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Silviculture Narrative
Adams Road Spruce

Massachusetts Department of Conservation and Recreation
Bureau of Forest Fire Control and Forestry

North Berkshire District
Savoy Mountain State Forest
Compartment 22
Stands 289, 290
Savoy, MA

Prepared by:

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Approved by:

DISTRICT FORESTER _____ DATE _____

PROGRAM SUPERVISOR _____ DATE _____

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Parcel Information

District:	North Berkshire
Management Unit:	Savoy Mountain State Forest
Compartment:	22
Stands:	289 – Norway spruce plantation – 13.0ac
	290 – Norway spruce plantation – 2.0ac
Access:	Adams Road

History

Norway spruce (*Picea abies*) is a non-native tree species that was widely planted in this region to reforest abandoned agricultural land and provide a source of dimensional lumber. The land that this plantation occupies was once non-forested; evidence of the past agricultural use remains, including stone walls, wire fences, stone bridge abutments, and an old road grade on the west side of Stand 289. It is unknown whether this plantation was established as a reforestation effort, or rather was planted following the clearing of previous forest stands. The Massachusetts Department of Conservation and Recreation (DCR) documentation does not indicate this plantation's year of origin. Core samples (2008) taken with a standard increment bore at diameter at breast height (DBH - 4.5' above ground level) indicate an approximate age of 75-80 years.

Current Forest Conditions

Overstory Summary:

Stands 289 and 290 are identified as such on the Sewell forest type inventory. Stand 290 contains a 2-acre Norway spruce plantation similar to Stand 289 in composition and structure. These two stands are grouped for the purposes of this project; data summaries included in Appendices A and B were generated from consolidated samples in both stands.

Adams Road Spruce – Preharvest. *Photo by Chris Stone, 2008.*

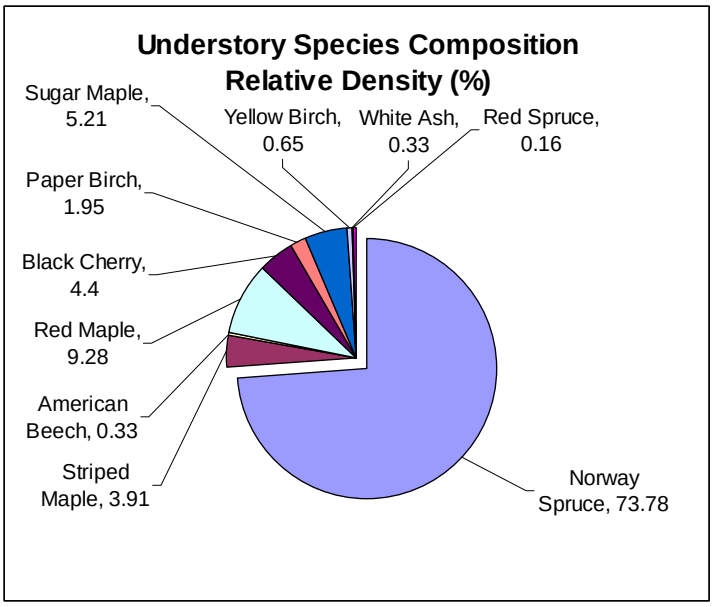
The overstory consists of an even-aged cohort of Norway spruce. This cohort has not been thinned in its history, and as a result is overstocked. According to research done on Norway spruce plantations in the northeast, this stand is considered overstocked (Halligan and Nyland, 1999). A range of crown classes are found in the overstory and they appear to be highly correlated to diameter. The less successful intermediate individuals are generally in the 4-10" DBH range, and the most successful codominants exceed 22". Most of the overstory consists of intermediate and codominant trees in the 12-19". Hardwood species are present in the overstory, though generally as widely scattered individuals. The most common species are black cherry (*Prunus serotina*), red maple (*Acer rubrum*), white ash (*Fraxinus Americana*), paper birch (*Betula papyrifera*), and yellow birch (*Betula alleghaniensis*). A small amount of native red spruce (*Picea rubens*) is contained in these plantations. A summary of overstory inventory data is contained in Appendix A.

Substantial decline in the continuity and vigor of the Norway spruce canopy was noted in mid-2008. In addition to what can likely be attributed to natural mortality due to competition, individuals and small groups of trees are exhibiting lower live crown ratio, crown density, and dieback. It is clear that the surviving trees have not had the ability to occupy the increased available growing space. The cause of this decline is unknown; one possibility is Armillaria root rot disease, a fungal condition that is common in Norway spruce (Williams et al., 1986). Norway spruce has also been reported to be experiencing specific symptoms of decline in other parts of the world, most notably needle chlorosis and thinning of the crown. Causes of these symptoms are thought to include air pollution (ozone, acid deposition, or toxic metals contamination) coupled with acidified, depleted soils (Sullivan, 1994).

Ice damaged Norway spruce – *Photo by Chris Stone 2008*

In December 2008, a severe ice storm caused substantial damage to trees throughout the higher elevations of Berkshire County. This stand suffered substantial damage to the crowns of hardwood trees and broke many of the spruce stems, usually in the upper half of the tree. Though the stand was not heavily damaged in comparison to much of the surrounding forestland, the effects of the ice storm will likely accelerate the natural decline already taking place here. It should be noted that the stand inventory was performed prior to the ice storm, and all stand statistics contained in this document have been calculated using these data.

Understory Summary:



Norway spruce seedlings are the most abundant component of this understory and are distributed in patches through the plantations. A variety of desirable hardwood regeneration is also present, consisting of black cherry, sugar maple, white ash, yellow birch, red spruce, red maple, and paper birch. Less desirable species are Norway maple, striped maple, and American beech. It is likely that in areas where hardwood regeneration is mixed with Norway spruce, the hardwood will succeed the spruce. The most abundant hardwood regeneration species is red maple, however the striped maple found in this stand is more developed and occupies more growing space than any other species. This undesirable species is a short lived (<100 years) small tree/large shrub (<50' maximum height). Cutting the striped maple saplings and providing conditions more appropriate to shade-intolerant

species will help desirable seedlings compete successfully. Native species are grouped in the above pie chart, separated from the non-native Norway spruce. A summary of understory inventory data is contained in Appendix B.

Invasive Species:

There are no invasive species concerns in the vicinity of the proposed harvest area.

Management Goals and Summary

The proposed management activities are consistent with management goals outlined in the North Berkshire District Forest Resource Management Plan. The following selected goals are taken from the Northern Berkshire Forest Resource Management Plan, approved November 7th, 2008. Specific management activities under this project that help meet these goals are bulleted below.

1. Speed the restoration of non-native and dead, dying, damaged, or at-risk plantations to resilient communities of native species;

    - Removal of the non-native Norway spruce overstory in decline will reduce its current abundance as well as the seed source for the persistence of this species. Hardwood seed tree retention, existing hardwood regeneration, and an ample canopy opening will encourage the establishment of native species.

2. Restore, more quickly than can be accomplished through natural disturbance, our predominantly 80-year forest to one with greater diversity of size and age classes, in order to provide more diverse wildlife habitat and increase resilience to climatic changes that may place significant and catastrophic risk to a single age-class forest;

    - This ~80 year-old plantation will be removed in a manner that mimics large scale disturbance (major wind event), retaining a portion of the older age class and creating 15 acres of early successional forest habitat that consists of a wide variety of native hardwood and softwood species.

3. Provide "in-kind services" used to cut and remove hazardous trees from areas near roads, campgrounds, trails, and other areas where they pose a safety hazard to the public (the cost of such removal is estimated at $150 per small tree and over $450 per larger tree). "In-kind services" are also used to fix eroded woods roads, recreation trails, install gates and remove invasive species;

    - A new access road and landing area will be constructed that will provide access to this and other adjacent stands for future management activities. These features may also serve as recreational access.
    - Adams Road is a town road in Savoy, and is also the main access road to the timber harvest area. Improvements to this road required for log truck access may be available as in-kind services funded by project revenue with cooperation by the Town of Savoy.

4. Provide a source of forest products for the public. Provide local economic benefits in the form of employment, and revenue to local cities and towns through deposits from the Forest Products Trust Fund;

    - All timber volume will be offered for bid to local and regional timber harvesting firms.

5. Protecting aquatic resources such as lakes, rivers, streams, riparian areas, wetlands, and vernal pools, by establishing and properly managing these areas and their associated buffer zones or filter strips;

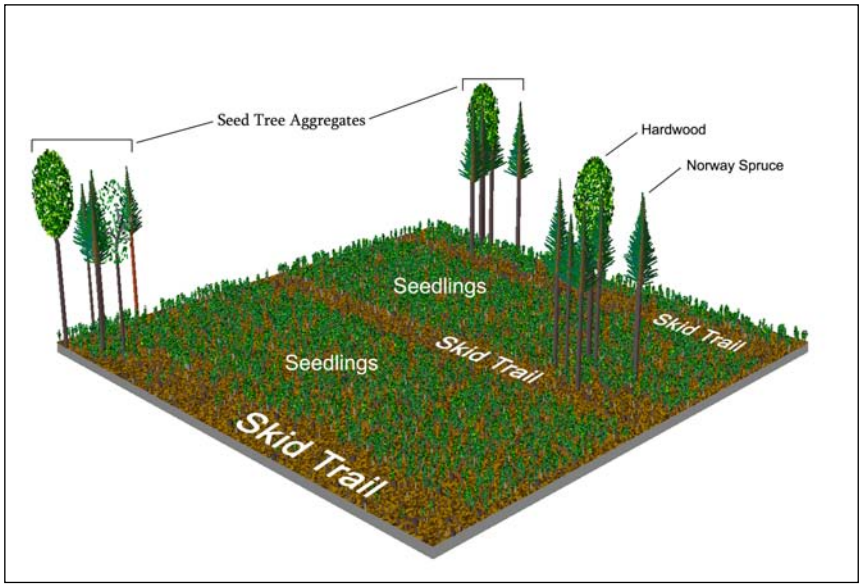
    - One brook is located within the harvest area and will be protected with the required 50' filter strip, in which no machinery will operate and ≥50% of the basal area will be retained.
    - One Certified Vernal Pool has been identified near the harvest area. All harvesting will take place ≥400' from this feature, and no machine activity will take place nearer than 100' from it. Specific species information was requested and received from NHESP and no state-listed species have been reported to be associated with this vernal pool.

Silviculture Summary

Silvicultural System:

This plantation will be managed as a small even-aged unit that contributes to the larger uneven-aged context in Compartment 22. To convert an unmanaged softwood plantation to a managed native hardwood condition, the "Seed Tree with Reserves" silvicultural method of even-aged management will be employed. Under this method, the majority of the overstory is removed while retaining appropriately spaced seed trees that will provide adequate seed dispersal for establishment of the future stand. A follow-up removal cut of the residual overstory is typical in this silvicultural method, however in this situation it is unnecessary, impractical, and will not be implemented. Therefore, these retained seed trees (reserves) will be left on site long-term. In addition, rather than widely spaced individuals, widely spaced small groups of trees will be retained. This arrangement should result in mutual support of the root systems and crowns, and along with careful site and species selection as described in the Marking Instructions, result in a more windfirm condition. Retained seed tree groups coupled with the advanced regeneration will ensure that a stand with a diverse structure develops after harvest (Kohm and Franklin, 1997).

Treatment:



Stand Visualization System graphic depicting proposed 2-year post harvest stand conditions. Simulation based on 2008 DCR inventory data for the Adams Road Spruce lot.

All Norway spruce and unacceptable hardwood growing stock will be harvested unless retained in a seed tree group reserve as described below in the Forest Marking Instructions. Seed tree group reserves will be retained to provide seed sources and long-term vertical structure.

Forest Marking Instructions:

Norway spruce is a shallow-rooted species, and the plantation is located at high elevation. Longer duration of winter, greater snowfall amounts, more frequent ice accumulation, and higher wind speeds all contribute to a substantial windthrow hazard. Rather than widely spaced individuals, widely spaced small groups of trees will be retained. The interlocking root systems should provide greater stability in adverse weather conditions.

Trees to be cut will be marked in blue paint. Trees to be retained will be marked with a different color of paint. Stump marks will be utilized on retained trees. Skid trails will be flagged and marked. A pre-harvest conference will be held with all operators that work on the lot to ensure that all harvesting, layout, and logistical aspects of the project are understood.

Group retention criteria:

- Groups should be anchored by one or more desirable hardwood species seed trees, where possible.
- Groups should be co-anchored by one or more vigorous, codominant Norway spruce individuals that will likely continue to thrive well into the future and provide a large root mat that will increase stability and help resist windthrow.
- Groups should include a small number of additional codominant and intermediate trees with root systems that interweave with the anchor trees roots, increasing the strength and stability of the root system to minimize the risk of windthrow, as well as to disperse wind pressures on the crowns and reduce the risk of stem breakage.
- Groups should be located on deep, well drained soils where possible. Areas with shallow soils, such as rock outcrops, and areas with poorly drained soils, such as depressions and other concave, low-lying landforms should not be selected as group-retention sites.

Due to the non-uniform distribution of the retained seed trees and the specific conditions related to their selection, it is impractical to assign a target values (either BA/acre or trees-per-acre) based on inventory data to the residual overstory, and therefore no such values are given here. It is possible, however, to specify a target amount of roughly 2 group reserves per acre, each with between 4 and 10 ft^2/ac of basal area. For reference, this translates to 5-12 trees per group using the stand quadratic mean dbh of 12.5 inches.

Snags should be selected for retention based on size, state of decay, species diversity, and current wildlife uses. Locations should be selected that minimize visual impact, such as near group reserves and harvest margins.

Much of the stand is intended to regenerate from seed sources within the group retentions as well as from the surrounding hardwood stand. Undesirable hardwood regeneration (striped maple, American beech) will be cut according to contract specifications rather than marking. Existing regeneration will protected as much as possible to further contribute to the quick stocking of desirable species following the harvest (see "Harvest Methods" below for more detail).

Regulatory Impacts on Silviculture:

A 50' filter strip is required along the stream that flows through the harvest area. Regulations require that ≥50% of the basal area be retained. In this filter strip, native hardwood species will have priority for retention, followed by healthy, vigorous, and windfirm Norway spruce where possible.

Desired Future Condition:

Short Term:

Developing new stand five years following the removal of a nearby Norway spruce plantation. *Photo by Chris Stone, 2008.*

Immediately following cutting, areas between skid trails should be cleared of the Norway spruce overstory except for those in seed tree group reserves. Slash should be largely limited to areas designated as skid trails, and this should be well compacted by machine operation. Desirable advanced regeneration should be largely undamaged in areas between skid trails and free to grow as a result of the overstory removal. There should be substantial coarse woody debris remaining from pre-harvest natural mortality. Within 5 years, natural seeding of native hardwood tree species should be established throughout most of the stand. Areas dominated by herbaceous growth will take slightly longer. Within 10 years, most of the stand should be densely stocked with hardwood saplings 8-20' tall (black cherry, sugar maple, yellow birch, paper birch, white ash, red maple) and some pockets of Norway spruce. Some less desirable species will undoubtedly be a part of the developing stand, however this should be minimal. Within 15 years of the harvest, the early successional habitat value will wane as a closed canopy of young trees shades the forest floor and the herbaceous and shrub growth that became established early on is shaded out.

Long Term: As the young trees continue to develop, native hardwoods should outcompete most of the spruce and dominate the site. A young stand of mixed native hardwood species can be treated commercially once merchantable diameters are reached, or non-commercially in order to establish multiple age classes for long-term uneven-aged management. During this first treatment, the younger Norway spruce can be removed. Given enough time, seed tree group reserves will begin to break up. They will topple, break and fall, and provide coarse woody debris to the developing forest. A few of the hardwood seed trees may survive for a longer period, providing legacy trees. This stand should be managed as part of a larger area of uneven-aged mixed hardwood and should eventually be combined with the surrounding stands 277 and 286. Shorter-lived species such as paper birch and red maple should become less abundant as the 100-year mark approaches, and the mature overstory should consist of black cherry, sugar maple, yellow birch, white ash, and red spruce.

A detailed summary of current inventory data (2008) is provided in Appendix A.

Harvest Methods & Sale Layout

A harvesting system consisting of harvesting and forwarding equipment type requirements, careful skid road and landing locations, designated processing areas, utilization requirements, and a well-constructed log truck access road will be implemented to achieve specific silvicultural goals as well as general management goals for this project.

A cut-to-length harvesting system will be required for directional felling and proper processing. Machine operation will be restricted to designated skid road locations; skid roads will be laid out to accommodate the width of the harvesting equipment, and an additional 6-8' adjacent to skid roads will be designated for

product bunching. All processing will take place on the designated skid roads. This will require a fixed-head system or a dangle-head with a particularly skilled operator. Skid roads will be spaced no more than 40-45' apart, allowing for harvester operation from the skid roads to reach all trees designated for removal without requiring the machinery to enter these areas.

The purpose of these measures is to minimize damage to existing regeneration, reduce soil impacts within the skid roads, and reduce the visual impacts of slash throughout the harvest area. Exact locations of these skid roads are too small scale for inclusion at this phase of the planning process. Main skid roads are shown on the Harvest Area Map (Appendix C) are proposed for planning purposes only and are subject to change.

One stream crossing will be required. This crossing will utilize a temporary, portable bridge placed over existing stone abutments in accordance with all requirements under Chapter 132 regulations. No impacts to the stream, its banks, or adjacent soils and vegetation are expected. The most likely stream crossing location is represented in Appendix C, but is subject to change depending on ground conditions at the time of harvest. Final stream crossing location will be contained in the filed Chapter 132 cutting plan and approved by the DCR Service Forester. A filter strip will be implemented along the stream as required by Chapter 132 regulations. This strip will extend 50' on both sides of the brook, perpendicular to the direction of flow. Consistent with regulations as well as with the machine access restrictions described above, machines will not operate within the filter strip.

A landing will be created approximately 300-400' south of Adams Road. The area in which this landing will be located is characterized by a mild (<5%) slope on even terrain, allowing for excellent drainage and minimal site preparation. A 250'-350' log truck access road will be created in order to connect Adams Road to the landing. Geotextile, processed gravel, and drainage techniques will be installed to create a suitable base and road surface for log truck access. Following the harvest, the landing will be graded and seeded with a conservation seed mix that will allow for quick soil stabilization.

Wildlife

Approximately 15 acres of new early successional habitat will be created. The early successional habitat created by this harvest has many benefits for wildlife conservation. These benefits have been extensively researched by numerous wildlife biologists, ecologists, foresters, and other scientists. This research is well documented and will not be cited here due to its abundance and broad scope. For those who are interested, a recommended source for information on the functions of early successional habitat is the DeGraaf et. al 2005 publication (see References) and the DeGraaf and Yamasaki 2001 publication. A recommended source for the historic and modern roles of early successional habitat is the Litvaitis et. al 1999 publication (see References). A recommended source for information on early successional habitat in the modern landscape is the Brooks 2003 publication. Recommended sources for understanding the role timber harvesting can play in creating early successional habitat are Costello et. al 2000 and DeGraaf & Yamasaki 2003.

Some snags (standing dead trees) will be retained for their contribution to the diversity of wildlife habitat. These features may serve as nesting sites for cavity nesting birds and bats (DeGraaf and Yamasaki, 2001). Snags selected for retention will be large enough to provide good cavity potential but should be distributed in such a way as to not overly impact the post-harvest aesthetic goals.

Rare Species:

An old borrow pit is located to the north of the harvest area, adjacent to the Adams Road. This area now contains a man-made vernal pool that was certified by NHESP in 2008 and is reported to have contained spotted salamander egg masses. The spotted salamander is not a rare species. NHESP has determined that no Priority Habitat is associated with this vernal pool, and therefore no Conservation Management Practices (CMPs) apply. Under Chapter 132, vernal pools that are located in harvest areas require a 50'

filter strip in which no machinery may operate and ≥ 50% of the basal area must be retained. All harvesting activity and machine access for this project is located well outside of this area and should not impact the vernal pool. The location of the Certified Vernal Pool is indicated on the Harvest Area Map (Appendix C).

Cultural Resources

As previously mentioned, this area was previously cleared for agriculture. A short segment of stone wall remains along the north side of the brook in the eastern portion of Stand 289. There are old stone bridge footings along the brook outside of the harvest area, and evidence of an old access road runs along the western edge of Stand 289 at its northwest corner.

The following are measures that will be taken to ensure the preservation of these cultural resources.

1. Skid roads and processing areas will be located such that the stone wall will not be impacted by machinery, processing, or skidding operations.
2. If the stone bridge footings are used as a stream crossing location, the use of a temporary portable bridge will disperse ground pressure and protect both the footings and the stream banks.
3. Portions of the old access road may be reused; this will not only preserve the original road location but avoid creating more road area in the forest than is necessary.

Aesthetics

Even-aged silvicultural systems are often at odds with forest managers' non-timber goals, most notably aesthetics. Harvesting aesthetics are a very important consideration on state lands. The regeneration and removal cuts that are a part of even-aged management can create a stark appearance due to the temporary but dramatic loss of the forest canopy, presence of slash, and sometimes, exposed mineral soil. It is important to understand that the aesthetic impacts of a harvest are not necessarily correlated to the ecological and economic function of the harvest area, but are still important due to the multiple-use goals of state lands.

This proposed harvest will have short-term aesthetic impacts that some people may regard negatively. There is simply no way to remove a non-native, unhealthy, and windthrow-prone plantation without causing a visual disturbance. However, in the 5-10 year period following this harvest, the site will be fully stocked with trees. By year 20, most casual observers should not notice any signs of harvesting within the plantation except for a general difference in the size of trees. By year 30, this area will likely be similar in appearance to the surrounding hardwood stands in Compartment 22. The following is a list of management practices and conditions that will minimize the visual impact of this harvest.

1. Seed tree group reserves will provide vertical structure and large residual trees that increase the visual diversity of the new stand.
2. The harvest area itself is over 450' from Adams Road and will not be visible from any point along it. The landing location will be roughly 300' from Adams Road. It may be slightly visible from certain points along Adams Road. It will be a small disturbance with exposed mineral soil, but following the harvest activity it will be graded and seeded. Within 2 years, it will be a small, grassy opening with young herbaceous and shrub growth. Areas such as these are often valued by recreationalists, hunters, and others because of their open condition, habitat values, and access benefits.
3. Visual impact along Adams Road will be limited to the log truck access road. The road bed itself will be identical to any rural gravel road. Any associated soil disturbance will be seeded and should be fully revegetated within one or two growing seasons.
4. Slash will be concentrated on designated skid roads, leaving the majority of the harvest area slash-free. The operation of machinery on these roads will compact this slash, reducing its height and visibility as well as speeding its decomposition.

5. Contractual requirements will ensure the removal of broken and damaged trees of all sizes, and restrict snag retention to those with significant wildlife habitat value.
6. Follow-up work may be performed by DCR management foresters if there is additional visual impact due to windthrow or breakage.

Recreational Use and Impact

The primary recreational use of this portion of Savoy Mountain State Forest is snowmobiling on Adams Road, a town road that is not maintained. No recreational trails, campgrounds, vistas, or other improvements exist in the vicinity of the harvest area.

The proposed landing will likely enhance recreational opportunities following the harvest by providing a small open area that can be used for a variety of passive recreational activities. After a period of time necessary for the decomposition of slash, many of the main skid trails will be suitable for these activities as well.

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APPENDIX A – Overstory Inventory Data Summary

Consolidated from Stands 289 and 290

NED report for Adams Road Spruce Generated: 10/24/2008 13:46
This report is for the 2008 inventory data

Stand Variable List

Variable	Value
Average dbh (in)	11.91
Average Merchantable dbh (in)	14.24
Basal area (sq.ft/ac)	174.0
Basal area of AGS (sq.ft/ac)	99.0
Basal area of UGS (sq.ft/ac)	75.0
Canopy closure (% closure)	63
Net board-foot volume (bd.ft/ac)	22860.39
Net cord volume (cords/ac)	48.3
Net tons (tons/ac)	96.7
q factor	1.13
Quadratic mean dbh (in)	12.49
Quadratic Average Merchantable dbh (in)	12.68
Relative density (%)	63.0
Stand ID	stand 1

90% confidence interval

degrees of freedom = 19
alpha = 0.100
t-value = 1.730

90% confidence interval

	Basal area (sq.ft/ac)	Net bdft vol (bd.ft/ac/ac)	Net pulp vol (cu.ft/ac/ac)	Rel. dens. (%/ac)	Stems/area (stems/ac)
90% c.i. mean lower limit	161.7	20374.8	338.0	55.9	166.4
90% c.i. mean upper limit	186.3	25345.9	784.0	70.2	242.9
90% c.i. # plots for w/in 15%	5	11	141	12	32
90% c.i. # plots for w/in 10%	11	24	317	26	70

APPENDIX B - Understory Species Composition and Diversity

Consolidated from Stands 289 and 290

NED report for Adams Road Spruce Generated: 10/24/2008 13:07
This report is for the 2008 inventory data.

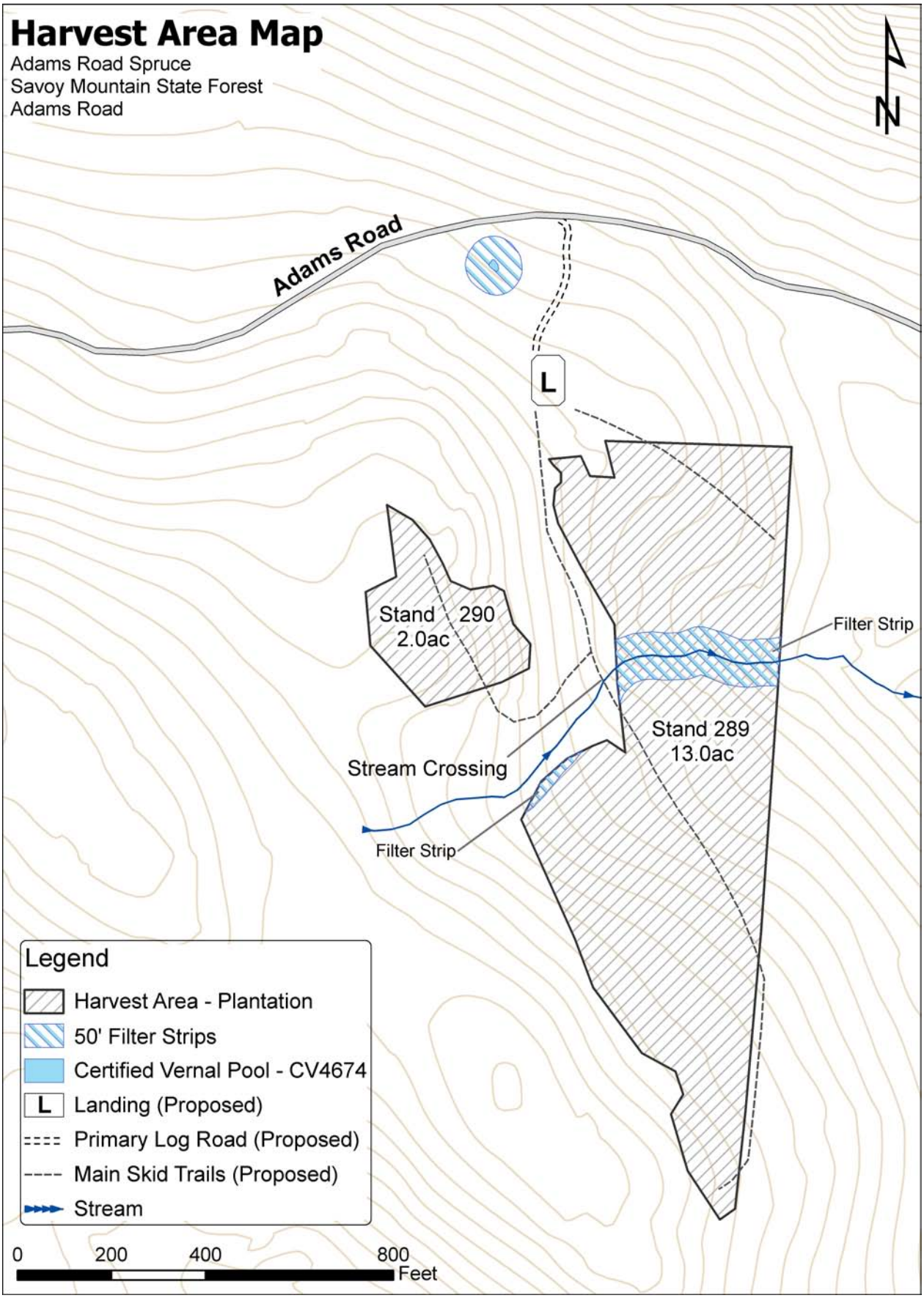
Understory Species Occurrence and Abundance - Live Stems Only

Species	Density	Relative Density	Frequency	Relative Frequency	Percent Cover	Relative Percent Cover	Importance Value
Norway Spruce	18875.00	73.78	100.00	31.58	16.67	49.75	51.70
Striped Maple	1000.00	3.91	41.67	13.16	7.17	21.39	12.82
Black Cherry	1125.00	4.40	50.00	15.79	4.92	14.68	11.62
Red Maple	2375.00	9.28	41.67	13.16	1.17	3.48	8.64
Paper Birch	500.00	1.95	33.33	10.53	1.08	3.23	5.24
Sugar Maple	1333.33	5.21	8.33	2.63	1.67	4.98	4.27
American Beech	83.33	0.33	16.67	5.26	0.58	1.74	2.44
Yellow Birch	166.67	0.65	8.33	2.63	0.08	0.25	1.18
White Ash	83.33	0.33	8.33	2.63	0.08	0.25	1.07
Red Spruce	41.67	0.16	8.33	2.63	0.08	0.25	1.01

Description of Table Items

- **Density** = Mean number of stems per acre, based on stems counted in each plot.
- **Rel Density** = Mean relative proportion or abundance of stems by species. The mean number of stems of a particular species divided by total number of stems.
- **Frequency** = The percentage of plots where this species was observed, based on the number of plots where species occurred divided by total number of plots.
- **Rel Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Percent cover** = Mean percent coverage. The mean proportion of area that is covered by a vertical projection of the foliage onto the ground surface for all stems or individuals of a given species.
- **Rel Percent cover** = Mean relative percent coverage, based on the individual species percent coverage or basal area divided by the total percent coverage or basal area for all species.
- **Importance Value** = Importance Value, a value computed by arbitrarily adding together the values for relative abundance, relative frequency, and relative dominance and dividing by three.

APPENDIX C – Harvest Area Map



APPENDIX D – Locus Map