

FOREST MANAGEMENT PLAN

for the

Sawyer Conservation Area

Atkinson, New Hampshire



Prepared for:

**Atkinson Conservation Commission
Atkinson, New Hampshire**

Prepared by:

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December 31, 2010

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Report Copy # _____

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The purpose of this plan is to provide natural resources information and forest and wildlife management recommendations to the Atkinson Conservation Commission, citizens of Atkinson, and others interested in the management of the Sawyer Conservation Area in Atkinson, New Hampshire. No part of this plan, including all written material, maps, plan format and organization, is to be copied or reproduced for any other purpose, particularly commercial purposes, without proper citation to the author, Charles A. Moreno, Consulting Forester.

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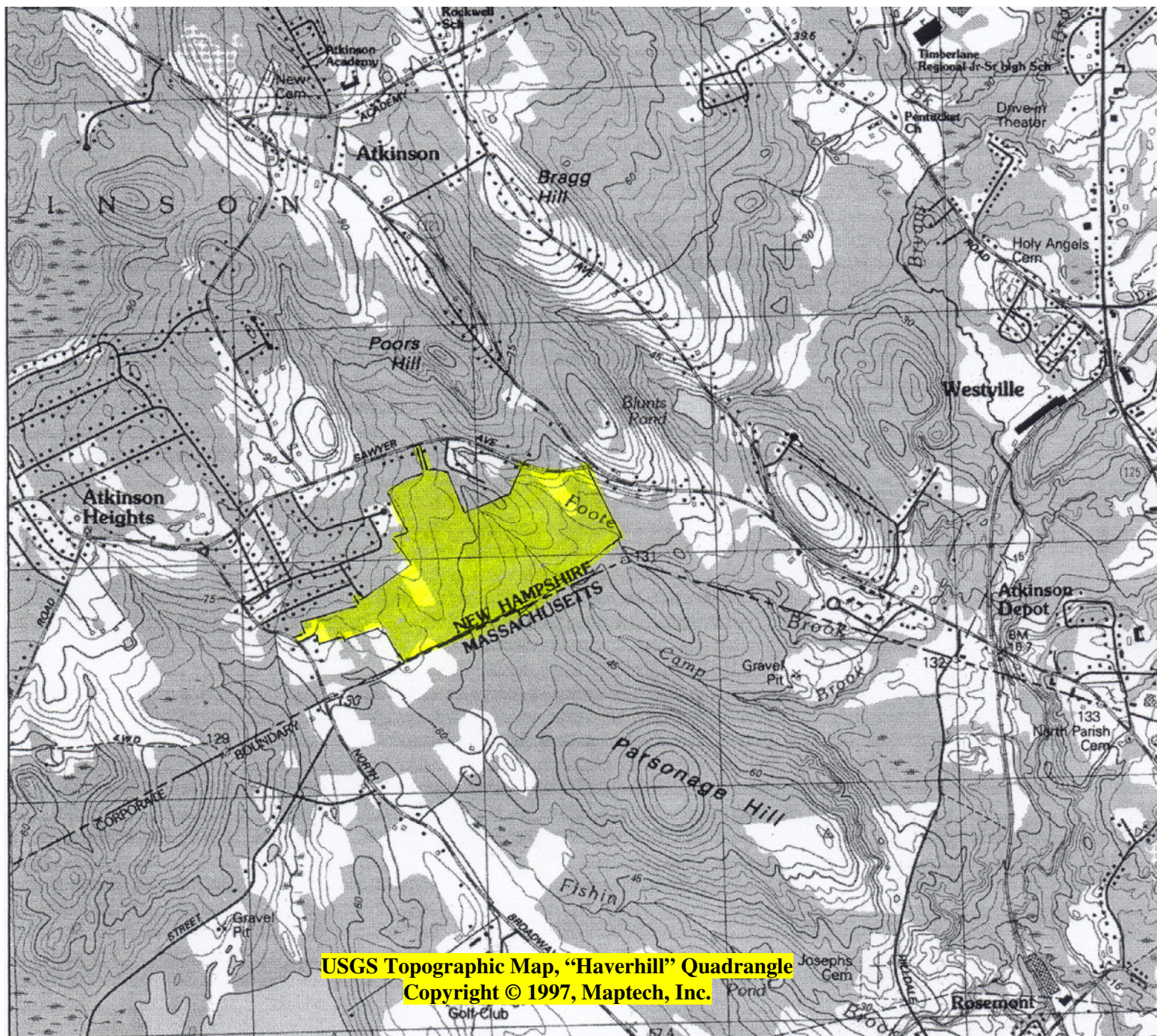
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MAP SCALE:
—————

1 inch = 2000± feet

Locus Map
of the
Sawyer Conservation Area
Atkinson, New Hampshire
140.4± Acres



USGS Topographic Map, "Haverhill" Quadrangle
Copyright © 1997, Maptech, Inc.

Forest Recommendations Map

for the Town of Atkinson's

SAWYER CONSERVATION AREA

Atkinson, New Hampshire

140.4± acres

MAP SCALE:
0 600'

Map Legend


Property Line ———

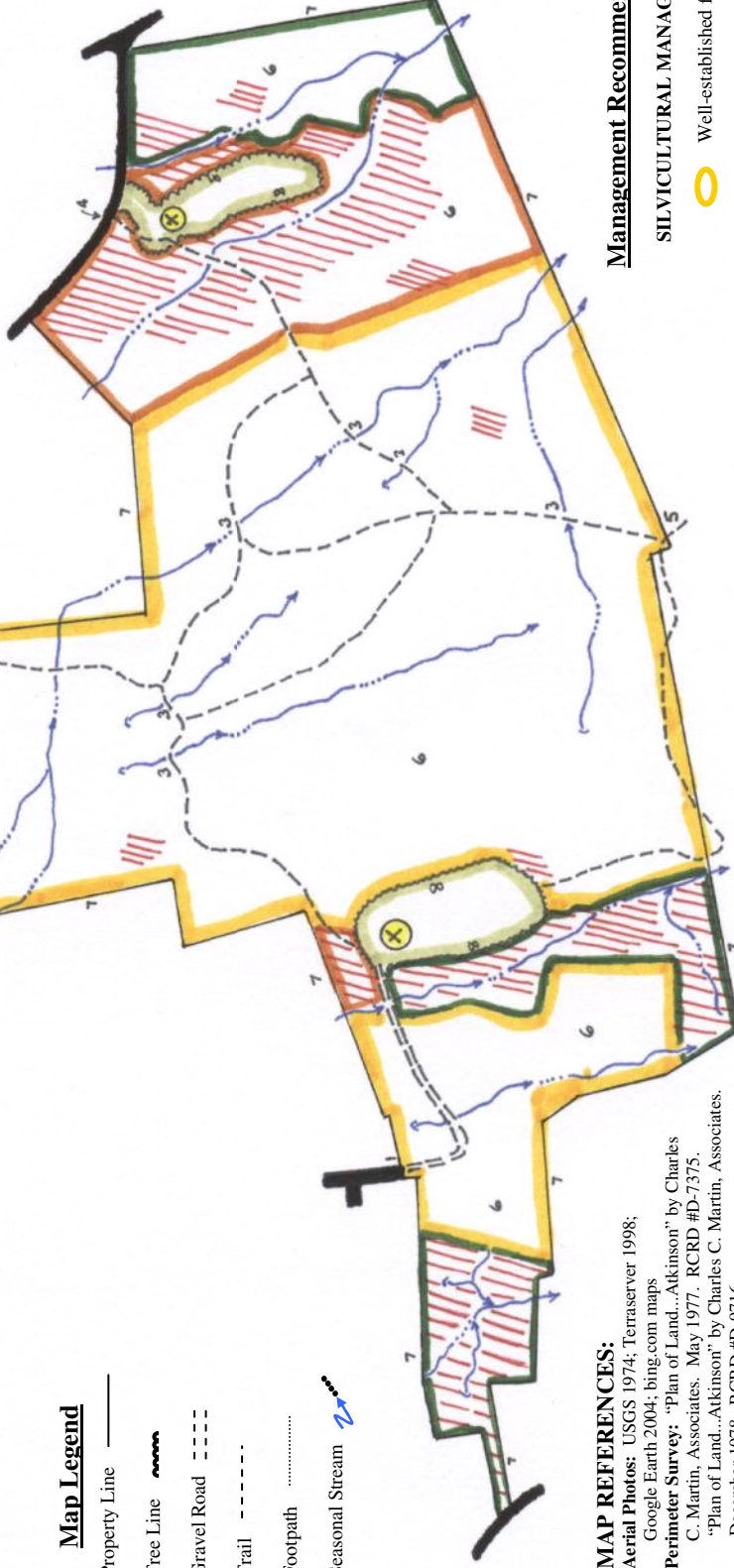
Tree Line ~~~~~

Gravel Road - - - - -

Trail - - - - -

Footpath

Seasonal Stream 



MAP REFERENCES:

Aerial Photos: USGS 1974; Terraserver 1998;
Google Earth 2004; bing.com maps
Perimeter Survey: "Plan of Land...Atkinson" by Charles C. Martin, Associates. May 1977. RCRD #D-7375.
"Plan of Land...Atkinson" by Charles C. Martin, Associates. December 1978. RCRD #D-9716.
"Plan of Land...Trust" by Charles C. Martin, Associates. March 1980. RCRD #D-11188.

Property Reconnaissance:






Charles Moreno, Moreno Forestry Associates, 2009-2010.

Map drawn by:

Charlie Moreno, Consulting Forester
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Management Recommendations

SILVICULTURAL MANAGEMENT

-  Well-established forest
-  Young forest/early-successional
-  Reserve
-  Control exotic, invasive plants
-  Landing site/staging area

FIELD MANAGEMENT

-  Late season annual mowing

Access Recommendations

- 1) Maintain gate
- 2) Improve public access
- 3) Improve seasonal stream crossing
- 4) Minor road upgrade for management access
- 5) Trail link to other local conservation areas
- 6) Trail-less area

Other Recommendations

- 7) Blaze & paint boundary lines
- 8) Trim-back field edges

The SAWYER CONSERVATION AREA

**Sawyer Avenue
Atkinson, New Hampshire**

INTRODUCTION

Four contiguous parcels were consolidated and protected to form the Sawyer Conservation Area, the largest of Atkinson's Town Forests. The property is managed forest and fieldland, containing a variety of cover types and habitats. A recreational trail system leads through a scenic upland pine and hardwood forest which contains trees of up to 2½ feet diameter. The county champion white ash, over 5 feet in diameter, is located off one of the trails. The trails pass by two late-successional grasslands that are maintained for wildlife, as well as a number of seasonal streams and forested wetlands.

PROPERTY INFORMATION

LOCATION

The Sawyer Conservation Area is situated in south-central Atkinson, lying between Sawyer Avenue, North Broadway Road, and the New Hampshire-Massachusetts state line. The property's Sawyer Avenue access is situated about 1½± miles south of the Atkinson town center.

III. REFERENCE INFORMATION

Surveys:

- > "Plan of Land...Atkinson", by Charles C. Martin, Associates (May 1977). RCRD #D-7375.
- > "Plan of Land...Atkinson", by Charles C. Martin, Associates (Dec 1978). RCRD #D-9716.
- > "Plan of Land...Trust", by Charles C. Martin, Associates (Mar 1980). RCRD #D-11188.

Aerial Photos: 1974 USGS; TerraServer 1998; Google Earth 2004; Bing.com birds-eye photos.

Tax Maps: Atkinson Tax Maps, 4 contiguous parcels, as follows—

- Map 3, Lot 19—57.87± acres;
- Map 3, Lot 108—12.98± acres;
- Map 4, Lot 11—20.0± acres;
- Map 4, Lot 11-1—48.38± acres.

Acreage: TOTAL – 140.4 Acres (according to surveys)

- Established upland forest – 90.1± acres
- Forested wetlands – 31.2± acres
- Early-successional/young forest – 9.4± acres
- Field lands – 5.6± acres
- Open wetlands (shrub/emergent) – 4.1± acres

Area prescribed for active forest management: 90± acres

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FOREST MANAGEMENT OBJECTIVES

Recommendations for the management of the Sawyer Conservation Area are based on natural resource findings and long-term management objectives, which the Atkinson Conservation Commission has considered for the property. These objectives include:

- **Manage for light recreational uses.** The extensive trail system is widely used by local residents for walking, often with dogs. Other low-impact uses are snowshoeing, cross-country skiing, geo-caching, and nature study. ATV travel is prohibited, yet difficult to control; rutting has occurred on several trails as a result.
- **Maintain a healthy forest in managed areas:** 1) Foster resilience to insects and disease; 2) Encourage tree species diversity that reflects natural community types; 3) Manage for tree age variety, including patches of early-successional growth, and ample mid-aged forest with older residuals, eventually 150+ years old; and 4) A comprehensive forest thinning in 2010 served to improve forest growth and promote quality timber; declining trees were salvaged, including those severely damaged by the December 2008 ice storm and the February 2010 windstorm.
- **Enhance wildlife habitat.** The Sawyer Conservation Area is an integral part of one of the remaining local open space blocks, providing important habitat to mammal, avian, reptile, and amphibian species. The management objective is to provide varied vegetative cover and remote habitat to benefit a broad diversity of wildlife. The long-term (2060±) target ratio of variously-aged cover types on the parcel is:
 - Field land with late season, biannual mowing – 4% of area (6± acres)
 - Early-successional and young forest (1-40± year forest) – 5% of area (6-9± acres)
 - Mid-successional, multi-aged forest (mostly 40-150± years) – 50% of area (70± ac)
 - Older, multi-aged forest (including 150+ years) – 40% of area (55± acres)
- **Protect water quality and wetland/stream integrity.** Install appropriate stream-crossing fords and discourage ATV usage. Mitigate potential pollution sources, including litter and pets. Protect the integrity of the property's forested wetlands and seasonal streams by maintaining low-impact recreational usage and strict application of BMP's in silvicultural management areas.
- **Sustainably manage the timber resource.** In silviculturally managed areas, upgrade timber quality, growth, and value over long-term. Periodic harvests are for the purpose of maintaining forest health and wildlife habitat, and improving forest growth. Timber income is for conservation uses, including Town Forest management.
- **Control exotic, invasive plants.** Intensive effort is needed to control the abundance of non-native, invasive plants. Over time, these plants threaten to diminish the property's biodiversity, habitat, ecological functioning, and scenic beauty.
- **Maintain the forest's scenic beauty.** Manage for natural forest attributes, though minor forest grooming may occur along entrance areas and main trails. NH Best Management Practices (BMP's) must be implemented by contractors during forest harvest operations. Avoid damage to stone walls.

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CAPSULE RECOMMENDATIONS for PROPERTY

High Priority:

- **Invasive Plant Control** – Immediately (spring 2011) initiate invasive plant control program. Implementation involves focus areas and strategic use of volunteers and contractors. Seed capture and complete uprooting of plants is the first line of action, though herbicide use by licensed applicators will probably be necessary in severe areas. Timber sale proceeds may provide some project funding.
- **Wildlife** – Continue management of the existing forest *towards complex structure* in terms of tree age, canopy cover, and woody debris. Promote cover type diversity, including: a) Rough fieldlands, maintained by late-season mowing; b) Early-successional/young growth forest (re-cleared in 15, 30, or 45 year intervals); and c) Ample intermediate-aged forest, with scattered older growth (eventually 150+ years) forest pockets and individual trees. Promote most forest attributes, as well as dense cover areas, potentially for New England cottontail.
- **Silviculture** – Long-term implementation of forest management with the purposes of maintaining forest health, enhancing habitat, improving timber growth and value, and creating complex forest structure. Management efforts were initiated in 1988 on the Sawyer Lot and continued in 2010. Management may be carried out sustainably on a *15± year harvest cycle*—harvests should not exceed the timber volume that the forest is capable of re-growing *in 15 years*—as detailed in the silvicultural prescriptions.

Medium Priority:

- **Boundary Maintenance** – Locate property lines using existing property surveys and boundary evidence (stonewalls, iron pins, and drill holes were noted during field investigations for this study). Minor re-surveying may be necessary for a few corner monuments which were missing. Long-term demarcation and maintenance of clearly located boundaries involves axe-blazing trees along the lines, followed by paintbrush painting of the blazes. Blazes should be re-brushed every 10 years. The Sawyer Conservation Area requires approximately 15,000± feet of boundary blazing.
- **Recreation** – Install appropriate trail fords at stream crossing points. Low-impact designs include three-sided box culverts, corduroy, bog bridges, and stepping stones, depending on the degree of flowage. Expansion of trail network is not recommended, as it presently totals 2± miles in length. Rather, retain trail-less areas for wildlife. Explore the feasibility of developing an interpretive trail map with corresponding educational points along the trails.
- **Water Quality** – Promote removal of litter and pet waste by community users. Also, apply NH Best Management Practices (BMP's) for recreational and forestry activities at stream crossings or in wetland riparian zones.

Lower Priority:

- **Property Access** – Re-establish the north access route from Sawyer Avenue through the former Cirome Lot.

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IV. FINANCIAL PROJECTIONS

The 2010 timber salvage/improvement harvest on approximately 80± acres of well-established forest in the Conservation Area generated \$27,345 in net revenue. This relatively conservative harvest focused in forest health and improvement, where declining, poor quality, or low-value trees were generally removed. Storm damaged trees were salvaged where possible.

Additional forest and habitat improvement work in the easternmost section of the property must be accessed from a second landing site off Sawyer Avenue. Due to the small acreage involved—10± acres—and the young age of this forest, timber revenue from this project will be minimal, presently projected as \$500±.

Income from the 2010 forest thinning can provide funding for other needed projects in the Conservation Area such as invasive control, boundary blazing, and early-successional habitat maintenance.

Invasive plant control is a high priority project, requiring multiple treatments. The budget below assumes that volunteer effort, and possibly grants, will help defray costs. Projected expenses include the cost of establishing strategy and organizing/training volunteers, hiring contractors for difficult removals, and project supervision/quality control/management.

Boundary location and demarcation is also an important property maintenance project. Projected costs are for boundary location and blazing/painting around the entire property. It is assumed that surveying is not needed, unless certain boundary lines are undecipherable.

Periodic maintenance of early-successional habitat for wildlife requires clearing of young growth with a Brontosaurus or skid steer. Timber harvesting may help minimize this cost, which runs \$1,200±/acre, plus project management. Presently, 3± acres of clearing are recommended.

Net income:

80± acre forest improvement cut and storm salvage (westerly and central areas)	\$ 27,345
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Projected income:

10± acre forest improvement in young growth (easterly area)	\$ 500±
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Estimated costs for conservation projects:

Invasive control	(\$10,000)±
Boundary location, blazing, painting	(\$2,400)±
Early-successional establishment	<u>(\$4,000)±</u>

PROJECTED NET REVENUE	\$11,500± (rounded)
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FOREST ACCESS and PUBLIC USE

Forest/Wildlife Management Access

The property entrance at the end of Forest Road provides the main access to stage forest thinning operations in the western and central sections of the Sawyer Conservation Area. The woods road leading from Forest Road (which is gated) to the interior field has been graveled in recent years. Two seasonal streams have culvert crossings. The westerly field provides an excellent staging area, particularly during dry summer/fall seasons or in winter. No further access improvements were needed to reach this landing site for the 2010 harvest.

Due to excessively long internal access distances from the westerly field, a second staging area is necessary to access the eastern section of the Conservation Area. The eastern field can provide an adequate landing, though road access to reach the field may need minor widening. This section of the property, including the field, tends to be wet; thus forest thinning and wildlife operations must be scheduled for frozen winter or dry summer conditions. Winter is somewhat preferable due to heavy community usage of this access point for trail use, particularly in the summer.

Interior access for forest thinning involves both close and long skidding distances from the westerly landing site (0 to 2,500± feet), with closer access for the eastern landing (0 to 800± feet). Passage through stone walls and across seasonal streams is required to reach the various sections of the property. Pre-planning helps avoid and minimize the number of both crossing types. Forest reconnaissance is necessary to locate and utilize existing barways as crossing points for interior stone walls. Where a barway is unavailable, contingency funding may be set aside by the Conservation Commission to re-erect the wall opening, if desired. Stream crossings are recommended for low-impact, narrow channel locations where possible; DES notification permitting for timber harvesting is required for the logger. Appropriate temporary fords according NH BMP guidelines must be installed, and then removed, by the logging contractor upon project completion.

Both the Forest Road and the easterly Sawyer Avenue access points will provide access to brush clearing machinery for early-successional wildlife management projects. A staging area is not required. Most of the early-successional management sites are located near the fieldland areas of the property.

While uplands dominate the Sawyer Conservation Area, seasonal streams and forested wetlands are dispersed through the property. Wetlands are easily impacted by logging equipment, and are therefore generally avoided. In addition, a few remote upland forest pockets are rendered inaccessible by wetlands. As a result, about 35± acres of forested wetlands and difficult-access areas in the Conservation Area are recommended for reserve status, without forest harvesting. The property's remaining land, including fields, is to be actively managed for forestry and/or wildlife purposes. The forestland is the parcel's *productive forest area*—the area accessible to silvicultural management—covering approximately 100± acres, 9± of which are for early-successional management.

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Public Use and Access

Recreational use of the Sawyer Conservation Area is fairly straightforward: most is trail-based, with the easterly Sawyer Avenue entrance and the end of Forest Road serving as the main access points. Southerly trail access points from private lands in Massachusetts are generally used by ATV's, though these trails also connect to an extensive open space block, much of which has been conserved.

The interior trail system in the Sawyer Conservation Area extends over two miles, and includes short and medium length loops in the easterly half of the property. A 1½± mile long loop traverses across the Conservation Area, through the westerly field, and for short segments, on private land south of the property.

The Conservation Area trails, especially the shorter loops, are widely used by local residents for walking, often with dogs. Other low-impact uses are snowshoeing, cross-country skiing, geo-caching, and nature study—activities that also range off-trail. ATV travel is prohibited, yet difficult to control; extensive rutting has occurred on moist segments of several trails due to off-road vehicle use.

A community trail network comes at a cost: Potential disruption of wildlife habitat, permanent stream crossings and possible water pollution, more challenging forest management access, and potential soil degradation. Negative effects may be mitigated by steering usage towards responsible, non-ATV, low-impact activities. Public education about litter and pet waste disposal are also factors.

While improvements are recommended for the existing trail loops, particularly for the installation of appropriate stream fords, expansion of the trail network is not recommended. The current trail loop system provides extensive forest access, while retaining some trail-less areas for wildlife. Protecting wildlife breeding habitat with minimal disruption is a worthy goal.

The Atkinson Conservation Commission may consider developing an interpretive guide of the Conservation Area, coupled with a trail map and numbered trail stations. The guide may highlight historical aspects of the land, natural features, and/or wildlife and forestry management work.

NATURAL RESOURCE SUMMARY

SOILS PROFILE

Upland Soils

Canton (42) gravelly fine sandy loam – This deep and well-drained glacial till covers an extensive area in the easterly section of the Conservation Area. The surface layer of Canton is gravelly fine sandy loam, with a substratum, below 2½ feet, of loamy sand with varying amounts of silt. While seasonal high water table is below 6 feet, the soil is wet during spring thaw or after extended rainy periods. Soil productivity is average to above average for pine and oak. Though mostly gently sloped, a few slopes up to 15% were noted.

Deerfield (313) fine sandy loam – Nearly always level, this moderately well drained soil has sandy texture and rapid water permeability. However, a seasonally high water table precludes early spring travel, especially for harvesting equipment. White pine and red oak grow well on this productive soil.

Mesic Soils

Woodbridge (129) fine sandy loam – Occupying a small area, this highly productive, moderately-drained, loamy till contains a hardpan clay layer at about a 1½± foot depth. The hardpan maintains soil surface moisture through dry periods with productive results for forest growth, including white pine and mixed hardwoods. The soil is typically too moist to operate on during wet seasons.

Scituate-Newfields (446) complex – These intermixed sandy loams (till) underlay 2/3rds of the property, particularly in the central and westerly area. Soils range from moist uplands to somewhat poorly drained forested wetland. This soil complex has a seasonally high water table and is prone to wetness, particularly through the spring and in the late fall. ATV's, mountain bikes, horses, and logging equipment are likely to cause soil ruts during wet seasons. *Scituate-Newfields* has above average productivity for mixed hardwoods and white pine. In moist areas, however, shallow-rooted pines are prone to blowdown.

Wetland Soils

Walpole (547) very fine sandy loam - This poorly-drained very fine sandy loam underlies the property's central drainageway. Wetland hardwood trees and shrubs—species whose root systems can endure periods of water saturation—are associated with this soil, including, red maple, highbush blueberry, and winterberry holly.

Ridgebury (657) very gravelly fine sandy loam– This moist, poorly-drained soil is found along streams and their associated riparian areas. It has a hardpan layer at 1 to 2 feet in depth.

Greenwood (295) mucky peat – This very poorly drained peatland soil underlies the property's saturated and seasonally flooded pools and swamps. Due to the high water table—if not flooded, the water table is often within ½ foot of the ground surface—Greenwood soils support little or no tree growth. Greenwood's peat layer is deep, with bedrock more than 5 feet below the soil surface.

SURFACE WATER RESOURCES

The Sawyer Conservation Area lies within the Merrimac River watershed. Several minor seasonal streams emanate from, or flow across, the property. Two more substantial streams join just below the eastern wetland. These streams are the first order headwaters to Foote Brook.

In addition to these streams, the eastern wetland system contains a fine emergent-cattail swamp and open water wetland. Shrub swamp and forested wetlands complete the system just upstream.

The Conservation Area contains several other small emergent/shrub swamps most of which contain winterberry holly, highbush blueberry, and in places, spicebush. Forested wetlands tend to follow the parcel's numerous drainages.

The property has at least one vernal pool, though a dug farm pond that overlaps onto the property to the south may now also function as a vernal pool. Vernal pools are small, shallow depressions that inundate in early spring and, sometimes, after autumn rains. These ephemeral pools are fish-free, and therefore provide potential breeding habitat to several salamander and frog species, as well as fairy shrimp and other invertebrates.

WILDLIFE HABITAT

Open Space

The Sawyer Conservation Area is part of a 500± acre undeveloped open space block that overlaps into the Parsonage Hill area of Haverhill, Massachusetts. Conservation efforts are underway to permanently protect these adjacent lands. The Atkinson-Plaistow-Haverhill area has undergone heavy development for the last half century, with open space lands largely reduced to separate islands. While heavily traveled roads and residential areas interrupt habitat connectivity and wildlife travel, the remaining open space islands are increasingly critical harbors for wildlife. Maintaining trail-less areas and a diversity of habitats are important wildlife considerations for these open space areas.

Core Habitats

Core habitats in the Sawyer Conservation Area are: a) Two fields; b) Several early-successional/young forest growth areas; c) The extensive, established pine/hardwood forest; d) Extensive, established mixed hardwood forest, including areas dominated by birch, maple, and oak/hickory, respectively; e) Open water and emergent wetlands, f) Forested wetlands and stream riparian areas; and g) A vernal pool.

The fieldlands are maintained in a late-successional state by the Atkinson Conservation Commission through biannual mowing. Mowing is deferred to late summer, after nesting season, a measure that protects wildlife as diverse as butterflies, songbirds, and deer. In addition to dense grasses, field vegetation includes a diversity of wildflowers. However, invasive exotic plants threaten both fields, particularly the westerly field where autumn olive is thriving.

Early-successional and young forest areas are forestlands containing trees that are generally under 50± years of age. In the Sawyer Conservation Area this habitat is found in the most recently abandoned fieldland on the property, generally near or adjacent to the existing fields. In addition

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to pioneer tree species such as quaking aspen, gray birch, and black cherry, these areas contain fruit-bearing brambles, shrubs, and vines, including blackberry, hawthorn, and grapevine. The abundance of food sources and available cover—both for escape, resting, and nesting—make these areas especially attractive to wildlife.

Over time, early successional areas grow into less dense established forest, with longer-lived tree species dominating. It is recommended that early-successional cover be maintained on at least 5% of the Conservation Area acreage, which requires periodic re-establishment by clearing with a brush cutting machine (Brontosaurus, or similar equipment). For further habitat diversity, early-successional areas can be differentiated by using different cutting intervals between patches, i.e., while some areas are re-cleared on a 15 year interval, other pockets are cleared on a 30 or 45 year basis.

The Sawyer Conservation Area is near or within one of the last remaining islands for New England cottontail populations, which have drastically diminished in recent decades. The critical habitat for this small mammal is extremely dense, low cover. Excellent vegetation includes dense native shrubs such as silky dogwood, winterberry holly, blackberry, and spirea. Ironically, exotic plants including honeysuckle, multiflora rose, and autumn olive may also provide good cover. Part of the early-successional habitat strategy is to create and maintain large contiguous areas (3+ acres) of dense shrub growth which may possibly aid this imperiled species.

Exotic, invasive plants are a major concern for the Conservation Area, with fieldlands, early-successional areas, and open wetlands providing unintended vectors for establishment. Most non-native invasive plants diminish habitat by providing poor food sources and limiting the diversity of native plants. However, some benefit may be found in the cover provided.

“Pasture pine”—white pines that are heavily limbed and contain multiple trunks—in the established forest areas provide good vertical structure. These trees are typically retained, as they provide nesting sites for small mammals, and perches for hawks and owls.

The Conservation Area contains an abundant mast resource, provided by large-crowned oaks and hickories. Acorns are a staple food for a diversity of wildlife. Managing the forest to maintain the development and vitality of good mast producers is an important objective. Silvicultural management also insures that oaks and hickories naturally seed and regenerate for the future.

Species of Concern/Natural Communities

The New Hampshire Natural Heritage Bureau was consulted in October 2009 about the potential presence of rare species (plant or animal) or exemplary natural communities on the subject property. A database check did not indicate the presence of any species or natural communities of concern, though a spotted turtle was reported in 2007 within 1 mile of the property. While no rare species or rare natural communities were noted during field examinations (C. Moreno) of the property in September/October 2009 and August-November 2010, potential spotted turtle habitat is confirmed to exist in the easterly wetland area.

Silvicultural Management for Wildlife

Habitat in the Sawyer Conservation Area will benefit from silvicultural management. Carefully planned, periodic harvesting (as specified in the Forest Type Prescriptions) will promote a complex forest structure over time: multi-aged, stratified forest canopy, increased herbaceous

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layer, and greater diversity of tree and shrub species adapted to site conditions. Complexity and diversity generally concur with habitat richness.

Silvicultural management will encourage an array of forest “structural zones”. The long-term (in 2060±) target ratio of variously-aged cover types on the parcel is:

- Field land with late season, biannual mowing – 4% of area (6± acres)
- Early-successional and young forest (1-40± year forest) – 5% of area (6 - 9± acres)
- Mid-successional, multi-aged forest (mostly 40-150± years) – 50% of area (70± ac)
- Older, multi-aged forest (including 150+ years) – 40% of area (55± acres)

Wildlife Habitat Recommendations

- Continue late-season, biannual mowing maintenance of fieldlands.
- Maintain at least 5% of the property area (6+ acres) as early-successional or young forest, i.e., under 40± years of age. Manage early-successional growth to potentially benefit the imperiled New England cottontail.
- In mid-successional areas, continue the development of multi-generational forest through silvicultural management. Forest age differentiation should occur both as groups or small pockets of trees, and as dispersed individual trees. Existing older growth (mapped as “significant trees”) should be retained.
- Designate and maintain wetland and remote areas as reserves, covering about 25% of the property area (35± acres). These should also be mostly trail-less, with the intent of providing expanses of undisturbed wildlife habitat for breeding, nesting, and denning.
- Leave a 75-foot minimal harvest and minimal activity buffer around open wetlands and the property’s vernal pools.
- Manage for large-crowned oaks and hickories, particularly in mid-successional areas.
- Retain cavity trees, snags, and large coarse woody debris for wildlife.
- Retain trees that provide good vertical structure, such as large pasture pine.
- Encourage the growth of native fruit-bearing shrubs including.
- Control exotic, invasive plants.

FINDINGS

Note: The forest inventory for the Sawyer Conservation Area was conducted prior to the property's 2010 thinning operation; therefore inventory statistics reflect data prior to the harvest. However, findings and inventory data have been updated to reflect post-harvest conditions as of December 2010, and included in this report.

Timber Volume and Value:

- The currently productive forest areas (127.9± acres) of the Sawyer Lot contain standing timber volumes as follows:
 - 538,300± board feet of sawtimber** (90% Confidence Interval: ± 144,489 BF)
 - Softwood – 344,000± BF
 - Hardwood – 194,300± BF
 - 6,858± tons of chipwood and softwood pulp**
 - 1,257± cords of firewood** (90% Confidence Interval: ± 141 cords)
- The total timber stumpage value is currently \$97,200±.
- On a per acre basis, *timber value averages \$760±/acre.*
- White pine sawtimber accounts for about 58% of the property's timber value. This species is likely to sustain value long-term.
- In the future, hardwood sawtimber value, which currently accounts for about 17% of the property's timber value, should increase. The property's soils favor the growth of high quality hardwoods, including red oak and black birch.
- Cumulatively, all other low-quality wood products, including pulp, firewood, and chipwood on the Sawyer Lot account for the remaining 23% of timber value.

Species Composition and Forest Structure

- Red maple, white pine, and black birch account for over 75% of the species composition (by basal area) on the property.
- Hardwoods represent about 74% of species composition (by basal area).
- About two-thirds (67%) of the property's trees are 10 inches or less in diameter. These trees will rapidly appreciate in value as they enter the sawtimber size class in the next decade or so.

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2010 TIMBER VALUATION

VALUATION OF STANDING TIMBER – TOTAL MERCHANTABLE VOLUME

Sawyer Conservation Area Atkinson, New Hampshire

Productive Forest Area: 127.9± acres

<u>PRODUCT/ SPECIES</u>	<u>TOTAL VOLUME</u>	<u>% of VOLUME¹</u>	<u>UNIT PRICE</u>	<u>TOTAL VALUE</u>	<u>% of VALUE²</u>
Sawtimber					
White Pine	344.0 MBF	63.9%	@ \$165/MBF ³	\$ 56,760	58.4%
Red Maple	67.1	12.5	\$ 40	2,684	2.8
Red Oak	34.6	6.4	\$250	8,650	8.9
Black Oak	30.4	5.6	\$100	3,040	3.1
White Oak	10.0	1.9	\$ 50	500	<1.0
Black Birch	21.9	4.1	\$110	2,409	2.4
Yellow Birch	2.4	0.4	\$110	264	<1.0
White Ash	7.0	1.3	\$ 75	525	<1.0
Other	20.9	3.9	\$ 20	418	<1.0
TOTALS	538.3± MBF			\$ 75,250	
Chipwood/Pulp	6,858± Tons	@ \$ 1/Ton		\$ 6,858	7.1%
Firewood	1,257± Cords ⁴	@ \$ 12/Cord		<u>\$ 15,084</u>	<u>15.5</u>
GRAND TOTAL				\$ 97,192	100.0%
ROUNDED				<u>\$ 97,200</u>	

December 2010

¹ % of total sawtimber volume.

² % of overall value, including logs, pulp, chipwood, and firewood.

³ Adjusted to include pallet grade logs.

⁴ Includes tree length firewood, only. Total yield including “cut and split” firewood and/or hardwood pulp is 2500± cords. In the table above, this additional volume is included as chipwood.

TIMBER VOLUME ESTIMATE NOTES:

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TIMBER VOLUME ESTIMATE NOTES:

- 1) MBF = One thousand board feet.
- 2) Sawtimber volume totals include veneer, grade log, and pallet log totals for each species, except where otherwise noted. Unit prices are average combined value of veneer and grade logs, with discount for pallet logs.
Note: Pallet log % of total volume figures for the following species is:
White Pine – 10%±
White Oak – 50%±
Black Oak – 50%±
Red Oak – 25%±
- 3) Softwood pulp conversion is 2.2 tons per cord, and it includes hemlock and white pine. Estimate assumes approximately 1 ton of top wood pulp per MBF of softwood sawtimber. Furthermore, all other potential pulp either from full trees or tree tops, is accounted for as chipwood.
- 4) Chipwood estimate assumes 95 tons of total biomass per acre (110 tons/acre – 16.8 tons/acre sawtimber – 24.6 tons/acre firewood = 53.6 tons/acre chipwood/pulp. Therefore, 53.6 tons/acre chipwood x 127.9 forested acres = 6,858± tons).
- 5) As of December 2010, the Sawyer Conservation Area contains standing timber volumes, as follows:

538,300± board feet of sawtimber (90% Confidence Interval: ±144,489 bf; Std. Error ±23%)

Softwood – 344,000± BF

Hardwood – 194,300± BF

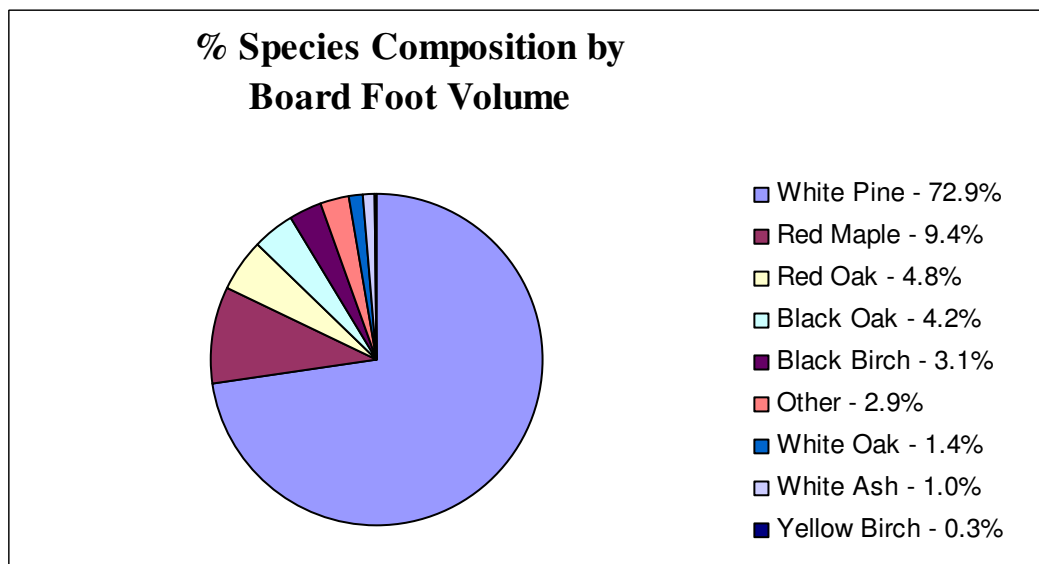
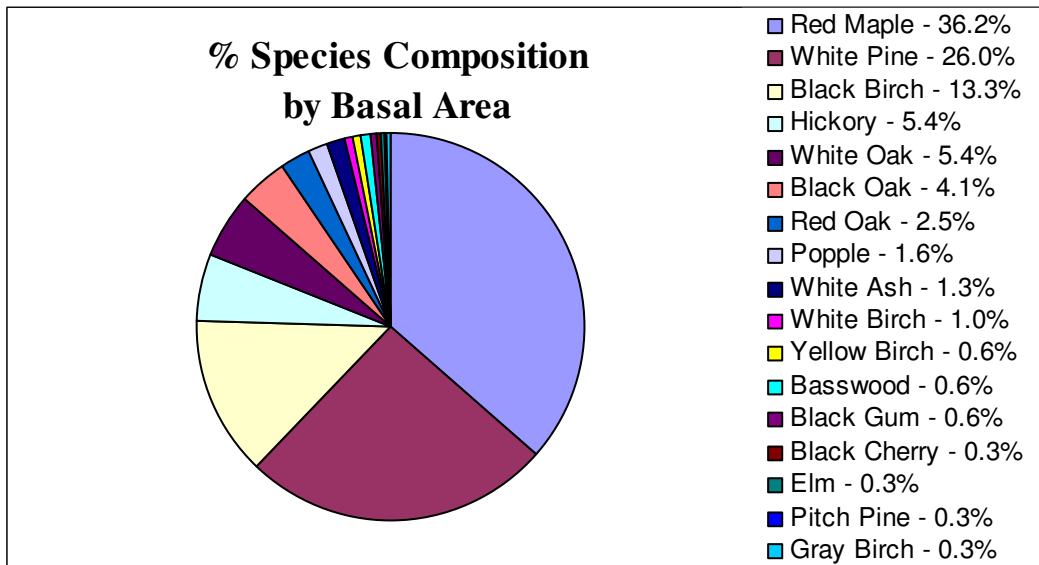
6,858± tons of chipwood and softwood pulp

1,257± cords of firewood (90% Confidence Interval: ± 141 cords; Std. Error ±5.2%)

SPECIES COMPOSITION

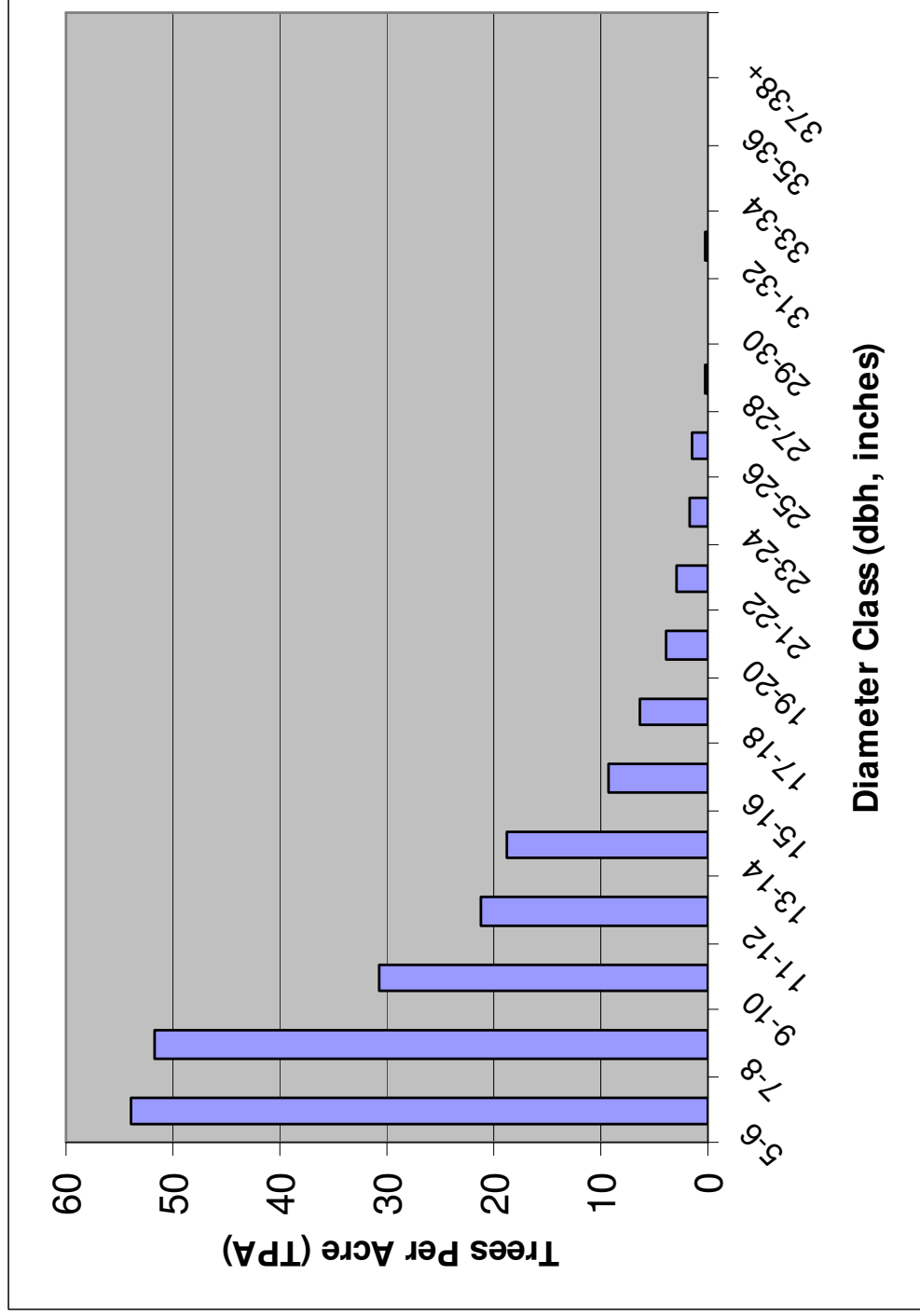
% Species Composition by Basal Area and Board Foot Volume

Sawyer Conservation Area Atkinson, New Hampshire



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Tree Diameter Distribution
Sawyer Conservation Area, Atkinson, New Hampshire



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TIMBER VOLUME—December 2010

ESTIMATED TOTAL POST-HARVEST TIMBER VOLUMES

Sawyer Conservation Area Atkinson, New Hampshire

<u>PRODUCT/ SPECIES</u>	<u>2010 VOLUME¹</u>	<u>2010 Harvest VOLUME²</u>	<u>Post-Harvest VOLUME³</u>
Sawtimber			
White Pine	523.7 MBF	179.7 MBF	344.0 MBF
Red Maple	67.2	0.1	67.1
Red Oak	34.7	0.1	34.6
Black Oak	30.4	0.0	30.4
White Oak	10.1	0.1	10.0
Black Birch	22.0	0.1	21.9
Yellow Birch	2.4	0.0	2.4
White Ash	7.0	0.0	7.0
Other	20.9	0.0	20.9
TOTALS	718.4± MBF	180.1 MBF	538.3± MBF
Chipwood/Pulp	8,570± Tons	1,712	6,858± Tons
Firewood	1,405± Cords	148	1,257± Tons

¹2008 forest inventory data was adjusted for 2 years growth and 2010 field observed volumes.

²2010 harvest volumes are timber volumes harvested from western and central section in the fall of 2010.

³Post-harvest volumes are the estimated residual volumes after the 2010 timber harvest, in Dec. 2010.



FOREST TYPES and PRESCRIPTIONS

A. White Pine/Hardwood, Older (80+ years) – 33.0± acres

Description – This forest type is characterized by scenic, well-established stands of white pine mixed with a variety of upland hardwoods. Overstory trees are generally at least 80 years of age,



and range upwards of 100+ years. White pines are relatively large, with most in the 16 to 20 inch diameter (DBH) range. The largest pines are over two-feet in diameter (a few 30+ inches) and 100± feet in height. Various species of oak and other hardwoods are also common *overstory* components, with oaks generally in the 12 to 20 inch range. While pine dominates the species mix (30 to 70% of composition), hardwoods—collectively—are also dominant, often representing half of the species composition.

This forest type developed from abandoned fieldland in the early 20th century. In 1988, several of the stands were lightly thinned; the healthiest trees were retained and provided with growing space. A follow-up improvement harvest was conducted in the fall of 2010. Trees that were severely damaged by the December 2008 ice storm or February 2010 windstorm were salvaged, diseased trees removed, and small openings (<2000 square feet) were created to foster pine and mixed hardwood regeneration.

The broad-crowned oaks, especially white oak, and hickories in this forest type provide an abundant source of mast to a wide variety of wildlife.

Species Composition –

Overstory: Primary¹ – White pine (in some areas hardwoods dominated stand composition)
Secondary² – Shagbark hickory, white ash, red maple, white birch, red oak, black oak, black birch, white oak, and pitch pine.
Tertiary³ – Mockernut hickory and pignut hickory.

Regeneration: In previously thinned areas – White pine, red oak, sugar maple, shagbark hickory, and black birch.

¹ Dominant tree species in main canopy layer.

² Fairly common to less common tree species.

³ A unique tree species, or only one or a few specimens in the forest type.



Forest Structure—

		<i>Prior to 2010 Harvest:</i>	<i>Post 2010 Harvest:</i>
<i>Composition</i>	Stand Structure	Even-aged	Same
	Silvicultural Stage	Late-intermediate	Same
	Stand Age	80-100± years	Same
<i>Tree Size</i>	DBH range	9 – 30+ inches	Same
	Mean DBH	15± inches	15± inches
	Avg. Maximum Height	100-110± feet	Same
<i>Stand Density</i>	Relative Stocking	Considerable/dense	Considerable
	Basal Area/Acre	155± sq. ft./acre	135± sq ft./acre
	Trees/Acre	130± trees	115± trees
	Canopy Closure	80 to 90± %	80 to 85%
<i>Ecological</i>	Canopy Stratification	Good—well developed understory and lower mid-story. Full overstory, with pine supercanopy.	
	CWD	Good accumulation, including some larger trunks and branches.	
	Invasive Plants	Low to moderate – Oriental bittersweet threatens to overtake stands if left unchecked.	

SILVICULTURAL PRESCRIPTION

Forest Type Prescription is found in the table at the end of the Forest Type section.

Structural Sequence: Even-aged (present condition)→ Three-aged (2040±)



B. White Pine/Hardwood, 50–80± years old – 4.7± acres

Description – This minor forest type is found in a few small patches that lingered as fieldland until the ±1950's. White pine generally represents 50% or more of species composition, while red maple is the predominant hardwood. Trees are mostly of poor timber quality, with crooked, multi-stem white pines and firewood-quality maples prevalent. Poor quality trees were thinned from the southwesterly pocket in the fall 2010 harvest, while the easterly stands await treatment (2011).

Abundant highbush blueberry in the understory of this forest type provides food and cover for wildlife, enhancing the stand. Glossy buckthorn, a seriously invasive exotic plant, was detected in the easterly stands. Immediate eradication efforts are strongly urged.



Species Composition –

Overstory: Primary – White pine and red maple.

Secondary – Black oak, red oak, big-tooth aspen, and white oak.

Tertiary – Pignut hickory and white birch.

Regeneration: White pine, red oak, white oak, white ash, shagbark hickory, red maple, and black cherry. Highbush blueberry is common in understory, with some hawthorn and buckthorn.

Forest Structure –

		<i>Prior to 2010 Harvest:</i>	<i>Post 2010 Harvest:</i>
<i>Composition</i>	Stand Structure	Even-aged	Same
	Silvicultural Stage	Young to mid-intermediate	Same
	Stand Age	65± years	Same
<i>Tree Size</i>	DBH range	7 - 20± inches	Same
	Mean DBH	11± inches	11± inches
	Avg. Maximum Height	65± feet	Same
<i>Stand Density</i>	Relative Stocking	Considerable	Considerable
	Basal Area/Acre	165± sq. ft./acre	140± sq. ft./acre
	Trees/Acre	250± trees	225± trees
	Canopy Closure	100± %	85%
<i>Ecological</i>	Canopy Stratification	Moderate– Light understory, with full overstory, upper mid-story and super canopy.	
	CWD	Moderate accumulation	
	Invasive Plants	Increasing incidence of glossy buckthorn.	

SILVICULTURAL PRESCRIPTION

Forest Type Prescription is found in the table at the end of the Forest Type section.

Structural Sequence: Even-aged (present condition)→Three-aged (2040)



C. Mixed Hardwoods, Oak/Hickory Dominated – 15.3± acres

Description – Found in several pockets, this forest type is dominated by red oak and/or shagbark hickory. Black and white oak are also common. All sections of the forest type are well-established, with



Forest type C--Red oak dominated area.



Forest type C--Hickory dominated area.

trees up to a century± old. Forest structure varies between stands, including areas that are even-aged and two-aged (indicating past harvesting), as well as even-aged with scattered large pine residuals (pine was previously harvested). Small white pine inclusions were noted. Firewood was lightly thinned in 1988 from the oak stand immediately east of the westerly field. All stands were thinned in the fall of 2010.

The stands in this forest type, with varied oak and hickory species as well as healthy, large-crowned trees, serve as a premier mast source for wildlife.

Species Composition –

Overstory: Primary– Shagbark hickory, red oak, black oak, black birch, white oak, and red maple.

Secondary– White pine, white ash, and pignut hickory.

Tertiary – Scarlet oak and popple.

Regeneration: White ash, red maple, black birch, white pine, shagbark hickory.

Forest Structure –

		<i>Prior to 2010 Harvest:</i>	<i>Post 2010 Harvest:</i>
<i>Composition</i>	Stand Structure	Even-aged w/ residuals; two-aged	Same
	Silvicultural Stage	Mid- to late-intermediate	Same
	Stand Age	75-100+ years	Same
<i>Tree Size</i>	DBH range	6 – 21+ inches (older residuals up to 36"±)	Same
	Mean DBH	12± inches	12± inches
	Avg. Maximum Height	70± feet	Same
<i>Stand Density</i>	Relative Stocking	Considerable	Same
	Basal Area/Acre	100± sq. ft./acre	85± sq. ft./acre
	Trees per Acre	125± trees	110± trees
	Canopy Closure	90 - 100±%	85 – 95%
<i>Ecological</i>	Canopy Stratification	Good – Well developed mid-story and overstory.	
	Coarse Woody Debris	Good – Ample accumulation.	
	Invasive Plants	Low/moderate incidence – Japanese barberry.	

Structural Sequence: Even and two-aged (present condition)→ Three/Multi-aged (2040±)



D. Mixed Hardwoods, Birch Dominated – 15.9± acres

Description – This forest type is found as three extensive stands in the central section of the Conservation Area. As with Forest Type C, hardwoods constitute the majority of the stands' species mix (75 to 100% of species composition). However, likely due to past disturbance (1930's), including heavy logging and possibly fire, black birch and white birch dominate stand stocking, with yellow birch found in moister areas. A variety of other hardwood species, as well as white pine, are also present, though in lesser quantities. Trees are commonly pole-sized, 7 to 11± inches DBH, indicating a younger overall stand age.



Nectria galligena, a pathogen which causes cankers on tree trunks and eventual mortality, affects a significant number of trees in this stand, particularly black birch. The 2010 thinning served to remove many of the affected trees. Due to aesthetic concerns for the degree of forest alteration if all the diseased trees were harvested, removals were limited to the most heavily afflicted trees. Further removal of diseased trees should take place during future harvests. Over time, healthy, high value oaks and birch will develop in this stand.

The stands have ample small diameter cavity trees and snags for wildlife presently.

Species Composition –

Overstory: Primary – Black birch and white birch.

Secondary – Red maple, red oak, yellow birch, white pine, black oak, shagbark hickory, white oak, black cherry, and white ash.

Tertiary – Big-tooth aspen.

Regeneration: Some white pine, black birch, red maple, and white ash. Small amount of sugar maple.

Forest Structure –

		Prior to 2010 Harvest:	Post 2010 Harvest:
<i>Composition</i>	Stand Structure	Even-aged w/ residuals	Same
	Silvicultural Stage	Mid-intermediate	Same
	Stand Age	60-85± years	Same
<i>Tree Size</i>	DBH range	5 – 17± inches (older residuals up to 24± inches)	Same
	Mean DBH	11± inches	11± inches
	Avg. Maximum Height	65± feet	Same
<i>Stand Density</i>	Relative Stocking	Considerable	Same
	Basal Area/Acre	110± sq. ft./acre	90± sq. ft./acre
	Trees per Acre	165± trees	145± trees
	Canopy Closure	80 - 100±%	80 - 95±%
<i>Ecological</i>	Canopy Stratification	Low to moderate: Upper mid story and overstory full, some low understory.	
	Coarse Woody Debris	Low to moderate accumulation.	
	Invasive Plants	Low incidence of Oriental bittersweet threatens to expand if not presently eradicated.	

Structural Sequence: Even-aged (present condition)→ Two-aged (2040±)



E. Mixed Hardwoods, Red Maple Dominated – 10.1± acres

Description – As with the other mixed hardwood forest types, deciduous species constitute 75-100% of forest composition in Forest Type E. This forest type typically occupies moister sites (but not wetlands) where red maple is the primary species. A number of red maple-dominated upland sites are found in the eastern and western sections of the Conservation Area; most contain relatively young forest, i.e., established between the 1930's and 1960.

While red maple predominates, white pine and red oak are present, representing potential seed sources for a future shift towards these species through silvicultural management. There is substantial low-quality maples (firewood quality), but straight, healthy individual trees may develop into a reasonably valuable sawlogs or veneer. The 2010 thinning in all the westerly stands of this forest type served to remove poor quality trees while providing growing space to promising individuals. The additional light should also promote understory white pine. Maple stumps sprouts will provide browse for deer and snowshoe hare for the next two to three years. This forest type has a serious incursion of several exotic plant species, especially near the field areas.



Species Composition –

Overstory: Primary – Red maple.

Secondary – White pine, red oak, and white ash.

Tertiary – Black cherry.

Regeneration: Some white pine.

Forest Structure –

		<i>Prior to 2010 Harvest:</i>	<i>Post 2010 Harvest:</i>
<i>Composition</i>	Stand Structure	Even-aged	Same
	Silvicultural Stage	Mid-intermediate	Same
	Stand Age	50-75+ years	Same
<i>Tree Size</i>	DBH range	5 – 15± inches	Same
	Mean DBH	10± inches	10± inches
	Avg. Maximum Height	60± feet	Same
<i>Stand Density</i>	Relative Stocking	Considerable	Same
	Basal Area/Acre	100± sq ft/acre	85± sq. ft./acre
	Trees per Acre	180 ± trees	155± trees
	Canopy Closure	80-100±%	80 - 95±%
<i>Ecological</i>	Canopy Stratification	Low – Full overstory, low understory only.	
	Coarse Woody Debris	Medium – some accumulation.	
	Invasive Plants	Serious incidence – Oriental bittersweet, Japanese barberry, honeysuckle, and glossy buckthorn are well-established.	

Forest Type Prescription is found in the table at the end of the Forest Type section.

Structural Sequence: Even-aged (present condition)→ Two/Three-aged (2040±)



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F. Forested Wetlands – 31.2± acres

Description – This forest type occupies the property’s poorly-drained soils, typically following swales and small drainages. While red maple is the dominant species, a variety of other wetland tree species are found, including swamp white oak. Due to wet ground conditions, the stands in this forest type are generally too wet to manage, though trees may be harvested on the edges, or during dry/frozen ground conditions. The summer/fall of 2010 was droughty, and the edges of some of the Forest Type F stands were harvested. The major purpose of harvesting in this forest type, if it can be accomplished without soil impact, is to create small openings and vegetative diversity for wildlife. A number of fruit-bearing shrubs including winterberry holly, highbush blueberry, and northern arrowwood, thrive when additional light is provided through gaps in the forest overstory. These shrubs provide important food sources, as well as dense cover.



Invasive plants, particularly Oriental bittersweet and honeysuckle, have infiltrated the wetland forest, particularly in the vicinity of the fields. Control of these invasive patches is critical if the plants are to be kept out of the Conservation Area’s upland forest.

Species Composition (Overstory) –

Primary – Red maple.

Secondary – White ash, white pine, elm, quaking aspen, swamp white oak (in mature stands).
Forest Structure –

<i>Composition</i>	Stand Structure	Two-aged w/ inclusions
	Silvicultural Stage	Mid-intermediate
	Stand Age	50-80+ years. (80-to 90 years in mature stands).
<i>Tree Size</i>	DBH range	8 – 16± inches (older residuals up to 24”+). (8” – 20” in mature stands).
	Mean DBH	10± inches
	Avg. Maximum Height	55± feet
<i>Stand Density</i>	Relative Stocking	Moderate/Considerable
	Basal Area/Acre	Variable: 40-120± sq ft/acre
	Trees per Acre	120 ± trees
	Canopy Closure	80±%
<i>Ecological</i>	Canopy Stratification	Good – Well-developed understory, some mid-story, and full overstory.
	Coarse Woody Debris	Medium – some accumulation.
	Invasive Plants	Serious incidence – Oriental bittersweet and honeysuckle.

Forest Type Prescription is found in the table at the end of the Forest Type section.

Structural Sequence: Even-aged (present condition)→ Multi-aged (2040±)



G. White Pine, Older (80+ years) – 7.4± acres

Description – This forest type is represented by one stand of well-established, older white pine in the east-central area of the property. Forest Type G contains pines similar in size and age to those which stock Forest Type A, however, in this stand, white pine easily dominates, constituting 75 – 100% of the overstory species mix.

The area occupied by this older pine forest type, as with all other sections of the Sawyer Conservation Area, was a pasture in 1900. This pasture was probably abandoned during World War I, and then overtaken by dense pine growth. The present stand contains the remaining pines from this initial growth. Past disturbances, including a light harvest in the 1980's, resulted in canopy gaps where black birch and white pine regenerated. Today, the 20 - 25± year saplings (1" to 3" diameter), represent a second age class in the stand. Two recent disturbances—the 2008 ice storm and the 2010 windstorm—severely damaged and uprooted a number of pines. The fall 2010 harvest served to salvage these trees, while creating canopy gaps for a new generation of forest growth. Over time it will be favorable to regenerate a mix of pine and upland hardwood in this stand.



In addition to straight, large diameter, valuable timber, this forest type also contains a number of gnarly, multi-stemmed, large “pasture” pines. These trees provide interesting vertical structure for wildlife, including red squirrels, barred owls, pine warbler, and red-breasted nuthatch.

Species Composition –

Overstory: Primary – White pine.
Secondary – Black birch. Tertiary – Black cherry.

Forest Structure –

		<i>Prior to 2010 Harvest:</i>	<i>Post 2010 Harvest:</i>
<i>Composition</i>	Stand Structure	Two-aged	Same
	Silvicultural Stage	Late-intermediate	Same
	Stand Age	80-100 years and 20-25± years	Same
<i>Tree Size</i>	DBH range	12 – 28± inches	Same
	Mean DBH	16± inches	16± inches
	Avg. Maximum Height	95± feet	Same
<i>Stand Density</i>	Relative Stocking	Considerable	Same
	Basal Area/Acre	160± sq ft/acre	140± sq. ft./acre
	Trees per Acre	110 ± trees	100± trees
	Canopy Closure	80±%	70 - 80±%
<i>Ecological</i>	Canopy Stratification	Medium – Pine overstory and super canopy, with black birch mid-story.	
	Coarse Woody Debris	Good – Uprooted large trees, with accumulation of large branches on forest floor.	
	Invasive Plants	Low, at present.	

Structural Sequence: Even-aged (present condition)→ Multi-aged (2040±)



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H. White Pine, Younger (40-80± years) – 3.5± acres

Description – Found as two stands in the eastern section of the property, these areas were pasture in the late 1950's. A few red cedars remain in this forest type, indicative of the former field condition. Presently, young white pines, mostly 40 to 50± years of age, constitute 75 to 100% of species composition. Trees average approximately 11 inches in diameter, while the density of trees and quality of the pine varies significantly. Vigorous, straight pines stand alongside multi-stemmed, heavily-limbed pines; the latter condition is a result of white pine weevil activity during stand development. While the stands have low commercial value at present, careful thinning (the stands were not thinned in 2010) to remove low-quality trees will improve growing conditions for the more promising pines. Some especially promising pine patches were noted.



There are incursions of Oriental bittersweet on the stands' edges from adjacent infested stands. Scattered Japanese barberry was also noted. Densely-shaded pine buffer strips may be retained *un-thinned* along the invasive plant edge to prevent further spread into the stands' interiors.

Presently, forest regeneration is sparse under the dense pine canopy. The stands are attractive to pine warbler and red-breasted nuthatch, as well as red squirrels.

Species Composition –

Overstory: Primary – White pine.
Secondary – Red maple. Tertiary – Red cedar (mostly dead) and gray birch.

Forest Structure –

<i>Composition</i>	Stand Structure	Even-aged
	Silvicultural Stage	Young- to mid-intermediate
	Stand Age	40-50± years
<i>Tree Size</i>	DBH range	7 – 20± inches
	Mean DBH	11± inches
	Avg. Maximum Height	60± feet
<i>Stand Density</i>	Relative Stocking	Considerable/Dense
	Basal Area/Acre	180± sq ft/acre
	Trees per Acre	270 ± trees
	Canopy Closure	100±%
<i>Ecological</i>	Canopy Stratification	Low – Full overstory with little understory.
	Coarse Woody Debris	Medium – Accumulation of mostly small stems.
	Invasive Plants	Moderate – Japanese barberry and Oriental bittersweet making incursions into stand.

Structural Sequence: Even-aged (present condition)→ Even/Two-aged (2040±)



I. Young Forest – 9.4± acres

Description – Forest Type I includes several pockets of young softwood/hardwood forest that lie adjacent to or nearby the Conservation Area's two fields. These areas were extensions of the current fields that were clear as recently as the late 1960's. A great variety of tree species populate the young stands, though white pine and red maple dominate, with white ash common in moister sites. The species variety is somewhat representative of early-successional forest growth, that is, the mix of sun-loving pioneer species that quickly occupy an abandoned field. Among these species are gray birch, aspen (popple), and white pine. Grapevine was also noted.



Early-successional forest growth provides valuable habitat for wildlife; dense vegetation provides cover, while many of the tree and shrub species associated with this forest type supply seeds and fruit that are utilized by wildlife. As New Hampshire and northern Massachusetts have transformed from agricultural communities to forested tracts and/or developing suburbs, the early-successional forest type has become increasingly scarce, with negative implications for wildlife, including a host of migrating birds. Chestnut-sided warble, Eastern towhee, and brown thrasher are a few of the species associated with early-successional cover.

It is recommended that at least two thirds (6+ acres) of the Conservation Area's young forest (Forest Type I) be managed and perpetuated as early successional cover. This requires periodic clearing of the sites and then allowing them to re-grow densely for a period of 25 to 30 years, when they would be cleared again. The acreage to be managed as early-successional should be done in "halves", i.e., 3± acres would be cleared on alternating 12 to 15 year cycles (to coincide with other work on the Conservation Area). Thus, it is recommended that at least 3± acres of Forest Type I be cleared at present, and another 3± acres cleared in 12 to 15 years, with the first area revisited for clearing in 25 to 30± years. Clearing of sapling growth is best accomplished with a Brontosaurus or Bobcat mulcher. Larger trees must be cleared by chainsaw or in conjunction with the prescribed biomass harvesting in adjacent stands. Clearing can be done in a mosaic pattern, perhaps with buffers left along Sawyer Avenue and the main recreational trail.

Forest Type I has a severe infestation of Oriental bittersweet, particularly along field and main trail edges. Other troublesome exotic invasive plants (some only in the property's western stands) include burningbush, autumn olive, and Japanese barberry. This infestation serves as a vector for the spread of invasive plants into the Conservation Area's interior. Immediate control efforts are needed in Forest Type I and the field edges to halt the spread of these plants before the entire forest is compromised. The invasives will be easier to control, at least initially, in areas cleared for early-successional growth.



Exotic invasives envelop a young forest area.



Species Composition –

Primary – White pine, red maple. White ash in pockets.

Secondary – Red oak, black oak, popple, white birch, black birch, shagbark hickory, and gray birch.

Tertiary – Red cedar and basswood.

Regeneration – Sugar maple and white ash.

Forest Structure –

<i>Composition</i>	Stand Structure	Even-aged
	Silvicultural Stage	Young-intermediate
	Stand Age	30-45± years
<i>Tree Size</i>	DBH range	2 – 12± inches
	Mean DBH	6± inches (variable)
	Avg. Maximum Height	45± feet
<i>Stand Density</i>	Relative Stocking	Considerable
	Basal Area/Acre	110-180± sq ft/acre (variable)
	Trees per Acre	180 ± trees (variable)
	Canopy Closure	90±%
<i>Ecological</i>	Canopy Stratification	Medium – Upper mid-story and overstory.
	Coarse Woody Debris	Low accumulation.
	Invasive Plants	Serious to extreme invasion of several exotic species, particularly bittersweet.

Forest Type Prescription is found in the table at the end of the Forest Type section.

Structural Sequence: Even-aged (present condition)→ Two/three-aged in patches (2040±)



FOREST TYPE PRESCRIPTIONS for SILVICULTURALLY MANAGED AREAS - Page 1

<i>FOREST TYPE</i>	A) Pine/Hardwood, 80+ year	B) Pine/Hardwood, 50-80± years	C) Mixed Hardwoods, Oak/Hickory	D) Mixed Hardwoods, Birch	E) Mixed Hardwoods, Red Maple
<i>OBJECTIVES—Long Term</i>					
Increase structural complexity	✓✓	✓✓	✓✓	✓✓	✓✓
Diversify species mix		✓✓	✓	✓	✓✓
Reserve or retain old trees	✓✓		✓✓		
Designate Reserve Area(s)					
<i>OBJECTIVES—Short Term</i>					
Abundant diseased trees present --Remove				✓✓	
Regenerate pine & oak	✓✓✓		✓✓		✓✓
Upgrade timber quality	✓	✓✓✓	✓	✓	✓✓
Growing space (overstory)	✓	✓✓	✓✓	✓✓	✓
Create openings for regeneration & wildlife	✓✓✓		✓✓		✓✓
Establish/release regeneration	✓✓✓		✓		✓
Wildlife	✓✓	✓	✓✓✓	✓	✓
Aesthetics	✓✓✓	✓	✓✓	✓✓	
Clear for early-successional					
Perpetuate early-successional					
Monitor/control invasive plants	✓✓	✓✓✓	✓✓	✓✓	✓✓
FAVORED SPECIES	Red oak, white pine, white oak, black birch, shagbark hickory.	White pine, red oak, white oak, shagbark hickory.	Shagbark hickory, red oak, white oak, pignut hickory, white pine	Red oak, yellow birch, black birch, white ash, shagbark hickory, sugar maple	White pine, red oak, white ash
DATE/TREATMENT					
2010/2011	Crown thinning/ Improvement cut/ Storm Salvage	Improvement cut/ Crown thinning.	Crown thinning/ Improvement cut.	Improvement cut/ Crown thinning/ Storm salvage	Improvement cut/Crown thinning.
2011-2015±	Invasive plant control	Invasive plant control	Invasive plant control	Invasive plant control	Invasive plant control
2023-2025±	Single-tree selection with micro-group openings	Improvement cut/ Crown thinning.	Single-tree selection/micro-group selection	Crown thinning/ Improvement cut	Improvement cut/Crown thinning.
2035±	Single-tree selection/Expanded micro- groups/Liberation	Single-tree selection/ micro-group openings	Single-tree selection/Expanded micro- groups/Liberation	Single-tree selection with micro-group openings	Single-tree selection with micro-group openings



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FOREST TYPE PRESCRIPTIONS for SILVICULTURALLY MANAGED AREAS - Page 2

<i>FOREST TYPE</i>	F) Forested Wetland	G) White Pine, 80+ years	H) White Pine, 40-80± years	I) Young Forest
<i>OBJECTIVES—Long Term</i>				
Increase structural complexity	✓✓	✓✓	✓	
Diversify species mix		✓		
Reserve or retain old trees	✓	✓		✓
Designate Reserve Area(s)	✓			
<i>OBJECTIVES—Short Term</i>				
Abundant diseased trees present -- Remove				
Regenerate pine & oak		✓✓		
Upgrade timber quality		✓	✓✓	
Growing space (overstory)		✓	✓✓	
Create openings for regeneration & wildlife	✓✓	✓✓		✓✓
Establish/release regeneration		✓✓		
Wildlife	✓✓	✓		✓✓
Aesthetics		✓	✓	
Clear for early-successional				✓✓
Perpetuate early-successional				✓✓
Monitor/control invasive plants	✓✓✓	monitor	✓✓✓	✓✓✓
FAVORED SPECIES	Protect swamp white oaks	White pine, black birch.	White pine, red cedar.	Aspen, black cherry, white pine, red cedar, basswood, sugar maple, shagbark hickory
<i>DATE/TREATMENT</i>				
2010/2011	Crown thinning/overstory openings to release wildlife shrubs	Single-tree selection/ micro-group openings/ Storm Salvage	TSI: Crown thinning/ Improvement cut.	Clearing to create early-successional
2011-2015±	Invasive plant control		Invasive plant control	Invasive plant control
2023-2025±	Crown thinning/overstory openings to release wildlife shrubs	Single-tree selection/Expanded micro-groups/Liberation	Crown thinning/ Improvement cut	Clearing to create early-successional
2035±	Crown thinning/overstory openings to release wildlife shrubs	Single-tree selection/Expanded small groups/Liberation	Crown thinning/ Improvement cut.	Clearing to perpetuate early-successional



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Appendix A: Conservation Area Photos



County champion white ash.



Wildlife tree: Large diameter snag with cavity.



Westerly field—fallow, managed for wildlife.



Early-successional herbaceous growth in west field.



Oriental bittersweet—advanced infestation.



Rutted trail crossing over seasonal drainage.



APPENDIX B: OBSERVED PLANTS

Sawyer Conservation Area, October 2009

Trees

Common Name

Scientific Name

Hardwoods

American beech	<i>Fagus grandifolia</i>
Northern red oak	<i>Quercus rubra</i>
Black oak	<i>Quercus velutina</i>
White oak	<i>Quercus alba</i>
Swamp white oak	<i>Quercus bicolor</i>
Scarlet oak	<i>Quercus coccinea</i>
Red (Swamp, Soft, White) maple	<i>Acer rubrum</i>
Sugar (Rock, Hard) maple	<i>Acer saccharum</i>
White (Paper) birch	<i>Betula papyrifera</i>
Gray birch	<i>Betula populifolia</i>
Black (Sweet) birch	<i>Betula lenta</i>
Yellow (Silver) birch	<i>Betula allegheniensis</i>
Ironwood (Musclewood)	<i>Carpinus caroliniana</i>
Shagbark hickory	<i>Carya ovata</i>
Pignut hickory	<i>Carya glabra</i>
Mockernut hickory	<i>Carya tomentosa</i>
Butternut	<i>Juglans cinerea</i>
Black cherry	<i>Prunus serotina</i>
White ash	<i>Fraxinus americana</i>
Basswood	<i>Tilia americana</i>
Bigtooth aspen (Popple)	<i>Populus grandifolia</i>
Quaking aspen	<i>Populus tremuloides</i>
American elm	<i>Ulmus americana</i>

Softwoods

White pine	<i>Pinus strobus</i>
Pitch pine	<i>Pinus rigida</i>
Eastern hemlock	<i>Tsuga canadensis</i>

Shrubs

Witch-hazel
Maple-leaf viburnum
Hawthorn
Alternate-leaf dogwood
Silky dogwood

- Continued -



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Beaked hazelnut
Spicebush
Winterberry holly
Highbush blueberry
Lowbush blueberry
Serviceberry
Northern arrowwood
Common elderberry
Nannyberry
Northern wild-raisin
Gray (Red-panicle) dogwood
Smooth sumac
Staghorn sumac
Speckled alder

Herbaceous/Ground Cover

Sweetfern
Poison ivy
Wild sarsaparilla
Jewelweed (Spotted Touch-Me-Not)
Bristly dewberry
Prickly dewberry
Bunchberry
Wintergreen
Partridgeberry
Starflower
Indian cucumber root
Common bellwort
Wood aster
Goldenrod
Steeplebush
Queen Anne's Lace
Milkweed
Wild grape
Virginia creeper
Meadowsweet
Solomon's seal
Whorled aster
Wood aster
Starflower
Partridgeberry
Wintergreen
Blackberry
Black raspberry

- Continued -



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Sheep laurel
Greenbrier
Indian Pipe

Ferns/Clubmosses

Bracken fern
Cinnamon fern
Hay-scented fern
Royal fern
Sensitive fern
New York fern
Massachusetts fern
Christmas fern
Marginal wood fern
Horsetail
Tree clubmoss

Invasives

Burningbush
Oriental bittersweet
Japanese barberry
European barberry
Autumn-olive
Tartarian honeysuckle
Norway maple
Glossy buckthorn
Multiflora rose



Appendix D: SILVICULTURAL TREATMENTS

Non-commercial Treatments (TSI):

Non-commercial treatments are used for the purposes of forest health, stand establishment, tree quality improvement, and habitat enhancement in stands or pockets of trees that are generally seedling to small pole sized (<1 to 9± inches). Thinned trees are not removed from the forest, therefore there is no transaction involved in this forest improvement activity. The work is a cost operation however, requiring compensation for the labor involved in selecting, felling, and or pruning the trees.

- *Inter-sapling release (Cleaning)* – A TSI treatment in sapling/seedling stands that releases promising young growth from competing stems, particularly to help establish a particular set of species that have naturally regenerated but are under competition from more shade tolerant species. This treatment requires meticulous use of a rotary brush saw.
- *Weeding & Thinning* – A TSI treatment in young pole-sized stands where poorly growing trees are removed, while providing growing space to promising young trees. Trees to be thinned should be selected and marked prior to cutting. Trees are then felled with a chainsaw, lopped, and typically left on the forest floor. Large trees (12”+) to be thinned should be girdled and left to decay standing while providing wildlife habitat.
- *Pruning* – A TSI treatment where the lower limbs of white pines or quality hardwoods are removed to enable valuable clear-wood growth.

Commercial Treatments:

Commercial treatments are applied in established stands of trees, where the spacing between trees allows for the use of wheeled (or tracked) equipment to harvest and/or remove the trees. Harvested trees are sold, processed, and marketed.

- *Crown Thinning* – The focus of this treatment is to provide growing space around the crowns of promising trees. Poorly growing trees are generally removed, with 5 to 8 feet of space provided on at least one side of the crown of favored trees. Crown thinning may be done in conjunction with liberation and/or improvement thinning.
- *Improvement Thinning* – Treatment where lower-quality, diseased, and declining trees are removed to upgrade overall stand quality. Additionally, certain species, such as red oak and white pine, are favored over other competing species, such as beech, that are prone to disease or poor-quality growth, and may dominate a site.
- *Liberation Cutting* – Applied to two-, three-, or multi-aged stands, where some overtopping trees are removed to provide light and growing space for favorable forest regeneration and established younger growth.
- *Single-tree selection* – Individual trees of various sizes and ages are removed with the purpose of encouraging forest regeneration and continuing the development of a multi-aged forest. Applied to a three-aged or multi-aged stand.
- *Group selection* – Micro (2 to 5 trees) to small (6 to 15 trees) sized groups of trees are harvested to create forest openings for regeneration and to develop a multi-aged forest. This may favor the establishment of more diverse species, including those less tolerant to overhead shade. Expanded micro-group cutting may follow an initial micro-group cut, where regeneration has become established and will benefit from additional overhead release.



APPENDIX E: FOREST INVENTORY SPECIFICATIONS

Sawyer Conservation Area Atkinson, New Hampshire

The Sawyer Conservation Area, comprising $140.4 \pm$ acres (**$127.9 \pm$ productive, forested acres**), was cruised in December 2008 using the variable-radius plot sampling technique. Data were collected from 50 prism points arranged in a grid pattern covering the forest. The average sampling intensity was 1 sample point per $2.55 \pm$ forested acres. Aerial photos and reconnaissance of the property were employed to delineate forest types into 3 strata for statistical purposes.

A summary of inventory and statistical specifications follows:

- 1) Statistical error around the total sawtimber volume estimate: $\pm 23.0\%$
(Total sawtimber includes grade logs, veneer, and pallet logs of all species).
538,300 Board Feet \pm 144,489 BF (90% Confidence Interval)
- 2) Statistical error around the total firewood volume estimate: $\pm 5.2\%$
1,257 cords \pm 141 cords (90% Confidence Interval)
- 3) Confidence level: 90%
- 4) Sample plot layout
 - a. Systematic sample
 - b. Spacing: 320' x 320' grid
- 5) Plot type and number: 50 prism plots
- 6) Number of strata: 3
- 7) Angle-gauge: 20-factor prism
- 8) Tree scaling/grading specifications:
 - a. Diameter: All merchantable trees > 5 inches DBH measured
 - b. Stem DBH measurements: 1 inch increments
 - c. Top diameters (merchantable heights)
 - Firewood – 4", straight stem
 - Sawtimber: White pine: 8 inches
Other softwoods: 10"
Hardwoods: 10"
 - d. Grades:
 - Veneer (white, black, & yellow birch; black, red oak, & white oak; red & sugar maple; white ash)
 - Grade sawlogs (Hardwood and softwood)
 - Pallet logs (Hardwood and softwood)



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Consulting Forester, Forest Ecologist

New Hampshire Licensed Professional Forester #115
Maine Forester License #2000

EDUCATION

B.S. FORESTRY – University of New Hampshire, Magna Cum Laude, May 1980
SAF Study Tour of France – Three-week study of French silvicultural methods, September 1983

PROFESSIONAL SERVICE and AFFILIATIONS

Forest Stewards Guild – Board of Directors (1999-2005), Chair (2005)
Society of American Foresters (SAF) – NH Chairman (1996)
New Hampshire Tree Farm Program – Executive Committee (1984-87)
Society for the Protection of New Hampshire Forests

WORK EXPERIENCE

1980 - Present	FORESTRY CONSULTANT, founder and proprietor of Moreno Forestry Associates. Thirty-one years experience managing private and public forests in New Hampshire. Projects include forest and wildlife management planning and implementation, ecological assessments, forest inventory and appraisals, timber sales, mapping, forest taxation and litigation, forest improvement and habitat enhancement, and conservation plans for towns, conservation organizations, and private landowners. 30,000+ acres under management.
1984- Present	TOWN FOREST MANAGER for the Towns of Exeter, Londonderry, Candia, Plaistow, Brentwood, East Kingston, Deerfield, Epping, Brentwood, Sandown, Rye, Pittsfield, Derry, Dover, Madbury, Strafford, and Rochester developing/implementing multiple-use plans for publicly owned forests.
1985- 1992	ALTON TOWN FORESTER. Consultant to the Town on Current Use Assessment and NH Timber Tax matters.
1980- 1988	K-F TREE FARM, Forest Manager. Experience in all areas of woodland and wildlife management in this intensively managed, 700-acre property in Alton, New Hampshire. Selected as 1988 Belknap County Tree Farm of the Year.

PROFESSIONAL RECOGNITION

New Hampshire Outstanding Forester Award (Society of American Foresters) -- 2001
National Outstanding Tree Farm Inspector Award -- 1999
Austin Cary Practicing Professional Award – (New England SAF, 1998)
NH Wildlife Stewardship Award – 1995
Outstanding New Hampshire Tree Farm Award 1987, 1992, 2002, & 2006
NH Tree Farm Inspector of the Year – 1985, 1990, 1992, 1993, 1998
Xi Sigma Pi (Forestry Honor Society, 1978)
Eagle Scout (1976)



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