

Forest Management Plan Prepared for the Tuftonboro Conservation Commission
The Sargent/Phelps Forest
147 acres, Tuftonboro, NH

June 2021

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Sargent/Phelps Lot- 149.84 acres

Acreages & Timber Types

Land Type		Acres
Forest Land	Stand 1 White pine/ Red Oak 1/2/3	100.0
	Stand 2A Hemlock/Sftwd/Hdwd 3/2/1C	8.9
	Stand 2B Hemlock/Hdwd 1/2/3C-Black Cherry saplings	3.4
	Stand 2C Hemlock/ Hdwd 4A	1.7
	Stand 3 White Pine/Hdwd 3/4B	3.7
	Roads and Landings	2.0
Forestland Total		119.7
Other	Wetlands	30.14
Total		149.84

Property Map



SARGENT/PHELTS LOTS
Forest Management Plan
Tuftonboro Conservation Commission
Rt. 171
Tuftonboro, NH

June 16 2021

Forest Timber Types	
1 White Pine/Red Oak 1/2/3C	100 acres
2A Hemlock/Softwood, Hardwood 2/3/1C	8.9 acres
2B Hemlock/Hardwood 1/2/3C	3.4 acres
2C Hemlock/Hardwood 4A	1.7 acres
3 White Pine, Hardwood 3/4B	3.7 acres
Roads and Landings	2 acres
Forestland	119.7 acres
Wetlands	30.14 acres
Total Acreage	149.84 acres

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TREE SIZE CLASSES	TIMBER TYPES	Tree Density
1. Saplings	WP- white pine	A. Overstocked
2. Poles 2-8 in Diameter Breast Height (DBH)	HO- red oak	B. Adequately stocked
3. Small Sawtimber 8-14 in DBH	HM- hemlock	C. Understocked
4. Large Sawtimber 16+ in DBH	HDWD- hardwood species	
	SFTWD- hardwood species	
	RM- red maple	
Timber Type Line		Ex. WP/RO 3A
Permanent Stream		
Intermittent Stream		
Wetland		
Stone Wall		
Wire Fence		
Trail		
Truck Road		
Log Landing Area		
IP- Iron Pipe (boundary line corner)		
STEEP		
Scale: 1 inch = 300+/- ft.		

Introduction

In 2019, these two adjacent tracts of forestland were purchased by the Town of Tuftonboro from Fred E. & Eunice Sargent (103.69 acres), and the Michael T. Phelps Trust (46.15 acres). These parcels are now managed together for a combined total of 149.84 acres, which is the subject of this forest management plan. The lands are identified on the Tuftonboro tax maps as parcels 31-1-2, and 31-1-1. Much of the timber was harvested from these lands prior to their being purchased by the town of Tuftonboro. This forest has had extensive harvesting activity over the past twenty years. The most recent harvest took place five years ago. Fortunately, the recent abundance of white pine and red oak seed years have led to excellent germination of these two highly desirable species on nearly all of this land. This feature now provides an opportunity to conduct timber stand improvement (TSI)* (the thinning of young saplings), (see Prescriptions) on most of this acreage.

Management Objectives

The Town of Tuftonboro wishes to manage these lands for the long-term benefit of the citizens of Tuftonboro. One primary goal for this public land is to use the site to demonstrate how to manage forests sustainably in addition to providing learning opportunities on how to do so. The Town will also maintain and grow a productive forest, which will provide a corridor of wild land connecting the Ossipee mountains with the Great Meadow and Lake Winnepesaukee. This corridor will facilitate the movement of wildlife across these landscapes where current connections between the mountain uplands and vital habitats, such as the Great Meadows ecosystems, have largely been circumvented by development. This plan will address priorities such as the removal of invasive species, creation of thriving habitats for native plants and animals, along with growing and managing healthy, fully stocked forests.

Fieldwork

A series of evenly-spaced, parallel transect lines were walked by the forester to assess the forest. A series of points were taken at set distances apart. At each point location, the forest conditions were assessed regarding tree species, size classes and densities, along with ground vegetation, soils conditions, wildlife habitat and signs.

Recent History

These parcels had a series of successive harvests conducted over the past twenty years. The most recent and thorough of these occurred five years ago, when the land was heavily harvested.

Location

These parcels are located approximately 700 yards south of RT 171 in Tuftonboro, NH. Located south and southwest of the Sargent parcel, are abutting parcels of land which are also owned by the Town of Tuftonboro, including the Great Meadow Conservation Area. Together, these constitute a large landscape of conserved land. This provides an opportunity to create habitat for plants and animals, such as bear and moose, which need larger habitats in which to breed and thrive.

Boundaries

The boundary lines are, for the most part, blazed red. The blazes on the Sargent boundaries are better than those on the Phelps lot, where the lines are hard to follow, and where many of the blazed trees were cut by a logging crew. The Phelps boundary lines should be re-painted within 10 years. The interior line separating the Sargent and Phelps lots does exist with sparse faint blue blazes which are very difficult to follow. If this line needs to be maintained, this effort should be undertaken very soon.

Access

The access that was used for most of the recent harvesting on these properties is a good quality road which begins on Rt. 171 at the Tuftonboro Waste Disposal Facility. The road leads to a large log landing on the Sargent Lot. There are a series of skid roads radiating from this log landing to most of the land area. One road leads to the Melvin River, where a hemlock, tree-length log bridge was installed years ago, and was used to access most of the timber on the Phelps lot. This bridge was not installed following NH Wetlands Board regulations. It was also not removed, which is required by law, and has now collapsed nearly or completely blocking fish migration in the brook. This likely prevents brook trout from reaching their spawning beds. The log blockage should be removed, which could still be accomplished using a grapple skidder with cables and choker chains. The decaying tree-length logs can then be left in the forest a short distance from the stream.

There is also an old road passing from the John B. Hersey Trust land, through the former Phelps property (see timber type map), which then crosses into the Sargent lot. There is likely a right-of-way to assure the use of this access road. This should be explored and documented.

Recreation

This is public land, and is open to all foot travel, fishing, and hunting. There is also a snowmobile trail crossing the land. Four-wheeled all-terrain vehicles are using the land from the power line. This should be discouraged as they will cause significant erosion and the inevitable degradation of the woods roads, while causing erosion and tree root damage. It would be advisable to post the land against ATV's.

Topography

The topography on these lands is relatively gentle, and does not prevent access to any of the lands. There is a short, steep slope which descends to the Melvin River, and a drop north from the power line toward the northern boundary line. The Sargent lot has a steady, gentle slope to the southwest, towards the meadow wetlands.



The Melvin River

Water Resources

The Melvin River is the primary water course on the property. It is a cold water flow, making it well suited to our native brook trout. The limiting factor for the proliferation of brook trout is that the river has what is primarily a fine sand bottom. Brooks with a uniformly sandy bottom are nearly always the result of erosion.

To improve the fishery, the Melvin River will have large woody debris added to it, without blocking the flow. Tin Mountain Conservation Center of Albany, NH, has procured funding to accomplish this for the town. The added wood causes the water to scour out the bottom, exposing gravel and larger stones. This gravel gives aquatic insects a place to adhere their larvae, creating habitat both for them, and the brook trout. The exposed gravel also creates spawning grounds for the trout. The river water appears to be of very high quality, and cold enough to provide a fine habitat for brook trout.

Cold Brook is the western boundary line of the property. Where it acts as the property line, Cold brook runs deep inside the Meadow marsh. A small brook enters the Great Meadow wetland in the south eastern corner of the Phelps lot. This brook has a year-round flow of cold, well-oxygenated, clean water which adds to the health of the Cold Brook watershed.



Speckled alder in the Great Meadow

Wetlands

There is one large wetland that extends into this property, the Great Meadow. The meadow is a shrub swamp, with a thick and healthy growth of speckled alder, maleberry, sweet gale, rhodora, and highbush blueberry growing in it. There is also likely to be huckleberry, and cranberry although these were not observed. This is great habitat for red-winged blackbirds, marsh wrens, kingbirds, marsh hawks (harriers), blue and green herons, bitterns etc.

There is also a rich floodplain along the Melvin River. This low elevation floodplain forest, which runs in a 200-400 foot wide band along the river, is essentially a boreal forest stocked with a red spruce balsam fir forest, along with red maple, black cherry, tamarack (eastern larch), as well as dying brown and white ash trees, due to the emerald ash borer infestation.

Cultural Resources

There was scant evidence of cultural resources on these parcels, other than wire fences, logging roads and landings. The soils are not suitable for growing crops, so the primary agricultural use was for animal husbandry.



Evidence of the emerald ash borer on a dying brown ash tree

Forest Health

This forest has had a liquidation harvest conducted on it over the past eighteen years. The most recent and complete harvest was 5 years ago.

The greatest threat to this forest ecosystem is the glossy buckthorn. The forester did not take note of this occurrence during his fieldwork in leaf-off conditions. Thankfully, Stephen Wingate brought it to my attention. Buckthorn is perhaps the worst woody invasive species in NH. If left unchecked it will form an understory in the forest 12-15 feet in height which will block the sunlight from hitting the forest floor. It thereby has a terrible impact on the forest ecosystem, by preventing the growth of natural vegetation on the forest floor. This includes tree regeneration, shrubs, and herbs. Buckthorn is not browsed by either deer or moose. It also proliferates readily, and widely, by its production of berries which birds will eat and spread in their fecal matter. Control of this noxious shrub can be temporarily accomplished by cutting it off. However, this is but a temporary remedy, as it will readily grow back. Cutting it may allow tree regeneration to rise above it. The only semi-permanent remedy is to use herbicides, which are toxic to aquatic organisms. In a discussion with Kyle Lombard, NH Forest Pathologist, on this issue he suggested using Round-Up judiciously. A two man operation would cut off the buckthorn stems, after which the cut stems would be touched with a brush, or a quick spray with a hand-held back-pack sprayer of Round-Up. Kyle suggested contacting Matt Bosiak, and/or Doug Cygen of the NH Department of Agriculture for a more detailed assessment. A licensed pesticide applicator must be used for commercial applications. This will not be a permanent solution, although it should allow the forest regeneration to rise above the buckthorn.

The Asian hemlock wooly adelgid has been found in Tuftonboro. The forester looked, and did not find it on this land, although it will not be long before it arrives. It is likely that the adelgid will cause the decline of hemlock trees on this over time. Kyle Lombard spoke to the fact that the hemlock wooly adelgid seems to have reached its current northern-most point of causing serious damage in southern Carroll County. This is due to our current winter low temperatures (-5 F) being just cold enough to cause 95% of the adelgids to not survive. As the climate continues to warm, this control mechanism will become less effective. This will be a gradual process. There is hope however, as biological controls have been implemented in NH. A few species of Asian black beetles have been released throughout NH. The beetles have been found to prey solely upon the Asian hemlock wooly adelgid, and they hold promise. This leads to forest management efforts to replace hemlock stocking with other softwood species in areas where there is a need for softwood cover, such as deer yards, and brook edges.

More dire results are in store for the white and brown ash where all of the trees at 8" DBH*+ are nearly certain to perish from the emerald ash borer. The brown ash trees in the wetlands along the Melvin River (photo above) were infested with them. These trees will all die within a few years. The latest information suggests that the parasitic wasps that lay their eggs in the ash borer larvae are proliferating where they have been introduced. The next generation of ash trees may be protected. Ash trees less than 8 inches DBH are not attacked by the ash borer.

Aesthetics

Although this forest was heavily logged five years ago, these open lands with scattered larger trees remain very attractive. The main logging road crossing the northern portion of the Sargent lot makes for a very pleasant walk. The Melvin River which flows across the land is beautiful to see and walk along,

especially in the open wooded wetlands areas. The river banks are relatively dry along this shoreline, flowing through areas of boreal forest with balsam fir and red spruce growing along the shores.

The Climate

Currently, a leading silvicultural consideration is the warming of our climate. Most of our trees will take 85+ years to mature. There is a wide range of species projected to decline due to the warming, and associated seasonal changes. The range of northern trees, such as the balsam fir, the spruces, paper birch, and the aspens are predicted to move northward as the climate warms. Other than white pine, most of our softwood species are projected to decline. The species which we wish to increase the proportions of will be those trees possessing a genotype and phenotype projected to endure or thrive in the projected warming scenarios. This is silviculturally accomplished by the harvest of, or the retention of, selected tree species, the season of harvest, the size of harvest openings, and timing harvests to coincide with the seed crops of the species desired to regenerate. The US Forest Service's projection of the list of trees that will be resilient to the warming include: white pine, the oaks, and the maples. The Sargent/Phelps lot is well positioned with suitable species for the next fifty+ years. Species management will be carried out to encourage the projected thrivers, while gently reducing the stocking of the species more susceptible to decline as the climate changes. Never-the-less, maintaining species diversity and maintaining high stocking levels are our best defense, as these modeled projections are not a certainty. Maintaining well-stocked forests with a good canopy will protect against drought damage, and as species begin to decline, thinnings can be conducted to remove unhealthy trees. The ash is dying, but they will likely be resurrected by biological controls for the next crop of ash trees. Paper birch and white ash trees are no longer living as long as they once did on most sites in NH. This is due to the calcium being permanently leached from our soils as a result of acid deposition (acid rain). The now frequent freeze-thaw cycles during the winter are also damaging our northern species, paper birch in particular. This reinforces the need to match the growth of tree species to their appropriate soil site indexes*.

Woody debris*

Larger downed woody material is referred to as coarse woody debris. There is a good supply of smaller woody debris (limb sections) on the land due to the recent heavy harvesting. There has been significant blowdown of the sparse tall white pines that were left, without the support of neighboring trees, on the wetter soils and on exposed sites. Wood on the forest floor provides a significant attribute for the enhancement of biodiversity in the forest. This debris provides habitat for a wide array of organisms from amphibians to bears. It adds nutrients to the soil, and helps facilitate tree seed germination. There is a good supply of small to moderate sized debris on these lots as a result of the recent harvest, combined with the resulting blowdown. Stand 2B has an excellent supply of woody debris due to the trees on wet soils being widely spaced, and thus blowing over after the recent harvest. Woody debris creates a basis for the forest food chain by growing increased wood decay fungus, along with herbaceous plants. Insects eat the fungi and plants, leading to higher insect populations, then to higher numbers of small rodents and birds. This continues on up the food chain to an increase in predatory raptors and mammals. The enhanced growth of hardwood regeneration grows more browse for the deer and moose. During timber harvests, the culled (decayed) butt portions of logs are best bucked off in the forest, versus on the log landing, to enhance the habitat throughout the forest. These large tree

butts provide den sites, shelter, and habitat for mammals, birds, reptiles, insects, and amphibians. Bears and woodpeckers use them extensively for feeding on grubs, and they serve as drumming locations for ruffed grouse. Large woody debris is also very beneficial as a repository of miccorhizal fungi, which have a symbiotic relationship with tree roots. The fungi provide minerals and soil nutrients to the tree roots, while the trees return the favor by providing carbohydrates to the fungal mycelium. It has been recently discovered that miccorhizal networks also initiate a symbiotic trading of nutrients between trees.

*See Glossary



A fresh set of moose tracks near the Meadow, with both an adult and a yearling calf present.

Wildlife

There was ample deer sign, coyote and fox tracks, two moose tracks were found in the snow, along with good grouse sign. As the aspen matures in Stand 1A over the next 12+ years, the grouse population will gradually expand, due to the excellent habitat provided by aspen flower buds. There were beaver sticks and stumps along the Melvin River. Adjacent to the wetland areas, with its lower softwood edges of hemlock, balsam fir, spruce, white pine, there was good snowshoe hare use. During the autumn, bears

spend time in the tops of both beech and oak trees eating nuts and acorns. In the summer they will climb black up cherry trees to eat the fruit. Productive mast trees can often be identified by bear claw marks in the bark, and by bears' nests in beech and oak trees. Bears will rest on clumps of broken limbs, from which they have eaten the nuts. This is known as a bear's nest. This is not really a nest at all, but simply their dinner chair. All mast trees greatly benefit a multitude of wild creatures such as deer, bear, grouse, and turkeys, along with a large number of small birds and mammals. Future timber harvests should encourage the release of trees with strong mast production allowing for the development of large, broad canopied trees. On both of these parcels there is a good presence of larger white oak trees. White oak acorns are highly preferred by deer and bear. There are scattered oak trees, along with small groups of larger red and white oak trees on this land. The forest duff showed that the deer, and perhaps bears, were scraping for acorns this spring. Large, super-canopy trees provide a feeling of security for many arboreal species. The recent harvest has led to the growth of raspberry and blackberry bushes in the openings. In moist areas with heavier forest cover there were patches of hobblebush growing, providing good browse and berries for bear and birds. Good forest management can encourage the proliferation of soft mast (fruit) producing trees and shrubs in the forest. Good sources of soft mast include hobblebush, black cherry, serviceberry (Juneberry), Rubus species (raspberry, blackberry, dewberry, and thimbleberry), blueberry, apple, viburnum, partridgeberry, bearberry and wintergreen etc. Where appropriate these shrubs and trees should be encouraged on the landscape. For birds, mast food sources also include seed from the birches, hophornbeam, and maple trees.

Forests for the Birds

A goal for this tract would be to encourage the development of multi-layered tree and shrub canopies which greatly enrich bird habitats, while sequestering higher volumes of carbon dioxide in the forest.

The American redstart and veery, along with black throated blue warblers, will all use these habitats. The ample softwood regeneration on these properties will improve the habitat for the Canada warbler, winter wrens, vireos, and wood peewees. The marshes in the Great Meadow provide excellent habitat for redwing blackbirds, king birds, bitterns and marsh hawks (harriers). The young aspen trees in Stand 1 will create some wonderful habitats. The ruffed grouse uses this habitat frequently where they spend their winters eating aspen buds. Aspen stands also have a light overstory allowing light to penetrate to the forest floor. This leads to a ground cover of herbaceous vegetation, shrubs, and advance tree regeneration which adds to the habitat criteria for grouse, snowshoe hares, deer, bear, and a wide array of song-bird species.

Mature red oak and beech trees, as are found in the western portion of Stand 1, provide the habitat needed for scarlet tanagers, oven birds, Blackburnian, and black throated green warblers. All mast trees greatly benefit a multitude of wild creatures such as deer, bear, grouse, and turkeys, along with a large number of smaller birds and mammals. Timber harvests should encourage the release of trees with strong mast production to encourage the development of large, broad canopied trees. The high canopy bird songs in a stand of large hardwoods can be amazing. There are areas of raspberry and blackberry bushes growing in the harvested openings. There is a strong correlation between the sites where raspberry grows and a richer site index. Silvicultural techniques can encourage the proliferation of soft mast (fruit) in the forest. A small stand of undisturbed, very old hemlock, red oak, and red maple exists along the Sargent/Phelps boundary line adjacent to the Great Meadow. This stand provides an island

habitat for birds requiring this mature softwood habitat. This small stand should be preserved by the town.

The cherry saplings growing under the scattered hemlock and hardwoods in Stand 2 will grow into a forest of black cherry, red oak and white pine trees. This habitat is a rare occurrence in this portion of New Hampshire, and in ten years, it will begin to produce large crops of wild black cherries. It will have a magnetic effect on many species of wildlife. It is amazing to see pileated woodpeckers hanging from the limbs of black cherry trees eating the fruit.

Vertical Structure and Crown Closure

Vertical structure is the layering of both live and dead woody plant crowns within a forest stand. In much of this forest this structure is lacking due to the recent heavy harvesting. However, there is a presence of taller oak, along with hardwood mid-story layers contributing to good neo-tropical bird habitats. Un-even aged and older forests are generally well stratified with layers of vertical structure, and support a far greater array of plant and animal species than an even-aged stand of younger trees. Typical late successional over-stories in north-central NH (a long-term goal) are composed of hemlock, spruce, beech, yellow birch, sugar maple, and red maple, along with white ash, red oak, and basswood. The small stand of old hemlock/hardwood along the Sargent Phelps boundary and adjacent to the Great Meadow is good example of a late successional forest.

When harvesting trees, it is important to regenerate an understory of both desirable future canopy tree species, along with shade tolerant shrub layers of species such as hobblebush (well-represented here) and viburnums. Species such as red spruce, hemlock, beech, and sugar maple are shade tolerant and can survive for many years in the understory (advance regeneration), and will begin rapid growth when a harvest or natural disturbance allows the sunlight to penetrate to the forest floor. This is occurring in Stand 2 where it meets the wooded wetland that gradually descends to the Great Meadow. The softwood sapling layer of hemlock, spruce and white pine here is creating a rich habitat for grouse and snowshoe hares.

Vertically layered stands develop as a result of light harvests over time, and from the death of older trees, resulting in the constant regeneration of trees in both natural and man-made openings in the stands. The goal of management, with regard to vertical structure, is to maintain and encourage diverse age classes with varying degrees of crown closure throughout the forest.

Soils

Soil Descriptions Carroll County Area, New Hampshire			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
35C	Champlain loamy sand, 8 to 15 percent slopes	39.4	25.0%
220C	Boscawen gravelly loamy sand, 8 to 15 percent slopes	21.9	13.9%
226C	Bice fine sandy loam, 8 to 15 percent slopes, very stony	7.7	4.9%
268B	Sutton fine sandy loam, cool, 0 to 8 percent slopes	30.1	19.1%
395A	Chocorua mucky peat, 0 to 3 percent slopes	9.9	6.3%
409A	Limerick silt loam, cool, sandy substratum, 0 to 3 percent slopes, frequently flooded	7.3	4.6%
895A	Bucksport muck, 0 to 2 percent slopes	31.9	20.2%
978B	Leicester-Moosilauke fine sandy loams, cool, 3 to 8 percent slopes, very stony	9.4	5.9%
Totals for Area of Interest		157.5	100.0%

Soil Descriptions

Boscawen soils- These relatively coarse soils are seasonally dry, and somewhat nutrient poor, making them well suited to softwood tree growth, particularly white pine, although red oak will grow adequately.

Champlain soils- Are excessively drained soils of loamy sand, making this a softwood site. Our drier sites will likely become more so in the coming years. Leaving a strong overstory of softwood trees on the site will protect it against tree damage due to drought.

Bice- This soil has a slightly higher nutrient level than the preceding soils, along with an increased level of water availability. These elements allow for a higher site index for oak and red maple trees, combined with a good site for white pine, and red spruce.

Sutton- A fine sandy loam with a perched water level at 22 inches. Although this is also a softwood site, the available water will enable the growth of high-quality red oak trees on this site.

Chocorua mucky peat- This is a wetland soil, upon which will grow a good forest of red and black spruce and hemlock trees, with a few lucky white pines. The forest does grow slowly on this cold water stratum, although these are viable stands that can be managed for spruce along the drier edges of this soil type.

Bucksport muck- An organic soil that supports shrubs, sedges and grasses, along with a rich array of wetland plants. These sites must remain undisturbed.

Leicester-Moosilauke- A cooler soil with a high water table situated on lower foot-slopes. The ample available moisture level combined with a deeper organic layer creates a higher site level in this soil for the production of northern hardwood trees, and in this case black cherry trees. This site will also grow sugar maples successfully.

Limerick- This is a floodplain soil occurring in what is described in Stand 2C. This is not a site where timber harvesting should take place. It is a location to encourage wildlife habitats.

General Silvicultural Recommendations

The forests of northern New England are diverse in both age class and species distribution. Therefore, written forest management prescriptions are but generalizations, as the composition of each location in a forest stand varies considerably. Only by careful selection of when, if, and how to manage, whether to harvest, and which trees to harvest, can the best decisions be made for the management and regeneration of our heterogeneous forests. In hardwood stands with a high site index and good moisture levels, enriched soils allow timber to be maintained at higher stocking levels. Conversely, lower site indexes should be maintained at lower stocking ranges in order to grow quality trees at a healthy rate. During a stand harvest there should be areas in each stand which are not included in the harvest area. There are numerous benefits to leaving exclusion zones in a harvest area. These areas allow for the maintenance of lower quality trees to fill out the volumes needed to conduct an economically viable timber harvests in the future, without having to harvest the high-quality trees prematurely. There is also the benefit of full crown closure with their increased levels of standing snags, favored by numerous bird and mammal species. Many ground and tree nesting species need these conditions (oven birds and scarlet tanagers). Light harvests allow for a sustainable yield with more frequent harvests in a forest stand over a very long period of time without lowering the growth potential of the forest. A general rule of thumb is to leave a basal area of 80-90 ft²/acre in a harvested hardwood stand with 120 ft²/acre in softwood stands.

Timber Stands

Notes on the Eastern Hemlock Tree

The eastern hemlock is a common tree in Carroll County, NH. It is a very shade tolerant species, and can survive with very little light. It can respond with enhanced growth when its light exposure increases, even after decades of suppression. In our locale it is one of the oldest trees in the forest with trees over 600 years of age being found in NH. However, it is also true that hemlock trees over 22 " DBH*, that have maintained their viability as a sawtimber* tree, is rare. The market value of hemlock logs has increased in recent years, and it is good to keep in mind that 20-foot logs are worth 40% more than shorter logs. Hemlock trees in areas heavily infested with the hemlock wooly adelgid have demonstrated far less mortality in stands that had been gently thinned to increase their vigor. Hemlocks develop seams and decay as they reach and exceed that size class.



Young white pine seedlings and saplings cover the ground in much of Stand 1

Stand 1 –White Pine/ Red and White Oak1/2/3- 100 acres

These stands occur in the northern and eastern section of these properties. The stands are largely underlain by very well-drained soils with low to moderate fertility levels. These soils (see Soils) are very well suited for the growth of white pine, red and white oak, along with red maple. There is a higher proportion of oak overstory trees in the current stand because nearly all of the white pine trees were harvested. The area was heavily harvested five years ago, with previous harvests having occurred 12-16 years ago. There is excellent white pine regeneration present from each of these harvests. The harvest five years ago coincided with a series of strong white pine and oak seed crops, which was a fortunate occurrence for the future of this forest. The harvest was carried out in the fall and early winter during a strong white pine seed year, largely in snow free conditions, which facilitated the excellent white pine seedling regeneration which is now growing in most of the stand. The regeneration is less uniform on areas further from the log landing where snow fell during the harvest, reducing scarification of the soil surface. This led to poorer pine seed germination, with less seedlings being present. Stand 1A is an area of dense, four year old big-toothed aspen regeneration. Otherwise, it is very similar to Stand1. There are areas of white pine poles in the stand which are 8-12" DBH in diameter; they are of good form and growing rapidly. They occur in loosely arranged groups, which will facilitate their management in the future. Residual (post-harvest) red and white oak trees are scattered over the entire stand. The good distribution of red oak regeneration is both seed sourced, and from stump sprouts. The white oak regeneration is limited to stump sprouts, which are being heavily browsed by the deer. The stand also has some beech, white birch and red maple saplings and small poles present. The five-year-old oak stump sprouts will begin to grow above deer browsing height this year, and will then begin rapid height growth. The red oak and white pine regeneration promise to grow into a high quality, fully-stocked white pine/oak forest in the future. The dense saplings will lead to the development of straight white pine trees with clear stems. The dominant, and tallest trees in the sapling stand will be crooked with larger knots due to their being open-grown, and having had their terminal leaders killed by the white

pine weevil. The slightly shorter, co-dominant and intermediate trees will be of excellent form, all things remaining equal. The future forest will have an overstory dominated by white pine and red oak. The oak stands will form an incomplete overstory with frequent inclusions of white pine, along with a uniform white pine mid-story which will also grow smaller sawtimber trees that will need an earlier thinning than the overstory (see Prescriptions below).

Prescriptions

In 1-3 years, a light timber stand improvement (TSI*) thinning is advised to remove the saplings of gray and white birch, most of the hophornbeam and beech, while also thinning the red maple and oak stump sprouts to the three best stems/stump growth. Poor quality and isolated 4-8" DBH hardwood trees should be double girdled at this time to release the excellent white pine and oak understory which has far greater potential to form good quality trees for the future. Girdling will minimize damage to the sapling growth. The poles will only be cut when they occur in isolation and not in viable stands of young hardwoods. A person must be trained with some level of supervision to conduct this type of timber stand improvement. This timber stand improvement will be of low intensity and can be accomplished for \$125/acre+/- . The stand can then be allowed to grow for 25 years, when it should be inspected for additional TSI. This work will be a long-term investment in the future productivity of this forest. The benefits of this effort will last for the foreseeable future. Good management of this future forest will lead to stands that will produce a sustainable level of periodic timber harvests.

The small stands of existing larger white pine and oak trees with a high canopy provide a habitat feature for raptor species and ravens, along with a supply of tree seeds. These small stands are to be retained.

Stand 1A- The big-tooth aspen saplings which cover this stand are growing rapidly (up to 5 ft/year) and they are best left to grow undisturbed. The aspen saplings are well stocked as a result of the aspen in this stand being harvested five years ago, which initiated coppice regeneration (sprouting from the root system) to form this dense stand of young aspens. Some saplings are already 15 feet tall, and will form a thick, beautiful aspen forest. Aspen is a shade intolerant tree leading to a low density shallow canopy layer which allows light to penetrate to the forest floor.

Big-tooth aspen will grow to be a large tree. The light reaching the ground under them allows for layered understory canopies to develop. These understories often provide rich wildlife habitats with dense softwood cover, or shrub species such as serviceberry, or viburnums (soft mast*). The aspen itself is also wonderful for wildlife (see Wildlife).

Prescriptions-

This developing aspen stand is to be left to grow and develop undisturbed for forty years into a rich habitat, providing a home for cavity nesting birds and animals. This will be combined with a rich ground cover of downed woody debris, as the aspen thins itself, and falls to the forest floor. The stand can be inspected in 45 years when a thinning may be appropriate



Stand 2A- Softwood understories with hemlock, white pine and red spruce

Stand 2A- Hemlock/White Pine/Red Spruce/Hardwood 3C – 8.4 acres

This is an understocked hemlock/softwood stand. This stand is very well stocked with saplings of hemlock, white pine and red spruce, along with a sparse overstory of small sawlog and pulp hemlock, red spruce, white pine and tamarack trees. The future looks bright in this stand. As the slope descends towards the wetland abutting the Great Meadow, the forest gradually transforms from white pine to hemlock and finally red spruce as the forest enters the wooded swamp. This dense softwood cover provides excellent wildlife cover and nesting habitat for songbirds. This was made obvious by the heavy snowshoe hare and grouse tracks observed by the forester in fresh snow.

Prescriptions

The remaining sparse overstory in this stand will not diminish the development of the excellent softwood understory in place here. There is not enough overstory timber volume here to warrant the destruction of this fine understory during a timber harvest. This will become a fine stand of timber and should be left undisturbed for the next 20 years, when conditions may allow a mechanical harvester to cut selected trees out of the stand.



This photo shows dense black cherry, red oak, white pine and spruce saplings in Stand 2B.

Stand 2B- Hemlock/Red Maple2/3C- 3.4 acres

This stand, with occasional poor-quality hemlock and red maple trees 18-14" DBH, is underlain by a beautiful sapling stand. The saplings are 85% black cherry with an even distribution of white pine, red oaks and red maple saplings. The saplings are well-stocked, which will assure that they grow into straight, clear log bearing trees. This remarkable sapling stand is much like one would see in Pennsylvania, where

black cherry trees grow beautifully. The few remaining larger black cherries in the stand demonstrate that cherry will grow into good quality trees on this site. This forest will be of great value to wildlife when the cherry trees are large enough to produce crops of cherries. July will be a remarkable time for bird enthusiasts to visit this site. At that time the site will be heavily used by black bears, cedar waxwings, thrushes, scarlet tanagers, orchard orioles, woodpeckers, ruffed grouse etc. The cherries will also provide for a higher population of small mammals providing a basis for the carnivorous food chain and thus a rich habitat for fishers, bobcats, coyotes, hawks and owls. There is a high level of woody debris in this stand due to blow-down resulting from too high a harvest level on a wet soil. However, the woody debris will only enhance the stand's value for wildlife habitat.

Prescriptions

In 0-5 years, the stand should have timber stand improvement conducted to girdle 70% of the stand's poor quality hemlock and hardwood trees. This work could be done for \$150./acre. Many of these trees should be double girdled and not cut down. They will cause much less damage to the saplings when they fall after standing dead for some years. These poor pulpwood trees have little value and are inhibiting the growth of the rich sapling understory. In 18 years the young hardwood trees should be gently thinned with a subsequent TSI thinning to release the good quality hardwood poles and the white pines. The stand can then be allowed to grow to maturity. The cherry trees will continue to produce cherries for the foreseeable future.



A photo in Stand 2C, where no harvesting has taken place for at least 70 years

Stand 2C- Hemlock/ Red Maple 4A- 1.74 acres

This small stand demonstrates what Stand 2 looked like prior to its being harvested. It is fully stocked with mature hemlock, large red maple trees along with a few red oaks and white pines. The stand is healthy with no short-term health issues. It should be allowed to grow undisturbed and can be shown to people who would like to see how a forest develops without human intervention. This stand is providing a good roosting habitat for many bird species that inhabit the Great Meadow lands.

Stand 3 White Pine/ Red Maple 3/4B- 3.7 acres

This small stand was excluded from the previous harvest. It is well stocked with large white pines, and with scattered hemlocks and red spruces. Portions of the stand have good quality small sawtimber red maples. The stand can be harvested in 15-20 years when the scattered clumps of white pine poles in Stand #1 will be large enough to thin. By combining these stands there will be enough area and timber volume to conduct an economically viable timber sale. The harvest should leave enough overstory (basal area 80ft/acre) to encourage the regeneration of white pine.

Action Items

Stand 1-

Conduct timber stand improvement in 1-3 years. Inspect the stand for additional TSI in 25 years.

Stand 1A-

In 40 years, inspect the stand for a light strip harvest thinning in the aspen stands.

Stand 2B-

Timber stand improvement can be done in 1-3 years to remove 80% of the poor hemlock and hardwood overstory, which was left by the previous logging crew. Most of these trees should be girdled to minimize the damage to the sapling growth.

In the resulting stand cherry trees, after 18 years, a subsequent timber stand improvement cutting can be carried out to improve and spacing of the growing hardwoods.

Stand 3-

This small stand of mature forest will be retained to provide diversity and habitat enhancement.

Endangered Species

The New Hampshire Heritage Bureau Review (see below) noted the following plants on the New Hampshire Threatened Species list: the silverling (*Paronychia argyrocoma*), northern tubercled bog-orchid (*Platanthera flava* var. *herbiola*), birds- the pied-bill grebe (*Paronychia argyrocoma*), along with the rare Marsh Wren (*Cistothorus palustris*). These are all marsh and open water species. While they will not be impacted by any forestry processes, it is important to be aware of their presence.

NH Natural Heritage Bureau Checklist



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Glossary and Acronyms

basal area (of a tree) - the cross-sectional area of the trunk 4 1/2 feet above the ground; (per acre) the sum of the basal areas of the trees on an acre; used as a measure of forest density.

BMPs - Best Management Practices: a set of guidelines to protect water quality. BMPs focus on careful road construction and maintenance, careful timber harvesting, minimal impact site preparation and protection of streamside management zones and wetlands.

board foot - a unit for measuring wood volume in a tree, log, or board. A board foot is commonly 1 foot by 1 foot by 1 inch, but any shape containing 144 cubic inches of wood equals one board foot.

browse - parts of woody plants, including twigs, shoots, and leaves, eaten by forest animals.

canopy - the continuous cover formed by tree crowns in a forest.

cord - a unit of wood cut for fuel that is equal to a stack 4 x 4 by 8 feet or 128 cubic feet. A cord is the legal measure of fuelwood volume in Maine and New Hampshire.

diameter at breast height (dbh) - standard measurement of a tree's diameter, usually taken at 4 1/2 feet above the ground.

even-aged stand - a stand in which the age difference between the oldest and youngest trees is minimal, usually no greater than 10 to 20 years. Even-aged stands are perpetuated by cutting all the trees within a relatively short period of time.

forest types - associations of tree species that have similar ecological requirements. Northern New England forest types include white pine, spruce-fir, hemlock, northern hardwood, oak-pine, and others.

group selection - a process of harvesting patches of trees to open the forest canopy and encourage the reproduction of uneven aged stands.

herbaceous vegetation - low-growing, non-woody plants, including wildflowers and ferns, in a forest understory.

high grading—The practice of removing only the biggest and best trees from a stand during a harvest operation and leaving only the poorest, lowest quality culls to dominate the site.

intolerance - a characteristic of certain tree species that does not permit them to survive in the shade of other trees.

landing - a cleared area within a timber harvest where harvested logs are processed, piled, and loaded for transport to a sawmill or other facility.

MBF - Thousand board feet. A unit of measure for tree volume or sawed lumber.

marking timber - indicating by paint or other means which trees are to be cut or otherwise treated. It is advisable to mark trees to be harvested twice-once at eye level and once on the stump.

mast - Fruits or nuts used as a food source by wildlife. Soft mast includes most fruits with fleshy coverings, such as persimmon, dogwood seed or black gum seed. Hard mast refers to nuts such as acorns and beech, pecan and hickory nuts.

overstocked - the situation in which trees are so closely spaced that they compete for resources and do not reach full growth potential.

pole timber - trees 4 to 10 inches dbh.

precommercial treatments - forestry operations that require landowner investment, such as cleaning or weeding stands to remove trees that have little or no cash value.

pruning - the act of sawing or cutting branches from a living tree. In forest management, pruning is done to promote the growth of clear, valuable wood on the tree bole.

pulpwood - wood suitable for use in paper manufacturing.

regeneration - the process by which a forest is reseeded and renewed. Advanced regeneration refers to regeneration that is established before the existing forest stand is removed.

regeneration cut - a timber harvest designed to promote natural establishment of trees.

release - to remove overtopping trees that compete with understory or suppressed trees.

residual stand - the trees remaining intact following any cutting operation.

sapling stand - a stand of trees whose average dbh is between 1 and 4 inches.

sawlog - a log large enough to be sawed economically on a sawmill. Sawlogs are usually at least 8 inches in diameter at the small end.

seed-tree harvest - the felling of all the trees in an area except for a few desirable individuals that provide seed for the next forest.

selection harvest - the harvest of all individual trees or small groups at regular intervals to maintain an uneven-aged forest. Selection harvests are used to manage species that do not need sunlight to survive.

shelterwood harvest - the harvest of all mature trees in an area in a series of two or more cuts, leaving enough trees of other sizes to provide shade and protection for forest seedlings.

significant wildlife habitat – habitats identified and mapped by the Maine Inland Fisheries and Wildlife Department and afforded special protection including deer wintering areas, bald eagle nests, shorebird nesting areas, etc., or identified by NH Fish & Game's Wildlife Action Plan. However, the NH Action Plan provides no special protection for these critical areas.

site index - a measure of the quality of a site based on the height of dominate trees at a specified age (usually 25 or 50 years), depending upon the species.

slash - branches and other woody material left on a site after logging.

slope – a measure of steepness of terrain and a feature that can limit equipment use; it is the vertical gain (rise) divided by the horizontal distance cover (run).

snag - a dead tree that is still standing. Snags provide important food and cover for a wide variety of wildlife species.

stand - a group of forest trees of sufficiently uniform species composition, age, and condition to be considered a homogeneous unit for management purposes.

stand density - the quantity of trees per unit area, usually evaluated in terms of basal area, crown cover and stocking.

stocking - the number and density of trees in a forest stand. Stands are often classified as understocked, well-stocked or overstocked.

stumpage - the value of standing trees in a forest.

thinning - a partial cut in an immature, overstocked stand of trees used to increase the growth of existing trees by concentrating on individuals with the best potential, no regeneration results

tolerance - a tree species' capacity to grow in shade.

understocked - a stand of trees so widely spaced, that even with full growth potential realized, crown closure will not occur.