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Silvicultural Prescription
King's Corner

Massachusetts Department of Conservation and Recreation
Bureau of Forestry

Western Connecticut Valley
Dubuque State Forest
Hawley, MA

Prepared by:

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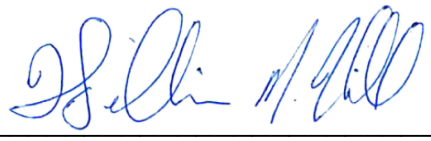
Management Forestry Program Supervisor  Date: May 13, 2014

William N. Hill, CF

Project Overview

The King's Corner Forest Management project is located on Route 8A in the town of Hawley. It is one of the main entry points into the forest and the location of the DCR Western Region Carpentry Shop. This project was chosen for forest management based on the following criteria:

- It was impacted by the 2008 ice storm and is experiencing widespread mortality.
- Proximity to good road system.
- Ability to serve as a demonstration area for sound silvicultural principles.
- Opportunity to repair access infrastructure on the forest.
- Meets DCR Guidelines for management in designated Woodlands.
- Begin the process of diversifying single age structure into a multiple age forest.
- Assist the town of Hawley with access issues for emergency vehicles.
- Demonstrate Best Management Practices applied to timber harvesting.
- Establish a system of monitoring regeneration results.
- Prevent additional erosion on existing roads damaged from illegal usage.
- Cooperate with stakeholders to insure successful outcome.

Management activities are planned for a 365 acre project area with one initial entry or more likely two separate entries to treat 20% of the project area.

1. SITE DATA

A. Hydrology and watershed

The Dubuque State Forest lies in the watershed of the Deerfield River. Basin Brook, King Brook and several smaller unnamed brooks flow through the management area and into the Chickley River. This flows north to join the Deerfield River in Charlemont. Numerous seeps are present among the rocky ledges and contribute to the smaller brooks in the area. Located nearby are several large wetland complexes which are the headwaters for Basin Brook and collect water from a myriad of springs, seeps and small tributaries.

B. Soils

The majority of the soil types are of the *Lyman* series which can generally be characterized as slightly droughty, shallow loams that have formed in glacial deposits derived mainly from schist. They are found on gentle slopes to very steep uplands in western Franklin County. A Lyman soil that has not been tilled will have a thin black loam surface area followed by several inches of forest litter. Under this there is a layer fine sandy loam which is underlain by a layer of subsoil down to 19" or so to bedrock. Stones on the surface are usually less than 50' apart and bedrock outcroppings are common. Variations within the series are based on steepness and number of stones/outcrops. This soil falls into Woodland Suitability Group 10 because of the variable depths to bedrock. Site indices are generally in the low to medium range but will vary due to the soil depth. Partial cuttings are not recommended as windfirmness may be an issue. The *Peru* series of soils are also found on the site and are somewhat similar to the Lyman series. These soils are moderately well drained loams that formed in compact glacial deposits derived from gray mica schist with some granite. They have a hard layer (often referred to as a hard

pan) at about 24" which is difficult to dig with a hand spade. It also presents problems with root development in some tree species. These soils are deeper than the Lyman series and will be sub-typed based on steepness, stone content and depth of the surface layer. These soils fall into Woodland Suitability Group 1 which means that most trees grow well and that hardwood species will develop windfirmness and regenerate well. Softwood species such as spruce and hemlock may have more difficulty regenerating and developing windfirmness due to hard pan layer. The *Ridgebury* series is also found here and consists of poorly drained fine sandy loams that formed in compact glacial deposits derived mainly from granite, gneiss, or schist. They also have a hard layer approximately 18" from the surface. They are found in depressions and on gently to moderately sloping areas of uplands. Stones on the surface are 10 to 24 inches in diameter and 5 to 50 feet apart. The soil is wet 7 to 9 months of the year. It has a high water table and receives surface water and seepage from surrounding slopes and falls into Woodland Suitability Group 7. High seedling mortality, windthrow, equipment limitations and road restrictions are results of the high water table.

C. Climate: Hawley receives approximately 47 inches of rain per year and average snowfall is 61 inches. The number of days with measurable precipitation is 112. On average there are 192 sunny days. The July average high temperature is 81 degrees F and the average January low temperature is 11 degrees F. Franklin county climate is characterized by warm summers, moderately severe winters and ample rainfall. The prevailing winds are from the southwest in summer and from the northwest in the winter, with occasional influences from the Atlantic Ocean 100 miles to the east. The local climate is influenced more by air moving over the continent rather than air moving in over the ocean. Daily variation in temperature is common because the county is near the path of multiple weather systems which bring in warm air from the south and cool air from the north.

D. Geology and Landforms: The Lyman soils dominate the management area and these are covered by a varying preponderance of stones and schist bedrock outcrops. Two large ridges running in a northwest-southeast orientation are the prominent features with brooks found to the north, east, west and center of the sale area. The ridge tops are relatively flat and rocky with shallow soils. The slopes vary from gentle to steep with areas of flat benches and saddles. Basin Brook is the principle drainage to the north and the land slopes accordingly. Several of the streams have steep rocky banks giving them a rugged and dramatic appearance.

E. Potential Vegetation: This section of the forest is comprised of three major forest types based on a combination of terrain location and past land use. The gentle sloping areas with fewer rocks were used for pastures and are often occupied by the White pine-hemlock (WK) forest types. The overstory consists of large white pines with a mix of eastern hemlock, red maple, sugar maple and members of the birch species. Stand development would have been in an open condition allowing many of the shade-intolerant species to reach dominance. The current understory is more a northern hardwood mix of beech, sugar maple, black and yellow birch and hemlock with some red spruce. Growing conditions will favor the shade tolerant hemlock and beech as the stand canopy remains mostly closed. The most dominant forest type found here is the northern hardwood or sometimes referred to as the beech-birch-maple forest (BB) type. A sub-type of this, Sugar maple (SM), is found in the north- eastern portion of the management area. This is very similar to the BB type in terms of stand characteristics but is dominated by Sugar maple in the overstory. Species found in the overstory are Sugar maple, black birch, yellow birch, white ash, beech and basswood. The understory has a similar stand composition with a higher portion of the shade tolerant species such as beech, hemlock, and red spruce. A third major forest type found in the riparian areas and northerly slopes is Hemlock-hardwood. This stand is dominated by Eastern hemlock and beech with other components from the northern-hardwood type. The understory is very heavily shaded and dominated by hemlock, beech and spruce regeneration. As mentioned earlier, there is a history of past agricultural land use in the Dubuque State Forest. West Hawley was once a moderately populated village with many productive farms and small mills. Most of the forest

was cleared for crops and pasture where soil conditions were favorable. Rugged and steep areas were often left as a source of firewood and timber or in some cases these areas were fenced off and livestock grazed where they could. The forest structure is even-aged in such that most of the overstory trees started growing at the same time and are of the same age. This is common in areas where the land has been cleared for cultivation then abandoned due to economics or other factors. The village of West Hawley experienced a severe economic decline and all but disappeared in the 1920's. The average age is approximately 104 years old which would confirm the time of abandonment.

Figure 1. Current understory conditions

F. Site Productivity: Analysis of the NRCS Soils Survey and the DCR Forest Complexity layer show the correlation between site quality and past land use. The same soils that support productive agricultural use will also support productive tree growth. The management unit has a variety of terrain features which account for highly productive sites interspersed among lower ones that have site index values in the 45 to 55 range. This can be attributed to the rock outcrops and shallow soils. The productive soils will be found in the less sloped areas adjacent to riparian areas and site values will range into the 65-75 range. The management strategy of creating an all-aged stand will focus on these areas of better site quality when possible.

G. Cultural and Archaeological Features: The Dubuque State Forest was once a very active agricultural community and as such many reminders of that past land use have been left behind. Stone walls border many of the forest roads. in addition to wire fence remnants that suggest former pastures. Cellar holes, stone wells and foundations are present throughout the forest and several are found in the management area. These features will be protected according to the DCR guidelines and avoided whenever possible. In some cases vegetation will be removed from old cellar holes in order to prevent damage from tree roots uprooting the stones. Such work will be done by hand and in compliance with agency guidelines. Stone walls will be crossed at existing barways when possible.

2. STAND DATA

A. Forest Stand Attributes: This part of the forest has a long history of past land use. There is ample evidence of historic clearing for pasture, charcoal and potash production. The last recorded timber sale occurred in 1958 and it appears that portions of the management area were harvested at a much later date. The 2008 ice storm caused severe damage on the high elevation portions and easterly slopes. Broken branches and snapped stems are abundant throughout the area. Beech bark disease, an insect-disease complex, is present on much of the beech and causing severe mortality. One result of the tree damage and reduction in live forest canopy from the ice storm was to release large amounts of beech seedlings and hobblebush. Both of these species can

be detrimental to preferred tree species regeneration due to the highly competitive nature and extreme shade tolerance.

The following set of tables looks at the stand attributes and composition for the forest type **White pine – Hemlock (**30 acres). This type is found on the better growing sites and is characterized as having a large mean diameter at breast height and a varied species composition of Red maple, yellow birch, American beech, Sugar maple, White ash, Paper birch, Sweet (Black) birch, Black cherry and Red spruce. White pine dominates because of its origin in old fields where the pine survived and took advantage of full-sunlight conditions. This forest will eventually gain a much larger component of shade tolerant species such as beech and hemlock as the tree canopy continues to close and less sunlight reaches the forest floor. Eventually white pine will become a minor portion of the stand due to unfavorable conditions for the moderately shade intolerant regeneration.

Table 1. Overstory information for White pine –hemlock (WK).

Composition

Overstory only

	All species	White Pine	red maple	Hemlock	yellow birch	American beech	sugar maple	white ash	paper birch	sweet birch	black cherry	Red spruce
Basal Area (square feet)	157.8	53.3	33.3	26.7	13.3	6.7	6.7	4.4	4.4	4.4	2.2	2.2
Percentage of stand basal area (%)	100.0	33.8	21.1	16.9	8.5	4.2	4.2	2.8	2.8	2.8	1.4	1.4
Stems Per Unit Area (stems per acre)	138.1	26.9	27.2	34.5	16.7	14.8	3.9	2.7	3.0	2.8	4.1	1.6

Diameters

Overstory only

	All species	White Pine	red maple	Hemlock	yellow birch	American beech	sugar maple	white ash	paper birch	sweet birch	black cherry	Red spruce
Medial DBH (inches)	18.9	25.7	17.3	13.2	12.8	12.3	20.0	18.5	16.5	17.0	10.0	16.0
Merchantable Medial DBH (inches)	18.9	25.7	17.3	13.2	12.8	12.3	20.0	18.5	16.5	17.0	10.0	16.0
Quadratic Mean DBH (inches)	14.5	19.1	15.0	11.9	12.1	9.1	17.8	17.5	16.5	16.9	10.0	16.0
Merchantable Quadratic DBH (inches)	14.5	19.1	15.0	11.9	12.1	9.1	17.8	17.5	16.5	16.9	10.0	16.0
Average DBH (inches)	13.3	16.9	14.4	11.6	11.9	8.2	17.2	17.2	16.5	16.9	10.0	16.0

Structure

Overstory only

	All species	White Pine	red maple	hemlock	yellow birch	American beech	sugar maple	white ash	paper birch	sweet birch	black cherry	Red spruce
Q Factor	1.13	1.09	1.10	1.20	1.18	1.12	1.10	1.12	1.13	1.16	0.00	0.00

Relative density

Overstory only

	All species	White pine	red maple	hemlock	yellow birch	American beech	sugar maple	white ash	paper birch	sweet birch	black cherry	Red spruce
Relative Density (percent)	89.89	23.53	18.32	16.14	10.78	5.57	5.15	1.49	4.28	2.37	1.10	1.17
percentage of stand	100.00	26.17	20.38	17.95	11.99	6.20	5.73	1.66	4.76	2.64	1.22	1.30

Volumes

Overstory only

	All species	White pine	red maple	hemlock	yellow birch	American beech	sugar maple	white ash	paper birch	sweet birch	black cherry	Red spruce
Sawtimber gross total (board feet/acre)	21,297	12,121	3,118	2,234	1,148	460	575	597	291	398	0	354
Sawtimber net total (board feet/acre)	21,297	12,121	3,118	2,234	1,148	460	575	597	291	398	0	354
Pulpwood gross total (cubic feet/acre)	1,451	312	408	206	128	61	90	52	78	53	44	19
Pulpwood net total (cubic feet/acre)	1,161	250	326	165	102	49	72	42	62	43	35	16
Gross total (cubic feet/acre)	4,636	2,017	894	569	342	132	183	135	124	119	44	78
Net total (cubic feet/acre)	3,709	1,613	715	455	274	106	146	108	99	95	35	63

Table 2. Understory tables for White pine- hemlock.

Understory Species Occurrence and Abundance - Live Stems Only

species	Density	Rel Density	Frequency	Rel Frequency	Importance Value
American beech	72.22	54.17	55.56	38.46	46.31
sweet birch	16.67	12.50	22.22	15.38	13.94
striped maple	16.67	12.50	22.22	15.38	13.94
eastern hemlock	11.11	8.33	11.11	7.69	8.01
sugar maple	5.56	4.17	11.11	7.69	5.93
serviceberry	5.56	4.17	11.11	7.69	5.93
red spruce	5.56	4.17	11.11	7.69	5.93

Table 2 illustrates the shift in the understory species composition towards shade tolerant species. Beech is becoming the most dominant and prolific species in the understory.
Figure 2 illustrates the general appearance of the white pine –hemlock stand found at King Corner. The white pine dominates the stand with other species filling in the gaps. The profile view illustrates the height difference and the hardwood species filling in the understory.

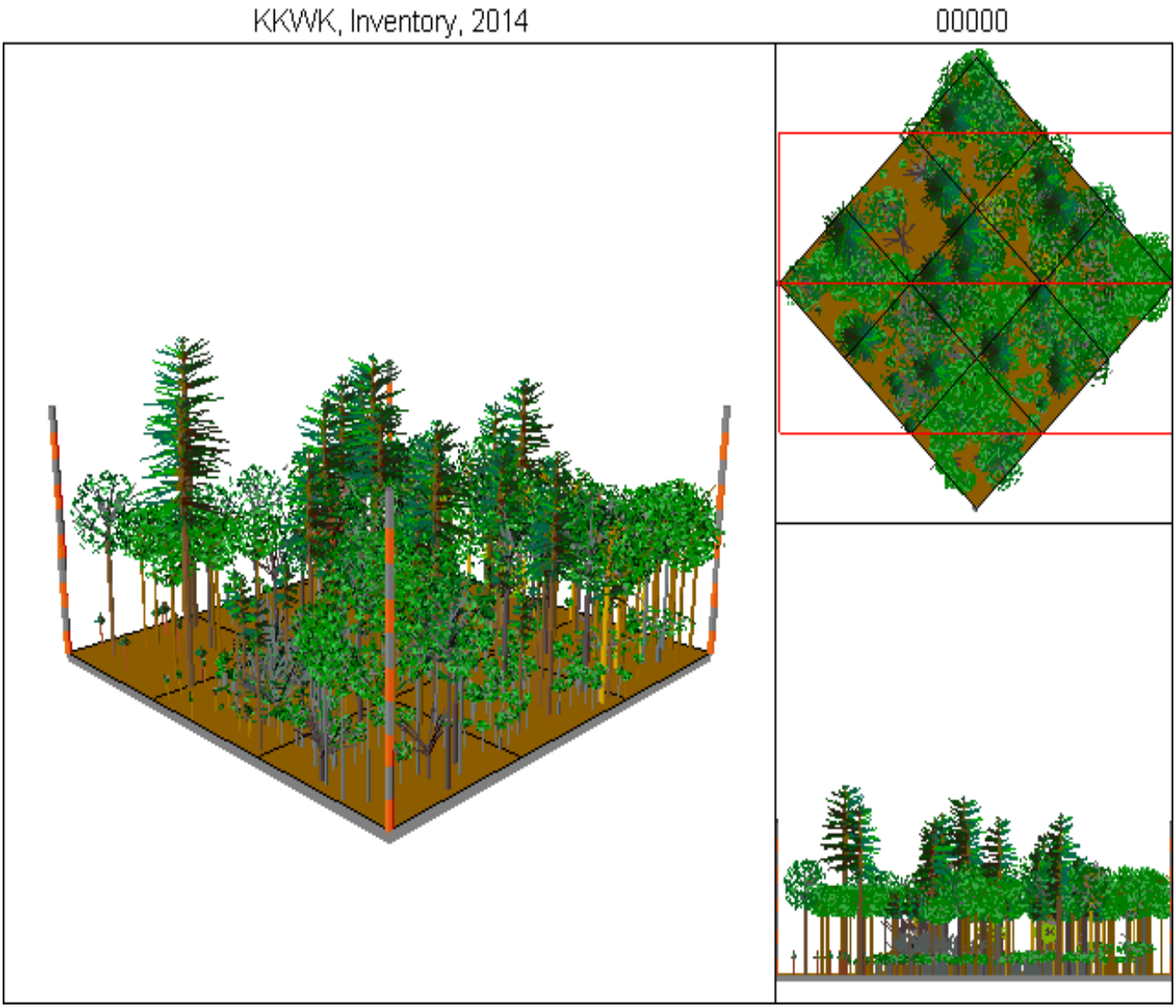


Figure 2. Stand Visualization of White pine-Hemlock. White pine dominates the vertical landscape.

The **Northern Hardwood** (290 acres**)** forest type occupies most of the management area and is a mixture of Sugar maple, Red maple, American beech, White ash, Yellow birch, Basswood, Black birch, Black cherry, Northern red oak and the occasional Eastern hemlock and Red Spruce. It is highly variable

in species composition and is found on a wide variety of topographical locations ranging from valley bottoms to ridge tops. The species mix for the northern hardwood (BB) forest type will generally have from 15 to as much as 100% Sugar maple. Sugar maple and White ash will occupy the better growing sites which will have well to moderately well- drained, fine textured or loamy soils. The management area has a very limited amount of these high quality growing sites due to the amount of rock and ledge found in this part of the forest. The end result is a species mix that will be comprised of over 50% beech with associates of Red maple and Sugar maple. The Northern hardwood type will vary from the classic beech-birch-maple which has the variable Sugar maple component to the beech-red maple stand which will often be found on the poorer growing sites. It is also possible to have inclusions of shade tolerant softwoods such as hemlock and red spruce. The natural regeneration of this forest type will favor the shade tolerant species such as beech and Sugar maple unless sufficient light from natural causes, such as disease, ice storms and windthrow, reaches the forest floor. See table 3 for a breakdown of species composition and statistical analysis.

Table 3. Overstory and understory information for the Northern Hardwood forest type (BB).

Composition

Overstory only

	All species	Sugar maple	Red maple	White ash	Sweet birch	Yellow birch	American beech	Black cherry	Paper birch	Northern red oak	Eastern white pine	Quaking aspen	Red spruce	Striped maple
Basal Area (square feet)	141.2	31.2	22.4	17.1	14.7	13.5	8.8	7.6	4.7	3.5	2.9	1.8	0.6	0.6
Percentage of stand basal area (%)	100.0	22.1	15.8	12.1	10.4	9.6	6.3	5.4	3.3	2.5	2.1	1.3	0.4	0.4
Stems Per Unit Area (stems per acre)	163.7	32.0	24.5	13.9	13.2	16.5	21.0	5.5	4.8	4.7	1.0	1.1	0.2	1.3

Diameters

Overstory only

	All species	Sugar maple	Red maple	White ash	Sweet birch	Yellow birch	American beech	Black cherry	Paper birch	Northern red oak	Eastern white pine	Quaking aspen	Red spruce	Striped maple
Medial DBH (inches)	15.2	15.3	15.6	17.4	15.2	15.0	10.7	16.9	13.8	13.2	26.4	18.0	22.0	9.0
Merchantable Medial DBH (inches)	15.3	15.3	15.6	17.4	15.2	15.0	10.7	16.9	13.8	13.2	26.4	18.0	22.0	9.0
Quadratic Mean DBH (inches)	12.6	13.4	12.9	15.0	14.3	12.3	8.8	16.0	13.4	11.7	23.3	17.1	22.0	9.0
Merchantable Quadratic DBH (inches)	12.7	13.4	12.9	15.0	14.3	12.3	8.8	16.0	13.4	11.7	23.3	17.1	22.0	9.0

Overstory only

	All species	Sugar maple	Red maple	White ash	Sweet birch	Yellow birch	American beech	Black cherry	Paper birch	Northern red oak	Eastern white pine	Quaking aspen	Red spruce	Striped maple
Average DBH (inches)	11.7	12.7	12.1	14.2	14.0	11.4	8.3	15.7	13.2	11.2	22.4	16.8	22.0	9.0

Structure

Overstory only

	All species	Sugar maple	Red maple	White ash	Sweet birch	Yellow birch	American beech	Black cherry	Paper birch	Northern red oak	Eastern white pine	Quaking aspen	Red spruce	Striped maple
Q Factor	1.21	1.23	1.16	1.07	1.09	1.15	1.22	1.17	1.17	1.17	1.08	1.12	1.07	0.00

Relative density

Overstory only

	All species	Sugar maple	Red maple	White ash	Sweet birch	Yellow birch	American beech	Black cherry	Paper birch	Northern red oak	Eastern white pine	Quaking aspen	Red spruce	Striped maple
Relative Density (percent)	91.13	24.80	12.90	6.16	8.34	10.85	7.48	2.70	4.45	3.16	0.92	1.01	0.14	0.42
percentage of stand	100.00	27.21	14.16	6.76	9.16	11.91	8.20	2.96	4.89	3.47	1.00	1.11	0.15	0.46

Volumes - Overstory only

	All species	Sugar maple	Red maple	White ash	Sweet birch	Yellow birch	American beech	Black cherry	Paper birch	Northern red oak	Eastern white pine	Quaking aspen	Red spruce	Striped maple
Sawtimber gross total (board feet/acre)	12,750	2,667	2,148	2,194	1,429	893	177	900	355	316	551	293	108	0
Sawtimber net total (board feet/acre)	12,750	2,667	2,148	2,194	1,429	893	177	900	355	316	551	293	108	0
Pulpwood gross total (cubic feet/acre)	1,603	386	242	192	148	175	111	80	60	38	30	12	3	10
Pulpwood net total (cubic feet/acre)	1,282	309	194	154	119	140	89	64	48	30	24	10	3	8
Gross total (cubic feet/acre)	3,593	820	590	500	392	326	136	208	121	86	107	54	18	10
Net total (cubic feet/acre)	2,875	656	472	400	314	260	109	167	97	69	85	43	14	8

Biomass

Overstory only

	All species	sugar maple	red maple	white ash	sweet birch	yellow birch	American beech	black cherry	paper birch	northern red oak	eastern white pine	quaking aspen	red spruce	Striped maple
Coarse Root Biomass (tons per acre)	18.10	4.96	3.07	2.16	2.01	1.83	1.20	0.96	0.62	0.53	0.40	0.21	0.08	0.06
Stem Wood Biomass (tons per acre)	60.82	16.75	10.37	7.46	6.81	6.14	3.76	3.32	2.08	1.74	1.25	0.72	0.24	0.17
Stem Bark Biomass (tons per acre)	12.20	3.36	2.08	1.48	1.37	1.24	0.79	0.66	0.42	0.35	0.23	0.14	0.04	0.04
Foliage Biomass (tons per acre)	1.99	0.52	0.32	0.22	0.21	0.19	0.14	0.10	0.07	0.06	0.10	0.02	0.02	0.01
Aboveground Biomass (tons per acre)	95.74	26.33	16.30	11.52	10.69	9.71	6.33	5.12	3.31	2.80	1.87	1.10	0.37	0.29
Total Biomass (tons per acre)	113.84	31.29	19.38	13.68	12.71	11.54	7.53	6.08	3.93	3.33	2.27	1.31	0.44	0.35

Understory Species Occurrence and Abundance - Live Stems Only BB

Species	Density	Rel Density	Frequency	Rel Frequency	Importance Value
American beech	97.06	51.56	58.82	37.04	44.30
Red spruce	16.18	8.59	20.59	12.96	10.78

The third forest type found in the management area is **Hemlock-Hardwood** (45 acres**).** This type is similar to the northern hardwood type with Eastern hemlock being the dominant species with associates of maples, birches, ash, cherry and spruce. An interesting point about Eastern hemlock is that it is the most shade tolerant of eastern coniferous tree species. It will regenerate under heavy shade and will respond to release after indefinite periods of suppression. Research has shown that hemlock will retain its vigor and actually will benefit from being suppressed. They will have smaller limbs that self-prune early and will have fewer problems with stem rot and ring shake. These two defects cause the most degradation in tree utilization and strength. Hemlock also is a shallow rooted species and is vulnerable to root damage and tree mortality when rapidly exposed to full sunlight and high evaporation of soil moisture. This forest type is found along the riparian zones and on the northerly facing slopes.

Table 4. Overstory and understory information for Hemlock hardwoods.

Timber Tables
This report is for the stand 'KKHH' inventory (2014) data.

Composition

Overstory only

	All species	red maple	paper birch	sweet birch	sugar maple	Eastern hemlock	white ash	American beech	yellow birch
Basal Area (square feet)	195.0	35.0	15.0	15.0	15.0	10.0	5.0	5.0	5.0
Percentage of stand basal area (%)	100.0	17.9	7.7	7.7	7.7	5.1	2.6	2.6	2.6
Stems Per Unit Area (stems per acre)	219.4	34.6	22.4	19.6	11.8	23.4	2.5	7.6	5.4

Diameters

Overstory only

	All species	red maple	paper birch	sweet birch	sugar maple	Eastern hemlock	white ash	American beech	yellow birch
Medial DBH (inches)	14.4	13.9	11.7	13.0	16.7	10.5	19.0	11.0	13.0
Merchantable Medial DBH (inches)	14.4	13.9	11.7	13.0	16.7	10.5	19.0	11.0	13.0
Quadratic Mean DBH (inches)	12.8	13.6	11.1	11.9	15.2	8.9	19.0	11.0	13.0
Merchantable Quadratic DBH (inches)	12.8	13.6	11.1	11.9	15.2	8.9	19.0	11.0	13.0
Average DBH (inches)	12.3	13.5	10.9	11.5	14.9	8.4	19.0	11.0	13.0

Structure

Overstory only

	All species	red maple	paper birch	sweet birch	sugar maple	unidentified non-comm hardwood	white ash	American beech	yellow birch
Q Factor	1.17	1.43	1.35	1.18	1.12	1.22	0.00	1.06	1.15

Relative density

Overstory only

	All species	red maple	paper birch	sweet birch	sugar maple	Eastern hemlocl	white ash	American beech	yellow birch
Relative Density (percent)	123.78	20.41	13.98	9.17	11.78	6.90	1.61	4.11	4.01
percentage of stand	100.00	16.49	11.30	7.41	9.51	5.57	1.30	3.32	3.24

Volumes

Overstory only

	All species	red maple	paper birch	sweet birch	sugar maple	unidentified non-comm hardwood	white ash	American beech	yellow birch
Sawtimber gross total (board feet/acre)	17,669	3,244	637	872	1,074	658	594	328	606

Overstory only

	All species	red maple	paper birch	sweet birch	sugar maple	unidentified non-comm hardwood	white ash	American beech	yellow birch
Sawtimber net total (board feet/acre)	17,669	3,244	637	872	1,074	658	594	328	606
Pulpwood gross total (cubic feet/acre)	1,972	285	247	176	230	99	67	57	20
Pulpwood net total (cubic feet/acre)	1,578	228	198	141	184	79	54	46	16
Gross total (cubic feet/acre)	4,735	829	351	337	406	203	150	103	124
Net total (cubic feet/acre)	3,788	663	281	270	325	162	120	82	99

Biomass

Overstory only

	All species	red maple	paper birch	sweet birch	sugar maple	Eastern hemlock	white ash	American beech	yellow birch
Coarse Root Biomass (tons per acre)	13.99	4.66	1.88	1.95	2.48	1.00	0.67	0.70	0.65
Stem Wood Biomass (tons per acre)	46.38	15.57	6.05	6.39	8.50	3.13	2.34	2.24	2.16
Stem Bark Biomass (tons per acre)	9.41	3.15	1.25	1.30	1.69	0.66	0.46	0.47	0.44
Foliage Biomass (tons per acre)	1.49	0.49	0.21	0.21	0.26	0.11	0.07	0.08	0.07
Aboveground Biomass (tons per acre)	74.06	24.70	9.91	10.29	13.18	5.26	3.56	3.70	3.45
Total Biomass (tons per acre)	88.05	29.36	11.79	12.24	15.66	6.27	4.22	4.40	4.11

Understory Species Composition and Diversity

This report is for the stand 'KKHH' inventory (2014) data.

Species Occurrence and Abundance

This table combines all height classes (if applicable) into a statistical summary for the understory, sorted by importance value.

Understory Species Occurrence and Abundance - Live Stems Only

species	Density	Rel Density	Frequency	Rel Frequency	Importance Value
American beech	150.00	75.00	75.00	42.86	58.93
yellow birch	12.50	6.25	25.00	14.29	10.27
striped maple	12.50	6.25	25.00	14.29	10.27
red spruce	12.50	6.25	25.00	14.29	10.27
hophornbeam	12.50	6.25	25.00	14.29	10.27

Dead/Down Summary

This report is for the stand 'KKWK' inventory (2014) data.

Coarse woody debris includes snags (standing dead trees) and larger woody branch and stem wood (greater than 1 inch in diameter) that has fallen either naturally or as a result of logging.

Snags

The following table lists the number of snags per acre by species for 6-inch size classes.

Species (Common Name) X DBH (in) Table for Overstory (Dead trees) and Understory (dead understory) Stems Per Unit Area (stems/ac): Dead trees only

dbh range	Total	red maple	black cherry	paper birch	White pine
< 6.00	0.00	0.00	0.00	0.00	0.00
>=6.00 and <=12.00	2.83	0.00	2.83	0.00	0.00
>12.00 and <=18.00	4.88	3.07	0.00	1.81	0.00
>18.00 and <=24.00	0.84	0.00	0.00	0.00	0.84
>24.00 and <=30.00	0.00	0.00	0.00	0.00	0.00
> 30.00	0.00	0.00	0.00	0.00	0.00

Dead/down woody material

The estimated volume of coarse woody debris in this stand is 743.07 cubic feet per acre.

This report is for the stand 'KKHH' inventory (2014) data.

Coarse woody debris includes snags (standing dead trees) and larger woody branch and stem wood (greater than 1 inch in diameter) that has fallen either naturally or as a result of logging.

Snags

The following table lists the number of snags per acre by species for 6-inch size classes.

Species (Common Name) X DBH (in) Table for Overstory (Dead trees) and Understory (dead understory) Stems Per Unit Area (stems/ac): Dead trees only

dbh range	Total	unidentified high value softwood	white ash	red maple
< 6.00	0.00	0.00	0.00	0.00
>=6.00 and <=12.00	9.35	9.35	0.00	0.00
>12.00 and <=18.00	3.00	0.00	1.59	1.41
>18.00 and <=24.00	0.00	0.00	0.00	0.00
>24.00 and <=30.00	0.00	0.00	0.00	0.00

Dead/down woody material

The estimated volume of coarse woody debris in this stand is 791.17 cubic feet per acre.

This report is for the stand 'KKBB' inventory (2014) data

Coarse woody debris includes snags (standing dead trees) and larger woody branch and stem wood (greater than 1 inch in diameter) that has fallen either naturally or as a result of logging.

Snags

The following table lists the number of snags per acre by species for 6-inch size classes.

Dead standing snags															
dbh range (in.)	**Total**	**sugar maple**	**white ash**	**white ash**	**American beech**	**black cherry**	**eastern hemlock**	**sugar maple**	**red maple**	**black cherry**	**white ash**	**white ash**	**white ash**	**white ash**	**sugar maple**
<6	**0.0**														
6 - 12	**6.3**							2.4							3.8
12 - 18	**10.7**	0.8	1.0	1.2	1.0	0.8			1.0	1.0	1.0	1.2	1.0	1.0	
18 - 24	**0.0**														
24 - 30	**0.3**						0.3								

B. Wildlife Habitat Conditions: There are no endangered species or priority habitat present according to the Natural Heritage and Endangered Species Program atlas. Inventory data shows an average of 740 cubic feet of coarse woody material and over 15 snags per acre in the white pine-hemlock forest type with lower numbers present in the other forest types. Standing snags, both living and dead, provide nesting habitat in the form of cavities, sources of food for birds and perches for birds of prey. Course woody debris also provides a source of food and habitat for a variety of species.

C. Water Resources: The terrain features of the management area limit wetland resources to fast running brooks and small seeps. Several potential vernal pools are to be found in the small depressions located on the two broad ridges that are the dominate features on the landscape. The soil types found here are well drained and very stony with a potential to be on the droughty side under conditions of low rainfall. There is a small wetland created by a beaver dam that is located at the northeastern edge of the management area and there is also a small wetland just south of King Corner Road that drains into the management area.

D. Recreation and Aesthetic Considerations: Trails in the management area are the Basin Brook Trail and the Hawley Pass trail. The Basin Brook Trail is adjacent to the sale area and north of Basin Brook. It will not be impacted directly by harvesting activity. The Hawley Pass Trail travels through the center of the area and is located adjacent to an unnamed tributary to Basin Brook. It is a foot trail that begins on an old logging road west of the sale area. Both of these trails see light to moderate use. King Corner Road and Hallockville Road see moderate use during the week and somewhat heavier usage during the winter season. The King Corner parking area is used for snowmobile access.

E. Forest Protection Concerns:

- *Sugar Maple Borer (Glycobius speciosus)* , a native insect, is present on the forest and the telltale damage is readily apparent. The main hosts are weakened Sugar maple trees that are suppressed and already stressed. Heavy infestations will damage the tree and cause substantial structural damage (see figure 2). Damage is caused by the larvae as they tunnel under the bark. Mitigation efforts involve the removal of damaged and suppressed trees thus improving the overall vigor of the remaining sugar maple trees.

Figure 2 Adult Sugar Maple Borer

- *Emerald Ash Borer (Agrilus plannipennis)* is present both to the west and east, and is expected to spread into Franklin County. It bores into the host tree and the larvae kill the tree by tunneling under the bark. This non-native insect will cause heavy mortality in all forest stands as White ash is a major component on the forest. Current strategy is to slow the spread of the insect by quarantining the infected areas to limit the spread of wood products that may harbor larvae, and to remove most of the host trees from the forest. There is no attempt at eradication due to the size of the insect population and mobility of the insect.

Figure 3 Emerald Ash Borer

- *Black Knot (Apiosporina morbosa)* is caused by a fungus that infects the twigs and stem of Black cherry. It will kill the twigs and in severe cases it will cause mortality on the entire tree.
- *Hemlock Wooly Adelgid (Adelges tsugae)* is a non-native insect that infects eastern hemlock. This insect has been found very close to the sale area and is expected to impact the lower elevations of the sale area. It causes mortality by feeding on the needles and depriving the tree of nutrients.

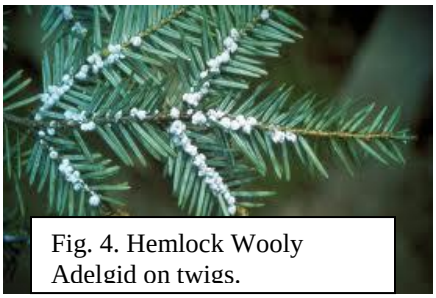


Fig. 4. Hemlock Wooly Adelgid on twigs.

- *Beech Bark Disease (Nectria coccinea)* is a complex infecting American beech and includes both insect and fungal components. The trees are first attacked by a scale insect which creates an environment that is favorable to the fungus *Neonectria*. Eventually the fungus has the potential to kill the tree and subsequently the next generation as well. There are no treatments for this disease other than to remove infected and weakened trees. Some individual trees successfully resist Beech-bark disease.

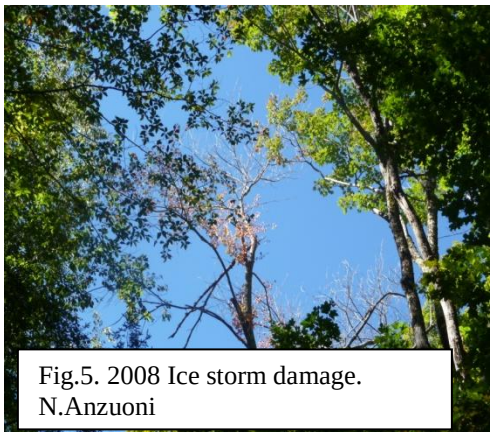


Fig.5. 2008 Ice storm damage. N.Anzuoni

- *Ice Damage* is common in this part of the forest with the last major event occurring in 2008. This will break branches and crowns and in some cases causing complete mortality.
- *Animal Damage* results from feeding activities from moose, deer, rabbits and porcupines. Regeneration is often a favorite target as the twigs and buds are readily available. Porcupines will chew on stems, twigs and bark. Moose and deer will also rub their antlers on hardwood saplings causing damage to the bark.

3. EVALUATION OF DATA AND PROJECTED RESULTS

A. Objectives of Forest Management

- Demonstrate use of silvicultural practices to convert an even-aged forest structure to multi-aged forest.
- Decrease large diameter White ash component to minimize overall affects from the spread of Emerald Ash Borer. EAB prefers large diameter trees for egg laying sites and by shifting the diameter range of White ash into the lower range it would limit the overall population of the insect.

- Increase plant species diversity by allowing more light to reach the forest floor and allow species that are less shade tolerant to regenerate.
- Create vertical structural diversity by varying age classes throughout the forest.
- Establish a network of skid roads and trails to facilitate future access to the forest.
- Repair existing forest road system to control erosion.
- Demonstrate use of Best Management Practices to conduct sustainable forestry operations on state lands.
- Maintain Coarse Woody Debris levels to agency guidelines.

B. Silvicultural Prescription

- Use the Group Selection regeneration method to create a series of 1/3 acre openings in all three forest types. This silvicultural system closely mimics the small-scale disturbance found in eastern forests.
- Anchor openings adjacent to preferred crop trees for seed retention, near aggregates of desirable advanced regeneration, near large diameter White ash, in areas of high mortality or low quality.
- Remove 20% of the stand in any single entry. This would be approximately 62 acres over the complete management area for a total of 186 1/3 acre openings.
- Enter the stand at approximately 25 to 30 year intervals to create significantly different age classes..
- Evaluate success of previous treatments when re-entering the stand and intervene if regeneration goals are not being met. This would be defined as the treated areas occupied by undesirable vegetation such as diseased beech, hobble bush and striped maple.
- Use herbicide treatments when needed to control undesirable competing understory vegetation such as beech and hobblebush. The Beech-Birch-Maple forest type will be the focus of these treatments as beech infected by Nectria is more prevalent here. Beech trees that appear unaffected by the Nectria will be retained in order to increase the overall resistance of the species to the disease and retain the abundant hard mast food source produced by beech..
- Remove large diameter white ash within 30’ of skid roads in anticipation of Emerald Ash Borer impacts to the forest. This would allow for a reduction of large diameter White ash without producing any significant residual stand damage.
- Large snags, 3-5 per acre, will be retained for wildlife benefits.
- Coarse woody debris will be maintained to DCR guidelines.

C. **Desired and Expected Results**

- The desired result of the silvicultural treatments will be to begin creating new age classes.
- Stand conditions will begin to be favorable for regeneration of desirable species including less shade tolerant species such as Black cherry, Yellow birch and Black birch.
- The forest structure will begin to shift from a single age class with a relatively homogenous canopy. Gaps in the canopy created by the 1/3 acre openings will create varying degrees of light reaching the forest floor. It will also create vertical and spatial diversity.
- Continued entries into the management area will alter the appearance of the forest over a period of time and create an all-aged forest with multiple, distinct age classes.
- A system of access roads will be created throughout the management area.
- Landing areas will be established for future use and maintained as forest openings.

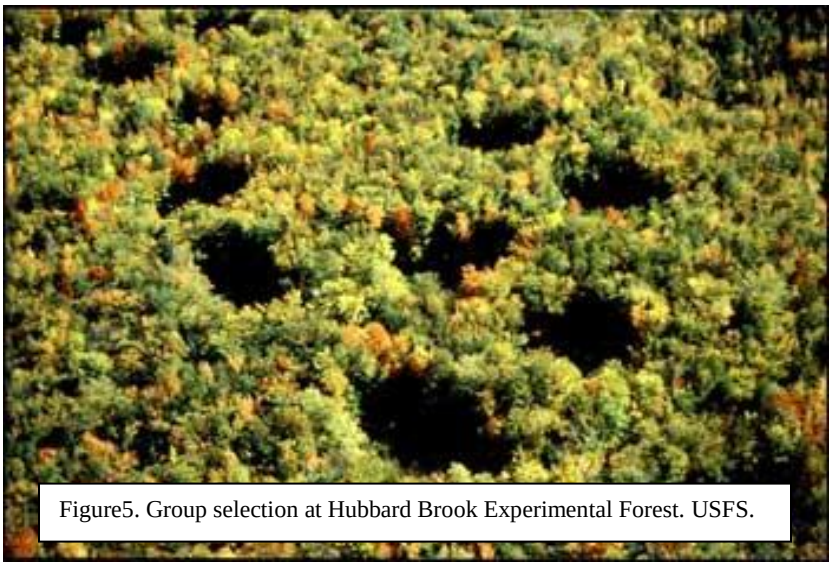


Figure5. Group selection at Hubbard Brook Experimental Forest. USFS.

Short and Long Term Desired Conditions:

Short Term Desired Conditions

- Creation of 1/3 acre group openings.
- Establishment of forwarder/skid road network.
- Stabilization of King Corner Road.
- Establishment of landing areas.
- Retention/creation of dead and live snags.
- Retention of large diameter coarse woody debris by leaving top wood and cull sections of trees in the woods.
- Initiation of desirable regeneration by creation of favorable seed germination sites. This will result from increased sunlight reaching the forest floor and scarification by mechanical disturbance.

Long Term Desired Conditions

- Creation of multiple age-classes. The forest canopy will begin to have a ragged appearance as the younger trees become established. Large trees that are in the un-harvested areas and retained large trees in the harvest area will maintain the tall canopy but it will be much more irregular. The stand will eventually differentiate into three or more distinct canopy layers that will be perpetuated over time. It should be apparent that large White ash are missing from the main canopy but will be represented in the regeneration and mid-stratum layers until they eventually reach maturity.
- Control of invasive and non-desirable species. This will be an ongoing activity with a combination of mechanical methods and herbicides as needed. The end result will be an irregular distribution of desirable native tree species regeneration based on their proximity to the group openings. It would be expected to see more shade tolerant species in the less

disturbed areas and the less shade tolerant species near the center of the group openings and in some cases along the skid trails. Beech will be a minor understory component and any non-native barberry will be absent from the stand.

- Successful regeneration of desirable species.
- Stable forwarder/skid roads. Roads should be covered with native vegetation and resistant to erosion.
- Continued live and dead snag presence. Residual live snags will die and become standing dead snags and begin to decay.
- Continued presence of large diameter coarse woody debris. This will be a result of large standing snags, pieces of live snags and dead snags falling to the ground.

D. Logging System Requirements:

- The nature of this sale will require harvesting equipment that can efficiently remove the forest products and transport them to a small landing.
- Terrain features will most likely limit skid road construction and location of landings.
- Access points will be from the parking lot on route 8A at King Corner and from Hallockville Road.
- The preferred system would use a cable skidder to pre-bunch material for a forwarder to transport to the landing. This would allow more effective use of the landing space and keep clean-up activities to a minimum.
- Mechanized cut-to-length systems will be permitted.
- The large proposed landing at King Corner will be restricted to forwarder use only.
- No whole-tree harvesting systems will be permitted.

4. PRESCRIPTION DOCUMENTATION

A. Marking Instructions:

The main focus of silvicultural treatments is to begin a transition to an uneven-aged structure throughout the forest. This will be accomplished by creating small openings up to 1/3 acre in size in order to favor hardwood regeneration. Preferred species will be Black cherry (Prunus serotina), Sugar maple (Acer saccharum) and Yellow birch (Betula alleghaniensis). The general marking guidelines will be as follows:

1. Identify preferred residual species in order to create openings.

2. Identify patches of preferred regeneration to be released.

3. Release regeneration by creating openings in the overstory. These shall be orientated to favorable conditions in terms of windfirmness and micro-site conditions. Size not to exceed 1/3 acre.

4. Create openings around preferred residual trees in order to initiate regeneration. Size not to exceed 1/3 acre. Mark individual trees to be removed with blue paint at breast height and stump.

5. Retain 3-6 large dead or live snags per acre. Diameters should be greater than 10". Live and dead snags will be retained when safety concerns are not an issue. This would affect landing areas and roadside sections more than the interior forest.

6. Retain 2-3 cords of down coarse woody material per acre.

7. Lay out skid/forwarder trails and paint trees to be removed.

8. Paint perimeter of openings with 2 red diagonal slashes.

9. Paint sale boundary with 2 diagonal slashes.

10. Number stream crossings with red paint to match Forest Cutting Plan designations.

11. Mark trees to be removed from main roads with blue paint at breast height and stump height.

12. Paint landing area perimeter when needed or flag and mark individual trees with blue paint at breast height and stump.

13. Follow DCR Bureau of Forestry guidelines for product marking.

Sale Layout and Harvesting Limitations:

Landings: Several landings will be utilized to facilitate removal of wood products. The parking lot at King Corner will serve as a possible landing site and has adequate room for loading trailers and storing wood products. It should be noted that this parking lot serves winter recreational users and also is used to turn school buses. Both of these uses will need to be taken into consideration. The eastern section of the sale is near Hallockville Road and several landings will be used to serve that portion of the sale. The road network is better here with less steep grades and an overall good road surface. A possible option to consider is a secondary woods road that leads from King Corner Road to 8A and would allow a landing to be constructed on a level portion of the forest near an existing landing. Final consideration will be based on volume of product removed and type of harvesting system used.

Forwarder Roads and Trails: Main forwarder /skid trails will be constructed prior to harvesting operations in order to facilitate an orderly flow of work. Existing roads will be improved and new roads will be rough graded as needed. In many cases these roads will utilize existing topographical features such as benches and shelves in order to minimize the road grade and also to minimize impacts to both the forest and the equipment.

Wetland and Stream Crossings: Wetlands and vernal pools will be located, marked and avoided by harvesting equipment. Stream crossing will be planned and marked in advance and will utilize temporary bridges in accordance with the Forest Cutting Practices Act and DCR guidelines. No fording of live streams will be permitted.

Road and Trail Buffers: Appropriate buffers will used to protect the visual quality on both roads and permitted trails. Best Management Practices will be used in addition to DCR Bureau of Forestry guidelines defining buffer strips. Hawley Pass Trail is located adjacent to an unnamed brook and will also be part of the filter strip.

Excluded Areas: Care will be taken to minimize impacts to trails, streams, wetlands and certain cultural features. Basin Brook and Kings Brook will utilize a minimum of a 50’ no cut filter with additional width as needed to comply with Chapter 132. Cellar holes will be protected from equipment impacts and steep slopes and ledges will be avoided. The Hawley Pass Trail is located adjacent to an unnamed brook that flows through the management area and will be included in a no cut corridor and visual buffer strip that will protect both the wetland and recreational values.

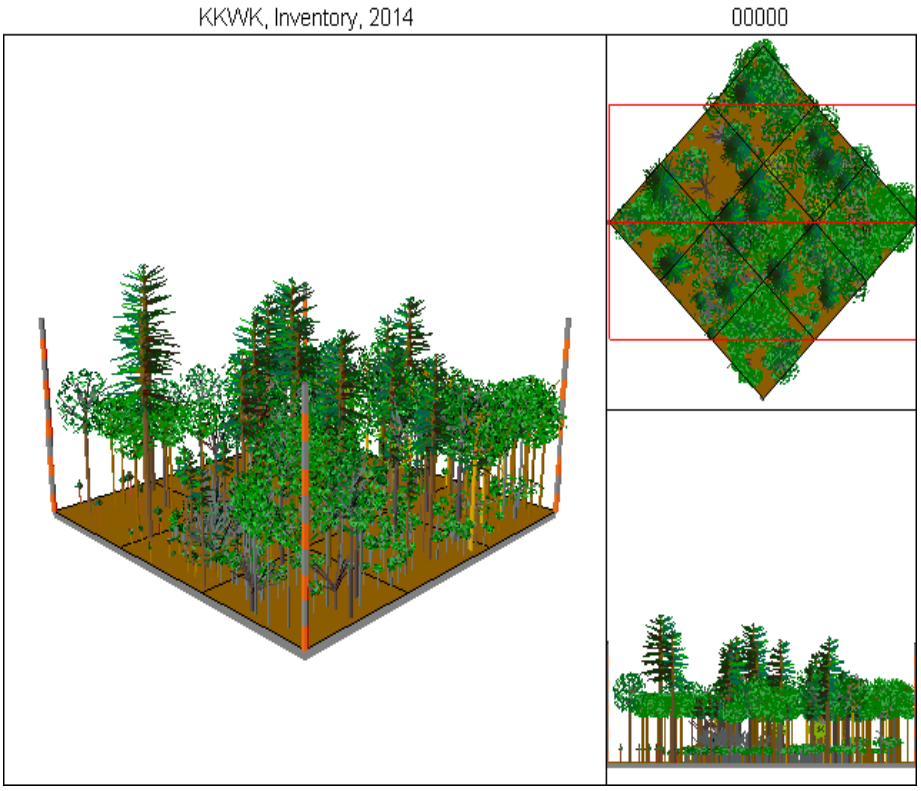
Erosion and Sedimentation and Site Restoration: King Corner road is in need of repair and has several non-functioning drainage culverts. The forest roads are currently being impacted by erosion and will need grading and drainage work. Main skid/forwarder trails will be stabilized according to DCR standards and Best Management Practices. This includes the use of water bars, grass seed and mulch as needed. Landings will be graded, seeded and mulched to prevent erosion. Unauthorized access will be blocked by gates or other barriers.

In Kind Services: Road repair will be the main consideration for in-kind services. Priority will be given to grading, gravel, crushed stone, gates, culvert replacement and headwall repair. Possible scenarios include purchase of material as in-kind goods with DCR staff providing the labor or having all goods and services contracted out and supervised by DCR staff.

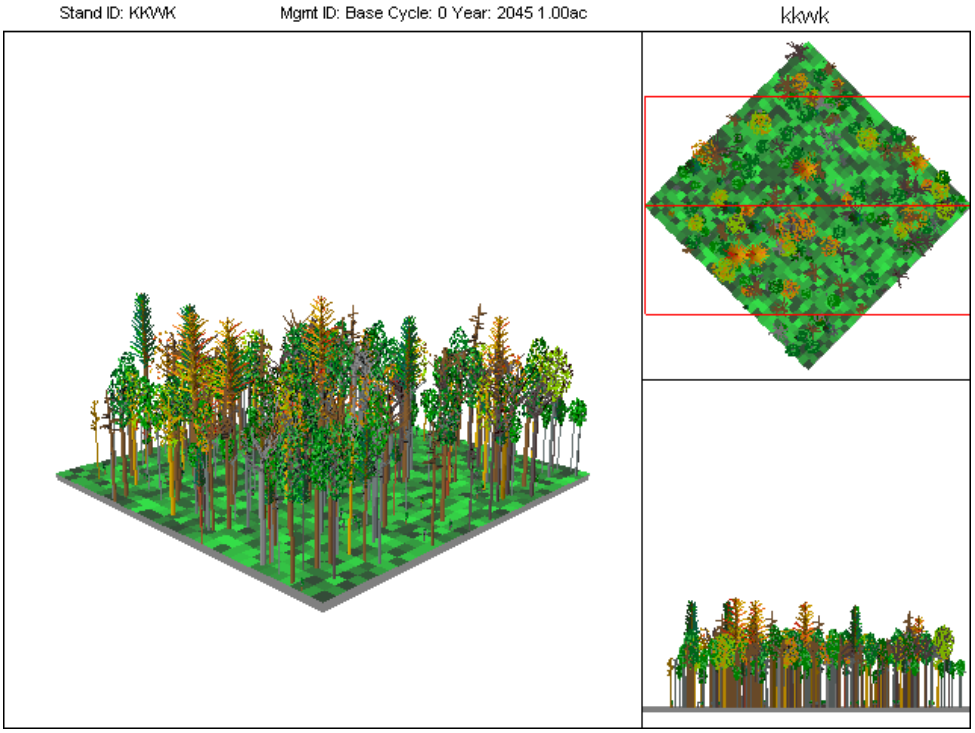
Future Silvicultural Treatments: The forest will be re-entered at approximately 25 year cycles until the remaining manageable areas are treated. A system of regeneration plots will be used to monitor regeneration in previous harvest areas to determine if regeneration goals are being met and if any invasive species are found. Future harvests may combine invasive species control with non-commercial timber stand improvement practices to meet regeneration needs.

Appendix 1. Stand Visualization Imagery

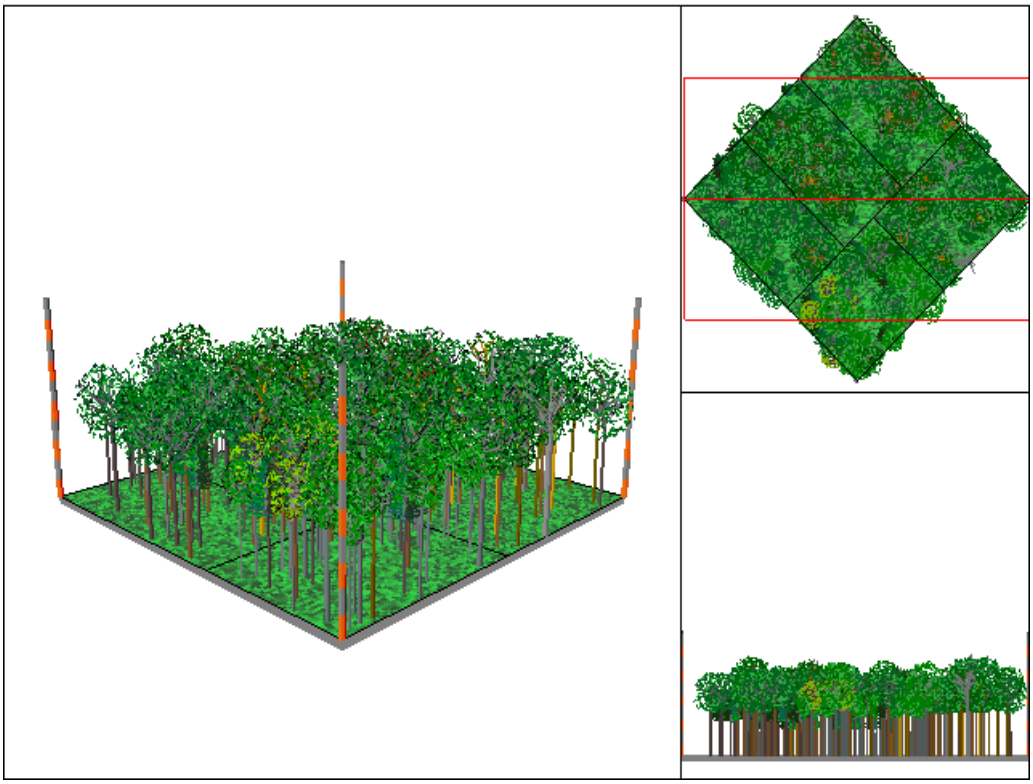
White Pine Hemlock - Present Conditions



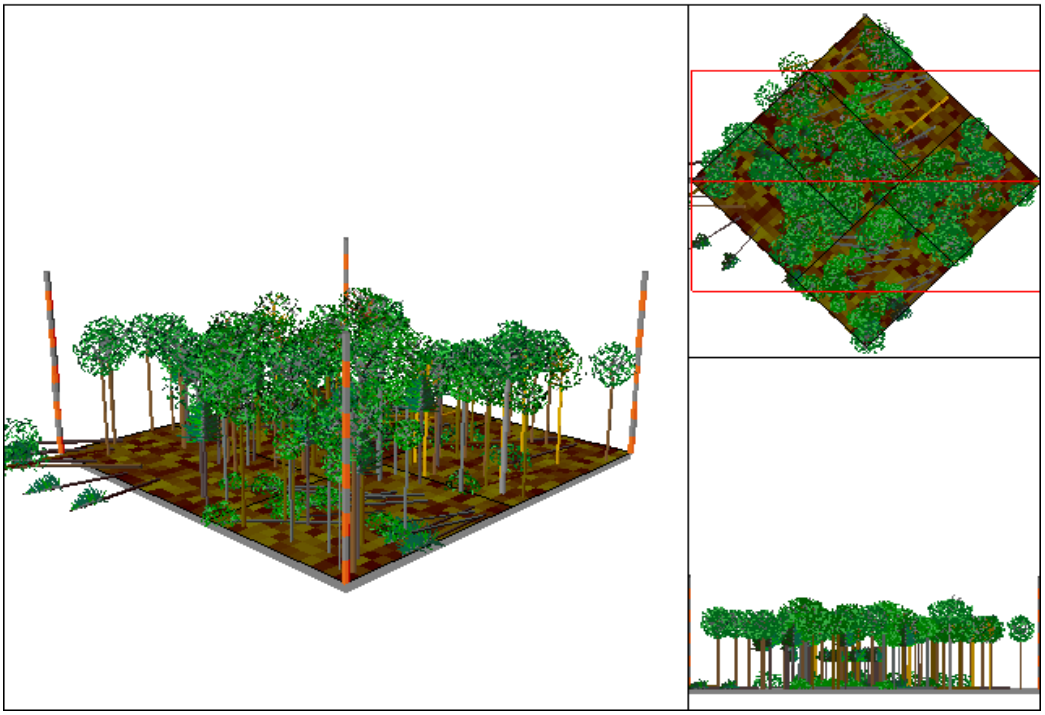
White Pine Hemlock - Post Harvest Conditions



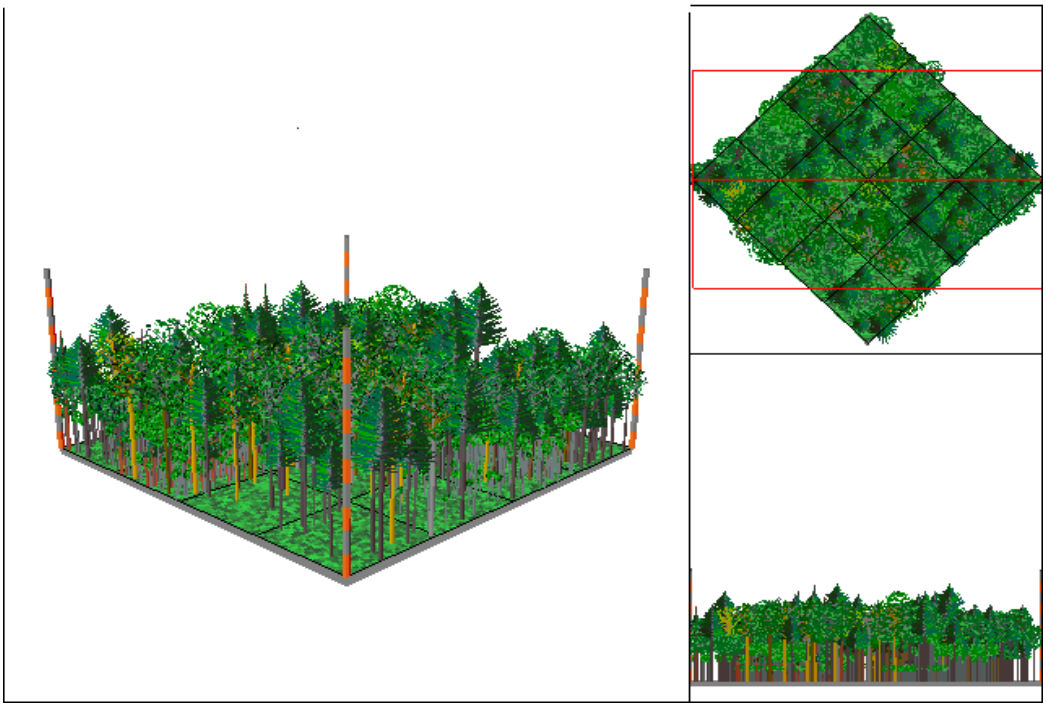
Northern Hardwood - Present Conditions



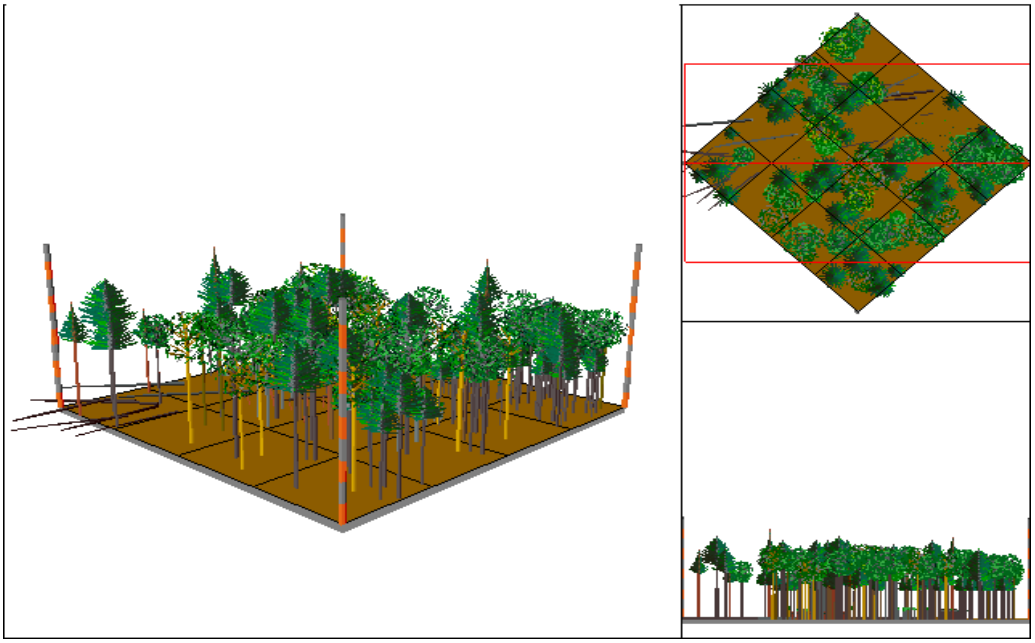
Northern Hardwood - Post Harvest Conditions



Hemlock Hardwood - Present Conditions



Hemlock Hardwood - Post Harvest Conditions



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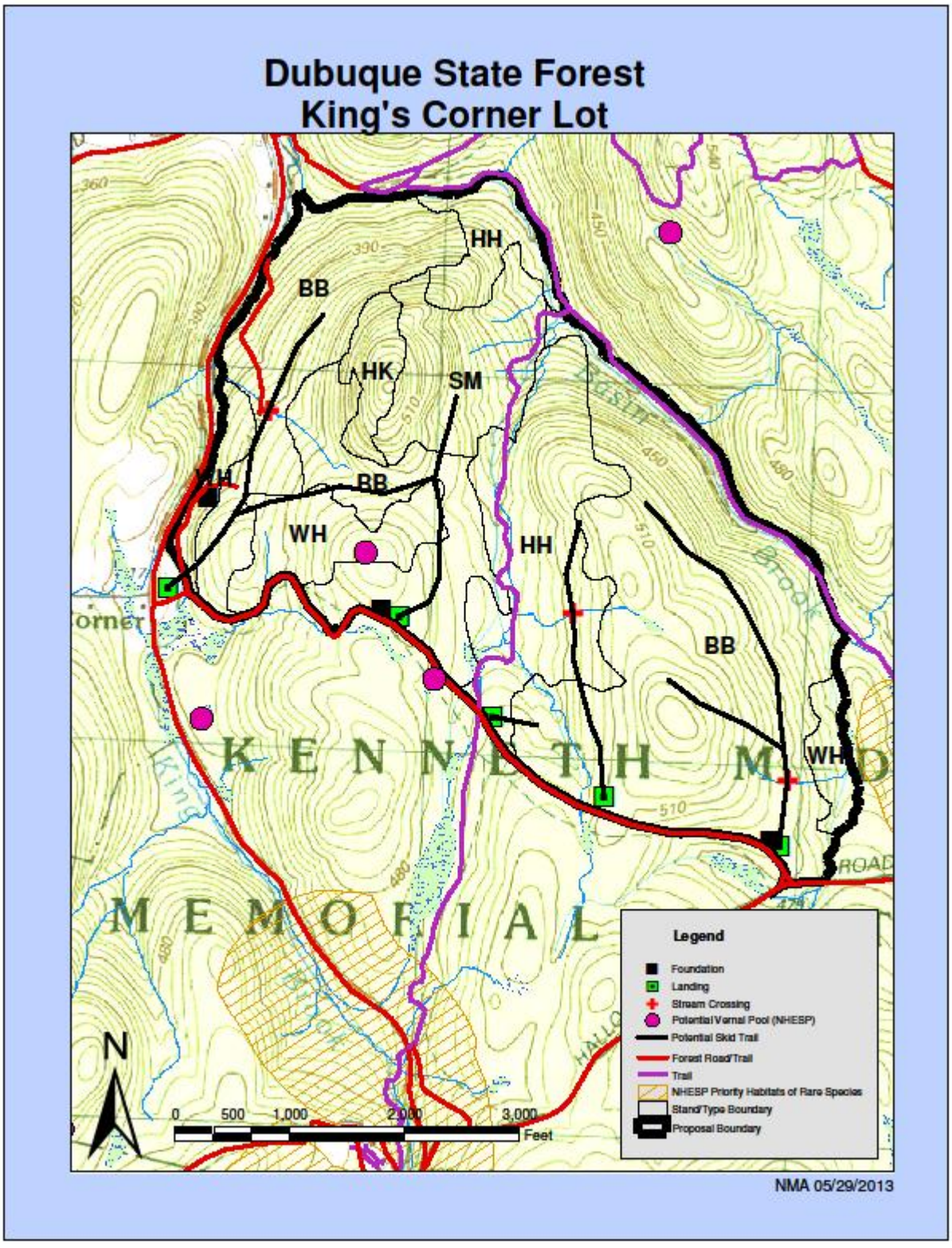
Dubuque State Forest
King's Corner Lot
HH
BB
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K E N N E T H
M E M O R I A L
Legend
Foundation
Landing
Stream Crossing
Potential Vernal Pool (NHESP)
Potential Skid Trail
Forest Road/Trail
Trail
NHESP Priority Habitats of Rare Species
Stand/Type Boundary
Proposal Boundary
N
0 500 1,000 2,000 3,000
Feet
NMA 05/29/2013

Kings Corner Forest Mangement Proposal
Debuque State Forest - Locus Map