dcr | Massachusetts Department of Conservation and Recreation

Silviculture Prescription

Balance Rock

Massachusetts Department of Conservation and Recreation
Bureau of Forestry

Northern Berkshire District
Balance Rock State Park
Lanesborough, MA

Prepared by:

Kevin Podkowka – Management Forester – Northern Berkshire District
Massachusetts Department of Conservation and Recreation
P.O. Box 1433, 740 South Street, Pittsfield - MA 01202
kevin.podkowka@mass.gov – 413-442-8928 ext. 125

Date

Approved by:

Management Forestry
Program Supervisor _____ Date: August 14, 2020
William N. Hill, CF

Site Data

Geology

This project is located in the Taconic Range between the east slopes of Potter Mountain and the western half of Laurel Hill. Slopes of the project are in the range of 1% - 2% in the southern portions of the project area and up to 30% in those areas around Laurel Hill. The parent materials over the site are primarily friable silt components over loose sandy and/or gravelly glaciofluvial deposits of either limestone, schist, or slate. The elevation of the project area is 1,200' at its lowest point up to 1, 600' at its highest. Due to the size of the project area there is a very broad range of soil depths with the most shallow approximately 20" to restrictive layers with other areas over 80" deep. Generally the lower in elevation on the project area, the deeper the soils.

Soils Data

The major soil associations within this project are as follows: Fredon, Halsey, Hero, Hoosic, Amenia, Pittsfield, Fullam, Lanesborough, Taconic, and Macomber. They are generally fine loams consisting of either sand or silt. Gravelly and/or stony components are located within the higher elevations of the sale area. Higher site productivity is contributed to fine loams and much of the site having decomposing leaf litter that is rich in nutrients (birch, ash, maple, etc.). Many areas of the site also have parent materials with a limestone component. Conditions that reduce productivity include the areas with larger gravels and stones, areas with heavier beech and oak leaf litter, and/or parent materials composed of slate and schist.

The Forest Productivity and Stand Complexity Model (Goodwin, Hill. 2012) indicates that nearly 50% the project area is considered highly productive while approximately 5% is rated as low productivity. This would indicate that areas with a dominance of American beech *(Fagus grandifolia)* regeneration; high relative basal areas of pole sized and/or mature northern red oak *(Quercus rubra)*; or areas of extensive growing stock that exhibit poor form, health, or vigor will benefit from openings 1+ acres in size. Additionally areas that have high densities of more shade tolerant species such as sugar maple *(Acer saccharum)* and yellow birch *(Betula alleghaniensis)* should be able to start new age classes in smaller openings that are 1/3 acre or less in size.

Drainage and Erodibility

Most of the site has well drained soils, with the exceptions being areas associated with wetland resources. There is a potential for rutting even though the soils are suited for skid trails and landings.

Climate

The mean annual temperature for the sale area is 39°F – 45°F with an average of 35" – 48" of preciptation per year. Strong tropical storm systems do not routinely affect this

area, but do occasionally move through, with the most recent being Tropical Storm Irene in 2008. Nor'easters and strong cold fronts from Canada have the potential for major impacts and occur more regularly. Other erratic weather events such as ice storms, early season blizzards, microbursts, and even tornados are not uncommon. Fires are also known to occur during times of drought or extended periods of dry and windy conditions; and may increase in frequency and severity in the future. This is because winters are expected to be shorter, warmer, and with less precipitation potentially lengthening spring and fall, which is when most fires occur in the northeast. The frequency of storms and the amount of precipitation is also expected to increase in the future during the summer months. According to the US Forest Service Climate Change Tree Atlas northern hardwoods and spruce/fir stands will most likely decrease. There are some species of trees located within Balance Rock State Park that may benefit from these climate changes, most notably northern red oak and various species of hickory *(Carya spp.).*

Hydrology

The wetland resources indicated on MAP 1 have been located. They currently consist of a mixture of perennial streams that also serve as boundaries for the sale area and internal intermittent streams. No vernal pools have been identified within the project area. MAP 1 also details the potential locations of filter strips that will be used for water and wetland resource protection. All activities conducted within, or near, delineated filter strips and wetlands will be compliant with current Massachusetts Forestry Best Management Practices. Water resources encountered during the marking phase of the project, that do not currently appear on MAP 1, include small intermittent streams and wooded wetlands that were too small to detect during the initial DEP wetland mapping project. If additional wetlands such as non-certified vernal pools, additional intermittent streams, upland wetlands, etc. are encountered; standards outlined in the most recent edition (currently 2013 2nd edition) of the Massachusetts Forestry Best Practices Manual will be followed as they relate to harvesting requirements, filter strips, water bars, slash management, etc.

Potential Vegetation

The project area currently supports most of the potential vegetation that is typical to the respective natural communities and forest cover types. Based on the productivity of the soils, the area was most likely cleared for agriculture; but it did not persist for an extended period of time. Overstory tree species present include northern red oak, sugar maple, red maple *(Acer rubrum)*, white birch *(Betula papyrifera*), yellow birch, white ash *(Fraxinus americana)*, eastern white pine (*Pinus strobus*), black cherry (*Prunus serotina*), black birch (*Betula lenta*), eastern Hemlock (*Tsuga canadensis*), and American beech. Ground cover, shrubs, and small tree species include princess pine (*Lycopodium spp.*), various ferns, Canada mayflower (*Maianthemum canadense*), serviceberry (*Amelanchier spp.*), striped maple (*Acer pensylvanicum*), hobblebush (*Vibernum lantanoides*), trillium *(Trillium spp.),* and rubus *(Rubus spp.)*

Archeological and Cultural Resources

All recommendations made by the DCR staff archeologist will be integrated into the project. They are as follows:

Resource Presence

A known significant archaeological resource (19-BK-44) is within the project parcel. The DCR archaeologist will visit the site and flag the area before cutting begins.

Resource Protection

Any cultural resource features located before or during the forestry project will be protected according to guidelines set forth in the *Massachusetts Forestry Best Management Practices manual, currently the 2013 2nd Edition* and indicated on harvest maps accordingly. Additional resources will be flagged, protected, photographed, and mapped. The DCR staff archaeologist will be consulted if there are any questions or concerns.

Aesthetic Resources

There are no designated scenic highways or specifically designated aesthetic resources within the project area. There are roads and trails that will be impacted by the harvest to include Olsen Road, Potter Mountain Trail, Balance Rock Trail, and Balance Rock Loop Trail. Maintaining the visual experience for the users of these roads and trails is a high priority. In order to ensure that this occurs, slash management and harvest guidelines outlined in the 2013 2nd Edition of the Massachusetts Forestry Best Management Practices Manual will be followed.

Recreation Resources

The resource based recreational activities that most forest users participate in throughout the project area are hiking, hunting, wildlife viewing, off-highway vehicle (OHV) riding, and snowmobiling. Potter Mountain Trail is a designated non-motorized trail while Balance Rock Trail and Balance Rock Trail Loop both permit OHV's and snowmobiles. As with the previous projects on Potter Mountain, recreation activities are not expected to be restricted beyond brief closures while logging is being conducted trailside.

Wildlife

Game and Non-Game Species

The wildlife occurring in this area is typical of northern forests. Observed species include black-capped chickadee, ruffed grouse, blue jay, and common crow. Other species expected to occur are black bear, various songbirds,

raccoon, various fur bearers, grey squirrel, various raptors, and other small mammals such as bats and rodents.

Recommendations by the Mass Wildlife are as follows:
The proposed expanding gap shelterwood harvest in an area hit by heavy tree mortality from EAB will likely have limited habitat impacts where 1/3 acre gaps are created, but these small gaps should favor sugar maple regeneration (Goal 2). Gaps of up to 5 acres created in the presence of >70% American beech infested with BBD Complex will likely have substantial positive impacts on wildlife, including young forest songbirds such as chestnut-sided warbler, Prairie warbler, and Eastern towhee, as well as game birds like ruffed grouse. Under "Snags and Retained Live Trees", nice to see that den trees and Beech >14" dbh[1] without BBD will be retained. When feasible, also feature overstory oak, sugar maple and hemlock retention.

Listed Species

Jefferson Salamander

Recommendations for protections measures for the Jefferson Salamander were made by the Massachusetts Natural Heritage Program and are as follows:

Required Protection Measures During Harvesting:

1) Off-road operation of motorized vehicles within 50 – 450 feet of the high-water mark of any vernal pool or potential breeding wetland habitat shall only occur during the time period beginning May 15th and ending February 28th, of any year
2) The vernal pool filter strip shall be a 50' no cut buffer zone (measured from the vernal pool high water mark). Trees shall not be cut within the 50' no cut buffer zone nor shall machinery enter this buffer zone
3) Timber harvesting between 50 and 450 feet of the vernal pool or potential breeding wetland habitat shall maintain > 70% of the area with > 65% canopy cover, or equivalent basal area, of trees > 30' in height. All trees to be harvested in this zone shall be marked prior to start of tree harvesting operations
4) Within the harvesting area, the boundary of the 50-foot no cut and the 450-foot canopy retention zone off the vernal pool(s) shall be clearly identified by flagging or marking prior to the cutting plan approval and harvesting. Boundaries shall be inspected by DCR Service Forestry or the Division prior to the start of tree harvesting operations

[1] ***Diameter at Breast Height (dbh)*** *is the diameter of a tree measured 4.5' above the ground.*

5) New forestry roads and log landings shall be located at least 100' away from any vernal pool.

Suggested protective measures

1) Increase the canopy retention to greater than 70% within the 450' buffer
2) Avoiding disruption of downed logs wherever possible (these provide habitat for mole salamanders)
3) Extend the canopy retention buffer to areas greater than 450' from suitable breeding areas
4) Leave slash and other non-merchantable portions of harvested trees in the forest as structures for wildlife.

Snags and Retained Live Trees

All snags will be retained on-site provided they do not pose a hazard to humans during or after operations. Live trees that appear to be a den or nest site either currently or in the recent past will also be retained. 1 to 3 live, large diameter (where possible >18" dbh) trees per acre and 4 live, 12" to 18" dbh trees per acre that are evaluated to have potential future value as a den or nest site will be retained at a rate of approximately 5 trees per acre.

Stand Data

Forest Stand Attributes

Forest Types

Beech – Birch – Maple; 118 acres

Composition

Red maple, sugar maple, black cherry, and white ash are the primary overstory species, while the primary ground cover consists of Canada mayflower, star flower, service berry and striped maple. Since there have been numerous forest management activities in the past the stand is trending towards an uneven-aged condition, however, the amount desirable regeneration is low and the need for a new cohort is apparent. These are the most productive stands within the project area. Complete species compositions, total and relative densities, etc. can be found in the *Stand Exam* section.

Stocking

The stand is well stocked with 122 trees per acre, and a relative density[2] of 86% (141 trees per acre would be 100% relative density). At 86% relative density there is very little room for new trees to establish, and the existing trees on-site are in significant competition contributing to stress. Under stressed conditions attacks from sugar maple borer on sugar maple trees becomes more likely and stress driven diseases such as black knot of cherry spread much more readily. The vertical complexity and diversity of ground cover within the stand is being degraded due to shading.

Pathogens

- Potential for Sugar Maple Borer
- Beech Bark Disease Complex (BBD)
- Emerald Ash Borer (EAB)
- Potential for Black Knot of Cherry

Oak – Hardwoods; 91 acres

Composition

The stand composition is very similar to that of the Beech-Birch-Maple stand, however, the amount of northern red oak and American beech is significantly increased and the amount of red maple is significantly decreased. All other constituent species, in both the overstory and understory are fairly similar in occurrence. Also, as with the Beech-Birch-Maple stand, the trend is towards an uneven-aged condition attributed to numerous forest management activities in the past.

Stocking

The relative density of the stand is 85% with 131 trees per acre (154 trees per acre would be 100% relative density). Similar to the Beech-Birch-Maple stand, there is very little room for the establishment of new trees; ground cover diversity is significantly reduced due to shading; and vertical complexity is lost due to midstory trees succumbing to shade induced mortality. The existing stand is also under stress due to extreme competition for light and growing space. Though there are not as many specific stress driven pathogens in the Oak-Hardwood stand, excessive competition leads to a condition where vigor is reduced. Reduced vigor negatively impacts growth rates and increases the

[2] ***Relative density*** *is the absolute density expressed as a percentage of a referenced level.*

instances of mortality from injuries and subsequent rot that would otherwise compartmentalize and heal.

Pathogens

- Beech Bark Disease Complex (BBD)
- Emerald Ash Borer (EAB)

White Pine – Hardwoods; 4 acres

This stand was originally identified as a viable stand for all active forest management activities, however, the stand exam revealed that a majority of the area is dominated by wetlands and/or other sensitive areas. As such, this stand will be excluded from any ground disturbing management activities but will be a candidate for exotic control work if required. Exotic control work in this area would take the form of manual mechanical treatments and appropriately labeled herbicide treatments administered by a licensed applicator. Any control work that would involve large machinery such as mowing will not be permitted.

Ground Cover

The primary species encountered during the Stand Exam were: Canada mayflower, princess pine, and mountain laurel *(Kalmia latifolia)*. A complete listing and occurrence of all groundcover species encountered can be found in the Stand Exam section.

Coarse Woody Debris

The project area has an average of 387 $ft.^3$/acre which is well above the minimum 256 $ft.^3$/acre established in the guidelines for the 2012 Landscape Designations for DCR Parks and Forests. No additional actions will be required, as biomass harvesting operations will not be permitted on this site.

Stand Exam Results

Beech-Birch-Maple Stand

Figure 1 – Beech-Birch-Maple Stand Species Composition

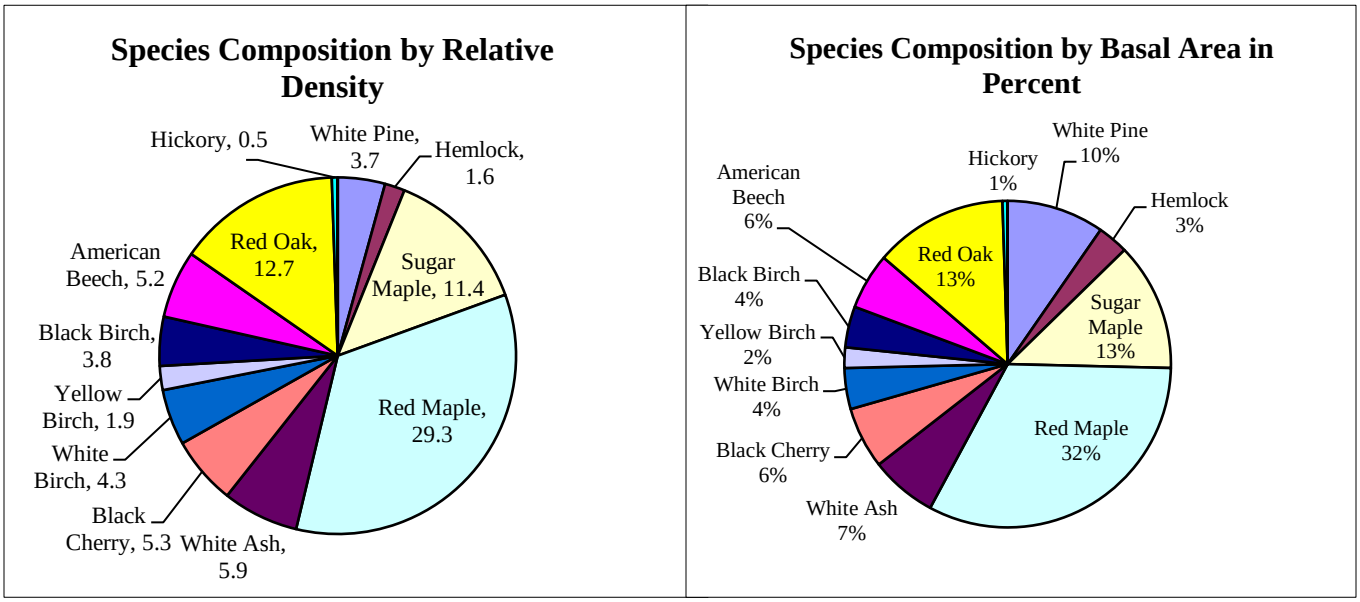


Table 1 – Beech-Birch-Maple Stand Stocking Diagnostics

Species	Total Trees/Acre	Total BA/Acre	% BA/ac by Species	Relative Density
White Pine	5.3	10.9	10%	3.7
Hemlock	5.6	3.4	3%	1.6
Sugar Maple	16.6	14.3	13%	11.4
Red Maple	45.5	36.6	32%	29.3
White Ash	7.9	7.4	7%	5.9
Black Cherry	4.0	6.9	6%	5.3
White Birch	6.3	4.6	4%	4.3
Yellow Birch	3.2	2.3	2%	1.9
Black Birch	9.1	4.6	4%	3.8
American Beech	12.7	6.3	6%	5.2
Northern Red Oak	6.4	14.9	13%	12.7
Hickory	0.3	0.6	1%	0.5
Total	122.8	112.6	100%	86
			Estimated Relative Density->>	86

Oak-Hardwood Stand

Figure 2 – Oak-Hardwood Stand Species Composition

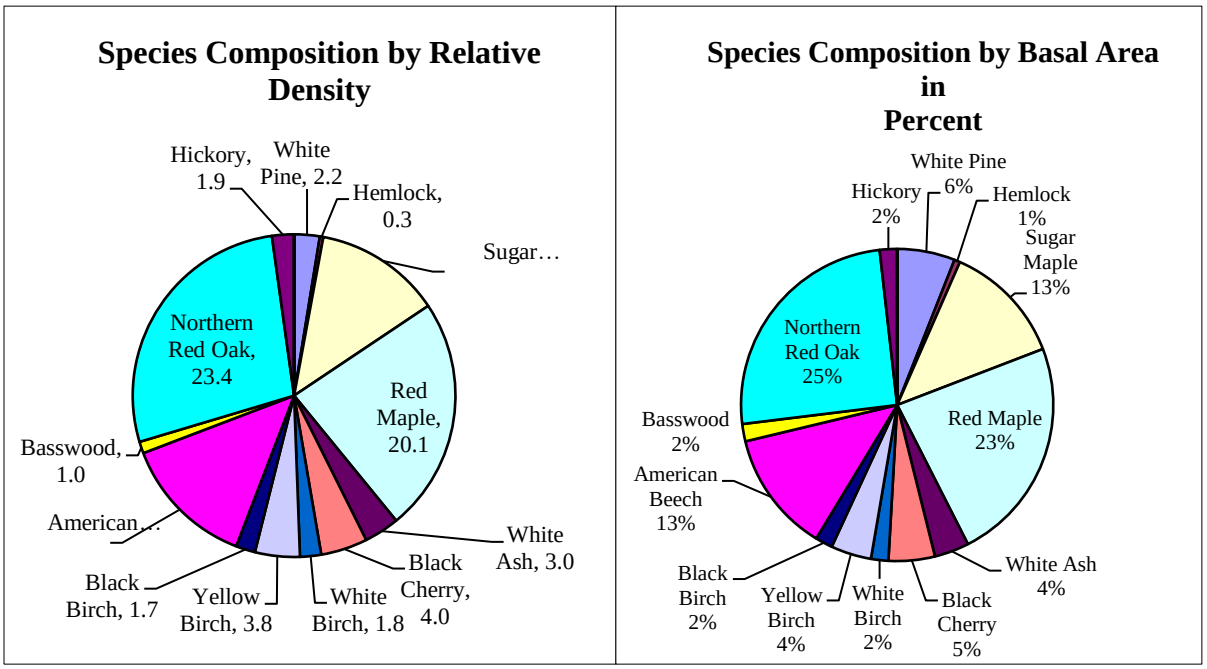


Table 2 – Oak-Hardwood Stocking Diagnostics

Species	Total Trees/Acre	Total BA/Acre	% BA/ac by Species	Relative Density
White Pine	3.5	6.5	6%	2.2
Hemlock	0.7	0.6	1%	0.3
Sugar Maple	16.1	13.5	13%	10.9
Red Maple	28.6	25.2	23%	20.1
White Ash	2.7	3.9	4%	3.0
Black Cherry	3.2	5.2	5%	4.0
White Birch	3.7	1.9	2%	1.8
Yellow Birch	10.7	4.5	4%	3.8
Black Birch	5.1	1.9	2%	1.7
American Beech	31.0	13.5	13%	11.4
Basswood	1.1	1.9	2%	1.0
Northern Red Oak	19.0	27.1	25%	23.4
Hickory	5.9	1.9	2%	1.9
Total	131.3	107.7	100%	85
			Estimated Relative Density ->>	85

Table 3 – Project Area Advance Regeneration

SPECIES		TOTAL
Beech	1013.11	1013.11
Sugar Maple	122.95	122.95
Yellow Birch	4.92	4.92
Red Maple	221.31	221.31
Black Cherry	4.92	4.92
Black Birch	14.75	14.75
Hemlock	49.18	49.18
Red Oak	93.44	93.44
Hickory	34.43	34.43
Aspen	4.92	4.92
White Birch	4.92	4.92

Table 4 – Project Area Ground Cover

SPECIES	AVG. % COVER	# plots observed
Rubus	0.42	2
Canada Mayflower	14.42	25
STRM	4.00	15
Grass	2.67	10
Barberry	0.50	2
Lycopodium	13.42	26
Garlic Mustard	1.75	4
Star Flower	1.25	9
Partridge Berry	1.75	6
Trout Lilly	0.08	1
Sedge	0.92	3
Service Berry	1.00	2
Tea Berry	1.25	4
Hobblebush	0.75	3
Mountain Laurel	5.92	5
Moss	0.83	1
Virginia Creeper	0.67	1
Azalea	0.17	1
Burning Bush	0.33	1

Data Evaluation and Projected Results

Goals and Objectives of the Balance Rock Forest Management Project

Goal 1: Successful Implementation of Silvicultural Prescription (MA DCR Goal – **Production of Wood Products, Diversified Habitats, Carbon Stock Management, Water, Recreational Opportunities**).

Objectives

- No cutting or harvesting within filter strips.
- No cutting or harvesting within 75’ of cemeteries.
- No loss of undesignated wood.
- Ensure harvesting contractor compliance with all BMP’s.
- Frequently monitor operations to minimize and/or mitigate damage to the site.
- Ensure full understanding of contractual requirements by the harvesting contractor.
- Meet success criteria specific to each stand.

Goal 2: Adequate Stocking in Harvested Areas (**MA DCR Goal – Diverse Habitats & Carbon Stock Management**).

Objectives

- 500+ stems per acre of healthy native hardwood or softwood regeneration across the stand, except those species which can dominate a site; i.e.: striped maple, pin cherry, diseased American beech, etc.; at 5 years post-harvest.

Goal 3: Increase biological diversity and introduce more complexity into existing stands (**MA DCR Goal – Diverse Habitats & Water**).

Objectives

- Install gaps within the beech-birch-maple and oak-hardwood stands in order to create early successional habitat and begin a new age class of trees.

Goal 4: Reduce populations of invasive vegetations (**MA DCR Goal – Diverse Habitats, Water, and Carbon Stock Management**).

Objectives

- Eradicate small populations of identified invasive vegetation and provide a first treatment on larger/vector populations.

Silviculture

The over-arching goal of all forest management projects on DCR lands is to fulfill the goals and objectives listed for each designation. This project is occurring on a Designated Woodland, and the goals and objectives for this land designation are listed as EXHIBIT 1. Residual basal area[3] ranges provided within objectives were determined using the Fox DS Cruiser version 2007.2 Workhorse (New Hampshire Forests & Lands Staff, 2009) which analyzes inventory data gathered in the field, and comparing those results with stocking tables located in the Silvicultural Guide for Northern Hardwoods in the Northeast (Leak et al., 2014)

[3] ***Basal Area*** *is the cross-sectional area of a tree 4.5 feet above ground. The basal area of all trees in a given land area describes the degree to which an area is occupied by trees.*

Forest Type

Beech – Birch – Maple

Objectives

Enhance diversity and complexity; i.e.: biological, density, age, size, and successional stages; manage for superior crop trees; pre-salvage white ash; create horizontal and vertical structural complexity; begin a new age class of trees; and control understory beech. This will be accomplished by:

- The introduction of a new cohort of regeneration by installing new gaps and expanding initial gaps with each successive entry
- Retaining legacy trees in the overstory;
- Varying thinning densities which will create a range of tree densities and light conditions in the understory
- Removing trees that are not expected to survive until the next silvicultural entry, freeing up resources and growing space
- Promoting crop trees that are ecologically desirable.
- Gaps that are created will comply with the standards set forth in the 2012 Landscape Designation for DCR Parks and Forests as it relates to retained trees.
- The average residual basal area for the stand will be between 50 ft^2 and 80 ft^2 of basal area per acre.

Harvesting Techniques

An expanding-gap variant of the irregular shelterwood system will be installed with the intention of expanding either previously conducted work or naturally occurring clearings. Gaps will be no less than 1/10 of an acre and will not exceed 1/3 of an acre unless the area is greater than 70% diseased beech, in which case the measures described in BBD Mitigation will be implemented. The stand will also be thinned between the installed gaps using variable density thinning within the range identified.

Table 5 – Beech-Birch-Maple Stand Estimated Volumes

Species	Sawtimber	Cords	Sawtimber	Cords
White Pine	68,204	10	159,142	22.3
Hemlock	670	3	12,724	53.1
Sugar Maple	12,248	13	110,233	113.3
Red Maple	88,255	273	88,255	273.1
White Ash	61,400	78	3,232	4.1
Black Cherry	24,184	9	56,428	20.0
White Birch	0	27	0	62.6
Yellow Birch	3,249	11	7,582	24.7
Black Birch	2,534	16	5,912	36.8
American Beech	14,769	87	3,692	21.7
Northern Red Oak	72,387	22	168,902	50.8
Hickory	0	1	0	11.3
Total	347,899	547	616,103	693.9

Oak – Hardwoods

Objectives

Objectives

Enhance diversity and complexity; i.e.: biological, density, age, size, and successional stages; manage for superior crop trees; pre-salvage white ash; create horizontal and vertical structural complexity; begin a new age class of trees; and control understory beech. This will be accomplished by:

- The introduction of a new cohort of regeneration by installing gaps in areas that are dominated by northern red oak.
- Retaining legacy trees in the overstory.
- Thinning will not be conducted between gaps because of residual basal area retention considerations
- Gaps that are created will comply with the standards set forth in the 2012 Landscape Designation for DCR Parks and Forests as it relates to retained trees.
- The average residual basal area for the stand will be between 50 ft^2 and 80 ft^2 of basal area per acre.

Harvesting Techniques

The irregular shelterwood system will also be used in this forest type to create irregular forest structure (multiple height and age classes) over a period of silviculture entries, One acre gaps will be installed within areas that are deemed to have a high potential for oak regeneration. Retained live tree requirements within gaps will focus on superior oaks that are vigorous and healthy. Scarification within the gaps will be encouraged and all competing vegetation down to 1" in diameter will be removed or destroyed as much as operationally feasible. Due to the amount of disturbance required in these areas treatment for invasive vegetation will occur prior to harvesting activities. Those areas that are dominated by 70% or more of diseased beech will be treated in accordance with the section listed as BBD Mitigation.

Table 6 – Oak-Hardwood Stand Estimated Volumes

Species	Sawtimber	Cords	Sawtimber	Cords
White Pine	30,878	5	72,048	11.2
Hemlock	0	1	0	6.8
Sugar Maple	3,123	6	59,340	110.8
Red Maple	36,277	167	36,277	167.2
White Ash	31,118	24	3,458	2.6
Black Cherry	18,976	1	44,278	2.5
White Birch	2,645	7	6,172	15.6
Yellow Birch	0	14	0	31.9
Black Birch	0	8	0	17.8
American Beech	20,724	144	5,181	36.1
Basswood	1,250		23,741	
Northern Red Oak	85,019	34	198,379	79.5
Hickory	0	1	0	20.7
Total	230,010	411	448,872	502.6

Pathogen Mitigation

Sugar Maple Borer

Sugar maple showing signs of borer damage, as well as mature sugar maple that are of poor health and/or vigor will be biased for removal. The only exceptions to this are those trees within 1 tree length of a group selection opening, as they will help to provide a seed source for new regeneration.

EAB

White ash trees greater than 10" in diameter will be biased for harvest due to the presence of emerald ash borer (EAB) in the project area. This forest pest has an approximate mortality rate of 99% on infested ash trees.

BBD

Beech greater than 6" in diameter and showing signs of BBD will be biased for removal. Healthy beech trees with no signs of infection and 10" + in diameter will be biased for retention. Areas with beech infected with BBD comprising more than 70% of the basal area of all species combined will have gaps of up to 5 acres installed. Future treatment recommendations will include the continuance of expanding gap treatments and creating the largest gaps in areas with BBD infested beech.

Invasive Vegetation

As part of the monitoring program implemented by DCR Bureau of Forestry – State Lands Management, data is collected on forest management projects within 5 years of completion. That data includes the location and density of invasive vegetation. The treatment of located vegetation will be coordinated with the DCR's Forest Ecologist as necessary, and will be accomplished via in-kind services in future projects located within the administrative unit of that forest or park. Minimal noxious and invasive vegetation is considered to be of a density and distribution that can be managed with local resources. Those resources may include on-site staff, contracting/in-kind services, volunteers, etc.

Desired Future Conditions

(Present – 100 Years)

Beech-Birch-Maple and Oak-Hardwood Stands

These stands will begin regenerating species such as black cherry, yellow birch, sugar maple, red oak and white ash. Areas where large gaps were installed on mesic sites are expected to continue to have high densities of beech; but pioneering hardwoods such as black cherry, white birch, yellow birch, and potentially aspen are expected to become established and overtake the regenerating beech to create more biologically diverse areas within the larger stand. Ground cover will increase in both diversity and occurrence after the canopy is either thinned and/or removed, but will become gradually more shaded and remaining understory vegetation will be comprised of a

sparse understory of shade loving plants. The more xeric sites will have less regenerating white ash and sugar maple, but more red oak. Near the end of the 100-year mark at least 3 more entries will have been made in these stands with similar objectives to this entry; allowing for a healthy, vigorous, and diverse stand that averages stocking between 60 ft^2 – 100 ft^2 ba/ac at any given point during this time period.

Logging System Requirements

Harvesting

This site is acceptable for both hand-felling and mechanized harvesting. Damage to the residual stand and advance regeneration will be minimized by requirements for controlled directional felling and the strategic placement of skid trails. Tops from trees will be required to remain where the tree is felled. Delimbing operations will not be permitted on any landings.

Skidding and Forwarding

Grapple and/or cable skidders will be permitted on this project. Forwarders will also be permitted, but not required on the sale. All guidelines and requirements listed in the Massachusetts Forestry Best Management Practices will be met, and when possible, exceeded.

Landings and Hauling

Due to the anticipated location of the primary landing for this project harvesting and hauling operations will not be permitted on Sundays or State Holidays. Landings will not have large diameter debris or an excessive amount of cut-off ends or blocks within the landing area. Landings will be of sufficient size to allow log trucks to be completely off the road while loading, and may require additional gravel or fill material to accomplish this.

References

Goodwin, D.W. and W.N. Hill. 2012. Forest Productivity and Stand Complexity Model [A GIS Grid Analysis using ArcGIS®]. Massachusetts Department of Conservation and Recreation, Amherst, MA.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Available online. Accessed [11/30/2017]

Natural Heritage & Endangered Species Program Staff. Massachusetts Division of Fisheries and Wildlife. NHESP Priority Habitats of Rare Species. Available Online. Accessed [11/30/2017]

Leak, Yamasaki, Holleran. 2014. Silvicultural Guide for Northern Hardwoods in the Northeast. US Forest Service Northern Research Station.

New Hampshire Forests & Lands Staff. 2009. Fox DS Cruiser ver 2007.2 Workhorse. New Hampshire Forests and Lands, Concord, NH.

Massachusetts Department of Conservation and Recreation Staff. 2012. Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines. Massachusetts Department of Conservation and Recreation, Boston, MA.

Raymond, Bèdard, Roy, Larouche, Tremblay. 2009. The Irregular Shelterwood System: Review, Classification, and Potential Application to Forests Affected by Partial Disturbances. Society of American Foresters Journal of Forestry.

Prasad, A. M., L. R. Iverson., S. Matthews., M. Peters. 2007-ongoing. A Climate Change Atlas for 134 Forest Tree Species of the Eastern United States [database]. https://www.nrs.fs.fed.us/atlas/tree, Northern Research Station, USDA Forest Service, Delaware, Ohio.

Northeast State Foresters Association. 2018. Northeast Silviculture Institute For Foresters - Northern Hardwood Session.

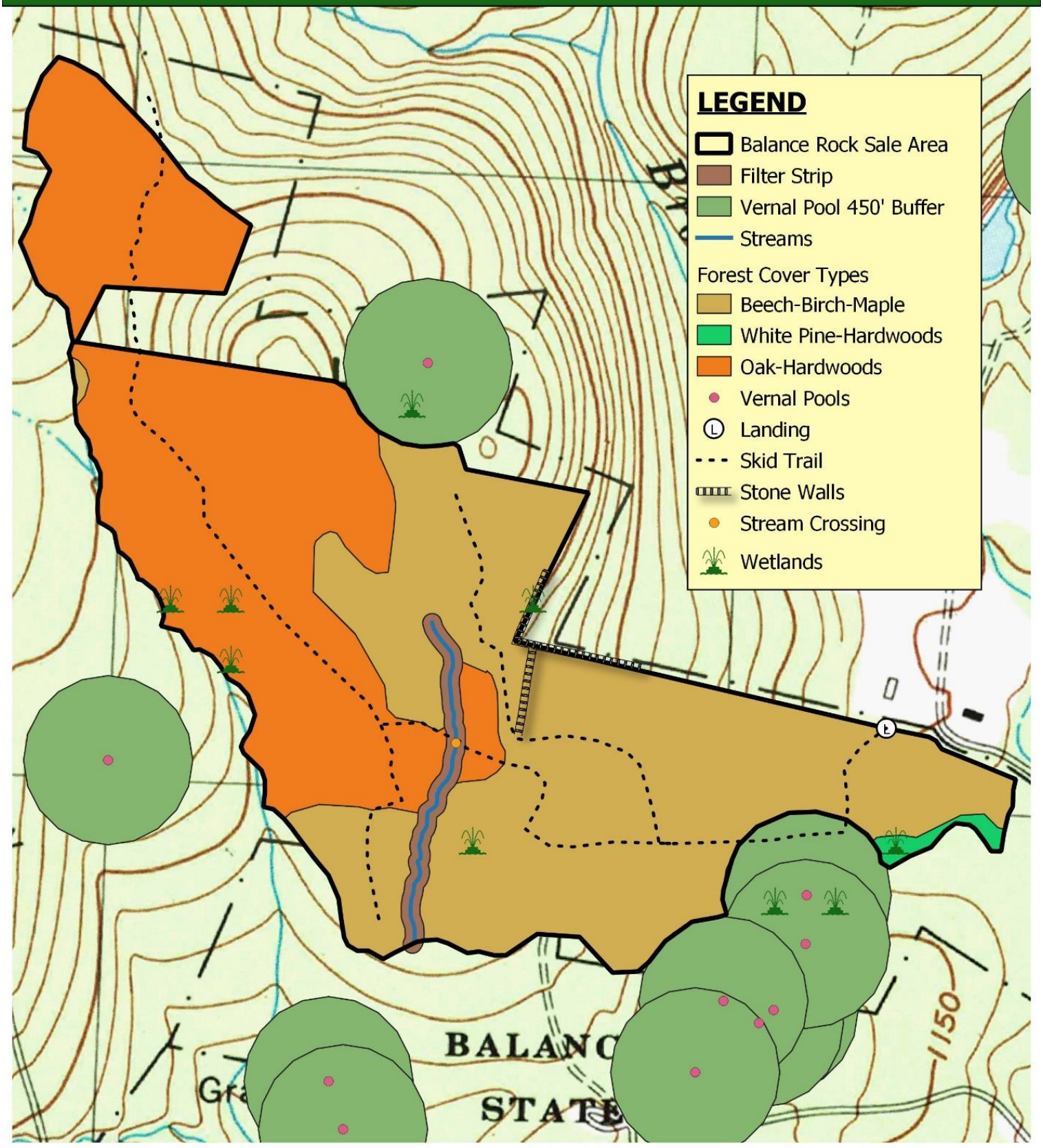
Northeast State Foresters Association. 2018. Northeast Silviculture Institute For Foresters – Mixed Oak-Hickory Session.

MAP 1

BALANCE ROCK PROJECT MAP

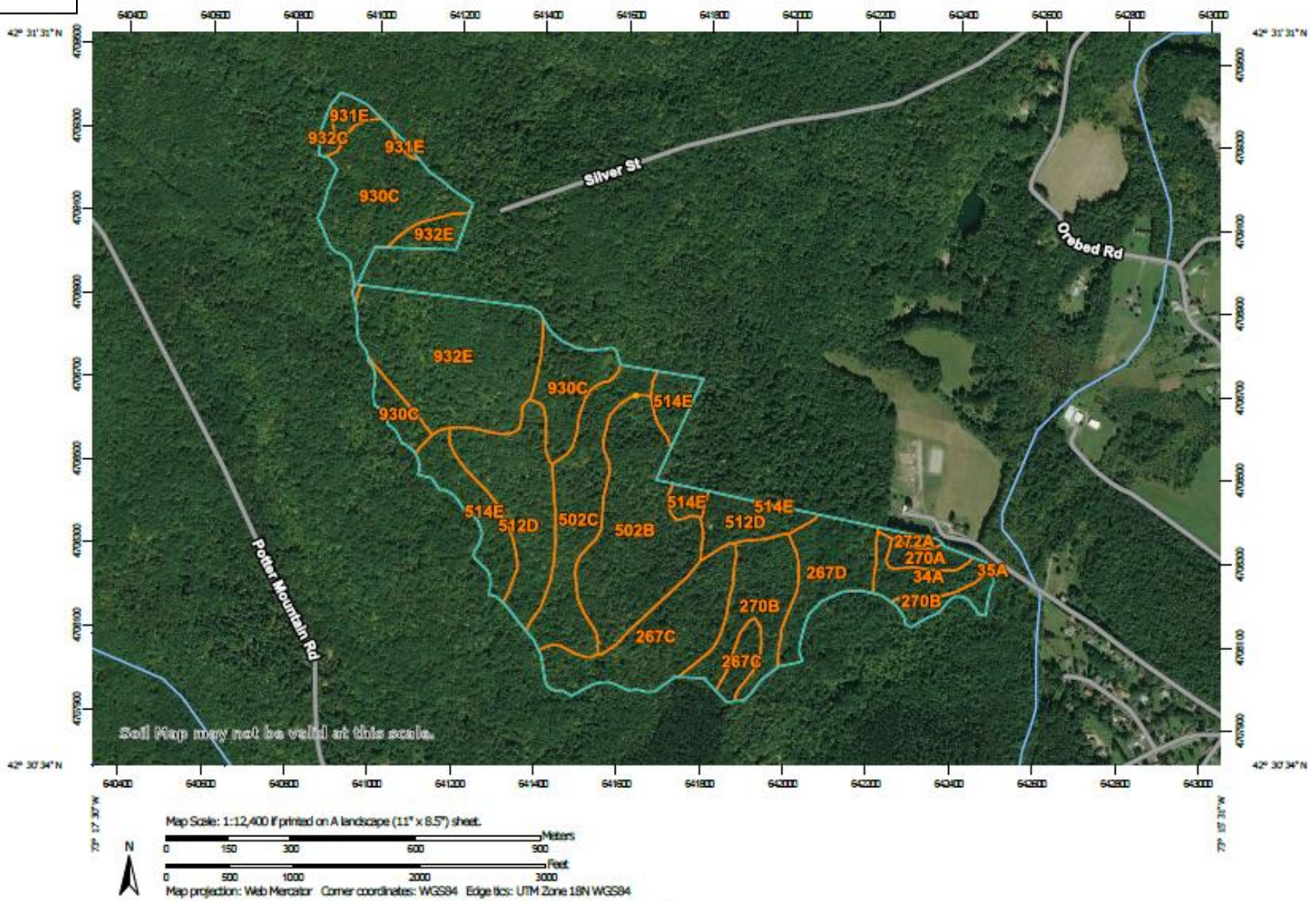
Balance Rock State Park

Lanesborough, MA



MAP 2

Custom Soil Resource Report
Soil Map (Balance Rock Forest Management Project)



Map Scale: 1:12,400 if printed on A landscape (11" x 8.5") sheet.
Meters: 0 150 300 600 900
Feet: 0 500 1000 2000 3000
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
34A	Fredon fine sandy loam, 0 to 3 percent slopes	4.9	2.5%
35A	Halsey fine sandy loam, 0 to 3 percent slopes	0.0	0.0%
267C	Copake fine sandy loam, 8 to 15 percent slopes	20.0	10.2%
267D	Copake fine sandy loam, 15 to 25 percent slopes	10.5	5.4%
270A	Hero loam, 0 to 3 percent slopes	2.5	1.3%
270B	Hero loam, 3 to 8 percent slopes	14.6	7.4%
272A	Hoosic gravelly fine sandy loam, 0 to 3 percent slopes	0.9	0.4%
502B	Amenia silt loam, 3 to 8 percent slopes, extremely stony	25.7	13.1%
502C	Amenia silt loam, 8 to 15 percent slopes, extremely stony	17.3	8.8%
512D	Pittsfield loam, 15 to 25 percent slopes, extremely stony	22.4	11.4%
514E	Pittsfield and Nellis loams, 25 to 35 percent slopes, extremely stony	12.8	6.5%
930C	Fullam-Lanesboro association, rolling, very stony	28.9	14.8%
931E	Lanesboro-Dummerston association, steep, very stony	2.1	1.1%
932C	Taconic-Macomber association, rolling, very stony	0.8	0.4%
932E	Taconic-Macomber association, steep, very stony	32.3	16.5%
Totals for Area of Interest		**195.8**	**100.0%**

EXHIBIT 1

MA Department of Conservation and Recreation
Division of State Parks and Recreation
Woodland Zone

The Mission of the Bureau of Forestry Management Forestry Program in lands designated as Woodland on State Forests, Parks and Reservations is to provide ecosystem services and benefits associated with active forest management.

Ecosystem services that are provided through active forest management on the Woodland landscape are:

- ***Production of wood products*** *that is ecologically and economically sustainable benefiting local economies.*

- ***Water*** *quality protection and enhancement of water supply.*

- ***Diverse habitats*** *that range from early seral vegetation to late successional forest encompassing many structural components and provide protection from extreme disturbance events.*

- ***Recreational opportunities*** *that are safe and fitting for their location determined in conjunction with the Operations staff of the Division of Parks and Recreation*

- ***Carbon stock management*** *using innovative and scientific forest management methods for increasing sequestration.*

❖ Forest management on DCR forests, parks, and reservations endeavors to demonstrate excellent forestry practices to private landowners and the public.

❖ The ecosystem services that state lands provide will be balanced across the landscape and the scale of time where they are deemed appropriate.