FOREST MANAGEMENT PLAN

for the Town of Durham's

OYSTER RIVER FOREST

Durham, New Hampshire

171.7± acres

Prepared by:

Charles A. Moreno, LPF

Consulting Forester

PO Box 60, Center Strafford, NH 03815

(603) 335-1961 January 24, 2017

Commissioned by:

USDA Natural Resources Conservation Service

Charles A. Moreno, NH LPF #115

Report Copy # _____

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for the Town of Durham's

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Durham, New Hampshire
171.7± acres

January 24, 2017

Above: Old, large, sugar maple in the Oyster River Forest reserve area.
Cover Page: The Oyster River.

The author of this forest management plan, Charles A. Moreno, LPF, certifies that the contents of the plan, except where footnoted, but including all written material, maps (base information referenced), plan format and organization, are original to the author.

The purpose of this plan is to provide natural resources information and forest management recommendations to the Natural Resources Conservation Service (NRCS) and their agents, as well as the landowner, the Town of Durham. This document is a work for hire done by Charles A. Moreno for the NRCS and the Town of Durham, and may be used by the NRCS or the Town of Durham for any purpose. Copying of this plan by any other individual or organization, including all written material, plan content and format, requires appropriate citation and/or the written permission of Charles A. Moreno, Consulting Forester.

Charles Moreno, Consulting Forester
Strafford, New Hampshire, (603) 335-1961

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MAPS

Map *of the*

OYSTER RIVER FOREST

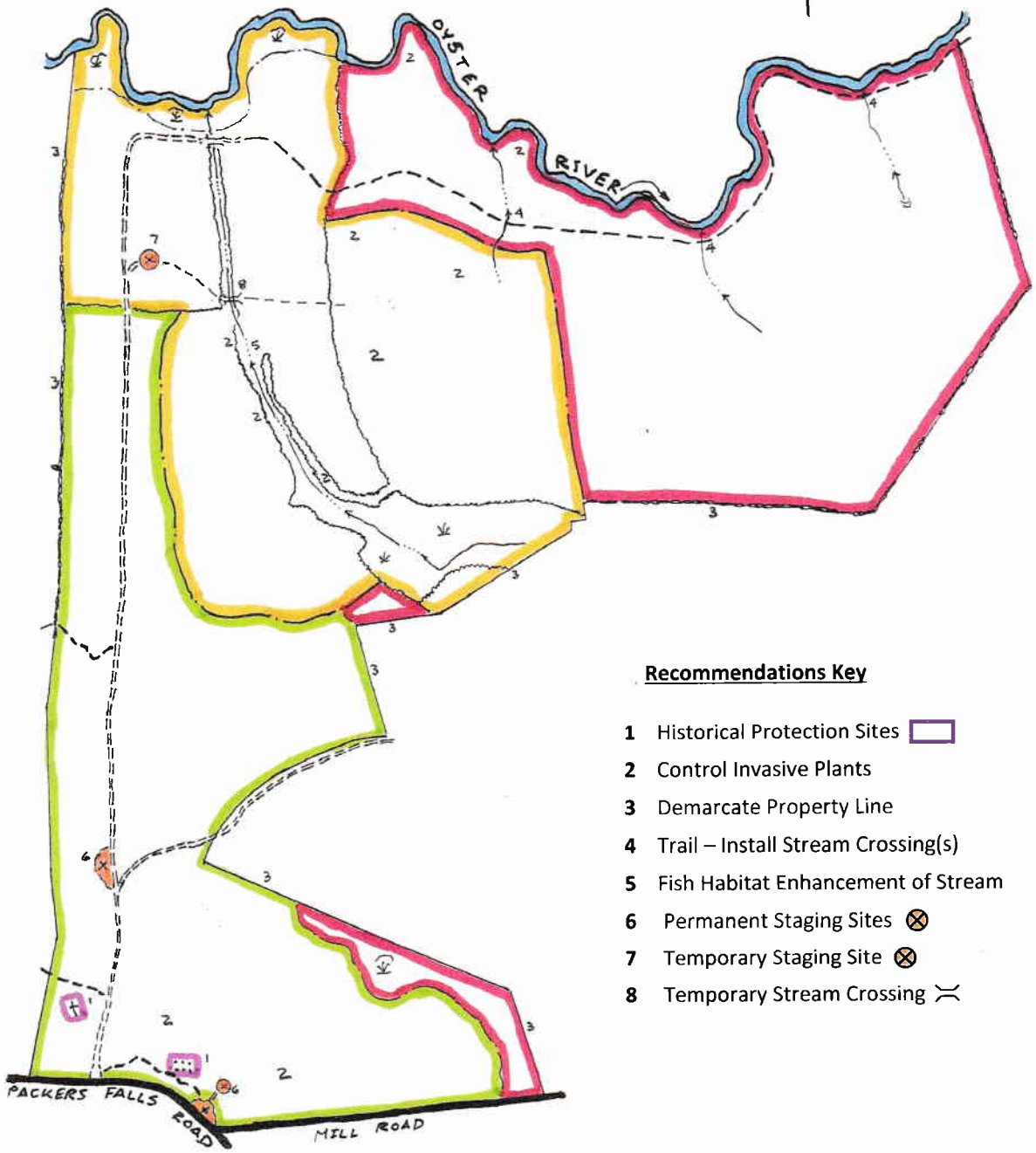
Durham, New Durham

171.7± acres

Showing Management Recommendations

MAP SCALE:

1 inch = 600± feet



Recommendations Key

1 Historical Protection Sites
2 Control Invasive Plants
3 Demarcate Property Line
4 Trail – Install Stream Crossing(s)
5 Fish Habitat Enhancement of Stream
6 Permanent Staging Sites
7 Temporary Staging Site
8 Temporary Stream Crossing

Management Areas

Silvicultural: 53.7± Acres

NEC Shrubland Habitat: 59.0± Acres

Reserve: 59.0± Acres

Map drawn by:
Charlie Moreno, Consulting Forester
Moreno Forestry Associates
Center Strafford, NH
(603) 335-1961 January 2017

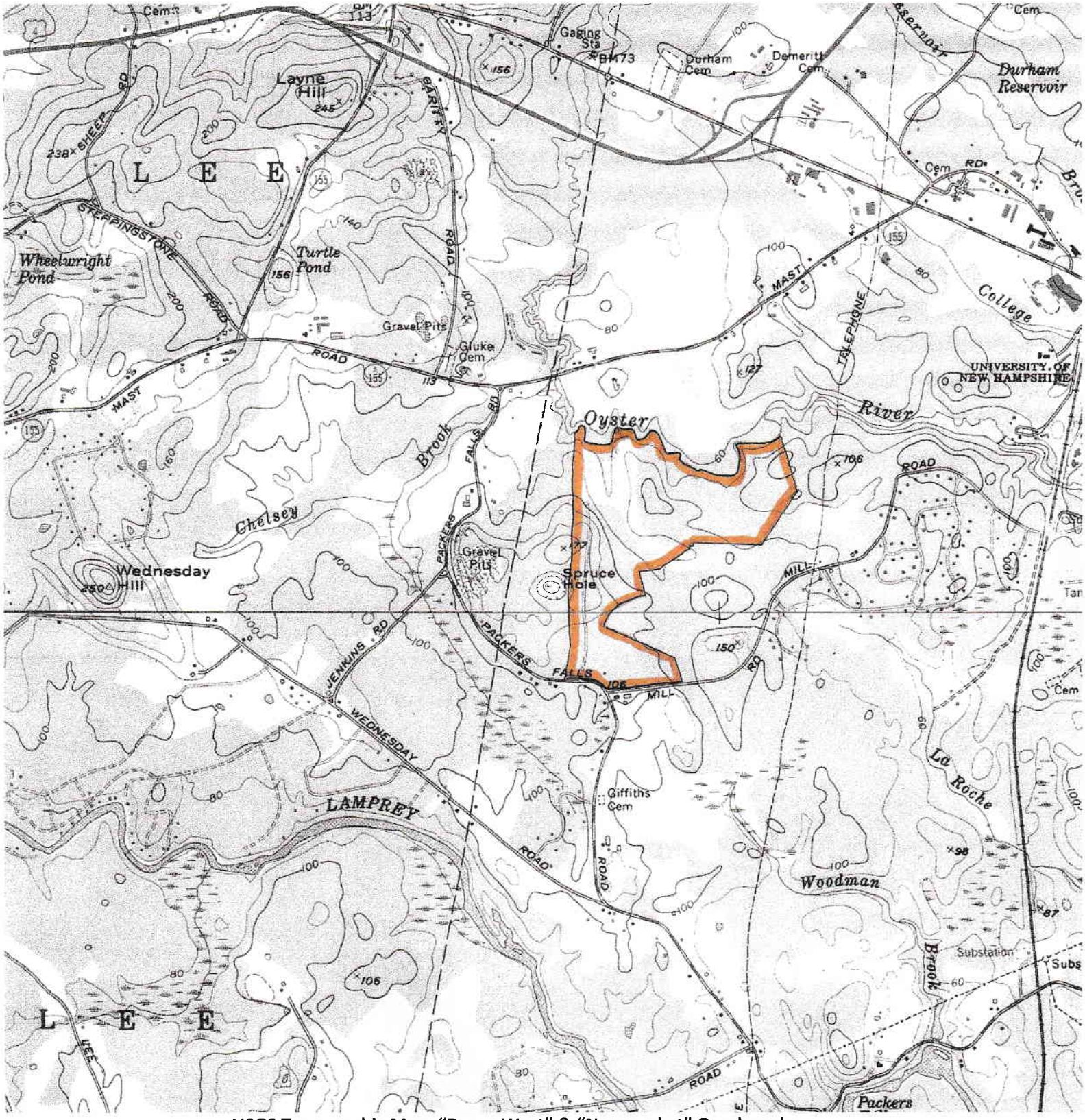
Reference Maps: Town of Durham Tax Maps
Surveys: D.W. Vincent, LLS SCRD Plan # 105-25, 105-26, & 105-27.
Aerial Photos: Google Earth
Property Reconnaissance:
Forest Inventory (Moreno Forestry Associates, 2016)
Field Examination (Moreno Forestry Associates, 2016-2017)

This map is not intended as a legal description or for legal purposes.

MAP SCALE:

1 inch = 2000± feet

Locus Map *of the Town of Durham's*
Oyster River Forest
Durham, New Hampshire
171.7± Acres



USGS Topographic Map, "Dover West" & "Newmarket" Quadrangles

Map *of the*

OYSTER RIVER FOREST

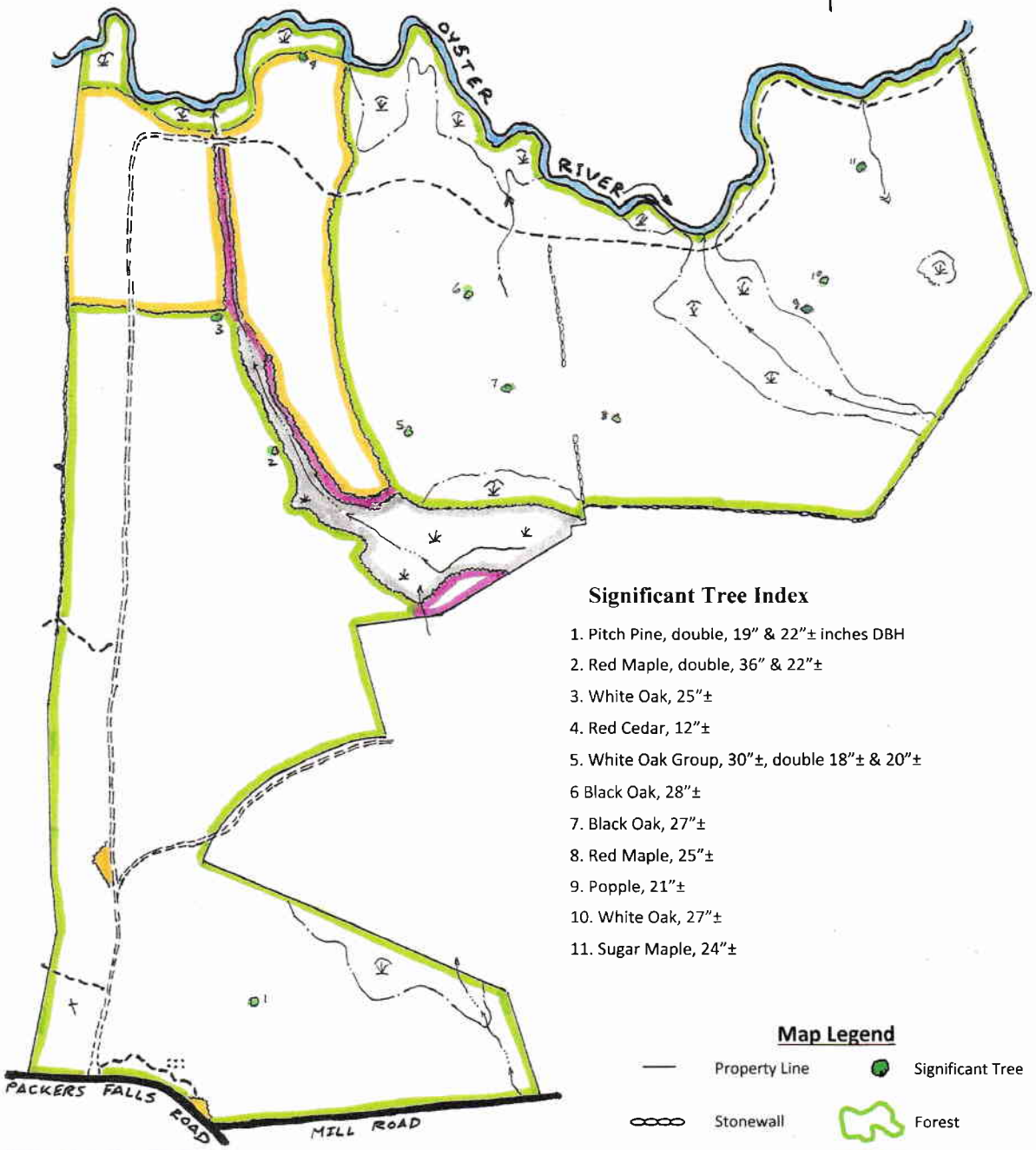
Durham, New Durham

171.7± acres

Showing Physical and Natural Features

MAP SCALE:

1 inch = 600± feet



Significant Tree Index

1. Pitch Pine, double, 19" & 22"± inches DBH
2. Red Maple, double, 36" & 22"±
3. White Oak, 25"±
4. Red Cedar, 12"±
5. White Oak Group, 30"±, double 18"± & 20"±
6. Black Oak, 28"±
7. Black Oak, 27"±
8. Red Maple, 25"±
9. Popple, 21"±
10. White Oak, 27"±
11. Sugar Maple, 24"±

Map Legend

- Property Line
- Stonewall
- Gravel Road
- Trail
- Cellar Hole
- † Wiggin-Tuttle Cemetery
- Significant Tree
- Forest
- Field
- Shrubland
- Forested Wetland
- Emergent Wetland
- Seasonal Stream

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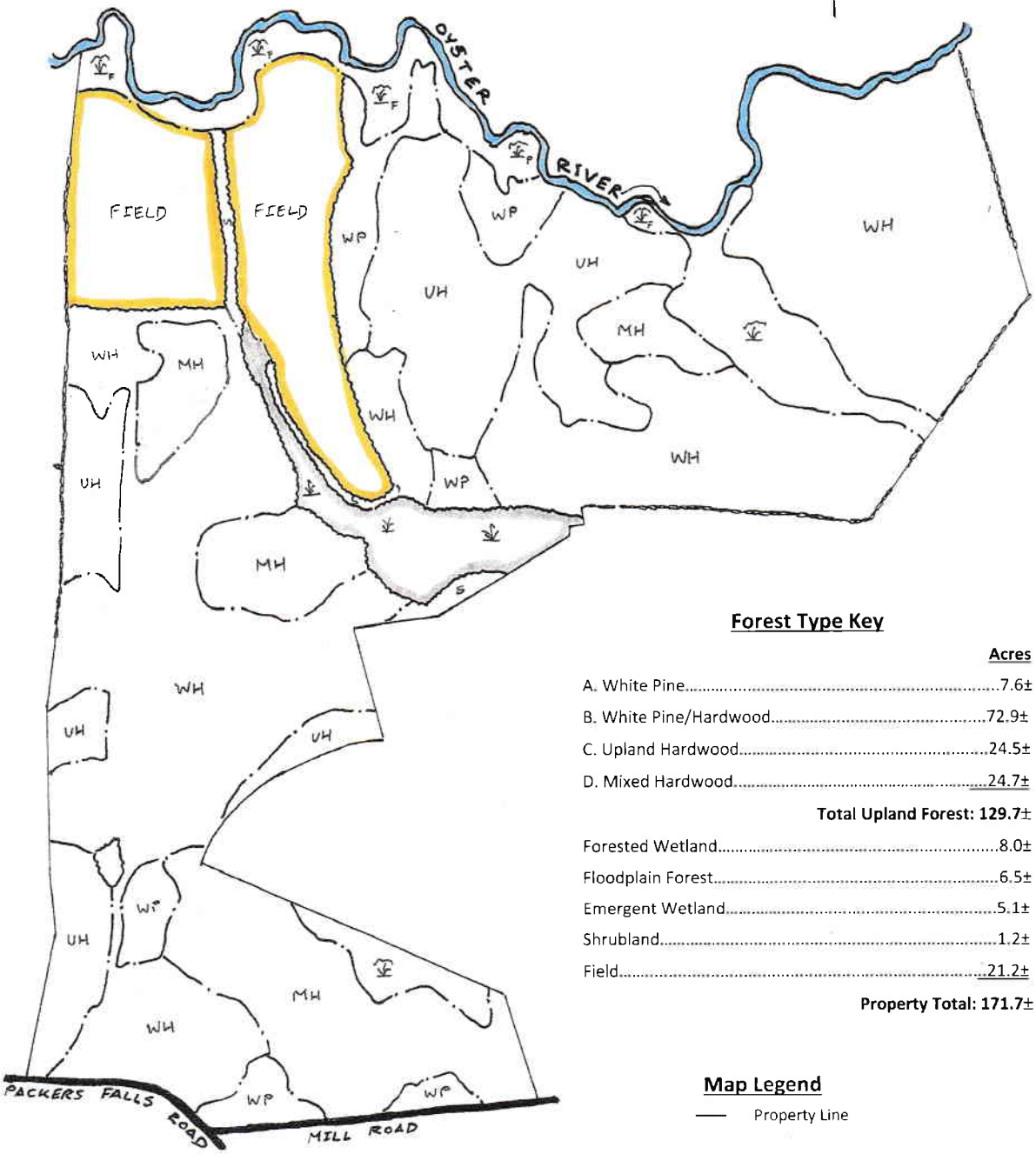
Map *of the*
OYSTER RIVER FOREST
Durham, New Durham
171.7± acres

Showing Forest Types

MAP SCALE:

1 inch = 600± feet



Forest Type Key

	Acres
A. White Pine	7.6±
B. White Pine/Hardwood	72.9±
C. Upland Hardwood	24.5±
D. Mixed Hardwood	24.7±
Total Upland Forest:	**129.7±**
Forested Wetland	8.0±
Floodplain Forest	6.5±
Emergent Wetland	5.1±
Shrubland	1.2±
Field	21.2±
Property Total:	**171.7±**

Map Legend

- Property Line
- Stonewall
- Forest Type Delineation
- Forested Wetland
- F — Floodplain Forest
- Emergent Wetland
- S — Shrubland

Map drawn by:
Charlie Moreno, Consulting Forester
Moreno Forestry Associates
Center Strafford, NH
(603) 335-1961 January 2017

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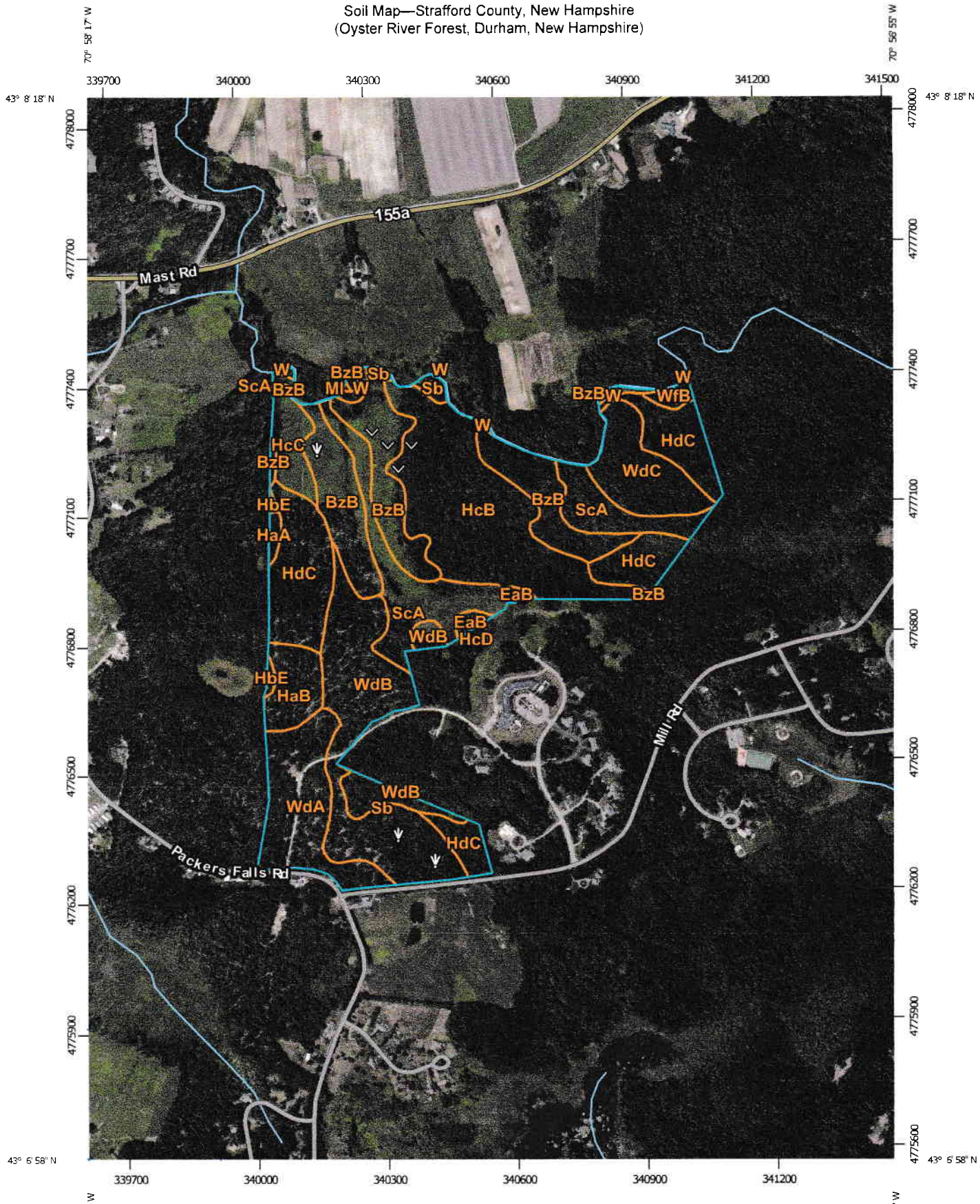
Soil Map—Strafford County, New Hampshire
(Oyster River Forest, Durham, New Hampshire)



Map Scale: 1:12,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 150 300 600 900

Feet
0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

INTRODUCTION

The Oyster River Forest

Durham, New Hampshire

INTRODUCTION

The 171.7± acre Oyster River Forest is a conservation property acquired by the Town of Durham, New Hampshire in March 2013. Primarily forested, the land also contains emerging shrubland, wetlands, and nearly 1 mile of frontage on the Oyster River. Located near downtown Durham on the north side of the intersection of Packers Falls Road and Mill Road, the Oyster River Forest connects two other valuable conservation properties, Spruce Hole and UNH's College Woods.

The Oyster River Forest is subject to a conservation easement that was granted to the USDA—Natural Resources Conservation Service (NRCS) under the Wetland Reserve Program (WRP). The purpose of the conservation easement is to "restore, protect, manage, maintain, and enhance" wetlands and other lands, as well as to conserve natural resource values. The easement allows "restoration and management activities" on the property under NRCS oversight. Low-impact recreation is also permitted. As landowner, the Town of Durham's objectives are consistent with the easement: To manage the tract for water quality and ecosystem protection, wildlife habitat, forest health, the protection of historic features, and light public recreation.

Small cascade on the Oyster River.

In addition to the extensive Oyster River riparian area, the tract contains diverse habitats. Significantly, it holds the potential to create and maintain shrubland, a declining habitat type that is critical for many wildlife species including the state-endangered New England cottontail (NEC).

Based on a study of the property's forest, habitats, and natural resources, this plan provides management recommendations and an implementation plan to: a) Create NEC habitat; b) Control exotic, invasive plants; c) Protect water quality and surface water resources; d) Enhance wildlife habitat; e) Maintain forest health and provide resilience; f) Manage recreational uses; and g) Protect historic features. The plan remains consistent with the purposes and intent of the WRP conservation easement and the Town of Durham's management objectives, with reference to applicable Natural Resource Conservation Service (NRCS) practices.

The plan is a "working" document; over time, updating is necessary to reflect ongoing management activities and property uses, unforeseen natural disturbances, new resource concerns, and ever-evolving knowledge and conditions.

Charles Moreno, Consulting Forester, Ecologist
Strafford, New Hampshire, (603) 234-0444

PROPERTY INFORMATION

LOCATION and GEOGRAPHY

The Oyster River Forest is located about 13 miles from the Atlantic Ocean in the Gulf of Maine Coastal Lowland ecoregion subsection[1]. The sea moderates the area's climate, allowing the northerly extension of the Appalachian oak-pine forest. The property thus hosts several southerly species including red cedar, shagbark hickory, and basswood.

Soils on the Oyster River Forest are of three distinct types. A well-drained, sandy plain (*Windsor, Hinckley* soils) is found along Packers Falls Road. About 2000 feet into the interior, soils transition to shallow glacial tills (*Charlton, Hollis*), from mica-schist parent material, with bedrock near the soil surface. There are also broad marine silt-clay glacioestuarine[2] areas with mesic (*Buxton*) and hydric (*Scantic*) characteristics[3].

Topography is both level and moderately sloped (0 to 15%), with a few low, but steep, ledge ridges. Elevations range from 50± feet above sea level where the Oyster River exits the northeastern corner of the tract to 160± feet on a knoll along the west-central property line. The property's streams are mostly within the Oyster River watershed, though a small wetland in the tract's southeastern corner appears to flow towards Woodman Brook and the Lamprey River, which flows ½ mile to the south.

REFERENCE INFORMATION

Deeds: >Fee simple conveyance (property acquisition): SCRD Book 4112, Page 0213.
>Tecce conservation easement: SCRD Book 4112, Page 0170.
>Sprucewoods conservation easement: SCRD Book 4112, Page 0186.

Surveys: > "Chet Tecce Jr. Revocable Living Trust", by D. W. Vincent, LLS (Jan 2013). SCRD Plan #105-25.
> "Sprucewoods Retirement Trust", by D. W. Vincent, LLS (Jan 2013). SCRD Plan #105-26.
>" Chet Tecce Jr. Revocable Living Trust & Sprucewoods Retirement Trust", by D. W. Vincent, LLS (Oct 2012). SCRD Plan #105-27.

Aerial Photos: Google Earth image 2015.

Tax Maps: Durham Tax **Map 13, Lot 14-2** (171.7± acres).

[1] Keys, J.E. and C.A. Carpenter. 1995. Ecological Units of the Eastern United States: First Approximation. U.S. Department of Agriculture, Forest Service.
[2] Moore, Richard B. 1990. Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins. US Geological Survey, US Dept. of the Interior. Water Resources Investigations Report 88-4128.
[3] USDA, Natural Resources Conservation Service, 2014. *Map Unit Description* for the property.

ACREAGE

TOTAL – 171.7± Acres

CURRENT CONDITIONS:

Forest -- **144.2± acres**
- Upland forest **129.7± acres**
  - Early-successional forest **0.1± acres**
  - Advanced-age forest (150+ years) **None**
- Floodplain forest **6.5± acres**
- Forested swamp **8.0± acres**

Wetlands
- Emergent -- **5.1± acres**

Fieldland
- Fallow field -- **21.2± acres**
- Shrubland -- **1.2± acres** (mostly riparian)

KEY PROPERTY FEATURES and POTENTIALS

Water Resources

- A stratified-drift aquifer saturates the sandy plain in the southwestern section of the tract. This deep sand and gravel deposit formed during the end of the last ice age at the glacial ice-ocean interface where a *grounding-line* delta formed the most transmissive type of aquifer[4]. This highly productive aquifer provides water to the Town of Durham.
- The property has approximately 1 mile of undeveloped frontage and forested riparian area along the south side of the Oyster River. The Oyster River Forest protects water quality and habitat along this significant riverine environment, which lies less than 2 miles west of its coastal interface.
- A seasonal stream flows from an emergent wetland on the property to the Oyster River, bisecting a field. Bounded by forest and dense shrub growth, this stream has had fish habitat enhancement by the strategic placement of tree trunks and branches in the watercourse to create eddies and pools.

Forest

- Upland forest covers about 130± acres presently. Dry-site forest in southerly areas favors white pine, red oak, and white oak growth, among other species. Established forest in the moister northerly sections contains species diversity, moderately-varied age structure, and scattered older individual trees (130 to 180± years). Silviculturally-managed areas of the forest will aim to maintain/create healthy, diverse conditions (composition and structure) for resilience and for wildlife habitat. Timber is a byproduct. The less accessible eastern section of the forest (Tecce parcel) may be retained as a reserve.
- Floodplain forest covers segments of the Oyster River's edges, occupying silt-clay sites with red maple and American elm, primarily. Control of glossy buckthorn and other exotics in these sites will allow native shrubs to thrive, thereby providing favorable conditions for wildlife and the river's natural flooding regime.
- The Oyster River's forest floodplain areas are classified as the natural community type, *Red maple floodplain forest,* which is listed in the NHB report as an S2 rare community.
- Forested wetland pockets are associated with minor drainages on the property. The largest is in the northeastern section, within the former Tecce parcel, which contains pockets of black ash. This less common species may be lost in the near future to the Emerald Ash Borer, an introduced exotic insect.
- The property does not contain any significant areas of early-successional forest (0 to 40± years of age) or advanced-aged forest (150+ years).

[4] Moore, Richard B. 1990. Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins. US Geological Survey, US Dept. of the Interior. Water Resources Investigations Report 88-4128.

Wildlife Habitat

- The established forest harbors a diversity of woodland wildlife. Managing the forest for complex structure, with a variety of tree ages and canopy layers, and a mosaic of cover types, will provide specialized conditions for more wildlife. Some missing habitat types, such as early-successional forest or mature forest, may be included in the future mosaic.
- Habitat features such as—cavity trees and pine snags; older, broad crowned oaks and hickories; a variety of native, fruit-bearing shrubs; and ledge outcrops with crevices—provide denning and nesting sites, and food sources for wildlife. Habitat features are taken into account when optimizing habitat areas.
- The Oyster River Forest contains 21± acres of reclaimed fieldland that will be allowed to develop as dense shrubland, the essential habitat type for New England cottontail. Presently, a variety of birds utilize the rough fields including tree swallows, field sparrows, American woodcock, and red-tailed hawk. Additionally, the fields provide habitat for pollinators, bats, fox, and deer.
- Adjacent to the field, stands of old field pine and younger mixed hardwoods hold opportunity for conversion to shrubland. In conjunction with the existing field and other supporting habitat areas, this could result in a 60± acre core habitat area for New England cottontail.
- The Oyster River and its main within-tract tributary provide habitat for three imperiled eel species: American Brook lamprey (endangered, possibly extirpated); Sea lamprey (species of concern); and American eel (species of concern). Wood turtles (species of concern) appear to use the river and surrounding landscape.
- Floodplain forest, presently overrun with glossy buckthorn thickets, may be restored to partial overstory and native shrub understory to provide attractive habitat for species such as common yellowthroat, alder flycatcher, and Carolina wren. Mink, otter, and raccoon utilize the river riparian areas.

Cultural Features

- Two historic features: An extensive homestead site, now a cellarhole, and the Wiggin/Tuttle family burial site, both near Packers Falls Road. Further exploration of the homestead's history, non-intrusive documentation of the cellar hole (following the Town of Lyme model), and possible computer modeling of the former structure, are possible areas of study.
- Recreational trails—mainly the Oyster River Trail—traverse 1½ miles of the property. The trails connect directly to the Spruce Hole bog and the College Woods. A pedestrian bridge was recently installed over the small tributary to the Oyster River. The trail system is increasingly used by residents of Durham and surrounding towns, as well as the UNH community. Motorized vehicles are not allowed.
- The tract's conservation easement, with close oversight by the Durham Conservation Commission and NRCS, provides protection of the tract's natural resources in perpetuity, as well as a stable environment for projects requiring long-term commitment, including restoring imperiled species and managing for healthy forest.

MANAGEMENT OBJECTIVES and RECOMMENDATIONS

MANAGEMENT OBJECTIVES
Summary Discussion and Recommendations

For the Oyster River Forest, NRCS-WRP endorses and supports focusing management efforts on the following resource potentials and concerns:

- **Expanding and long-term management of NEC habitat;**
- **Controlling non-native, invasive plants;**
- **Protect water quality and surface/subsurface water resources;**
- **Enhancing wildlife habitat;**
- **Maintaining forest health;**
- **Managing recreational uses; and**
- **Protecting historic features.**

Summary discussion and recommendations are provided in this section.

Map *of the*

OYSTER RIVER FOREST

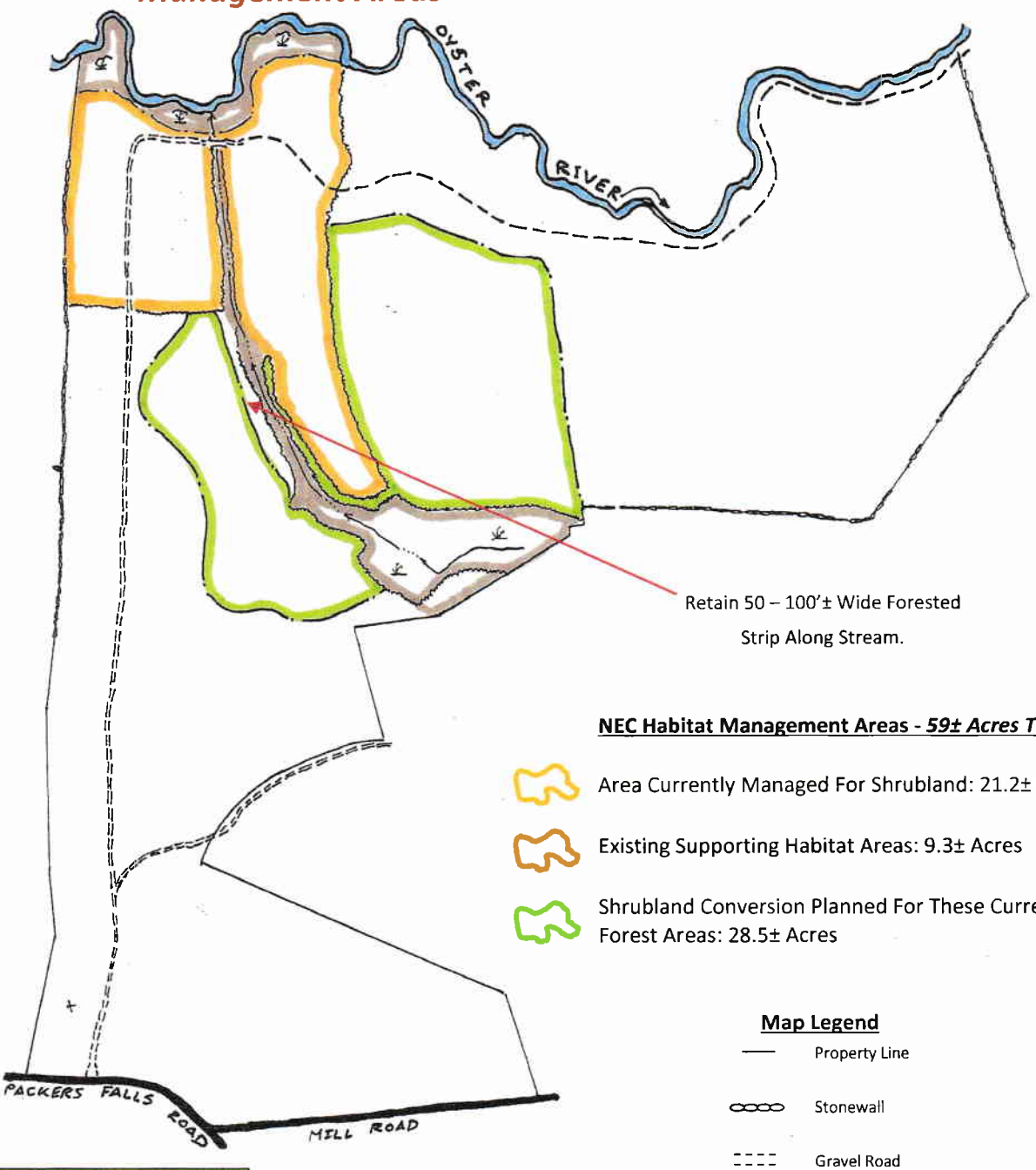
Durham, New Durham

171.7± acres

Showing New England Cottontail Habitat Management Areas

MAP SCALE:

1 inch = 600± feet



Retain 50 – 100'± Wide Forested Strip Along Stream.

NEC Habitat Management Areas - *59± Acres Total*

Area Currently Managed For Shrubland: 21.2± Acres

Existing Supporting Habitat Areas: 9.3± Acres

Shrubland Conversion Planned For These Current Forest Areas: 28.5± Acres

Map Legend

- Property Line
- Stonewall
- Gravel Road
- Trail
- † Wiggin-Tuttle Cemetery
- Forested Wetland
- Emergent Wetland
- Seasonal Stream

Map drawn by:
Charlie Moreno, Consulting Forester
Moreno Forestry Associates
Center Strafford, NH
(603) 335-1961 January 2017

Reference Maps: Town of Durham Tax Maps
Surveys: D.W. Vincent, LLS SCRD Plan # 105-25, 105-26, & 105-27.
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NEW ENGLAND COTTONTAIL HABITAT: Creating a core habitat area.

Background: The New England cottontail (NEC) rabbit is threatened with extinction largely due to habitat loss and competition by an introduced species, the Eastern cottontail rabbit. NEC requires extremely dense shrub cover. Known as "shrubland", this habitat type has diminished from the landscape over the past 50 years. While satellite patches of NEC habitat, optimally covering 20 to 25 acres, are important, occasional "core" shrubland areas encompassing 50 or more acres are essential on a regional basis. NEC may come and go in nearby smaller patches, but the core area allows the rabbits to persist over time.[5] Many other species of wildlife benefit from the creation of openings, shrub thickets, and young forest. These include increasingly uncommon or declining species such as whip-poor-will, woodcock, and eastern towhee.

There exists opportunity to create a large core NEC habitat in the Oyster River Forest due to several circumstances. First, the property is community-owned and permanently protected. Secondly, several key agencies, including NRCS and NH Fish & Game, strongly support the creation of this needed habitat, with long-term funding potential. Finally, a 21± acre area on the property has already been dedicated and managed toward the development of shrubland, with full support from the town's conservation commission and land stewardship network. Including existing supporting habitats such as adjacent wetlands and floodplain forest, a prospective 60± acre contiguous core habitat may be created by clearing two areas of adjacent forest. When viewed as a whole, the proposed core NEC habitat area will cover about 1/3 of the Oyster River other 2/3rds of the tract. Locally, the addition of a large shrubland area will be an improvement for wildlife diversity over existing conditions.

Existing rough field area, with potential to expand into forest area in background to create a 60± acre New England cottontail core habitat.

Creation of NEC habitat is the first step. Commitment is required to maintain the habitat over many decades, with associated financial costs. Conservation grants through NH F&G and NRCS are potential funding sources, as are the timber proceeds from the initial clearing, if reserved in a dedicated town-held account. Maintenance entails periodic re-clearing (a section every 5± years) with specialized equipment such as a Brontosaurus.

Concerns: There are four concerns related to expanding the current NEC habitat area:

- *Adverse public reaction* to the visual effect of clearing two large patches of forest. Poor visuals are compounded by the need to leave structure—downed trees, brush piles, stumps—within the clearings as cover/denning features that are later used by wildlife. Cleared sites require 2 to 3 years of re-vegetation to allay the visual impact.

[5] Holman, Heidi. Jan 2017. NH Fish and Game Department. Personal communication.

- *Lack of adequate funding* for future shrubland management. The forest sites must be re-cleared periodically, at the cost of $500 to $1000± per acre, to create and perpetuate shrubland. If the shrubland is not re-cleared, it will revert to forest.
- The spread of *exotic, invasive plants* once the openings are created. Both proposed forest clearing sites contain invasives, primarily glossy buckthorn. Due to the winter 2017 clearing schedule, funding and an organized plan are needed to treat existing plants in spring 2017. Monitoring and control are then needed in subsequent years.
- *Site impacts* are expected in several areas during the course of forest harvesting and timber extraction. There are several sites of concern: a) The 200'± ADA-improved segment of the service road at the tract entrance; b) A partially washed-out sloping section of service road beginning at about 1700±' and running downhill to just before the field; c) The field landing site; d) The crossing of the tributary stream which bisects the field; and e) The skid trail across the fields.

Recommendations: The following recommendations are made to address concerns about clearing approximately 25± acres of forest to expand NEC habitat on the Oyster River Forest:

- Educational public outreach is needed during all stages of the project. Town newsletter (electronic and printed), signage, public forums, and field tours are recommended communication avenues. The town conservation commission may take the lead.
- Future funding must come from a variety of sources including the town's timber harvest proceeds fund, grants through NH F&G from the National Fish and Wildlife Foundation, and possible continued WRP funding from NRCS. New Hampshire's Young Forest Initiative should focus funding, especially on core habitats, for the next 25± years.[6]
- Rockingham County Conservation District (RCCD) will be funded through NRCS to apply the first round of invasive control in 2017 on all severely and moderately infested tract areas. RCCD will organize and coordinate efforts with the town and contractors. Funding and follow-up efforts are needed for future years; in addition to contractors, the town's stewardship network may organize volunteers. It is important to prevent a new leading edge of invasives on the forested edges of the clearings.
- Careful planning and the use of BMP's will be applied for the harvest operation. The project depends on an extended period of cold weather in February 2017. While cold weather is likely, intermittent thaws may occur, resulting in site impacts due to the use of trucks and heavy equipment. Mitigation includes the installation of portable bridges to cross the stream and the use of a single skid trail across the field. The landing must be positioned on high, level ground, and away from a wild parsnip patch. Despite these measures, it is difficult to predict the extent of post-harvest remediation. NRCS-WRP funding is needed for possible remediation at all five potential impact sites.

Logistics: Due to NRCS funding deadlines and the need for cold weather/frozen ground, the harvest of trees from the two proposed NEC clearing areas must be conducted in February 2017. A professional forester will conduct project management, including preparation and layout, contracting, supervision, and administration. The harvest must be conducted as a biomass

[6] Holman, Heidi. Jan 2017. NH Fish and Game Department. Personal communication.

operation to enable the harvest and removal of small trees and treetops. However, retaining substantial structure—biomass—on the site will be an important harvesting specification.

Invasive plant areas should be identified on the ground and GPS'd prior to the harvest. While the clearing operation may disturb flagging on invasive perimeters, these can be re-installed post-harvest with GPS mapping, even if evidence of exotic presence may be otherwise blurred.

Planning for re-clearing should begin in 4± years, and staged in 2022±.

Map *of the*

OYSTER RIVER FOREST

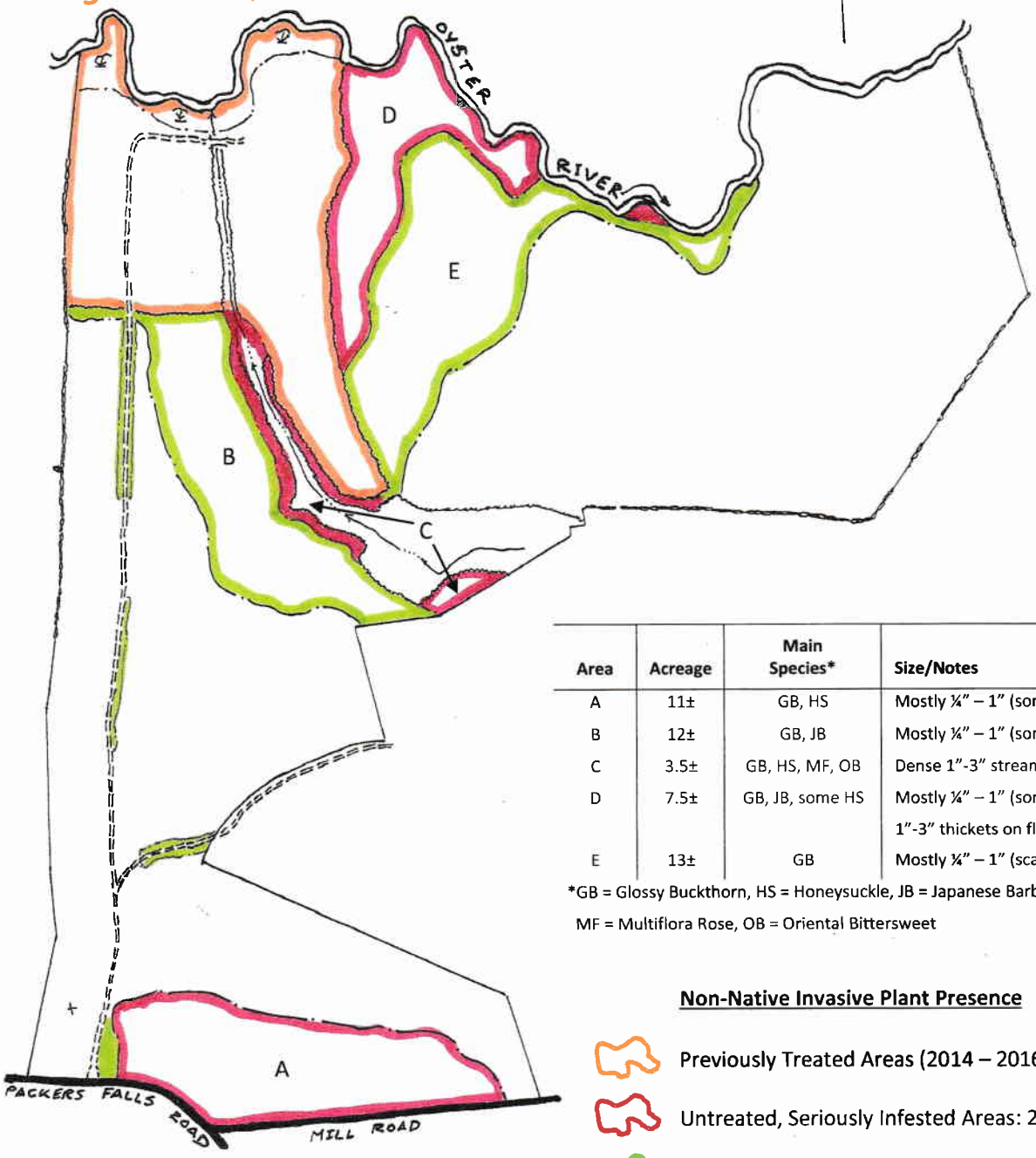
Durham, New Durham

171.7± acres

Showing Non-Native Invasive Plant Presence

MAP SCALE:

1 inch = 600± feet



Area	Acreage	Main Species*	Size/Notes
A	11±	GB, HS	Mostly ¼" – 1" (some larger)
B	12±	GB, JB	Mostly ¼" – 1" (some larger)
C	3.5±	GB, HS, MF, OB	Dense 1"-3" streamside thickets
D	7.5±	GB, JB, some HS	Mostly ¼" – 1" (some larger); 1"-3" thickets on floodplain
E	13±	GB	Mostly ¼" – 1" (scattered)

*GB = Glossy Buckthorn, HS = Honeysuckle, JB = Japanese Barberry, MF = Multiflora Rose, OB = Oriental Bittersweet

Non-Native Invasive Plant Presence

- Previously Treated Areas (2014 – 2016): 22.2± Acres
- Untreated, Seriously Infested Areas: 22.0± Acres
- Untreated, Moderately Infested Areas: 25.0± Acres

Map Legend

- Property Line
- Stonewall
- Gravel Road
- † Wiggin-Tuttle Cemetery
- Forested Wetland
- Seasonal Stream

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INVASIVE PLANTS: Control of exotic, invasive plants.

Background: Several species of non-native, invasive plants infest sections of the Oyster River Forest. Affected areas cover approximately 69± acres, or 40% of the property. It is notable, however, that approximately 60% of the Oyster River Forest is *largely free* of invasives at present. Furthermore, in 2014-2016, extensive mechanical control of invasives was applied on 22± acres to reclaim the property's field and adjacent floodplain forest (follow-up control must continue). Thus, about 27% of the property—mostly forested—remains, needing resolute control efforts. The map on the previous page, ***Non-native Invasive Plant Presence***, roughly illustrates currently infested locations, with notes on primary species and average plant sizes.

Thickets of multiflora rose and bittersweet line one of the property's streams.

Glossy buckthorn (*Rhamnus frangula*) is the forest's major invasive species. This species is capable of rapidly overtaking a variety of environments—both wet and dry sites, under shaded or fully lit conditions, and particularly after disturbance. On the property, glossy buckthorn has densely invaded floodplain forest pockets and shrubland thickets, as well as the pine stand east of the field and the forested area along Packers Fall Road and Mill Road. Other invasives on the property include honeysuckle (*Lonicera spp.*), Japanese barberry (*Berberis thunbergii*), Oriental bittersweet (*Celastrus orbiculatus*), multiflora rose (*Rosa multiflora*), autumn olive (*Elaeagnus umbellata*), black locust (*Robinia pseudoacacia*), and wild parsnip (*Pastinaca sativia*), the latter found strictly in the field. The property forest, field, and wetlands are vulnerable to other non-native, invasives including: European barberry, common buckthorn, Norway maple, *Phragmites*, purple loosestrife, and garlic mustard.

Concerns: Severe invasive plant infestations alter microenvironments, while disrupting the forest as a whole. Biodiversity is diminished, wildlife habitat affected, and perhaps most alarming, the forest's ability to successfully regenerate is increasingly compromised.

The task of controlling and largely eliminating invasive plants from the Oyster River Forest is formidable, cost-intensive, and ongoing. However, *inaction leads to ever-increasing numbers of exotic plants*, threatening the forest's long-term integrity and existence.

Recommendations: In addition to the ongoing control in the field and adjacent floodplain area, NRCS funding is needed to treat seriously infested (22± acres) and moderately infested (25± acres) areas in 2017. An organized, multi-faceted strategy is needed, including effective treatment of the invasives' leading edge to prevent expansion into unaffected areas. In forest areas, care is needed to avoid cutting or damaging the existing natural regeneration of native trees and shrubs (seedling/sapling), which is typically mixed with the invasives. Furthermore, in the silviculturally managed area, soil scarification—prevalent with some logging equipment when snow cover is absent—should be avoided until invasives have been successfully treated. Non-extractive forest stand improvement work without logging equipment is acceptable, while

commercial harvesting utilizing cut-to-length (CTL) equipment or logging with winter snow cover will minimize soil disturbance.

Annual follow-up treatments are necessary starting in 2018, though the intensity of treatment will diminish. Over time, treatment will consist of monitoring for invasive plant presence, followed by immediate spot-control response. The goal is to maintain the entire property free of invasive plants. Every year of inaction escalates control costs and intensifies the problem.

Logistics: The following steps are suggested:

1) On-the-ground reconnaissance to define the invasive treatment polygons within the forest. Flag or paint (facing in) the polygon perimeters. GPS the polygons in order to map them and estimate acreages.
2) Develop multi-faceted strategy considering the following:
    - Invasive species mix, prevalent species;
    - Plant size;
    - Degree of intermixing with natives;
    - Site sensitivity, including proximity to wetlands;
    - Time of year;
    - Cost;
    - Magnitude of follow-up treatments;
    - Ease and cost of follow-up.
3) Apply for permits. Organize work crews, volunteers, contractors. Schedule. Implement.

WATER RESOURCE PROTECTION: Surface and subsurface waters.

Background: The Oyster River Forest contains exceptional surface and subsurface water resources. Protection of surface waters from impacts and alterations caused by humans is a major objective. These include sedimentation, pollution, erosion and terrain changes, and water temperature increases (especially from vegetation removal).

Protection of the property's underlying aquifer and its recharge areas from pollution is also a primary concern. The aquifer provides the town of Durham with drinking water.

Concerns/Recommendations: The major surface water feature is the tract's mile of undeveloped frontage along the Oyster River. The property's river trail traverses along most of the river frontage. In the field, the trail crosses the tributary stream; a small bridge was installed in 2015 and the stream's embankments restored, preventing a source of sedimentation, erosion, and possible pollutants from recreationists and field service equipment. Three additional unprotected stream crossing locations are found in the forest. A total of 6 crossing points were noted, as the middle location contains a braided stream with 4 crossing points. Loosened sediments from foot traffic and other recreational uses are eroding from the crossing points on these seasonal drainages directly into the Oyster River, which lies 30 to 50 feet away.

Unimproved trail crossing near the Oyster River.

The town has contracted a trail service that will design and install stream fords for these locations, while re-routing the trail away from the river in at least one crossing point. This project is expected to occur in 2017.

A substantial area of the property (59± acres), including the former Tecce parcel, the river front, and forested wetland areas, is recommended as ***reserve***, where regular silvicultural management is excluded. A main reason for this designation is that management access to these areas requires stream and wetland crossings. A single disturbance, with post-harvest restoration, is planned to clear the NEC area. Afterwards, no further stream crossings are planned for the area east of the field.

The property contains a stratified drift aquifer which underlies the sandy plain at the property entrance along Packers Falls Road and extends beyond Spruce Hole. Surface activities in this area may introduce pollutants into the soil which may penetrate the aquifer. Therefore, well-maintained logging equipment and on-board spill kits are important for forest management work. Furthermore, care is needed to minimize the use of herbicides for invasive plant control, with any use planned, permitted, and supervised by a licensed applicator. The town may also consider installing a dog waste station at the trail head, as dog walking is an increasing property use.

ENHANCING WILDLIFE HABITAT: Providing a variety of habitats.

Background: The Oyster River Forest contains a variety of habitats, including upland and wetland forest, rough fieldland, river riparian, and shrubland/emergent wetland. This plan proposes an overall vision to enhance and manage these habitats within three general areas, each covering about 1/3 of the property. With visual reference to the ***Management Recommendations Map*** on page 1, these include:

This emergent wetland is one of several habitat types on the property.

- A ***silviculturally managed area (53.7± acres),*** with the main objective to maintain species diversity while increasing structural complexity, both for forest resilience and habitat purposes.
- An area devoted to ***shrubland (59.0± acres)*** and young forest growth, specifically, to provide a large core habitat for New England cottontail (NEC).
- A large ***reserve block (59.0± acres),*** covering the eastern section of the property, where human-caused disturbance is minimized, and older growth conditions develop over time.

Habitat features within these blocks are to be preserved and/or enhanced.

Concerns/Recommendations: The Oyster River Forest has the potential to provide habitat for a great variety of wildlife species, including imperiled species such as New England cottontail, sea lamprey, and wood turtle. Managing the property to protect and enhance habitat for these and many other species, while accommodating increasing recreational use of the land, is a growing challenge.

Most recreational activity on the property is trail-based. The Conservation Commission and the Stewardship Network are involved with trail improvements and delineation. Trail incursions through the middle of habitats—the NEC shrubland, for example—should be avoided. These carry attendant disturbance including people presence, noise, and dogs, and opens pathways for predators such as fox. *A policy of non-expansion of trails is recommended, while retaining the existing habitat blocks intact.*

Silviculturally Managed Area

Over time, the silviculturally managed area holds the potential for developing towards a multi-aged forest, with a number of tree-age cohorts ranging from young seedlings to 200+ year old ancients. Stratification of the forest canopy, abundant forest floor woody material, including large trunks, and the presence of large cavity trees and snags, are some of the characteristics of complex forest structure. Careful management of the overstory canopy and consequent young growth to encourage diversity of tree, shrub, and herbaceous species is also favorable. Complex structure and species diversity in this forest area will meet the needs of a wide variety of animals.

Shrubland Area

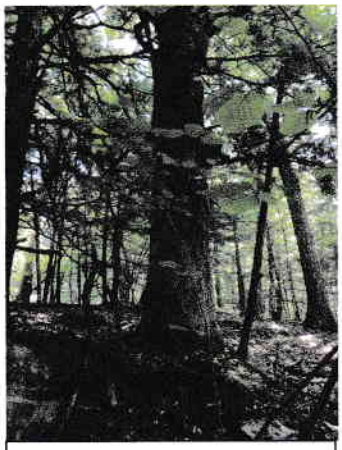
In addition to NEC, the central shrubland area provides habitat for a variety of birds and mammals which need open conditions with dense cover. In previously forested areas, scattered trees, including recognized significant trees of large diameter, uncommon species, or old age, will be retained providing habitat for species that prefer shrubland with some trees. Shrubland re-clearing must occur on a 5 to 10± year basis in a mosaic pattern, so that some areas are left uncut while others grow back.

Woody additions to stream by Trouts Unlimited (2016)

Small tree trunks and logs were recently added by Trouts Unlimited to the tributary stream that bisects the fieldland. The purpose was to create small pools and eddies to improve trout habitat. NH F&G biologists should be consulted to ascertain if stream improvements can also be helpful to eel species utilizing the Oyster River and possibly the tributary. Additionally, a forested strip (50 to 100± feet wide) will be left on the west side of this stream as a riparian buffer (it may help moderate stream temperatures) and as a vault of woody material, including tree trunks, that will be naturally added to the stream over time.

Reserve Area

The reserve area contains mixed hardwood, upland hardwood, and white pine/hardwood growth, as well as the emergent wetland, forested wetlands, and much of the floodplain forest. A few ledge ridges in the area, as well as the eastern section of the Oyster River terrace, contain pockets of older hemlock mixed with hardwoods. The forest is intermediate-aged, with most trees 40 to 100 years of age. A few scattered residuals, 125 to 180± years old are found. The stands are generally two or three-aged.



Old white oak in the reserve section of the Oyster River Forest.

These stands lie within the property's eastern forest reserve, where periodic silvicultural (habitat/forest health based) entries are excluded. Over time, natural disturbances in the area will accumulate, including the upcoming loss of hemlocks and ash due to exotic insects. These loses will probably not be sufficient to justify a response, other than that hazard trees along the river trail may need to be felled. For acute natural disturbances—ice storm, microburst, hurricane, fire—consideration must be made whether mitigation response is warranted, or whether the area should continue evolving naturally, without intervention. Depending on the natural disturbances that occur, older trees may survive in this area, with the opportunity for the development of a 200+ year mature forest, over the next century. This habitat type will provide interesting contrast to the adjacent acreage of shrubland/young forest.

Logistics: Proposed distribution and management of habitats:

Habitat Type	Management	Acres	% of Tract Acreage	Acres	% of Tract
		CURRENT		FUTURE	
Floodplain Forest, Emergent Wetland	**Reserve,** with invasive control	11.6±	7%	11.6±	7%
Forested Wetlands	**Reserve,** with invasive control	8.0±	5%	8.0±	5%
Rough Field	Bushhog every 2 to 4 years	21.2±	12%	10±*	6%
Shrubland^	Re-clear every 5 to 8± years	1.2±	0.7%	41±*	24%
E-S and Young Forest	Re-clear every 10 to 20± years	.1±	<.1%	>.1	1%
Mid-aged forest	Present forest condition	129.7±	76%	0	0
Mixed-age forest	**Silvicultural**	0	0	53.7±	31%
Mature forest	**Reserve,** with invasive control	0	0	44.5±	26%

^Currently, shrublands include stream and wetland edges which may delineate as wetlands.
*The acreage proportion of rough field and shrubland are interchangeable and subject to change.

MAINTAINING FOREST HEALTH: Managing for resilience in silvicultural areas.

Background: A multitude of agents threaten forest health including climate change, pronounced storm events and seasonal stresses, introduced insects, diseases, and invasive plants, and greater human pressures on forests. Encouraging complex forest conditions—mixed age, rich structure, diverse species—is the objective of silvicultural management. Complexity promotes the forest's *resilience,* which is its ability to rebound from disturbance and changing conditions.

Concerns/Recommendations:

Silvicultural Management

The broad variety of native species that are adapted to the Oyster River Forest's various sites should be encouraged. Silvicultural management on the Oyster River Forest is intended to promote the natural regeneration of mid-tolerant species, including the oaks, shagbark hickory, black and yellow birch, and white pine. Woodland shrubs including beaked hazelnut, maple-leaved viburnum, nannyberry, and highbush blueberry are also encouraged. Without canopy openings and measures to promote the advance regeneration of these species, beech will increasingly overtake the understory. The result is a less diverse forest.

A closed-canopy oak-pine stand. Reduced light penetrates to the forest floor, favoring shade tolerant species such as beech.

Silvicultural management also aims to introduce new generations of trees with every mild harvest entry. Varied age structure lowers the risk of total loss from storm events. Applying a 15± year harvest cycle, the weakest trees are removed while creating small canopy gaps (1/20th to 1/10 acre). Over time the gaps are expanded. Young growth proliferates in these canopy openings.

Oak and Pine regeneration in light opening.

Forest regeneration (seedlings) and young growth (saplings and poles) also require attention. Removal of overtopping trees, inter-sapling release, and weeding and thinning are necessary to insure a favorable species mix and vigorous growth of young trees. While the management of older trees is typically revenue producing (from the sale of marketable trees), silvicultural treatment of young growth is cost-incurring. Cost-incurring treatments on young growth is often referred to as "TSI" or "FSI" (forest stand improvement).

Due to substantial harvesting on the Oyster River Forest by previous owners between 1990 and 2005, young forest growth flourished. White pine, red oak, white oak, and black birch seedlings and saplings are abundant. A couple of white pine polewood pockets also exist. All are in need of FSI treatment, which can begin in the winter/spring of 2017. Trees are thinned using a chainsaw (or brushsaw for younger growth).

Harvested trees are lopped down and left in the forest. Low-value, larger trees are girdled. Logging equipment will not be needed initially, as the next commercial harvest (where marketable trees are harvested and sold) should be timed in conjunction with a silvicultural harvest in the adjacent Spruce Hole parcel, 5 to 10 years hence (2022 to 2027). Exotic, invasives should be eliminated from the stands before logging equipment is used.

Insects and Disease

The prevalence of forest diseases is relatively low in the Oyster River Forest. Due to the relatively low presence of hemlock, beech, and white ash on the property, several increasingly menacing insect and disease agents pose only moderate risk.

The table below summarizes the *current* prevalence of various pathogens and insects affecting local forests, and the susceptibility of the Oyster River Forest. Over time, silvicultural management can improve the forest's resilience to pathogens, insects, storm events, and climate change.

Pathogen or Insect	Species *Most* Affected	Prevalence	Vulnerability
Beech bark disease	Beech	Widespread	Moderate
Nectria canker	Black birch, yellow birch	Moderate	Low
Strumella canker	Red oak	Low	Low
Pine blister rust	White pine	Low	Moderate
Hemlock wooly adelgid	Hemlock	Moderate	Moderate
Gypsy moth	Oaks, birches, hemlock	Low	Moderate to High
Emerald ash borer	White ash, black ash	None	Low
Red pine scale	Red pine	Low	None

MANAGING RECREATIONAL USES: Allowing public access while minimizing impacts.

Background: The property's conservation easement allows low-impact public recreation on the property. Recreational use cannot be commercial ("developed"), and cannot adversely impact wetlands or the property's other "natural values". The majority of recreation is pedestrian and trail-based, though mountain bikers and horseback riders also use the trails. Motorized recreational vehicles of any type are not permitted. Hunting and fishing are allowed.

Recently installed bridge over tributary stream for pedestrian use and field maintenance equipment.

Concerns/Recommendations: Usage of the property increases as community and local awareness of the land expands. Consequent natural resource concerns can be minimized with adequate stream fords, appropriate trail erosion structures where needed, non-expansion of the trail system, and limiting the public to low-impact uses.

Mountain biking and horseback riding can be detrimental to trails and water crossings, particularly if practiced during spring thaw or extremely wet times of year. These uses must be monitored accordingly. Additionally, mountain bikers may need to be dissuaded from creating new unauthorized trails. Rogue mountain bike trails have proliferated in other local town forests; heavy usage has affected wildlife patterns.

PROTECTING HISTORIC FEATURES

Background: The property's historic features include a large cellarhole near Packers Falls Road and the nearby Wiggin/Tuttle family burial site. A former mill site or river ford may be located on the Oyster River. Additionally, an abandoned field harrow is found in the forest edge along the field's southeast side.

Possible former mill site, dam, or stream crossing on the Oyster River.

Concerns/Recommendations: Disturbance to these historic sites and artifacts is to be avoided. In the future, careful removal of deteriorating individual trees within and surrounding the cemetery and cellarhole may be necessary to prevent damage to gravestones or the foundation walls caused by fallen trees. Also, since the silvicultural area encompasses these sites, surrounding 100' buffers (a tree height) should be recognized. However, this does not preclude the harvest of unstable trees within the buffers which may otherwise naturally break apart and damage the structures.

Abandoned 1950's harrow to be left intact within proposed shrubland area.

Trees within cellarhole may need eventual removal to prevent damage to walls.

A footpath now traverses alongside the cellarhole as a point of interest. Further exploration of the homestead's history, as well as non-intrusive documentation of the cellar hole (following the Town of Lyme model), and possible computer modeling of the former structure, are possible areas of study. Additionally, the Oyster River site needs further investigation.

2017 SUMMARY PRACTICE TABLE

Season	Section(s)	Practice	Acres	NRCS Funding?
Winter	Shrubland	NEC habitat creation – Forest clearing project.	25±	Yes
Winter-Spring	Silvicultural	FSI – Non-commercial thinning to release young growth.	16±	Yes
Winter-Summer	All	Invasive plant control—Forest areas.	50±	Yes
Spring	Reserve	River trail: Install steam crossings.	6 crossings	No
Spring-Summer	Shrubland and main road	Post-harvest restoration, as needed, to service road, landing, stream crossing, and field skid trail.	5 locations	Yes
Spring-Summer	Shrubland	Invasive plant control—Follow-up in field areas and adjacent floodplain.	22±	Yes

FOREST RESOURCES

FOREST RESOURCES

FOREST CONDITIONS

- *Almost all of the Oyster River Forest consists of a mid-successional species mix. Late-successional areas are absent, as would be indicated by a hemlock and/or beech overstory. Neither species is a significant overstory component.*

- *Forest stands consist of an even-aged, two-aged, three-aged, and four-aged structure, with increasing canopy stratification. Nearly all areas have been logged once or twice since the 1960's, with extensive harvesting south of the fields in 1992 and 2005.*

- There are scattered older trees in the forest, mostly oaks, of 125 to 180± years of age. Several have been identified on the ***Physical and Natural Features Map*** as significant trees.

Significant trees on the ORF, including a sugar maple, big-tooth aspen, white oak, and butternut, respectively.

- Except for a small band of early successional growth on the southeastern edge of the field, the property contains no young forest areas (<40± years old). Early-successional tree species such as gray birch, quaking aspen, and black cherry, are not prevalent.

- The forest contains at least 25 tree species, including species that do not tend to penetrate the overstory canopy such as ironwood and hophornbeam. White pine, red maple, and the oaks (red, black, and white) constitute over 80% of the property's species mix.

- Beech regeneration (seedling/sapling) is found under the forest canopy in most areas. Young white pine is dense especially in previously harvested areas of the sandy plain. Red maple, shagbark hickory, white oak, and red oak regeneration is also found.

- As a total, the tract contains about 300± thousand board feet (MBF) of sawtimber, and 11,800± tons of biomass. The silviculturally managed area, covering 52.2± acres, contains 100± MBF of sawtimber and 4800± tons of biomass, totaling about $26,000± in value. Current timber value per acre of the silviculturally managed area is about $500/acre. The sustainable harvest value presently is about $100/acre or $5,000 total every 12 to 15 years. Please refer to the ***Timber Volume and Value*** tables on pages 32 and 33.

SPECIES COMPOSITION

The Oyster River Forest has a reasonably diverse species composition. While white pine and red maple constitute over 50% of composition, a number of other species are present. —white pine, red oak, and red maple—constituting nearly 90% of the trees. Several species appear at the northern edge of their range. A qualitative approximation of the property's forest overstory tree species abundance is:

Abundant	– White pine, red maple.
More Common	– Red oak, black oak.
Common	– Shagbark hickory, white oak.
Less Common	– Hemlock, big-tooth aspen, beech, white birch, black birch, black cherry, American elm, yellow birch.
Scarce	– White ash, gray birch, sugar maple, red cedar, pitch pine.
Rare	– Black ash, red pine, basswood, butternut.
Not Observed	– Red spruce, swamp white oak, black tupelo, American chestnut, quaking aspen, sassafras, black willow. Though not observed, these species may be present.

Shrub species are diverse, and include: Witch-hazel, speckled alder, nannyberry, Northern arrowwood, beaked hazelnut, maple-leaf viburnum, silky dogwood, winterberry holly, highbush blueberry, lowbush blueberry, maleberry, and common juniper.

FOREST RESOURCE DATA

FINDINGS

Timber Volume and Value:

- The Oyster River Forest contains standing timber volumes as follows:

301,045± board feet of sawtimber
Softwood – 178,350± BF
Hardwood – 122,695± BF
10,272± tons of chipwood/softwood pulp
594± cords of firewood/hardwood pulp

- The total timber stumpage value is currently $71,954. **The total available timber stumpage value in the proposed silviculturally managed area is $25,918.**

- On a per acre basis, including productive forest acreage (129.7± acres), timber value averages **$555±/acre**.

- White pine sawtimber accounts for over one-third (37%) of the property's timber value.

- Red oak sawtimber also accounts for over one-fifth (22%) of the property's timber value.

- Cumulatively, all other sawtimber, pulp, firewood, and chipwood on the Oyster River Forest accounts for the remaining 41% of timber value.

Tree Species Composition

- White pine, red maple, red oak, and black oak are the property's dominant species, accounting for 33%, 24%, 11%, and 11% of tree species composition (by basal area), respectively.

- Beech and white pine are the most commonly found regeneration in the Oyster River Forest. Shagbark hickory, red maple, white oak, and red oak are somewhat less common seedling/sapling growth. Invasive plants, especially glossy buckthorn, pose a threat to successful regeneration of desired species.

Tree Quality and Density

- White pine quality is generally average – most pines have at least some branches, and thus are not premium quality. There are also many pasture pines.

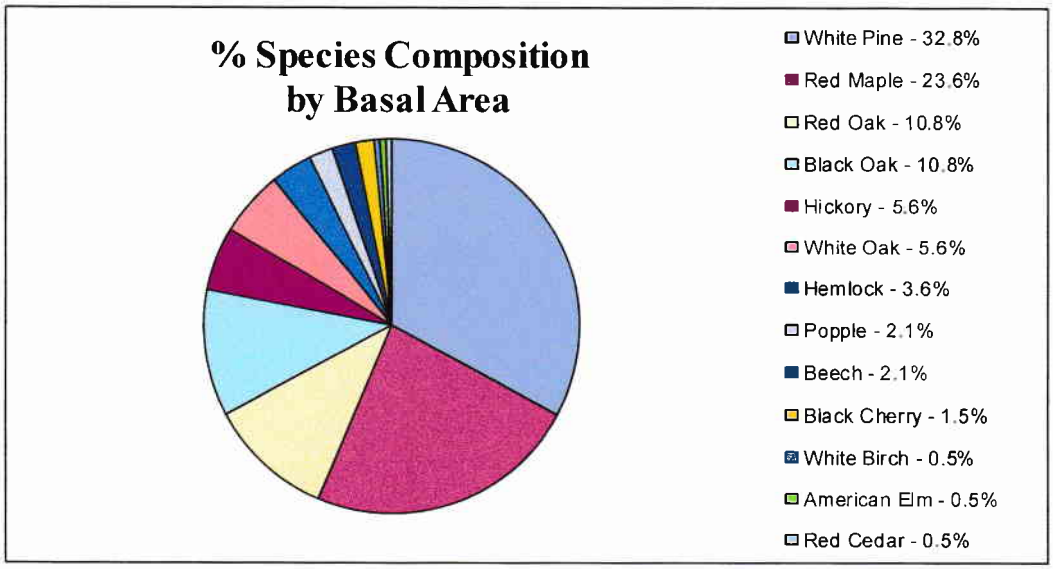
- Hardwood quality is generally average, including some grade-sawtimber along with low-grade pallet logs, and lesser amounts of high-quality veneer.

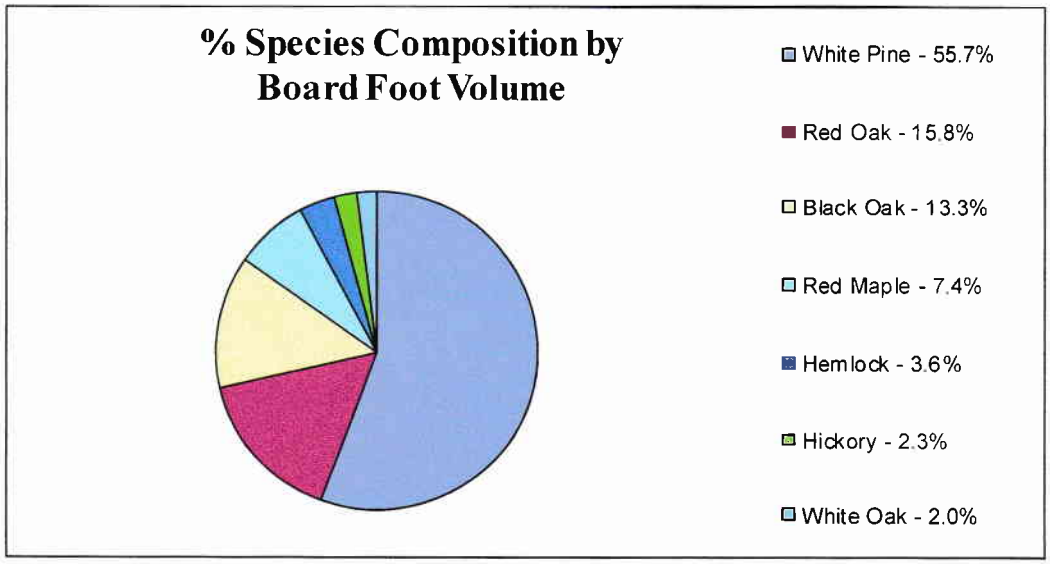
- The soils on the Oyster River Forest are capable of growing good-quality white pine and hardwood sawtimber. Forest management should focus on optimizing forest growth. The ideal condition is a large inventory of valuable white pine and hardwood sawtimber, with an abundance of promising mid-aged growth, and excellent forest regeneration (especially pine, oak, birch, and maple).

SPECIES COMPOSITION

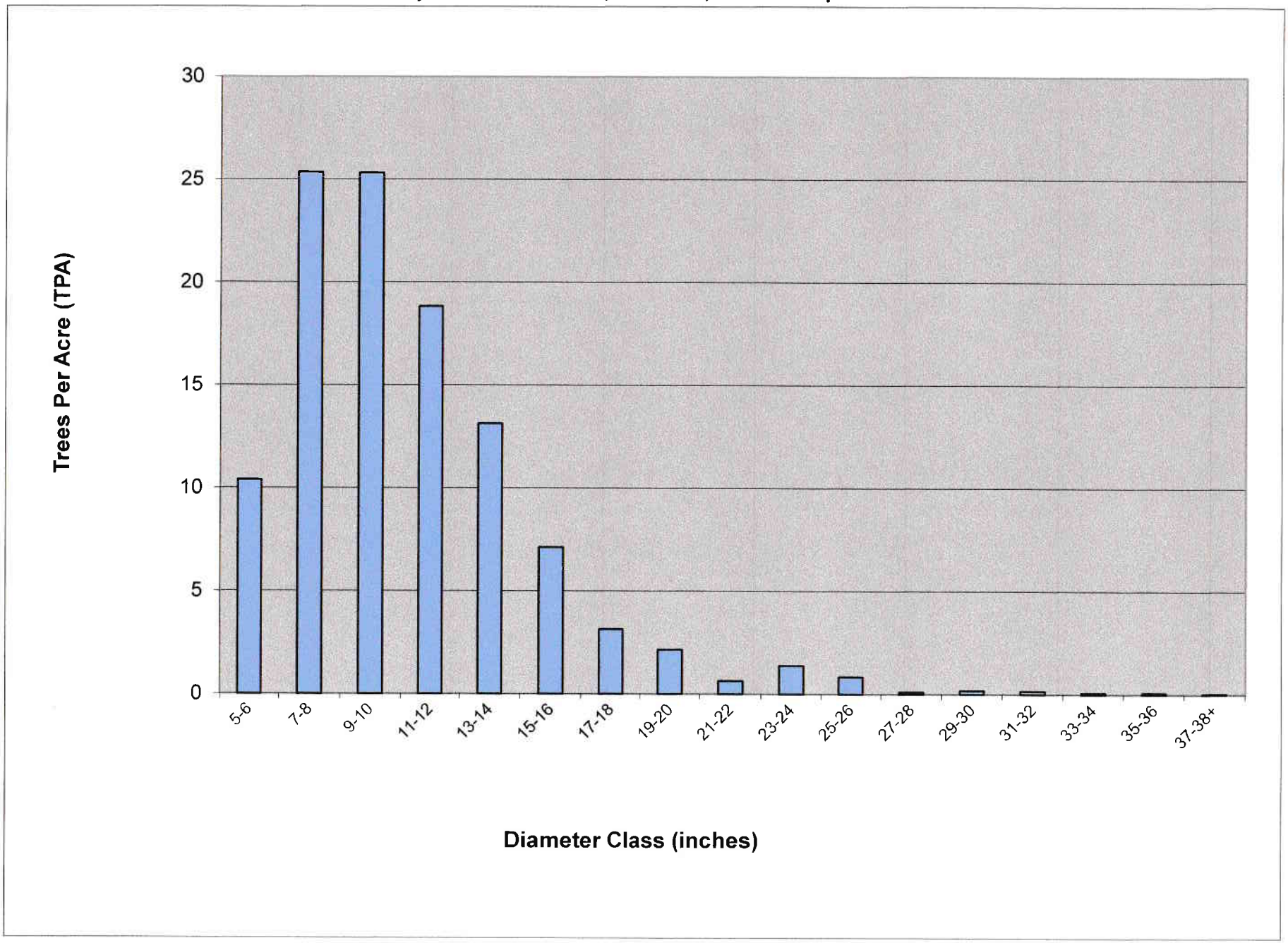
% Species Composition by Basal Area and Board Foot Volume

Oyster River Forest
Durham, New Hampshire





Tree Diameter Distribution
Oyster River Forest, Durham, New Hampshire



TIMBER VALUATION – Silvicultural Management Areas

VALUATION OF STANDING TIMBER – TOTAL MERCHANTABLE VOLUME

Oyster River Forest
Durham, New Hampshire

Proposed Silviculturally Managed Forest Area: 52.2± acres[1] **January 2017**

PRODUCT/ SPECIES	TOTAL VOLUME	% of VOLUME[2]	UNIT PRICE[3]	TOTAL VALUE	% of VALUE[4]
Sawtimber					
White Pine	59.5 MBF	60.0%	@ $160/MBF	$ 9,520	36.7%
Hemlock	4.1	4.1	30	123	<1
Red Oak	14.4	14.5	330	4,752	18.3
Black Oak	17.3	17.5	200	3,460	13.3
Red Maple	3.8	3.8	50	190	<1
TOTALS	99.1± MBF[5]			$18,045	
Chipwood/Softwood Pulp	4,213± Tons	@ $ 1.00/Ton		$ 4,213	16.3%
Firewood/Hardwood Pulp	244± Cords[6]	@ $ 15/Cord		$ 3,660	14.1
			GRAND TOTAL	**$25,918**	100%
			ROUNDED	**$26,000**	

[1]% Includes proposed silviculturally managed forest areas only.
[2]% of total sawtimber volume.
[3] Sawtimber prices adjusted to include pallet grade logs.
[4]% of overall value, including logs, pulp, chipwood, and firewood.
[5]Standard Error of the Mean: 41,052 board feet; 90% Confidence Interval: ±71,677 board feet
[6]Standard Error of the Mean: 108 cords; 90% Confidence Interval: ±189 cords

TIMBER VOLUME ESTIMATE NOTES:

1) MBF = One thousand board feet.
2) Sawtimber estimate may not include a small volume (10± MBF) of other species (e.g., white birch, beech, sugar maple) that are present on the property but were not sampled in the forest inventory.
3) Softwood pulp conversion is 2.2 tons per cord, and it includes white pine, red pine, pitch pine, red cedar, and hemlock. 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 top wood tips, is accounted for as chipwood.
4) Chipwood estimate assumes 100 tons of total biomass per acre (100 tons/acre – 7.6 tons/acre sawtimber – 11.7 tons/acre firewood = 80.7 tons/acre chipwood/pulp. Therefore, 80.7 tons/acre chipwood x 52.2 productive, silviculturally managed forested acres = 4,213± tons).

TIMBER VALUATION

VALUATION OF STANDING TIMBER – TOTAL MERCHANTABLE VOLUME

Oyster River Forest
Durham, New Hampshire

Productive Forest Area: 129.7± acres[1] **January 2017**

PRODUCT/ SPECIES	TOTAL VOLUME	% of VOLUME[2]	UNIT PRICE[3]	TOTAL VALUE	% of VALUE[4]
Sawtimber					
White Pine	167.7 MBF	55.7%	@ $160/MBF	$26,832	37.3%
Hemlock	10.7	3.6	30	321	<1
Red Oak	47.5	15.8	330	15,675	21.8
Black Oak	40.1	13.3	200	8,020	11.1
White Oak	6.1	2.0	100	610	<1
Red Maple	22.2	7.4	50	1,110	1.5
Hickory	6.8	2.3	30	204	<1
TOTALS	301.1± MBF[5]			$52,772	
Chipwood/Softwood Pulp	10,272± Tons		@ $ 1.00/Ton	$10,272	14.3%
Firewood/Hardwood Pulp	594± Cords[6]		@ $ 15/Cord	$ 8,910	12.4
			GRAND TOTAL	**$ 71,954**	100%
			ROUNDED	**$ 72,000**	

[1]% Includes proposed silviculturally managed, NEC shrubland conversion, and reserve areas.
[2]% of total sawtimber volume.
[3] Sawtimber prices adjusted to include pallet grade logs.
[4]% of overall value, including logs, pulp, chipwood, and firewood.
[5]Standard Error of the Mean: 28,158 board feet; 90% Confidence Interval: ±47,306 board feet
[6]Standard Error of the Mean: 62 cords; 90% Confidence Interval: ±105 cords

TIMBER VOLUME ESTIMATE NOTES:

1) MBF = One thousand board feet.
2) Sawtimber estimate may not include a small volume (20± MBF) of other species (e.g., white birch, beech, sugar maple) that are present on the property but were not sampled in the forest inventory.
3) Softwood pulp conversion is 2.2 tons per cord, and it includes white pine, red pine, pitch pine, red cedar, and hemlock. 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 top wood tips, is accounted for as chipwood.
4) Chipwood estimate assumes 100 tons of total biomass per acre (100 tons/acre – 9.3 tons/acre sawtimber – 11.5 tons/acre firewood = 79.2 tons/acre chipwood/pulp. Therefore, 79.2 tons/acre chipwood x 129.7 productive, forested acres = 10,272± tons).
5) As of January 2017, the Oyster River Forest averages **108.9 trees per acre** ≥ 5" diameter at breast height (90% Confidence Interval: ±19.0 trees per acre) and **79.6 ft² of basal area per acre** (90% Confidence Interval: ±10.2 ft² of basal area per acre). The **mean stand diameter is 11.6± inches**.

Charles Moreno, Consulting Forester
Strafford, New Hampshire, (603) 335-1961

FOREST TYPES – INTRODUCTION

The Oyster River Forest varies considerably in forest structure and species composition. Forest types define the distinctive character of various forested areas: A ***forest type*** represents forest areas with a distinctive set of species that results from similar soils, hydrology, land uses, and disturbance history.

Five forest types were defined and delineated on the property as part of the forest assessment phase of this management plan. These are illustrated in the "Forest Type Map", and are described in detail in the upcoming pages. Wildlife values and timber attributes are summarized. The management of each forest type is discussed, with corresponding prescriptions for wildlife and forest management.

All of the forest types have ***variant*** areas. Though variant areas are broadly similar in species composition or the type of site they occupy, there are differences in the proportions of species, and/or the age and spacial structure of the forest type. These variations are described.

A ***stand*** is a pocket of a particular forest type, which is located separately from other pockets of the same forest type. In the Forest Type Map, the forest types are delineated as stands with the cumulative acreage calculated for each forest type. Silvicultural prescriptions apply to the managed areas of the forest types; with the exception of invasive plant control, reserve areas will not receive silvicultural management.

A. White Pine – 7.6± acres

Description – Found as several small pockets, this forest type's distinctive feature is that white pine constitutes at least 75%, and sometimes, nearly 100%, of *overstory* stocking. The pasture pine variant (A1) is found along the eastern edge of the property's fieldland as well as along the Oyster River. It is characterized by a prevalence of multiple-stemmed white pines, a condition that resulted primarily from pine weevil damage when the pines first became established in former open pasture. The trees have minimal wildlife or timber value. The A2) variant is found as small pockets in the sandy plain section of the property. It includes pole-sized pine (averaging 9 inch diameter) areas with interspersed seedling and sapling pine, beech, and oak groups. Light thinning of the polewood and release of the young growth from overtopping shade are measures to improve growth. The A3) variant, found as a couple of pockets along Packers Falls Road, contains polewood as well as somewhat older pine (70-85± years). As a result of previous harvesting, the stands contain at least three age cohorts, including a young seedling/sapling age group. Glossy buckthorn heavily invades the understory of both stands.

Pasture Pine in the A1) variant.

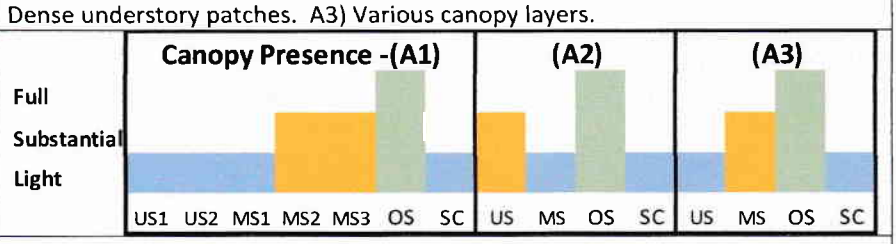
A2) White pine polewood with interspersed regeneration in minor canopy openings.

Older pine and polewood in the A3) variant.

Species Composition	**A1) Pasture Pine**	**A2) Younger Pine**	**A3) 3-aged Pine**
Primary[1]	WP	WP	WP
Secondary[2]	RM	WO, RO	
Tertiary[3]	SH, BO, BC, GB, PP	RM	RM, RO, BO
Regeneration (saplings)	RM, WO, BE	WO, WP, BE	WO, RO, WP, BE
Native Shrubs	Witch-hazel		

[1] Dominant tree species in main canopy layer.
[2] Fairly common to less common tree species.
[3] Less common, or a unique tree species with only one or a few specimens in the forest type.

Forest Structure	**A1) Pasture Pine**	**A2) Younger Pine**
Composition		
Stand Structure	Even-aged	Even-aged; some 3-aged areas
Successional Stage	Mature	Young/Mid-intermediate
Stand Age	60± years	50± years
Tree Size		
DBH range	6 – 26± inches	5 – 15± inches
Mean DBH	15± inches	9± inches
Avg. Max. Height	70± feet	55± feet
Stand Density		
Relative Stocking	Considerable/Dense	Considerable/Dense
Basal Area/Acre	190± sq. ft./acre	200± sq. ft./acre
Trees/Acre	160± trees	440± trees
Canopy Closure	90 to 100%	90 to 100%

Wildlife/Ecological	
Habitat Features	Red-breasted nuthatch, pine warbler, hermit thrush, and red squirrels utilize pine stands. A1) Substantial forest floor woody debris, though smaller. A2) Dense understory patches. A3) Various canopy layers.
Canopy Stratification	
Woody Deadfall	A1) Good accumulation; A2) Moderate; A3) Moderate.
Invasive Plants	A1) & A3) Heavily infested w/ glossy buckthorn and some honeysuckle. A2) Little or no infestation

Key: US= Understory MS=Mid-story OS=Overstory SC=Supercanopy

Management Recommendations

White Pine Forest Type

Variant A1

2017: Stand on east edge of field: ***Clear as part of NEC management area.***
Oyster River stand: ***Retain*** most of this stand as part of ***reserve area***.
2017 – 2020±: ***Invasive plant control.***

Variant A2

2017: FSI: Polewood thinning, release of favorable understory.

Variant A3

2017 – 2020±: ***Invasive plant control.***
2022±: Single tree and micro group selection. Liberation of existing regeneration.

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B. White Pine/Hardwood – 72.9± acres

Description – White pine is a prominent component of this extensive and wide-ranging forest type. The proportion of pine and hardwoods varies, as does stand structure. Variant B1) is a mixed-aged stand with a fairly open sawtimber pine/hardwood overstory, which covers much of the sandy terrace in the southern area of the property. There are good quality white pines in the stand, despite substantial harvests in 1992 and 2005. The overstory pines and oaks serve as valuable seed sources (including acorn mast for wildlife), having self-planted at least two young forest generations that have filled the forest openings created by the harvests. This regeneration—white pine, red oak, white oak, black birch—can continue to thrive *with* light release, both inter-sapling, as well as careful removal of overtopping trees. This work is non-commercial (cost-incurring) FSI, which is currently eligible for NRCS grant funding.

B1) Substantial seedling, sapling, and young pole pine and oak regeneration in harvest opening.

Variant B2) is found in the moist transitional till areas towards the field. Also harvested in the recent past, much of the residual overstory in this area consists of large multi-trunked, pasture pines. Towards the moister soil areas, forest regeneration consists markedly of more black, birch, red maple, and beech, versus pine and oak. A portion of this variant, lying east of the service road, is proposed for clearing for as part of the 2017 expanded NEC habitat area.

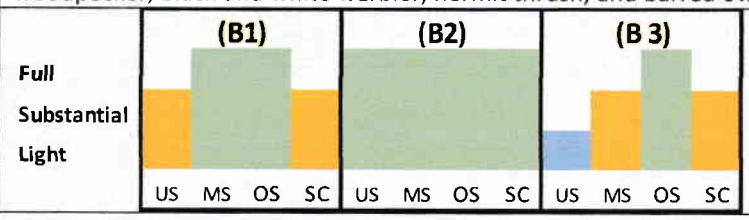
B2) Mixed hardwood regeneration under large pasture pines.

Variant B3) covers much of the upland area on the former Tecce parcel. Though structured with 2 or 3 age cohorts, these stands have not been harvested or disturbed since the 1970's. Thus, the youngest age class is 40 to 65± year old polewood (mostly 8 to 11" diameter). The oldest trees, similar to other areas of the property, are 100± years, with a few scattered older residuals. Though common, white pine is generally not as dominant, with the oaks and other hardwoods also found in the overstory. Most of the area described by this variant lies within the proposed reserve area, while a few pockets west of the Tecce parcel are within the NEC habitat expansion area.

B3) A large oak amidst 60± year pines, oaks and hickories, within the former Tecce parcel.

Species Composition	**B1) Dry Site, Harvested**	**B2) Moister Site, Harvested**	**B3) Not Recently Harvested**
Primary	BO, WP	BB, WP	RO, WP
Secondary	RO, RM, WO, BB	SH, RM, RO, IW	BO, WO, SH, RM, HM
Tertiary	WB, BE, SH, PO	BC, BE	SM, BE, PO, BB, YB
Regeneration	BB, WP, RO, WO, BO, BE	BB, BE, RM, WP, SH	RM, BE
Native Shrubs	Lowbush blueberry		Witch-hazel

Forest Structure	**B1) Dry Site, Harvested**	**B2) Moister Site, Harvested**	**B3) Not Recently Harvested**
Composition			
Stand Structure	Three-aged w/ scattered residuals; some four-aged areas	Four-aged	Two/three-aged
Successional Stage	Mid-intermediate	Mid to late-intermediate	Late-intermediate
Stand Age	10–15±//25±//50–70± years	10–15±//25±//40–70± // 100–120±years	40–60±//80–100± years
Tree Size			
DBH range	1< to 18± inches	1< to 34± inches	4–26± inches
Mean DBH	9± inches	16± inches	10± inches
Avg. Max. Height	70± feet	100± feet	65± feet
Stand Density			
Relative Stocking	Moderate	Moderate/Considerable	Considerable
Basal Area/Acre	100± sq. ft./acre	140± sq. ft./acre	140± sq. ft./acre
Trees/Acre	230± trees	100± trees	240± trees
Canopy Closure	40 to 100% (variable)	70±%	90 to 100%

Wildlife/Ecological	
Habitat Features	Good structural features: pasture pines and downed trees; cavity trees, snags, and dead stubs. Substantial forest floor woody material. Substantial canopy layering. B3) Good diversity of hardwoods including mast-producing oaks and hickory. Birds utilizing these stands include white-breasted nuthatch, downy woodpecker, black and white warbler, hermit thrush, and barred owl.
Canopy Stratification	
Woody Deadfall	Good accumulation generally in all areas.
Invasive Plants	B1) – Heavy buckthorn in Packers Falls Road area, otherwise low. B2) – Incipient Japanese barberry, glossy buckthorn. B3) – Much of the former Tecce parcel is free of invasives.

Key: US= Understory MS=Mid-story OS=Overstory SC=Supercanopy

Management Recommendations

White Pine/Hardwood Forest Type

Variant B1

2017: FSI: Inter-sapling and overhead release.
2017 – 2020±: ***Invasive plant control.***

Variant B2

2017: Near field: ***Clear as part of NEC management area.***
2017 – 2020±: ***Invasive plant control.***

Variant B3

2017 – 2020±: ***Invasive plant control.***
No-harvest: Retain most of these stands as part of ***reserve area.***
Small stands east of field: ***Clear as part of NEC management area.***

C. Upland Hardwood – 24.5± acres

Description – This forest type is characterized by its preponderance of hardwoods, particularly oak. The C1) variant is located as several pockets on dry, well-drained soils in the sandy plain section of the property. White oak and black oak are the primary species. Areas that were lightly harvested in 1992 and 2005, now consist of 2 or 3-aged structure, with oak, pine, black birch, and beech regeneration. Areas that were not previously harvested are even-aged, with a consistent overstory canopy.

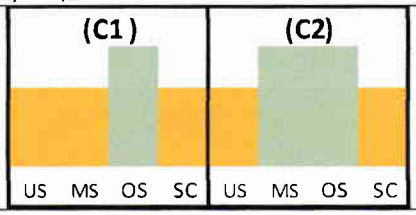
C1) Black oak and white oak overstory dominates dry site hardwood areas.

C2) covers a substantial area east of the field, overlapping into the former Tecce parcel. Situated on glacial till with near-surface ledge (and occasional outcrops), the area's soils hold more moisture than the sandy plain, which in turn promotes a wider range of tree species. White oak predominates in areas, though this transitions to red oak and red maple with variations in soil moisture. A heavy cut in the former Sprucewood parcel in the 1960's resulted in a pronounced younger age cohort, now 40 to 60± years of age. In addition to residual overstory trees, a few much older trees persist scattered in the stand, likely as remnants of a previous stand (in the Tecce parcel), or, as with broad-crowned white oaks, as trees within the former pasture. Additionally, scattered red cedars are found as remnants of the old field that once occupied the site. With the exception of reserve areas along the Oyster River, and a 100-foot wide visual buffer along the river trail, clearing of the stand area within the former Sprucewood parcel is proposed to provide valuable habitat for NEC and other wildlife species. The scattered old remnant trees within the clearing are to be left.

C2) A wider mix of hardwoods; composition varies with soil moisture.

Species Composition	**C1) Dry Site**	**C2) Mesic Site**
Primary	WO, BO	WO
Secondary	WP, RO	RO,BO, SH, WP, RM
Tertiary		RC, SM, BW, PO, HH
Regeneration (seedlings/ saplings)	BO, RO, WO, BB, BE, WP	BE, IW, HM WO. *Less common:* BC, YB.
Native Shrubs	Lowbush blueberry	Beaked hazelnut, maple-leaved viburnum

Forest Structure	**C1) Dry Site**	**C2) Mesic Site**
Composition		
Stand Structure	Even/Two & three-aged	Two-aged w/residuals
Successional Stage	Late-intermediate	Mid-intermediate
Stand Age	10–15±//25±//70–100± years	40–60±//70–90+ years Residuals: 125+ years
Tree Size		
DBH range	8–18± inches	6–22± inches
Mean DBH	9.5± inches	14± inches
Avg. Max. Height	55± feet	60± feet
Stand Density		
Relative Stocking	Considerable	Considerable/Dense
Basal Area/Acre	110± sq. ft./acre	135± sq. ft./acre
Trees/Acre	220± trees	130± trees
Canopy Closure	80 to 100%	90 to 100%

Wildlife/Ecological	
Habitat Features	Substantial mast, including oak (especially white oak) and hickory. Cavity trees and older, broad-crowned residuals, especially in C2. Wide variety of animals utilize dry/mesic hardwoods: Wild turkey, blue jay, ovenbird, broad-winged hawk, gray squirrel, flying squirrel, gray fox, deer.
Canopy Stratification	
Woody Deadfall	C1) Moderate accumulation; C2) Moderate to good accumulation.
Invasive Plants	C1) Minimal; C2) Glossy buckthorn moderately invades westerly section. Minimal presence on former Tecce parcel.

Key: US= Understory MS=Mid-story OS=Overstory SC=Supercanopy

Management Recommendations

Upland Hardwood Forest Type

Variant C1

2017: ***Examine*** for invasive plant presence, and remove if any.
FSI to release regeneration, in previously harvested pockets.

2022-2027: ***Single-tree and micro-group selection/Liberation*** of regeneration. In conjunction with next improvement harvest on adjacent Spruce Hole parcel.

Variant C2

2017: Stand on east edge of field: ***Clear as part of NEC management area.***
Stand beyond stonewall on former Tecce parcel: ***Retain*** as part of ***reserve area***.

2017 – 2020±: ***Invasive plant control.***

D. Mixed Hardwood – 24.7± acres

Description – The mixed hardwood type occurs in a few pockets of moister till soils between dry sites and wetlands. Species composition is broader than the upland hardwood forest type, especially towards wetland edges. Variant D1) encompasses a broad area near Mill Road; westerly areas blur into an upland condition with no defined edge. Tree growth is relatively tall due to moisture, and unlike other sections of the property, pitch pine is present along with white pine. The forest is mildly 2 and 3 aged due to past light harvesting. Young pine and mixed hardwoods in the understory will benefit from light overstory release. Additional regeneration should also be established. A small area defined as mixed hardwood in the Tecce parcel is similar, though the younger age cohort is older as with other stands in the parcel. This area lies within the planned reserve.

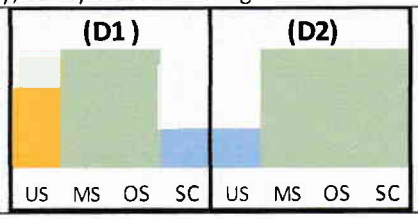
D1) Mixed hardwoods, with young pine and hardwoods in understory.

D2) Sapling and young pole hardwoods prevail in the moist D2) sites.

D2) defines two mixed hardwood pockets with mostly young growth, 10 to 25± years of age, in the area south of the field. Both pockets occupy moist sites. While pine sawtimber was removed in the past, a few pines and larger hardwoods remain. Young growth is primarily red maple, ironwood, and black birch. The two pockets are mostly included in the expanded NEC clearing area.

Species Composition	***D1) Older***	***D2) Younger***
Primary	RO, RM	IW, RM, BB
Secondary	WP, BB, PP, PO, BO	PO, WP, HM, WB, SH
Tertiary	BE, WO, SH, SM	GB, RO
Regeneration (saplings, seedlings)	WP and BE. Also, RM, BB.	IW, RM, SH
Native Shrubs	Maple-leaved viburnum, nannyberry	Witch-hazel

Forest Structure	***D1) Older***	***D2) Younger***
Composition		
Stand Structure	Two/three-aged	Three-aged with residuals
Successional Stage	Late-intermediate	Young-intermediate
Stand Age	25±//50–70±//90–100+ years.	10-–15±//25±//40–60± years
Tree Size		
DBH range	5–25± inches	3–16± inches
Mean DBH	10± inches	8.5± inches
Avg. Max. Height	90± feet	50± feet
Stand Density		
Relative Stocking	Considerable	Moderate/Considerable
Basal Area/Acre	140± sq. ft./acre	80± sq. ft./acre
Trees/Acre	260± trees	200± trees
Canopy Closure	90 to 100%	70±%

Wildlife/Ecological	
Habitat Features	D1) stands have substantial species variety including mast-producing trees. Additionally, cavity trees and snags are abundant.
Canopy Stratification	
Woody Deadfall	Both stands have substantial downed woody material, including blowdowns in D2).
Invasive Plants	D1) Glossy buckthorn present on edges adjacent to infested pine & pine/hardwood areas. D2) Incipient to moderate infestation of buckthorn, barberry, and honeysuckle.

Key: US= Understory MS=Mid-story OS=Overstory SC=Supercanopy

Management Recommendations

Mixed Hardwood Forest Type

Variant D1

2017- 2019±: ***Invasive plant control***.

2022-2027: ***Single-tree and micro-group selection/Liberation*** of regeneration. In conjunction with next improvement harvest on adjacent Spruce Hole parcel.

Variant D2

2017: ***Clear as part of NEC management area.*** Retain visual

2017 - 2019±: ***Invasive plant control***.

E. Wetland Forest– 14.5± acres

Description – Wetland forest areas on the Oyster River Forest include E1) substantial floodplain forest along the Oyster River, and several areas of E2) forested wetlands on the property. The floodplain forest is recognized as a rare S2 natural community in New Hampshire, however, much of the area is heavily compromised with invasive plants. Intensive effort was made in 2015-2016 to remove glossy buckthorn, black locust, honeysuckle and other invasives from the floodplain forest areas adjacent to the fields. Remaining pockets remain east of this, with thickets of glossy buckthorn the major invasive.

E1) Elm in the Oyster River floodplain forest.

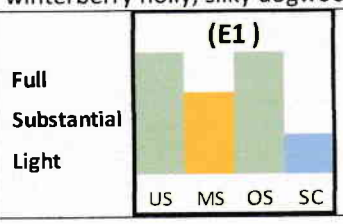
E1) Mechanical removal of invasive plants on Oyster River floodplain.

In addition to small pockets, two main forested wetlands are found on the property: The first is located in the southern section of the property, along a drainage that runs to Mill Road. Red maple dominates. A second large forested wetland, containing a wider diversity of species bisects the former Tecce parcel in the property's northeastern section. Red maple again dominates, but ironwood, American elm, yellow birch, and a pocket of black ash are also found. A single, recently dead butternut was also found on the moist edge between wetland and mixed hardwoods. This forested wetland surrounds a tributary stream to the Oyster River.

parcel forested wetland. **Above**—Pine blowdowns in forested wetland pocket along emergent wetland.

Species Composition	***E1) Forested Wetland***	***E2) Floodplain Forest***
	RM	RM
	WP, IW, EL, YB	EL
	BA, WA	BC, SH

Forest Structure	***E2) Floodplain Forest***
Composition	
Stand Structure	Even & two-aged
Successional Stage	Mid-intermediate
Stand Age	60–70± years
Tree Size	
DBH range	6–16± inches
Mean DBH	n/a
Avg. Max. Height	55± feet
Stand Density	
Relative Stocking	Moderate/Considerable
Basal Area/Acre	n/a
Trees/Acre	n/a
Canopy Closure	80 to 100%

Wildlife/Ecological	
Habitat Features	E1) Dense understory, though presently glossy buckthorn primarily. Cavity trees, stubs, snags. E2) Areas with dense understory shrub layer, especially highbush blueberry, winterberry holly, silky dogwood.
Canopy Stratification	
Woody Deadfall	Moderate accumulation. Some blowdown areas in E2).
Invasive Plants	E1) Severe presence of glossy buckthorn in eastern floodplain patches remain. near Route 91. Scattered glossy buckthorn and Japanese barberry found in interior stands. E2) Generally low presence, though scattered glossy buckthorn and Japanese barberry noted.

Key: US= Understory MS=Mid-story OS=Overstory SC=Supercanopy

Management Recommendations

Wetland Forest Type

All areas are designated as no-harvest reserves, however, monitoring and treatment for exotic, invasive plants is on-going.

APPENDICES

NEW HAMPSHIRE NATURAL HERITAGE BUREAU

DRED - DIVISION OF FORESTS & LANDS
172 PEMBROKE ROAD, CONCORD, NH 03301
PHONE: (603) 271-2214 FAX: (603) 271-6488

To: Charles Moreno
PO Box 60
Center Strafford, NH 03815

From: Sara Cairns, NH Natural Heritage Bureau
Date: 2016-08-17
Re: 2016-07-08

NHB File ID: 2445
Project type: Landowner Request

Town: Durham, NH
Location: Map 13, Lot 14-2

I have searched our database for records of rare species and exemplary natural communities on the property(s) identified in your request. Our database includes known records for species officially listed as Threatened or Endangered by either the state of New Hampshire or the federal government, as well as species and natural communities judged by experts to be at risk in New Hampshire but not yet formally listed.

NHB records on the property(s):

	Mapping Precision	% within tract	Last Reported	Listing Status		Conservation Rank	
Natural Community				**Federal**	**NH**	**Global**	**State**
Red maple floodplain forest	High	25	1996	--	--		S2
Vertebrate species (For more information, contact Kim Tuttle, NH F&G at 271-6544)				**Federal**	**NH**	**Global**	**State**
American Brook Lamprey *(Lampetra appendix)*	Medium	5	1959	--	E	G4	S1
Sea Lamprey *(Petromyzon marinus)*	High	52	2008	--	SC	G5	S3
American Eel *(Anguilla rostrata)*	High	52	2008	--	SC	G4	S3

NHB records within one mile of the property(s):

	Last Reported	Listing Status		Conservation Rank	
Invertebrate Species (For more information, contact Kim Tuttle, NH F&G at 271-6544)		**Federal**	**NH**	**Global**	**State**
Bog Elfin *(Callophrys lanoraieensis)*	1900	--	--	G3	SH
Ringed Boghaunter *(Williamsonia lintneri)*	1995	--	E	G3	S2

NOTE: This review *cannot* be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.

NEW HAMPSHIRE NATURAL HERITAGE BUREAU

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172 PEMBROKE ROAD, CONCORD, NH 03301
PHONE: (603) 271-2214 FAX: (603) 271-6488

Lyre-tipped Spreadwing *(Lestes unguiculatus)*	2008	--	--	G5	S1
Taiga Bluet *(Coenagrion resolutum)*	2007	--	--	G5	S2
Natural Community		**Federal**	**NH**	**Global**	**State**
Red maple floodplain forest	1992	--	--		S2
Herbaceous seepage marsh	1996	--	--		S3
Red maple - lake sedge swamp	1996	--	--		S3
Red maple - Sphagnum basin swamp	1991	--	--		S4
Hemlock - beech - oak - pine forest	1984	--	--		S5
Kettle hole bog system	1998	--	--		S2
Plant species		**Federal**	**NH**	**Global**	**State**
Purple Milkweed *(Asclepias purpurascens)*	1942	--	E	G5	SH
Northern Blazing Star *(Liatris novae-angliae)*	1936	--	E	T3	S1
Beck's water-marigold *(Bidens beckii)*	2002	--	T	G4	S2
green rockcress *(Boechera missouriensis)*	2003	--	T	G5	S2
Virginia three-seeded-Mercury *(Acalypha virginica)*	1933	--	E	G5	SH
crested sedge *(Carex cristatella)*	1943	--	E	G5	S1
rufous bulrush *(Scirpus pendulus)*	1982	--	E	G5	S1
ivy-leaved duckweed *(Lemna trisulca)*	1972	--	E	G5	S1
Netted Chain Fern *(Woodwardia areolata)*	1973	--	E	G5	S1
Marsh Horsetail *(Equisetum palustre)*	1953	--	E	G5	SH
Engelmann's Quillwort *(Isoetes engelmannii)*	0	--	E	G4	S1
Vertebrate species (For more information, contact Kim Tuttle, NH F&G at 271-6544)		**Federal**	**NH**	**Global**	**State**
Jefferson/Blue-spotted Salamander Complex *(Ambystoma hybrid pop. 3)*	2010	--	--	GU	S2

NOTE: This review *cannot* be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.

NEW HAMPSHIRE NATURAL HERITAGE BUREAU

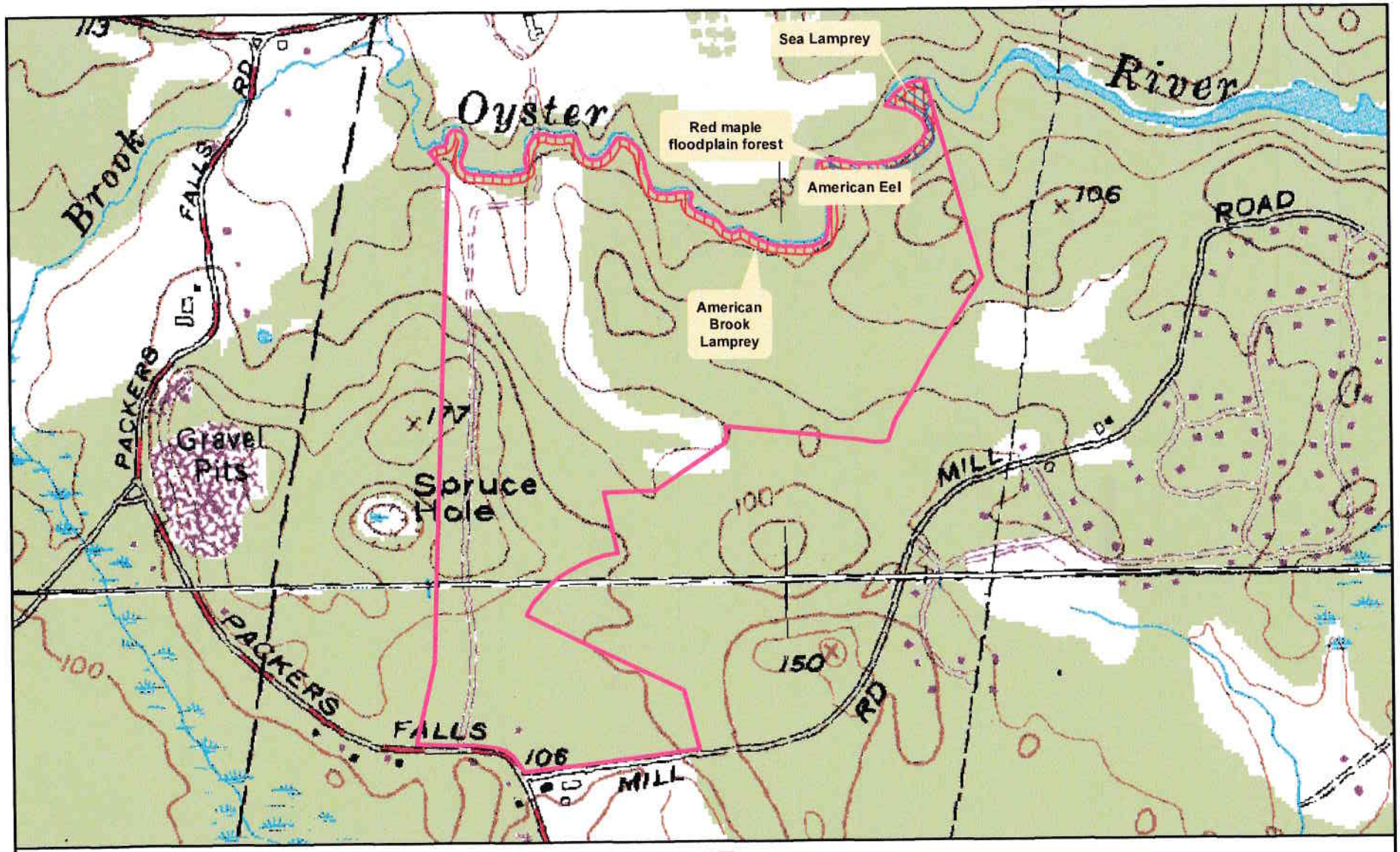
DRED - DIVISION OF FORESTS & LANDS
172 PEMBROKE ROAD, CONCORD, NH 03301
PHONE: (603) 271-2214 FAX: (603) 271-6488

Pied-billed Grebe *(Podilymbus podiceps)*	1994	--	T	G5	S2B
Least Bittern *(Ixobrychus exilis)*	1994	--	SC	G5	S1B
Sora *(Porzana carolina)*	1989	--	SC	G5	S3B
Common Moorhen *(Gallinula chloropus)*	1997	--	SC	G5	S2B
Upland Sandpiper *(Bartramia longicauda)*	2002	--	E	G5	S1B
Sedge Wren *(Cistothorus platensis)*	1998	--	E	G5	S1B
Marsh Wren *(Cistothorus palustris)*	2014	--	--	G5	S3B
Vesper Sparrow *(Pooecetes gramineus)*	2002	--	SC	G5	S2B
American Brook Lamprey *(Lampetra appendix)*	1959	--	E	G4	S1
Sea Lamprey *(Petromyzon marinus)*	2006	--	SC	G5	S3
American Eel *(Anguilla rostrata)*	2000	--	SC	G4	S3
Swamp Darter *(Etheostoma fusiforme)*	1984	--	SC	G5	S3
Spotted Turtle *(Clemmys guttata)*	1993	--	T	G5	S2
Blanding's Turtle *(Emydoidea blandingii)*	1900	--	E	G4	S1

Listing codes: T = Threatened, E = Endangered SC = Special Concern
Rank prefix: G = Global, S = State, T = Global or state rank for a sub-species or variety (taxon)
Rank suffix: 1-5 = Most (1) to least (5) imperiled, "--", U, NR = Not ranked. B = Breeding population, N = Non-breeding. H = Historical, X = Extirpated.

A negative result (no record in our database) does not mean that no rare species are present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

NOTE: This review *cannot* be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.



Natural Heritage Bureau

Landowner Element Occurence Reporting

Project ID Number: 2445

	# of Records
Property Bounds	
Plant Occurence:	0
Animal Occurence:	3
Natural Community:	1
Ecological System:	0

0 0.1 0.2 Mile

New Hampshire Natural Heritage Bureau - Animal Record

American Brook Lamprey *(Lampetra appendix)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G4: Widespread and apparently secure but with cause for longterm concern
State:	Listed Endangered	State:	S1: Critically Imperiled

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	1955: (fall) 1 adult male caught. 1958: (December) "Some Ammocetes" found. 1959: 7 adults collected constructing nests (5/8). 13 adults (4 females, 9 males) collected (5/10). 1 adult seen (5/13).
General Area:	1955: A 5 to 6 foot wide sandy bottom stream with pools widening to 10 to 12 feet. Length of entire stream is about 1.25 miles.
General Comments:	1982: Thought by Karsten Hartel to still be present in 1982.
Mgmt Comments:	

Location			
Survey Site Name:	Oyster River		
Managed By:	UNH - College Woods		
County:	Strafford		
Town(s):	Durham		
Size:	126.2 acres	Elevation:	80 feet
Precision:	Medium		
Directions:	1955: Wednesday Brook. A small tributary of the Oyster River and 1 specimen from the Oyster River.		

Dates documented			
First reported:	1955	Last reported:	1959-05-13

New Hampshire Natural Heritage Bureau - Animal Record

Sea Lamprey *(Petromyzon marinus)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G5: Widespread and secure
State:	Special Concern	State:	S3: Rare or Uncommon

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2008: Not enumerated.
General Area:	
General Comments:	
Mgmt Comments:	

Location			
Survey Site Name:	Oyster River		
Managed By:	UNH - College Woods		
County:	Strafford		
Town(s):	Durham		
Size:	1.9 acres	Elevation:	
Precision:	High		
Directions:			

Dates documented			
First reported:	2008-07-17	Last reported:	2008-07-17

New Hampshire Natural Heritage Bureau - Animal Record

American Eel *(Anguilla rostrata)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G4: Widespread and apparently secure but with cause for longterm concern
State:	Special Concern	State:	S3: Rare or Uncommon

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2008: Area 13322: Not enumerated.
General Area:	
General Comments:	
Mgmt Comments:	

Location			
Survey Site Name:	Oyster River		
Managed By:	UNH - College Woods		
County:	Strafford		
Town(s):	Durham		
Size:	1.9 acres	Elevation:	
Precision:	High		
Directions:	2008: Oyster River		

Dates documented			
First reported:	2008-07-17	Last reported:	2008-07-17

New Hampshire Natural Heritage Bureau - Natural Community Record

Red maple floodplain forest

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	
State:	Not Listed	State:	S2: Imperiled

Description at this Location	
Quality Rank:	Fair
Quality Comments:	
Detailed Description:	1996: A series of small sites along a 1-mile stretch of the Oyster River. The tree canopy was dominated by Acer rubrum (red maple), with considerable Prunus serotina (black cherry) and Ulmus americana (American elm), and occasional Tilia americana (basswood), Acer saccharum (sugar maple), Quercus bicolor (swamp white oak), and Carya ovata (shagbark hickory). Carpinus caroliniana (musclewood) was abundant in the subcanopy. Other shrubs included Cornus amomum (silky dogwood) and Toxicodendron radicans (poison ivy), and occasional to frequent non-native species including Lonicera morrowii (Morrow's honeysuckle), Berberis thunbergii (Japanese barberry), and Rhamnus cathartica (European buckthorn). Characteristic floodplain herbs included Cinna arundinacea (wood reed), Solidago rugosa (rough goldenrod), Athyrium filix-femina (lady fern), Smilacina racemosa (false-solomon's seal), Thalictrum pubescens (tall meadow rue), and Elymus cf. riparius (river wild rye).
General Area:	1996: The floodplains and river channel are, on average, approximately 30 m (100') in width between upland banks along the lower portion of this stretch of river, and widen to about 152 m (500') at its west end at the transition to the alluvial red maple streamside swamp. The annual floodplain appeared to be approximately 2-3.5 feet above the present river level (the level may have been slightly elevated from recent higher water associated with recent heavy rains). Soils ranged from fine sandy loams on somewhat higher terraces and levee features to somewhat poorly drained silt and silt loam soils on lower terraces (buxton, scitico, or podunk soils).
General Comments:	
Mgmt Comments:	

Location			
Survey Site Name:	Oyster River/College Woods		
Managed By:	UNH - College Woods		
County:	Strafford		
Town(s):	Durham		
Size:	8.3 acres	Elevation:	50 feet
Precision:	High		
Directions:	From west, take Rte. 4 to University of New Hampshire exit, go east ca. 0.5 miles toward campus. Site is at south end of College Woods along the Oyster River, ca. 0.25 miles southwest of Mast Rd (Rte. 155A).		

Dates documented			
First reported:	1996-09	Last reported:	1996-09

FOREST INVENTORY SPECIFICATIONS

Oyster River Forest
Durham, New Hampshire

The Oyster River Forest, comprising 171.7± acres (**129.7± productive, forested acres**), was cruised in June 2016 using the variable-radius plot sampling technique. Data were collected from 49 prism points arranged in a grid pattern covering the forest. The average sampling intensity was 1 sample point per 2.64± productive 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: ± 28,158 board feet
   (Total sawtimber includes grade logs, veneer, and pallet logs of all species).
   301,045 Board Feet ± 47,306 BF (90% Confidence Interval)

2) Statistical error around the total firewood/hardwood pulp volume estimate: ± 62 cords
   594 cords ± 105 cords (90% Confidence Interval)

3) Confidence level: 90%

4) Sample plot layout
   a. Systematic sample
   b. Spacing: 350' x 350' grid

5) Plot type and number: 49 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 (ash, birch, maple, & oak)
      - Grade sawlogs (Hardwood and softwood)
      - Pallet logs (Hardwood and softwood)

Map Unit Legend

Strafford County, New Hampshire (NH017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BzB	Buxton silt loam, 3 to 8 percent slopes	27.5	16.2%
EaB	Elmwood fine sandy loam, 3 to 8 percent slopes	1.2	0.7%
HaA	Hinckley loamy sand, 0 to 3 percent slopes	0.7	0.4%
HaB	Hinckley loamy sand, 3 to 8 percent slopes	5.6	3.3%
HbE	Hinckley loamy sand, 15 to 60 percent slopes	0.5	0.3%
HcB	Hollis-Charlton fine sandy loams, 3 to 8 percent slopes	29.5	17.4%
HcC	Hollis-Charlton fine sandy loams, 8 to 15 percent slopes	4.6	2.7%
HcD	Hollis-Charlton fine sandy loams, 15 to 25 percent slopes	0.0	0.0%
HdC	Hollis-Charlton very rocky fine sandy loams, 8 to 15 percent slopes	24.7	14.6%
MI	Mixed alluvial land, wet	0.2	0.1%
Sb	Saugatuck loamy sand	4.0	2.4%
ScA	Scantic silt loam, 0 to 3 percent slopes	18.1	10.7%
W	Water	1.4	0.8%
WdA	Windsor loamy sand, 0 to 3 percent slopes	14.5	8.5%
WdB	Windsor loamy sand, 3 to 8 percent slopes	26.0	15.3%
WdC	Windsor loamy sand, 8 to 15 percent slopes	10.1	6.0%
WfB	Windsor loamy fine sand, clay subsoil variant, 0 to 8 percent slopes	1.1	0.6%
Totals for Area of Interest		**169.7**	**100.0%**

CHARLES MORENO, LPF
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
AFF Study Tour Germany/France/Switzerland—Mixed-aged silvicultural methods, Oct 2016

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-six 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, corporations, and private landowners. 40,000+ acres under management.
1984- Present	TOWN FOREST MANAGER for the Towns of Exeter, Londonderry, Candia, Plaistow, Atkinson, East Kingston, Deerfield, Epping, Brentwood, Sandown, Rye, Pittsfield, Chichester, Derry, Dover, Barrington, Strafford, Northwood, Rollinsford, and Rochester developing/implementing multiple-use plans for publicly-owned forests.
1988- Present	FOREST MANAGER for multiple forest properties owned by conservation organizations, land trusts, and schools. Prepared and presented numerous workshops and field tours teaching silviculture, wildlife habitat management, natural history, forest ecology, low-impact harvest techniques, and other topics.
1990- Present	FOREST CONSULTANT for environmental studies, forest appraisals, and/or project management including Pease Tradeport (Newington, NH), Emerald Necklace (Boston, MA), Trust for Public Lands, Southeast Land Trust, and Siemon Family Charitable Trust.
2009- Present	TECHNICAL SERVICE PROVIDER (TSP) for Natural Resources Conservation Service (NRCS). Approximately 50 management plans completed, as well as project management for forest improvement, habitat enhancement, invasive control, & woods road construction.

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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