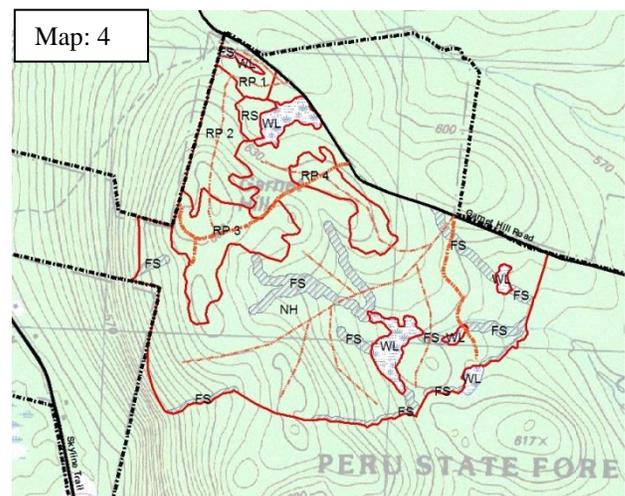
- Garnet Peak – This is an unmaintained recreation area used by hikers, horseback riders and ORV users to view the scenic vista, picnic and camp (not permitted). This area historically was popular for blueberry picking as well. Currently access is limited to OHV vehicles and foot traffic due to the poor condition of the Garnet Hill Road and the spur road. This area falls within the red pine plantations that are experiencing heavy tree mortality.
- Plane Crash Site – There is a large 5 foot tall fieldstone memorial located near the eastern edge of the project area to honor the victims; 13 paratroopers who died and 3 who survived when an Army plane crashed on August 15, 1942. Until recently this site was accessible by foot on a poorly maintained trail, which most likely was the unplanned path cut by the rescue party to access the crash. During the summer of 2017 DCR staff by request of the town of Peru improved/relocated the path to access the site for the 75<sup>th</sup> anniversary memorial service. In the past DCR staff had assisted family members to gain access to the site. More information about the memorial can be found by following the Berkshire Eagle Link below.  
[http://www.berkshireeagle.com/localnews/ci\\_9374534](http://www.berkshireeagle.com/localnews/ci_9374534)

**Cultural and Archeological Feature:** There are no known pre-contact sites within the proposed project. There are several Civilian Conservation Corps (CCC) era fire water holes as well as homestead foundations and remaining stone walls found within the harvest area. These foundations and stone wall segments are the remains of the Zacharian Haskell Farm, Athorpe Farm, and Moses Cone Farm, Herman Cone Farm, and the Abby Lot all of which were acquired by the State between 1924 and 1926. The CCC era features were constructed by Camp# S-74 while it was in operation. These known features as well as any other features found within the project area will be protected from disturbance during operation and will be treated according to guidelines set forth in the “Bureau of Forestry – Cultural Resource Management Protection Standards & Guidelines”.

### **Stand Data:**

**Forest Stand Attributes:** This prescription will describe the conditions and treatments within the 280 acre project area. (Map: 4) This project area will be broken up into three forest types for silvicultural treatment. These types will be red pine (58 acres), red spruce (3 acres) and northern hardwoods (205 acres). The remaining 14 acres consist of wetlands that will not be managed.

**Disturbance History:** Much of this State Forest including the prescribed project area were agricultural land until early in to the 20<sup>th</sup> century. Some areas were re-planted with red pine, white pine or Norway spruce while other areas were left for natural succession to take over. According to department records of 1927 much of the natural



regeneration consisted of grey birch, aspen, black cherry, sugar maple, ash, beech and yellow birch from brush size to 8” diameter and generally of poor condition.

This project area has been shaped in recent years by red pine scale and ice storms. There has been no recent forest management conducted by the DCR in this prescribed area since planting occurred based on department records however, 12 timber harvests have occurred since 1981 in adjacent areas. These harvests consisted of similar silvicultural practices as will be prescribed here.

**Stand Structure:** All three of these forest types are approximately 90-100 years old and are considered to be fully stocked. The northern hardwood stand is in fair to poor condition due to storm damage. Due to biotic (insect and disease) agents the overstory trees of the red pine are in significant decline. These original single age class stands are beginning to break up due to the above mentioned disturbances and regenerate slowly a mix of native tree species. The red spruce type is in fair condition.

**Red Pine (RP):** Since the ice storm of 2008 these plantations have been in decline due to the sustained physical damage. This has allowed the red pine scale to quickly spread causing mortality. Density throughout these stands range from high to sparse as a result of the red pine scale, existing canopy openings larger than one acre from deceased trees are present. Due to the highly variable state of the red pine no overstory inventory has been taken. Based on a visual inspection while conducting the understory exam the remaining live red pines are an average of 14” DBH and 60’ in height. Most of the trees have crown damage and many show signs of red pine scale. The red pine type can be separated into two distinct plantations; the ridge top stand and the lower stand.

- **Ridge Top Stands 2&3:** The overstory of these areas is very thin with present mortality ranging from 40-100 percent. Stand 2 has dense fern cover and areas of exposed bedrock resulting in a “savanna” type stocking of residual red pine and regeneration larger than 5”dbh. Within stand 3 much of the understory regeneration is above the 5” dbh mark and the stand is considered fully stocked. The understory of this plantation consists of a dense shrub layer as well as emerging tree regeneration. Regenerating tree species are dominated by red maple, beech, striped maple, serviceberry and yellow birch. There is also red oak, black cherry, white ash, red spruce and sugar maple present. Throughout these stands mountain ash, white pine and fir were also noted although they are not well represented in the inventory. The shrub and herbaceous species present include ferns, briars, may flower, sarsaparilla, grasses, high bush blueberry, low bush blue berry, azalea, vines, arrow-wood and lycodium.

Table 1: Red Pine Ridge Top Stand Existing Understory Tree Species (Live trees less than 5”dbh)

SPECIES	Size Class				Total
	>1'	1'-4.5'	4.5'-1"	1"dbh+	
Red Maple	82.50	22.50	22.50	7.50	<b>135.00</b>
Beech	56.25	30.00	15.00	30.00	<b>131.25</b>
Striped Maple	60.00	30.00	18.75	11.25	<b>120.00</b>
Serviceberry	26.25	22.50	11.25	22.50	<b>82.50</b>
Yellow Birch	37.50	15.00	7.50	11.25	<b>71.25</b>
Red Oak	30.00	18.75	0.00	0.00	<b>48.75</b>
Black Cherry	15.00	11.25	15.00	0.00	<b>41.25</b>
White Ash	15.00	3.75	3.75	3.75	<b>26.25</b>
Red Spruce	3.75	11.25	0.00	7.50	<b>22.50</b>
Sugar Maple	0.00	0.00	0.00	3.75	<b>3.75</b>
<b>Total</b>	<b>330.00</b>	<b>165.00</b>	<b>93.75</b>	<b>97.50</b>	<b>686.25</b>

- Lower Stands 1&4: These stands show less mortality than 2 and 4 described above. It is estimated that 20-50% of the Lower Stands have experienced mortality however; there are pockets within these stands of 100% mortality. The understory of these stands is dominated by beech, red maple, red oak and yellow birch. Hop-hornbeam, stripe maple, black cherry, red spruce and white pine was recorded in lesser amounts. (Table 2) Although not recorded on plot, mountain ash was observed within stand 4. Shrub and herbaceous species recorded on plots within these stands were ferns, mayflower, sarsaparilla, low bush blue berry, azalea, high bush blueberry, hobble bush, lycopodium, wild strawberry, winter berry, briars, arrow-wood, grasses, Solomon’s seal and starflower.

Table 2: Red Pine Lower Stand Existing Understory Tree Species (Live trees less than 5”dbh)

SPECIES	Size Class				Total
	>1'	1'-4.5'	4.5'-1"	1"dbh+	
Beech	25.71	150.00	51.43	30.00	<b>257.14</b>
Red Maple	102.86	30.00	12.86	17.14	<b>162.86</b>
Red Oak	115.71	25.71	0.00	8.57	<b>150.00</b>
Stripe Maple	55.71	8.57	0.00	4.29	<b>68.57</b>
Black Cherry	25.71	25.71	17.14	0.00	<b>68.57</b>
Yellow Birch	8.57	12.86	4.29	8.57	<b>34.29</b>
Red Spruce	12.86	8.57	0.00	0.00	<b>21.43</b>
Hop-hornbeam	0.00	17.14	0.00	0.00	<b>17.14</b>
White Pine	4.29	0.00	0.00	0.00	<b>4.29</b>
<b>Total</b>	<b>351.43</b>	<b>278.57</b>	<b>85.71</b>	<b>68.57</b>	<b>784.29</b>

Due to red pine mortality, snags and downed trees in these stands range from 20-100% of the stems over 12”dbh per acre. Most snags observed on plots were red pine; however several hardwood snags were seen throughout the stand. The inventoried range of coarse woody debris (CWD) within the four stands was 209.7 – 917.3 cu.ft./ac. This fluctuation is probably due to the variability or patchiness in mortality. This CWD assessed is greater than three inches in diameter and three feet in length. Although the 209 cu.ft./ac in stand 1 is currently below the recommended minimum of 256 cu.ft./ac of CWD as required in the “Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines”, this amount is expected to increase post-harvest.

**Northern Hardwoods (NH):** This stand is over stocked with an overstory basal area of 106 ba/ac and an average of 144 trees/acre. According to local stocking charts this falls in between the B and A level. When a forest stand is “overstocked”, trees are in competition for light, nutrients, and growing space inducing mortality in weaker and/or understory trees. Under the current condition the stand is low quality due to ice storm damage and poor growing conditions. Acceptable growing stock, trees free of mechanical and biological defects, account for 43% of the stand. Red maple, beech, yellow birch, black cherry, sugar maple and white ash dominate the overstory with red spruce, black birch, red oak, paper birch and white pine present in smaller amounts. Several red spruce and mountain ash were observed in the stand however they were not represented in the plots. The quadric mean of the overstory stand is 11.6”dbh with several measured trees reaching 36”dbh. (Table 3)

The understory of this stand is dominated by American beech seedling and saplings of all size classes (2995 stems/acre). Other understory species include striped maple, yellow birch, red oak, service berry, black cherry, red maple and sugar maple. (Table 4) Shrub and herbaceous species recorded on plots within these stands were ferns, hobblebush, Solomon’s seal, grasses, briars, may

flower, wild strawberry star flower, vines, sarsaparilla, trillium, twin flower, partridge berry, low bush blue berry, lycopodium, azalea, hawthorn, and arrow-wood.

Throughout the stand there is an average of 20.6 snags per acre. The majority of these snags are red maple, beech and red spruce over 12”dbh. Snags as large as 24”dbh were recorded in the stand inventory and black cherry snags over 28”dbh were observed in the field (Table 5). An average 581 cubic feet of coarse woody debris (CWD) per acre were recorded in inventory transects. This material is greater than three inches in diameter and three feet in length. Much of this CWD is a result of the 2008 ice storm and is still in the hard/sound category. This figure exceeds the recommended minimum of 256 cubic feet of CWD as required in the “Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines”.

Table 3: Northern Hardwoods Overstory (all measured trees greater than 5”dbh)

	All species	Red Maple	Beech	Yellow Birch	Black Cherry	Sugar Maple	White Ash	Red Spruce	Black Birch	Red Oak	Paper Birch	White Pine
<b>Basal area (square feet)</b>	<b>106</b>	30	25	18	13	5	5	3	2	1	1	1
<b>percentage of stand BA</b>	<b>100</b>	29	24	17	13	5	4	3	2	1	1	1
<b>% in AGS</b>	<b>43</b>	28	11	89	70	38	29	80	67	100	50	0
<b>Stems per Acre</b>	<b>144</b>	39	43	27	11	7	5	5	2	1	3	.5
<b>Quadric Mean Diameter</b>	<b>11.6</b>	11.9	10.4	11.0	15.2	11.7	13.7	11.5	13.7	13.2	8.8	20
<b>Relative Density</b>	<b>71</b>	18	24	11	5	5	2	2	1	1	1	0
<b>Sawlog Gross Total (bd/ac)</b>	<b>6742</b>	1855	1162	953	1262	253	521	417	180	100	0	35
<b>Cords Gross Total (cda/ac)</b>	<b>31.2</b>	9.5	6.4	4.9	4.7	1.6	1.5	1.0	0.6	0.4	0.4	0.2

Table 4: Northern Hardwoods Understory (measured trees less than 5”dbh)

SPECIES	Size Class				Total
	>1'	1'-4.5'	4.5'-1"	1"dbh+	
Beech	196.50	342.00	259.50	100.50	<b>898.50</b>
Stripe Maple	162.00	66.00	28.50	3.00	<b>259.50</b>
Service Berry	141.00	19.50	3.00	1.50	<b>165.00</b>
Yellow Birch	72.00	52.50	7.50	4.50	<b>136.50</b>
Red Maple	120.00	6.00	4.50	6.00	<b>136.50</b>
Red Oak	43.50	15.00	0.00	0.00	<b>58.50</b>
Sugar Maple	34.50	15.00	1.50	6.00	<b>57.00</b>
Black Cherry	33.00	6.00	0.00	1.50	<b>40.50</b>
Red Spruce	4.50	7.50	1.50	3.00	<b>16.50</b>
White Ash	12.00	0.00	0.00	0.00	<b>12.00</b>
White Pine	6.00	0.00	0.00	0.00	<b>6.00</b>
Dogwood	1.50	0.00	1.50	0.00	<b>3.00</b>
<b>TOTAL</b>	<b>826.50</b>	<b>529.50</b>	<b>307.50</b>	<b>126.00</b>	<b>1789.50</b>

Table 5: Northern Hardwoods Snags

	All species	Red Maple	Beech	Yellow Birch	Black Cherry	Sugar Maple	White Ash	Red Spruce	Black Birch	Red Oak	Paper Birch	White Pine
<b>Basal area (square feet) Snags</b>	15.3	6.7	2.7	0	3.3	0	0.7	1.3	.07	0	0	0
<b>Trees per Acre Snags</b>	20.6	9.3	3.2	0	3.6	0	1.96	1.4	1.2	0	0	0

**Red Spruce (RS):** This stand was originally mistyped as Norway spruce plantation. Due to it being retained as un-managed no formal survey was conducted. Based on a visual survey this stand has a fully stocked overstory dominated by red spruce with individuals of white pine, hemlock and black cherry present in smaller amounts. This stand is composed of a large red spruce trees in fair health.

The understory of this stand is occupied by red spruce, and hemlock with small amounts of hardwood species present. In this stand blueberry, ferns and grasses are the predominant ground cover species.

### **Evaluation of Data, Silviculture and Projected Results:**

**Primary/Secondary goals:** The primary goal of treatment in these stands will be to ensure future diversity of age, size and species mixture by demonstrating several types of silviculture. These practices will help in ensuring diverse and resilient forests as directed in the goals of the “Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines”. This is being accomplished by creating a well-planned and balanced science based forestry plan.

Secondary goals of this project are to capture value of damaged and/or diseased trees and to provide raw materials to the forest products industry. This project will also assist the community by repairing the forest roads / trails and provide income to the town from the Forest Product Trust Fund.

**Red Pine Plantations:** Due to the species composition and rapid mortality of these stands, even aged silviculture will be utilized to manage for improvement. The silvicultural practices in these stands will be an overstory removal with reserves of native hardwoods. These stands will be managed to change this stand from a planted red pine dominated overstory to a natural oak – hardwood stand. Forest management efforts will also be aimed at creating and maintaining vertical structure (tree heights) by retaining the present native hardwood and softwood species as well as protecting the desirable regeneration (trees under 5”dbh) within these stands. Red oak, white pine, red spruce, black cherry and red maple are predominate native species present within these stands.



This harvest will create openings in the current overstory greater than 1/3 acre and therefore DCR Commissioner approval has been obtained as required in the “Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines” . The stand will remain fully stocked upon completion of this harvest, consisting roughly of 20-40 native trees per acre, approximately 60-100 saplings (1”-5”dbh) per acres, and 589-706 seedling (under 1”dbh) per acre.

The primary objective of the treatment in these stands is to remove the diseased red pine while retaining, protecting and releasing the small pole understory and advanced regeneration currently in place. The secondary objective of management in these stands is to capture the potential product and value of the red pine prior to total stand mortality.

- **Silviculture Methods:** An overstory removal also called single stage shelterwood with reserves will be prescribed for the red pine plantations. This will be the only step in converting these plantations to new natural oak-hardwood stands. Within these stands all red pine will be removed except when needed to satisfy filter strip requirements. It is anticipated that all poplar will be harvested promoting the sprouting and retention of this species in the future. Trees of other species including red oak, white pine, red spruce, black cherry and red maple which make

up approximately 10 percent of the current overstory will be retained during the harvest to provide structural diversity and a seed source in the stand. After this harvest releases the current understory (a new age class) will be established under the reserved overstory trees.

- **Desired Future Conditions:** By releasing the sapling sized stand of hardwoods by harvesting the diseased red pine, the resulting stand will provide habitat diversity in size and structure in the larger forest ecosystem for years to come. Each of these stands will appear different post-harvest due to differences in the current understory, amount of other over story species present, current amount of mortality, and elevation. The future composition of the stand will be native hardwoods with varied amounts of softwoods dispersed throughout. It is anticipated that the current beech regeneration will not thrive under the full light exposure post-harvest.
- **Anticipated Future Treatments:** This stand should be examined in approximately 5 years to ensure the desired advanced regeneration has survived and additional regeneration is of desired species. No further treatment is expected until this stands reaches 40-50 year old, at which time commercial thinning may be conducted.

**Northern-Hardwoods:** Although there is diversity in species composition over the 205 acres of this forest type it can all be considered a single stand based on age class. Due to environmental factors that include high elevation/wind, ice damage, emerald ash borer, beech bark disease, black knot and sugar maple borer, these stands are considered high risk/low quality. There are currently some small natural openings as a result of these factors. The silviculture within this forest type will utilize irregular shelterwood with patch openings that vary in size from approximately 3 to 5 acres to begin transforming the single cohort, poor quality / high risk stands into uneven aged, irregular structured stands. This project has the approval from the DCR Commissioner as required in the “Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines” for harvest opening larger than 1/3 acre.

Within these northern hardwood stands there are inclusions of hemlock and white pine as both individuals and groups up to several acres. The density of the softwood inclusions is higher surrounding wetlands which will in most cases extend the no harvest buffer beyond the currently mapped wetlands. Care will be taken to retain the individual softwood species throughout the project area.

Due to crown loss in overstory trees there is a current understory of desirable species including cherry, maple and birch as well as undesirable beech. Retaining desirable understory trees will be a priority.

- **Primary/Secondary goals:** The primary goal of treatment in these stands will be to convert to irregular structured, uneven aged northern hardwoods with diversity of the tree, shrub and herbaceous layers. Other goals of harvesting in this area are to provide areas of early succession habitat as well as structural diversity for wildlife species that depend on young forest conditions.
- **Silviculture Methods:** These stands will be managed using an irregular shelterwood system. Initial cutting to create openings up to 5 acres will start the process of creating irregular structure across the 205 acre stand. Small openings will favor more shade tolerant species such as sugar maple and yellow birch, particularly where established. The larger openings will be created where shade intolerant and mid tolerant species such as black cherry, black birch and white pine are present and favored. Opening size, location, shape, and retention of overstory trees will take into consideration and follow when applicable the attached recommendations from MA DFW. Openings will not cover more than 50% of this forest type. Between these openings the stands will be thinned at varying amounts based on health, stocking and quality

removing up to 75% of the basal area. Chemical control of beech may be used in these stands to ensure other desirable native species will be competitive after the harvest.

- **Desired Future Conditions:** Ten years after this treatment it is anticipated that these stands will have greater diversity in size and structure. The openings created will provide early successional habitat and species that require it will flourish. It is anticipated that the current beech regeneration will not thrive under the full light exposure post-harvest.

**Red Spruce:** This small stand of native red spruce will be retained in the current state and no silvicultural work will be conducted. Retention of this stand will add to the overall diversity of the forest by retaining healthy mature conifer trees.

**Anticipated Future Treatments:** These stands will be monitored in approximately 7-10 years to determine regeneration success. Combinations of the “expanding gap” and “extended” irregular shelterwood variants may be used depending on regeneration success; gaps are expanded from successfully regenerated areas and the overstory cohort is held or extended in the absence of successful regeneration. If the density of beech regeneration becomes a concern, chemical control may be prescribed.

**Logging System Requirements:** This project will be divided into two operational units based on forest product type due to size, location, market, equipment, and seasonal restrictions. The harvesting of the red pine stands will be primarily accomplished with a cut-to-length harvester and forwarder to ensure work is safely, efficiently and effectively. Use of this this set of mechanized equipment will also protect the existing understory. Within the hardwood stand there will be no equipment restrictions. Whole tree harvesting will be allowed in both the red pine and hardwood stands.

**Project Access and landings:** Access to the proposed project area will be from Route 143 in the town of Peru, south onto Curtin Road then west on Garnet Hill Road. The project area begins approximately ½ mile from Curtin Road. Garnet Hill Road traverses the length of the project area and then continues off of state land. Coordination with the Town of Peru and the abutting land owner will be sought when determining the type and amount of repair needed on Garnet Hill Road.

There are no currently existing landing areas large enough to support a modern timber harvest operation. Currently three landings will be proposed off of Garnet Hill Road to support a variety of equipment setups. Efforts will be made to set the landing back approximately 50 feet from the road to ensure the required buffer strip is kept intact where feasible. Each of these proposed landing may be converted to parking areas after the forest products harvest is complete.

**Forwarder Road and Skid Trails:** Throughout the project area forwarder / skid trails will be laid out to avoid all water features and to avoid steep slopes. Any existing segments will be evaluated and connected as needed. Primary skid trails will be laid out and marked prior to the project being advertised. Any unavoidable stream or wetland crossing will be designed at or above the standards of the “Massachusetts Forestry Best Management Practices”.

Upon completion of all harvesting activity all forwarder / skid road will be left in a stable state and water bars will be installed according the “Massachusetts Forestry Best Management Practices”. All stream/wetland crossings will be stabilized and entrances will be blocked to prevent illegal access.

**Wildlife Resources:** Sale layout will incorporate the attached recommendations from MA DFW to help promote both early seral and provide unique high elevation habitat types. Current snags will be retained; however operators have the right to remove any snag that poses a safety hazard to themselves or equipment. Operators will not be required to utilize cull trees, if left behind they will add to the amount of large diameter CWD. Limbs and tops (slash) may also be left in place to augment existing CWD and add soil nutrients through decomposition.

**In-kind Services:** Upon final tally of product the extent of in-kind services will be determined.

- Maintenance, repair, and restoration of drainage features on Garnet Hill Road and Garnet Hill Spur Road.
- Repair and restoration of illegal off-road vehicle damage of the Plane Trail, installation of water control devices to ease maintenance. An attempt to block access to illegal vehicles will be made.
- Conversion of new landing sites for recreation parking use.

**Prescription Documentation:**

**Project Marking Guidelines:** Follow the directions below for marking instructions of sale and stand level features.

**Sale Level:**

1. Locate, flag (pink wetlands) and paint with two red diagonal stripes the buffers and filter strips along all wetland and associated streams.
2. Locate, flag and paint with two red diagonal stripes the remaining wooded project boundary line. This will not be done where the project boundary is a road.
3. Flag temporary layout of the primary skid trail network with orange/yellow flagging. Using orange paint mark small noncommercial stems or stems already marked for removal located along adjusted skid trails upon completion of marking (Orange).
4. Flag temporary layout of any unavoidable wetland and stream crossing with labeled orange flagging. Using paint mark and label each crossing upon completion of marking and any final adjustment to location.
5. Locate and mark perimeter of landing and group openings with one red diagonal stripe.
6. General tree marking guide:

Marking type	Type of Tree	Tally Method	Mark Type
Leave Tree	Leave Tree	As needed	Red Horizontal Line
Cut Tree	Red Pine All Sizes	Individual tally DBH - 1/10 height	Blue Dot
Cut Tree	Cut Saw Log	Individual tally DBH & height	Blue Horizontal Line
Cut Tree	Cut Pulp/Cord Wood	Individual tally DBH - 1/10 height	Blue Dot
Cut Tree	Cut Live Cull Tree	No tally	Blue X
Cut Tree	Dead Tree Warning	No tally	Blue X

**Red Pine:** Overstory Removal: Remove all red pine within the stand. Road buffer may be reduced below the 50% basal area restriction for removal of red pine and hazard trees only. All other softwoods and hardwoods should be retained to ensure adequate stocking.

1. All live red pine

2. Road side hazard trees \ white ash

Retention of mature seed producing red oak and small diameter white ash and hemlock within the thinned portion of the stand is desirable.

**Oak Hardwoods:** Patch Cuts: On no more than 50% of the stand layout patch cuts ranging from 1/3 to five acres. Patches should be laid out to enhance current natural openings, remove portions of heavily diseased beech, and be diverse in elevation and aspect. Each patch will be delineated by one red strip painted on perimeter trees (to be retained after harvest) and GPSed to verify acreage. Within these patches all live trees 5" dbh and above will be marked for harvest, 5 trees with good wildlife features or preferred genetic stock will be left per acre. Aggregation of retention trees is preferred.

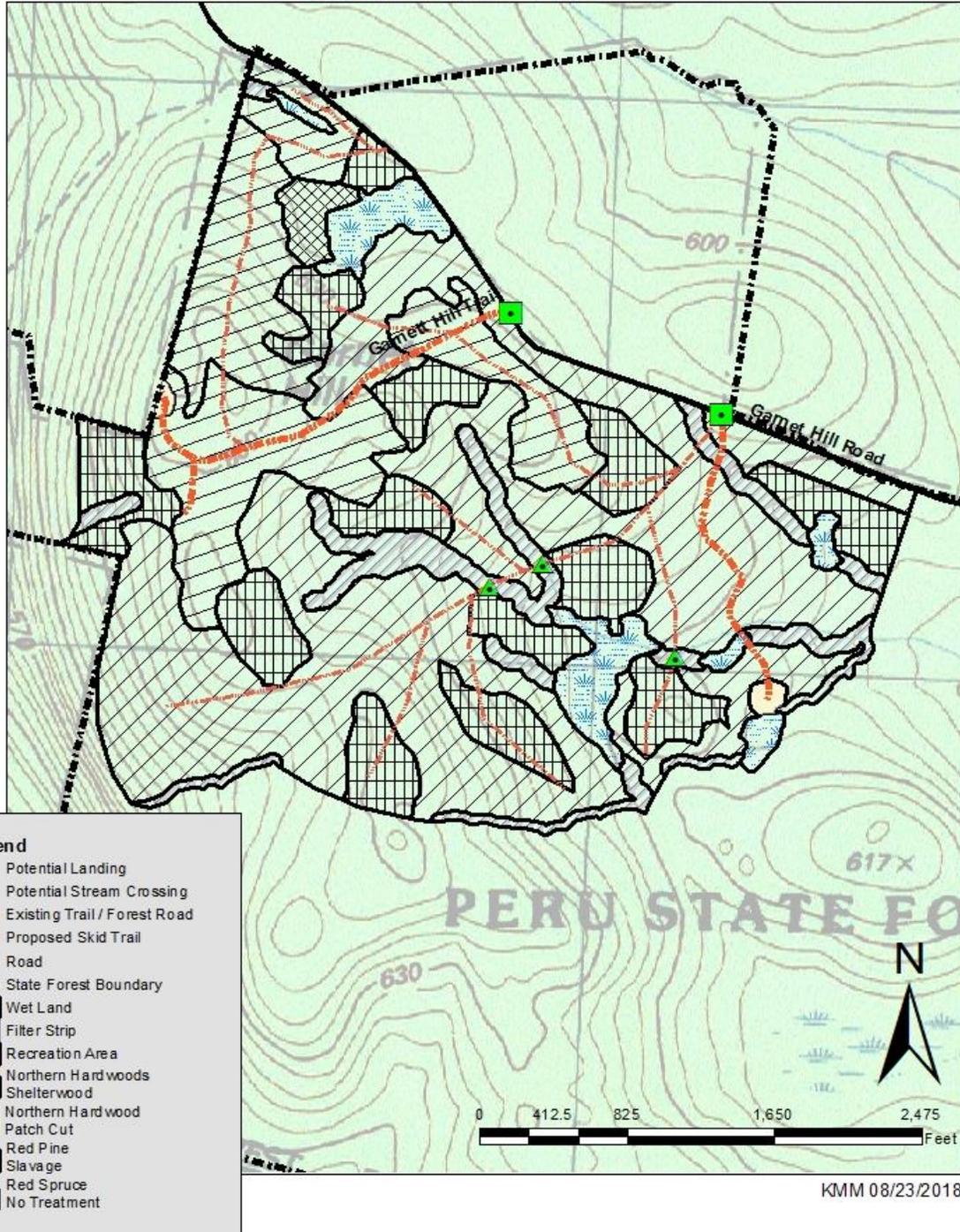
**Irregular Shelterwood:** In the remainder of the stand remove 30 to 80% of basal area within remaining project area based on existing ground conditions, including tree health, form and vigor using the following prioritized guide below. Residual density should remain higher in areas with acceptable growing stock.

1. White Ash greater than 10" DBH
2. Any infected American Beech greater than 5" DBH
3. Any species with less than 25 percent live crown
4. Unacceptable Red Maple, Sugar Maple, Birch
5. Unacceptable Red Oak
6. Unacceptable Black Cherry
7. Unacceptable Soft Wood Species
8. Other Acceptable Hardwood

Attached:

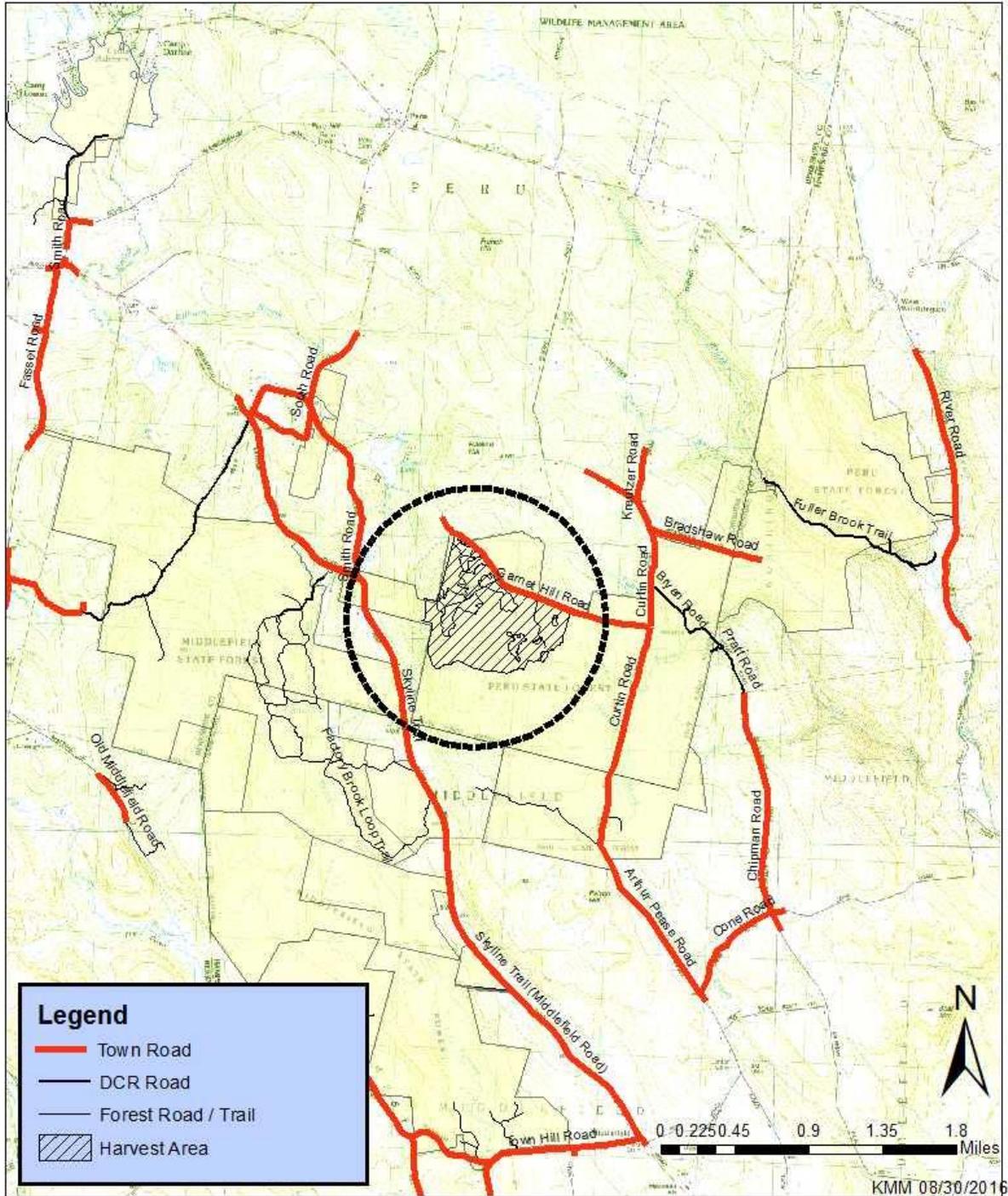
- Stand Map
- Locust Map
- MA DFW Correspondence

# Peru State Forest Garnet Hill Lot



The “Northern Hardwood Patch Cut” polygons are a representation of the how this project may be laid out. Final position will be determined on the ground during final sale layout.

# Garnet Hill Lot Peru State Forest



**Apendix A:**

**From:** Massini, Kris (DCR)  
**Sent:** Tuesday, June 26, 2018 9:57 AM  
**To:** Scanlon, John (FWE); Hawthorne, Brian (FWE)  
**Cc:** Hill, William (DCR)  
**Subject:** RE: Peru SF young forest habitat

Brian and John,

Thank you for the comments and suggestions from the wildlife perspective to improve the forestry project in the Peru SF. As I prepare the final prescription for the project I will incorporate many of the management techniques you have suggested. Due to our operational needs, current policy restraints, and value of the products to be harvested some of the requested items may be difficult to incorporate.

Spending the afternoon with Brian was a reminder of how similar but different our management programs are. When we are preparing a project with wildlife as the main goal this type of coordination is a great way to ensure we are on the right track. As this project moves forward I will keep you both in the loop.

Kristopher Massini  
Management Forester  
Central Berkshire District  
P.O. Box 1433  
Pittsfield, MA 01202  
(413) 442-8928 \*121

**From:** Scanlon, John (FWE)  
**Sent:** Friday, June 22, 2018 11:38 AM  
**To:** Hawthorne, Brian (FWE); Massini, Kris (DCR)  
**Cc:** Hill, William (DCR)  
**Subject:** RE: Peru SF young forest habitat

Brian & Kris – Thanks for looping me in on this. In turn, I'm adding Bill Hill to the copy list for his input. The Garnett Hill proposal came to MassWildlife in 2017 (see attached). I support everything in Brian's recommendations and would add a couple of additional thoughts:

- 1) Build in retention of downed woody material (DWM) using Northeast Forest Guild Guidelines. I would favor whole tree harvesting in the plantation area to get adequate sunlight on the ground to stimulate pin cherry regeneration where there is a soil seed bank resource, so identifying DWM in the plantation that will stay on the site before hand is critical. The northern hardwoods work seems amenable to wither whole tree or CLT. If CTL harvesting is used in the plantation, suggest including a contract requirement to do some loose windrowing of slash to get portions of the forest floor into open sunlight. Here is text from a MassWildlife Habitat Plan describing how retention is identified:
  - Trees to remain on site will be marked/painted in red prior to harvest. These will consist of both single and aggregate retention of both live and dead trees covering about 10-15% of the project area including mast species such as oaks, black cherry and hickory but also other species such as maple (red & sugar) and eastern hemlock. Retention groups will focus around snags, large downed logs, forested seeps and vernal pools.
  - All trees painted/marked in yellow will be felled and left on site to provide DWM. Yellow arrows (or the knot in yellow flagging) indicate desired felling direction (trees to be retained as DWM should be felled into or on the north side of retention groups so that the DWM is at least partly shaded when feasible). Average DWM volume across the site averages >10 tons/ac and is consistent with recommendations for DWM provided by the Forest Stewards Guild (2010) See link below..

- 2) Identify opportunities for aspen regeneration within the northern hardwood regeneration patches. Try to focus one or more larger (4-5 acre) patches on an amenable area with enough existing aspen to provide extensive root suckering following overstory removal. Ideally, cut the aspen in the dormant season. Fine to cut and leave the aspen as part of the DWM. If CTL harvesting is used, try to contract windrowing of slash to enhance aspen regeneration.

John Scanlon  
Habitat Program Supervisor  
Massachusetts Division of Fisheries & Wildlife  
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Forest Stewards Guild Biomass Working Group. 2010. Forest Biomass Retention and Harvesting Guidelines for the Northeast: [https://www.forestguild.org/publications/research/2010/FG\\_Biomass\\_Guidelines\\_NE.pdf](https://www.forestguild.org/publications/research/2010/FG_Biomass_Guidelines_NE.pdf)

**From:** Hawthorne, Brian (FWE)  
**Sent:** Friday, June 22, 2018 10:11 AM  
**To:** Massini, Kris (DCR)  
**Cc:** Scanlon, John (FWE)  
**Subject:** Peru SF young forest habitat

Kris,

Thanks for the opportunity to visit the Garnet Hill section of the Peru State Forest with you on Wednesday afternoon. Your proposed harvest their sounds like it will be a great benefit to wildlife in the area. I am writing to summarize our discussion, and I am cc'ing John Scanlon, in case he has any comments to add. Please correct me if I am misremembering anything from our walk.

You said that under the DCR forest management guidelines for this site, you would be able to salvage all of a 75-acre damaged and failing red pine plantation, and that you were looking for my input on whether that was worthwhile from a wildlife perspective, or better to just leave it to die and regenerate on its own. You also said that in the adjacent roughly 200-acre area of northern hardwoods, you could cut up to 20 openings, 1 to 5 acres in size, but retaining some number of trees per acre. In the area outside the openings, you said you could remove up to 70% of the basal area.

We first walked the northern hardwood area. I saw a mixed northern-hardwoods forest that is typical of much of the Berkshire plateau. With the exception of a few large wetlands which are at least partially shrub swamps, I saw only a few scattered patches of young forest, none of which are large enough to provide adequate room for area-dependent species that rely on such habitat. Given this lack of young forest habitat in the immediate area, I made several recommendations:

1. Where possible, openings should be as close to your 5-acre limit as possible. This is the size where habitat benefits just begin for those area-dependent species. Smaller openings will provide much less benefit.
2. Retained trees within openings should be aggregated, rather than dispersed. This will minimize the likelihood of future windthrow, and provide a small amount of closed-canopy microclimate within the opening. We discussed centering these retention groups around legacy trees, such as the few large oaks and cherries present, large white pine and spruce, or other features. We also discussed retaining a mix of species wherever possible within a retention group.

3. Locate openings on a variety of topographic positions, consistent with avoiding erosion or impacts on streamwater quality, including knolls or ridgetops, benches, or on gentle slopes. Where there are existing fern openings on ridgetops due to shallow soil to bedrock, consider locating new openings adjacent to these natural openings in order to add on additional acres.
4. Try to minimize the amount of hard edge between the young forest habitat and the surrounding closed-canopy forest. This implies roughly convex openings, rather than openings with more complex shapes or edges. Edges should be "feathered" where possible. One example might be a 5-acre opening with a single retention group within it, all other trees cut within the opening, and then a surrounding strip which varies gradually from the full 70% cut that you are allowed immediately adjacent to the opening to no cutting a couple of tree heights from the opening. This feathered edge can reduce predation on the species using the opening by providing understory cover.
5. Buffer perennial streams, intermittent streams which drain wetlands, and forest seeps by at least a 50-foot no-cut filter strip, to protect the additional habitat values provided by these resource. Use wider strips on steeper slopes or around especially well-developed forest seeps.
6. Consider locating one or more openings in the uplands immediately adjacent to a wetland, if it can be done in such away so as to avoid sedimentation into the wetland while still connecting new young forest habitat to existing shrub swamp habitat.
7. Consider clustering openings. By this, I mean that you might have openings farther apart in the sections of your stand which have steep slopes or wetlands, and closer together in the upland and flatter sections.
8. In the closed-canopy forest between the openings, consider varying the intensity of the harvest based on the topography and understory/overstory species present, including some areas with the no cutting and some areas cut as heavily as allowed. If possible, consider aggregating retention rather than dispersing retention wherever appropriate.

We next walked the red pine plantation area. Much of this is along a rocky ridgetop, with an excellent understory in places of blueberry and other dry site indicators, as well as exposed bedrock. While there are small patches of young forest habitat where the red pine mortality has been heaviest, these areas are already starting to grow out of their young forest condition, and other areas of red pine show the rather sparse understory dominated by pine-needle beds that is typical of such closed canopy red pine plantations. Salvaging as much of this red pine plantation as feasible would provide a dramatic increase in the amount of young forest habitat available, and would provide an immediate boost to the blueberry and other soft-mast-producing shrubs. I would encourage removing as much of the remaining red pine as possible to maximize these benefits.

Thanks again for providing MassWildlife with the opportunity to review this harvest. It is exciting to see the possibility for creating a significant amount of young forest habitat in a landscape which is a high priority for such habitat not only from the perspective of MassWildlife, but also as expressed to us by our partners such as Massachusetts Audubon and the Ruffed Grouse Society.

**Brian Hawthorne**

Habitat Planning Coordinator

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