

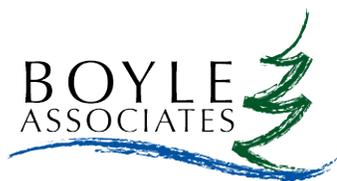
# SCARBOROUGH LAND TRUST

## Warren Woods Ecological Assessment Report

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Prepared by:



Boyle Associates, Environmental Consultants  
Mailing Address: 25 Dundee Road  
Gorham, Maine 04038  
(207) 591-5220  
[www.boyleassociates.net](http://www.boyleassociates.net)

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## Introduction

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The study property, known as Warren Woods, is an approximately 160-acre parcel of land consisting of forests, woodlands, and shrubby fields located along the Nonesuch River near the center of Scarborough, Maine. The property is undeveloped except for some small equipment sheds. The Warren property has several important ecological habitats. In addition to large forested and shrub wetlands, Warren Woods houses a rare pitch pine bog and other special wetland communities, outstanding habitat for New England cottontail rabbits, large areas of mature forested uplands, and a functioning floodplain ecosystem along a locally significant and widely protected river corridor. The property's unique character, large size, threats from development, potential for habitat restoration and enhancement, and strong recreational opportunities make this a desirable property for conservation and preservation purposes. In 2012 the Scarborough Land Trust (SLT) began the process of acquisition of the Warren property. SLT hired Boyle Associates, a Maine-based environmental consulting company, to prepare this ecological assessment. The goal of this report is to present findings from the ecological survey of the Warren Woods property, and to describe potential restoration and enhancement opportunities on the site.

## Location

The Warren Woods property is located on the east side of Payne Road, north of a large block of properties owned by and abutting the Scarborough Downs harness racing facility. The site is two miles south of the Maine Mall and approximately 1 mile north of the Maine Turnpike Exit 42. A portion of the northern boundary of the property borders the Nonesuch River. Most of the land west of the property consists of large, single-family house lots. An aerial photograph and a topographic map of the property are provided as Figures 1 and 2.

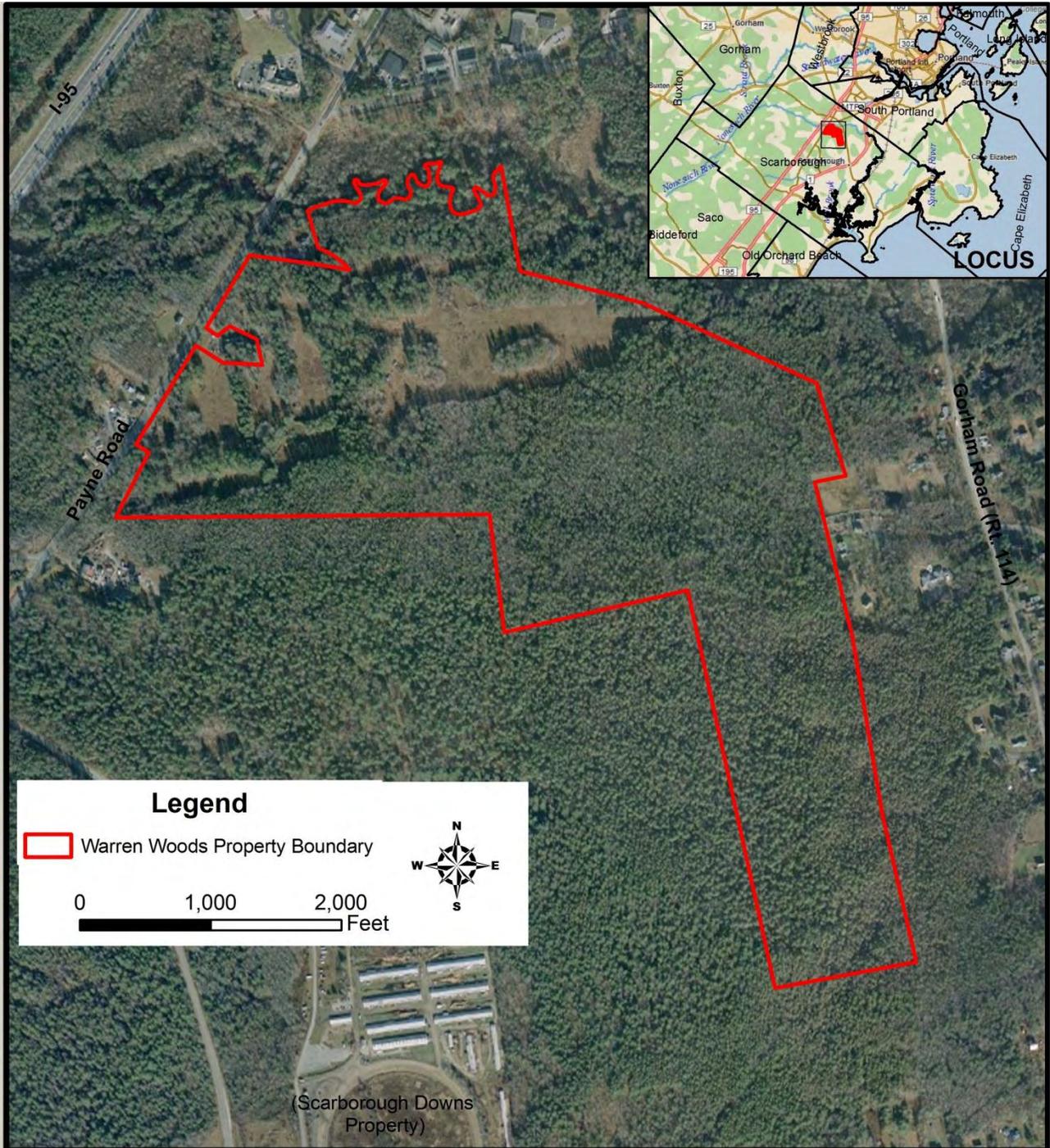


Figure 1. 2010 Aerial photograph of Warren Property (source: ESRI).

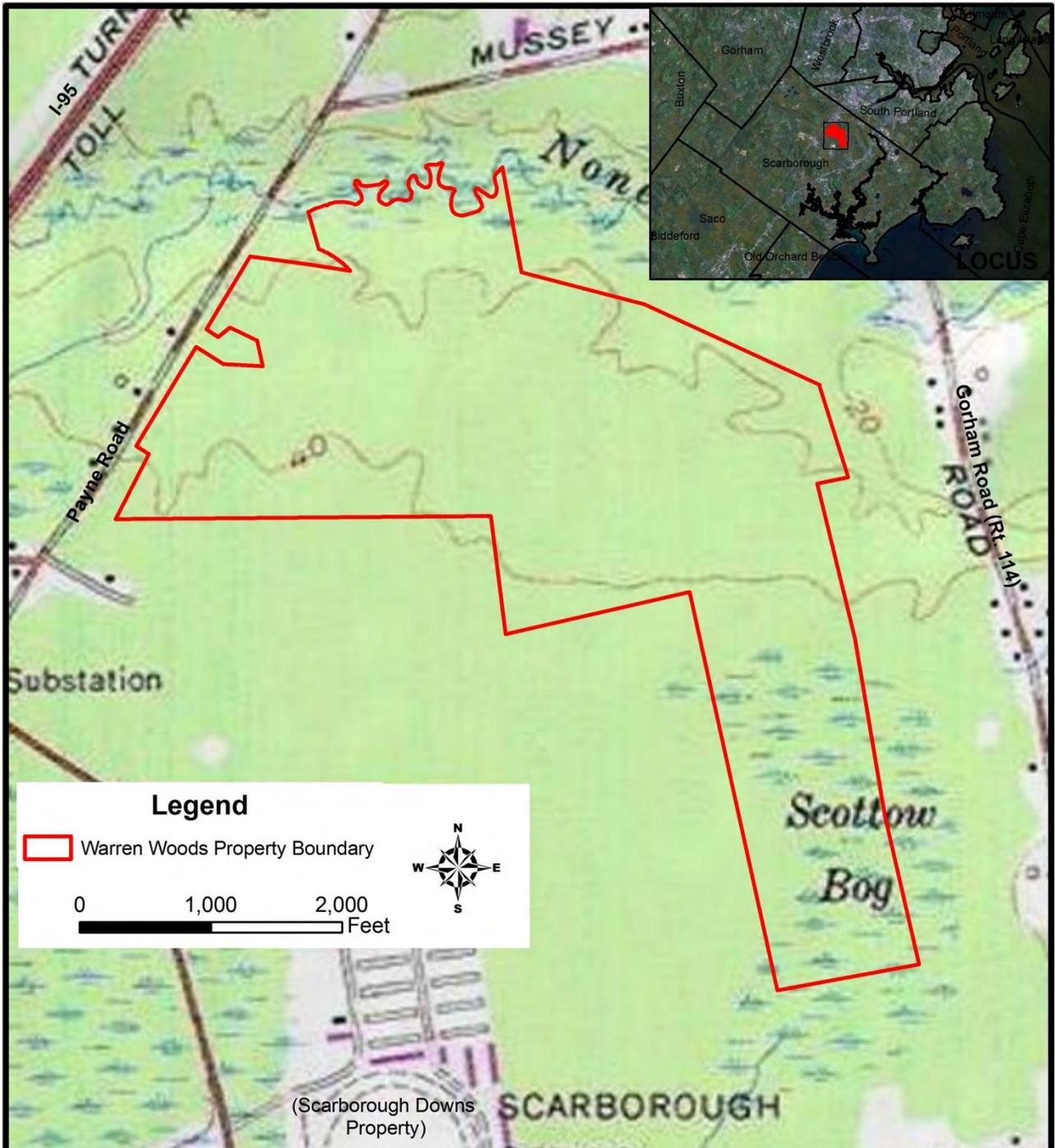


Figure 2. 2012 USGS topographic map of Warren Woods Property.

## Site Description and History

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Biologists from Boyle Associates conducted site visits in June, July and August 2012. The property assessment began with a desktop-level review of the site. This included a GIS review of existing data including aerial photography, topography, soils, and National Wetlands Inventory data; the assessment also included a request for review of any known information on rare and unique features by the Maine Natural Areas Program (MNAP) and the Maine Department of Inland Fisheries and Wildlife (MDIFW), as well as a review of potential cultural and historic resources from the Maine Historic Preservation Commission (MHPC). Boyle Associates also spoke with members of the Warren family and the Scarborough Land Trust (SLT) for additional site history and information.

### Topography, Geology and Soils

Like most of Scarborough, the Warren property retains sedimentary and geological evidence of its glacially-influenced past. Much of the Warren property consists of former floodplain terraces rising away from the river. Starting from an elevation of less than 20 feet above sea level (ASL) at the northern end of the parcel (the river), the topography slopes up from the current river valley and rises to the south. Between 1,500 and 2,000 feet south of the river, the property rises abruptly to a large, flat terrace at an approximate elevation of just over 40 feet ASL. The land on this terrace is fairly flat, and hosts a forested, perched bog community known as Scottow Bog. Scottow Bog exists at the upper split of the watershed, with surface overflow draining both to the north (to the Nonesuch River) and the south (to Mill Brook).

The terraces along the Nonesuch River are former floodplains and indicative of a much larger river system that flowed through the valley near the end of the last ice age. During this period, Maine was covered by the Laurentide ice sheet, an approximately 1 mile high glacier that extended from northern Canada and south as far as New York. While under the massive weight of the ice, the land mass was compressed and subsided. As the sheet melted, ocean water flowed onto and across the depressed landscape, covering most of the southern Maine with water for a few thousand years.

While under water, the land was covered with fine-grained materials (*e.g.* fine sand, silt and clay) that washed in and settled on the ocean floor. Eventually, the atmosphere warmed, the glaciers retreated and the land began to decompress. As the land rose to its current elevation, the sea water retreated but the sediments remained. Known as the Presumpscot Formation (named after exposed deposits found along the Presumpscot River,) this blanket of fine-grained material often creates a nearly impervious layer of compact subsoil that is found under many of the wetlands and floodplains in the region. Because glacial advance and retreat continued for several thousand years, and due to riverine flooding, weathering, and sedimentation, soil horizons in this formation can vary. The finer-grained marine sediments can range in both thickness and proximity to the soil surface, and may be completely absent in areas where it has been eroded. Within the current basin of the Nonesuch River, many of these fine sediments were eroded during strong floods that carved the current river valley. Riverine sediments (*e.g.* sand and silt) and glacial outwash (*e.g.* sandy gravel) were left in place or re-deposited over many of these areas by the subsequent floods and additional glacial melting.

On the Warren property, even though there have been many disturbances to soil and hydrology on the site, the soil makeup reflects the area's geologic history (see Appendix 1: NRCS Medium-Intensity Soil Survey information). Soils near the river, along the first former floodplain terrace, consist of mixed loamy sand and sandy loam. Further south of the river, onto the second terrace, the soils are more indicative of marine/lacustrine parent materials and are made up of fine sandy and silty loams. Hydrology in the wetlands on the lower, northern portion of the site is generally maintained by shallow, poorly-drained loamy sand soils underlain by coarse-textured, cemented sand horizons. Wetlands in the

upper portion of the site are generally perched on cemented or compacted silt and silty clay, and have deeper organic topsoil. Soils in the lower area, by the fields, display more evidence of historic disturbances, including ditching, draining and fill.

## Land Use History

Scarborough has a rich Native American history, and the Nonesuch River corridor may have been used as a travel way between inland and coastal camps and settlements. According to correspondence with the land owner, Mr. Warren, *“There is a preserved ancient Indian stone calendar in an Indian agricultural complex where many stone agricultural tools have surfaced. A former deed speaks to the stepping stones across the Nonesuch River...”* A data-request to the Maine Historic Preservation Commission (MHPC) revealed no specific or known locations of historical significance but does suggest a pre-historical archaeological review of the property.

Following European settlement, beginning in the 17<sup>th</sup> century, homestead and farming development in Scarborough spread from the coastal areas inward. Based on historic map reviews, cleared areas indicate that the Warren property has had some sort of land use going back to at least 1914. A trail that can still be found today is shown as a road on a 1917 USGS topographic map. Located on the southern terrace, the trail was most likely used for logging purposes, and traversed the property from Bridges Drive to Asselyn Drive (off Route 114 to the west). The trail is now mainly used by ATVs, snowmobiles, hunters, mountain bikers, and hikers.

Around the property, several large-scale developments led to changes for the property and the area. The Maine Turnpike, constructed just west of the property, completed construction in 1947. Shortly after the Turnpike was completed, the Scarborough Downs Harness Racing Facility opened in 1950, just south of the Warren property. Large portions of the land on which the track sits are depicted as “made land”, on to the county soil survey (Appendix 1). Development of the Downs property has likely altered the hydrology into and out of Scottow Bog over the last half century. For examples, streams shown on old maps can no longer be found, and the extent of the Scottow Bog is greatly reduced from mid-20<sup>th</sup> century depictions.

The parcel was purchased by the Warren family in 1966 from Etta Shaw. After buying the property and throughout the next few decades, Mr. Warren worked with two local foresters -- Frank Knight and Rene Noel -- to develop forest management plans and to clear portions of the site. It does not appear that any of the forests have been harvested within the last few decades (at least). In the 1970s, several areas on the northern and northeastern end of the site were cleared to create a private 9-hole golf course and a grass runway for Ultralight personal aircraft. For development of the golf course and runway (the landing strip shared space with one of the fairways) Mr. Warren cleared trees and stripped and/or imported topsoil from several areas across the site. Additionally, a series of drainage structures (*i.e.* piping and ditches) were installed to facilitate drainage from the wet fields.

## Current Zoning and Surrounding Land Use

The portion of the parcel located adjacent to Payne Road is zoned B2-Regional Business and the interior portion is zoned RF-Rural Residence/Farming. Uses allowed in the B2 district include retail businesses, warehouse and wholesaling facilities, and hotels and motels. Uses allowed in the R-F district include residential development and agricultural facilities.

There are several large, commercial developments along Payne Road in the vicinity of the Warren Woods project (e.g. the Cabelas-anchored *Gateway Shoppes at Scarborough* is one mile to the south and the Maine Mall is two miles to the north). Additionally, there are small businesses adjacent to the parcel along Payne Road. Properties along this portion of Payne Road have access to municipal sewer

and water infrastructure and easy access to the Maine Turnpike and Interstate-295. Along with proximity to other large business developments and easy access to main thoroughfares, the amenities and location of the property would make it an attractive candidate site for development.

The area east of the property is less developed, and consists mainly of large, single-family house lots. The Scarborough Downs facility is to the south, and 400 acres of that property are listed for sale by the landowners. Portions of the Downs property are split into the B2 and Haigis Parkway zones – both designed to allow and facilitate businesses and campus-style developments.

Currently, the Warren Woods property has been unused for several years. Over this time, the drainage devices installed in the fields have been gradually failing, allowing several of the fields and former fairways to return to wetland conditions. The airstrip was last mowed in 2008 and the other fields have been left unmowed for at least a decade. There are also several relic structures and unused materials (e.g. signs, lumber, tools, debris) found throughout the northern third of the site.

### Connectivity to Open Space and Preserved Lands

Protection of properties along the Nonesuch River corridor has been a long-term goal of the Town of Scarborough and the SLT. As stated in Chapter 6 of the Town of Scarborough Comprehensive Plan (2006): “Many of Scarborough’s unique natural areas and wildlife habitats are located in the Nonesuch River watershed. The impact of potential growth on these resources should be kept in mind as areas for growth and protection are delineated in the development of this Comprehensive Plan.” In its Updates to the Comprehensive Plan - 2006, the Town of Scarborough included the following objective:

“Objective F. 7. Establish a “greenway” along the length of the Nonesuch River. Most of the area adjacent to the Nonesuch River is subject to either Resource Protection or Shoreland Zoning. The width and requirements of these zones vary. The Town should work with landowners to maintain a naturally vegetated “greenway” along the entire length of the Nonesuch. Where possible, the objective should be to establish a 250 foot wide vegetated buffer along both sides of the river. In doing this, existing development rights should not be reduced by allowing the development that could have occurred on the land within the greenway to be clustered on other parts of the property away from the river.”

The SLT, the Town, private landowners, and state and federal entities have protected and preserved several large and small properties throughout the town of Scarborough. Figure 3 provides a depiction of preservation, conservation, open space, and recreational lands in the town. Largest amongst the protected lands is the vast and vitally important Scarborough Marsh estuary, where several rivers meet the ocean. Open and recreational space near the Warren property includes the Scarborough Middle School to the south and the Nonesuch golf course to the west. Protected areas east of the Warren property along the river include the Hunnewell Street Land easement, approximately ½ mile downstream from Warren Woods. This area is owned by the Town of Scarborough and consists of nearly 100 acres of protected space and a mile of frontage on the Nonesuch River. Protected properties west of the site along on the Nonesuch River include CMP’s Nonesuch River Mitigation Project (a.k.a. Libby Farm Property), R.J. Grondin & Son’s Larrabee Farms Mitigation Project area, Nonesuch Land Trust’s Scarborough Fish & Game Property, and SLT’s Fuller Farm.

South of the Warren Woods project site is the large land holdings of Scarborough Downs. Abutting the Scarborough Downs and Warren property are some larger, privately-owned parcels of forested lands. SLT has met with the landowners of these properties and is interested in pursuing acquisition and protection to increase the protected area covered by the Warren Woods project. Immediately north of the Warren site, on the opposite shore of the Nonesuch River, are three town-owned lots. These parcels are mostly wetland and SLT has approached the town about including these properties within the

protection envelope of the eventual easement created to protect the Warren Property. Northwest of the Warren Property and downstream from the town-owned lots is an unoccupied parcel of land (at the southeast corner of Mussey Road and Route 114). SLT has also met with the landowners of this parcel to express interest in obtaining it for permanent protection. In combination with the Warren property and town lands, protection of this parcel would provide habitat and water quality protection for nearly a mile of the Nonesuch River and its floodplain in this rapidly developing area.

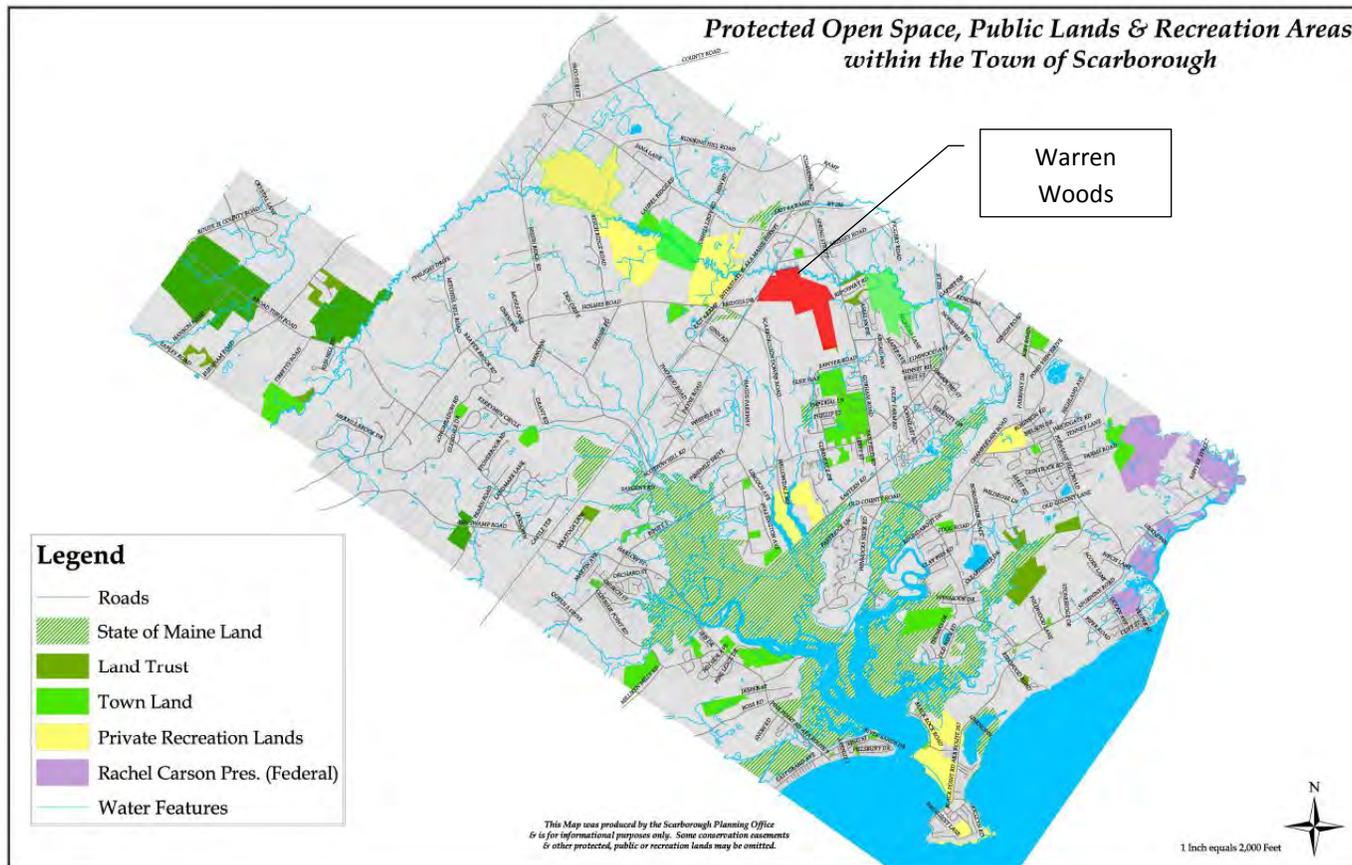


Figure 3. Preservation, Conservation, Recreation, and Open Space Areas in Scarborough (Scarborough Planning Office basemap).

## Ecological Assessment

### Assessment Methodology

Following a desktop-level data investigation, biologists from Boyle Associates performed on-the-ground meander surveys of the property. The scientists traversed the site taking note of plant and community types, sketching wetland and stream locations, noting bird species observed and signs of wildlife usage, and surveying for potential vernal pools and other significant and unique natural habitats. This review is not designed to provide a thorough delineation of resources suitable for acquiring environmental permits; rather, it is meant to provide a base description and approximation of natural resources for planning and values assessment purposes. Locations of features were mapped using a combination of

hand sketches and GPS locations that were digitized and depicted using GIS software. Follow-up site visits were performed in 2012 with biologists from MDIFW, US Fisheries and Wildlife Service (FWS) and MNAP.

## Habitat Types

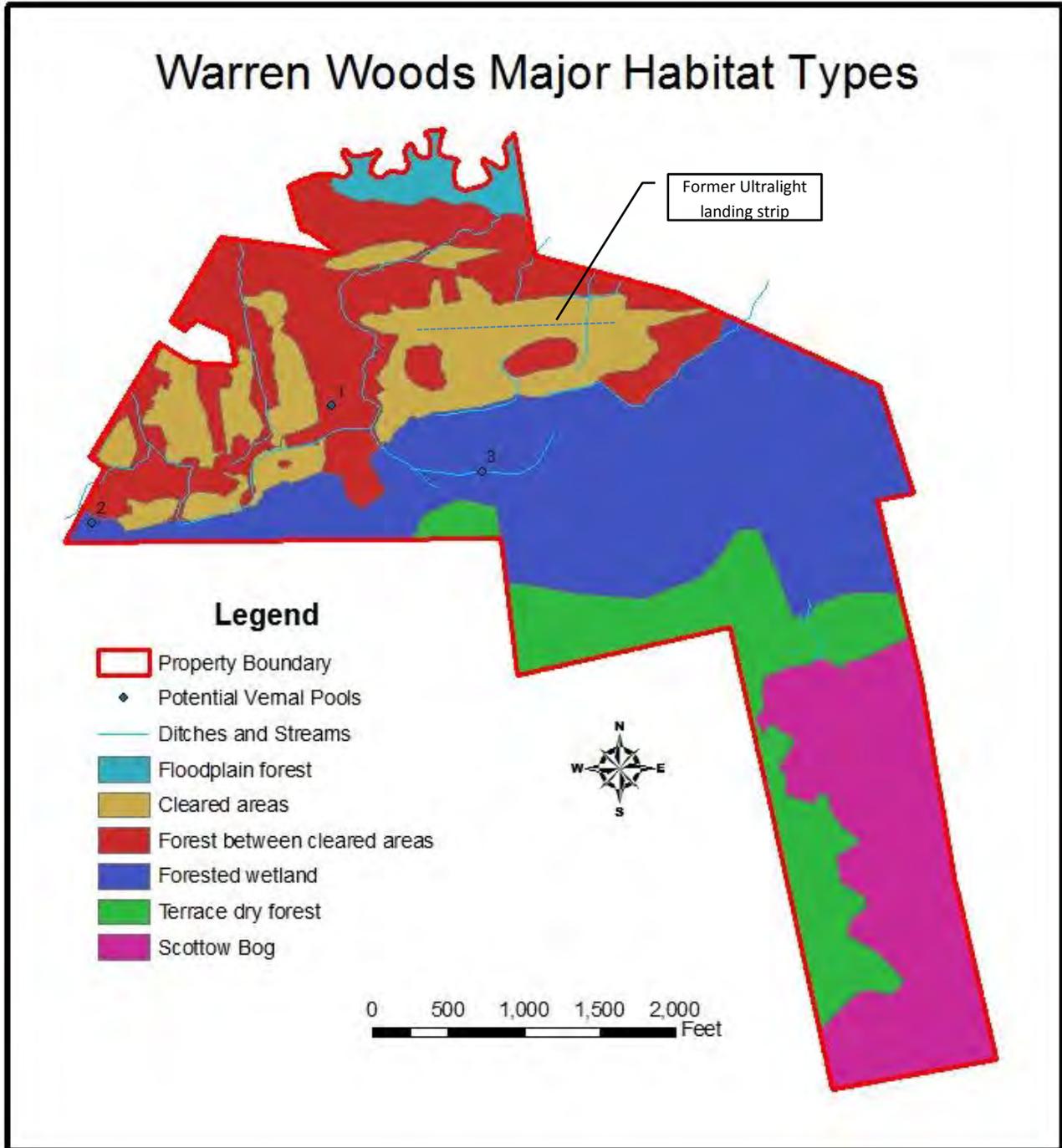


Figure 4. Major Habitat Types

Figure 4 shows a map of the existing habitat types on the site. The habitat types are defined based on location, landform, and general vegetation type. The boundaries are approximate, and have been

sketched to depict the general location of each type. All plants discussed in this section are included in Appendix 2, in which we have also included scientific names.

**Floodplain forest:** The lowlands along the Nonesuch River are predominantly red maple woodlands, with small stands of white pine. Hawthorn is a common tall shrub, and the understory is dominated by sedges and ferns. Other common herbaceous species are fringed yellow loosetrife, meadow rue, and clematis vines (a.k.a virgin's bower). Trees are very shallowly rooted due to the high water table and restrictive clay soils. The area is difficult to traverse due to several areas of fallen trees and criss-crossed blow-downs, but these thick entanglements provide great foraging habitat and cover for small mammals and birds.

**Cleared areas:** The open areas once cleared for a golf course are regenerating into a variety of low-growing plant communities. The vegetative community makeup of these areas depends primarily on their hydrology. Drier sites tend to have thick, low-growing cover of blueberries, with taller islands of bayberry, whereas wetter sites range from cattail pools and wet meadows to sphagnum bogs. On the southern edge of the largest field (the field with the former landing strip), one large area has a saturated sphagnum moss mat and supports a robust population of bog vegetation, e.g. orchids, bog spikemoss, sundew, cottongrass, bog white violet and sheep laurel. Cranberry is abundant throughout the cleared areas, especially where it is wet for at least part of the growing season. Red maple and gray birch are regenerating in some patches, and speckled alder is regenerating in the wettest cleared area on the western side of the site.

**Streams, ditches and pools:** Drainage around the site was altered in the past with the goal of creating dry land in the cleared areas. Most of the fairways are ringed by drainage ditches. A couple of the ditches have evolved into or were sited along existing perennial streams, making it difficult to distinguish between natural, unnatural, and natural modified streams. At least one dug channel flows year-round through underground drainage pipes and a wooden box culvert under a portion of the landing strip in the largest field. Some of the drainage ditches empty into or drain from man-made borrow holes and pools. Some of these pools hold water for portions or most of the year and provide habitat for aquatic insects and amphibians.

**Forest between cleared areas:** This is a catchall category for treed areas between and within the cleared areas. These include a mix of wetland and uplands. Many of the drainage ditches flow through these areas, between the fields. This category also includes the forested, mostly upland islands within the cleared areas. These islands appear to consist of mounds of displaced topsoil that was scrapped off the cleared areas during construction of the former fairways. Some of these islands and strips of trees house groves of large old white pine with pink lady slippers and highbush blueberry in the understory, others consist of mixed dry/wet forests with pine, spruce, oak and balsam fir in the tree stratum, and raspberry and ferns in the herbaceous stratum.

**Forested wetlands:** Forested wetlands occupy much of the land between the old golf course and the terrace to the south. Trees include red maple, black spruce, tamarack, and hemlock, with scattered white pines and balsam fir. The ground is laced with the raised roots of the trees, covered in sphagnum moss and obscured by a tall layer of skunk cabbage and cinnamon fern. Some of the wetter areas have a more open canopy of primarily black spruce and a uniform coverage of sphagnum moss. Several of the forested wetland areas have a dense, tall shrub stratum dominated by winterberry, mountain holly and high-bush blueberry. A sketch of all wetlands found on the property is depicted in Figure 6.



Figure 5. Forested wetland.

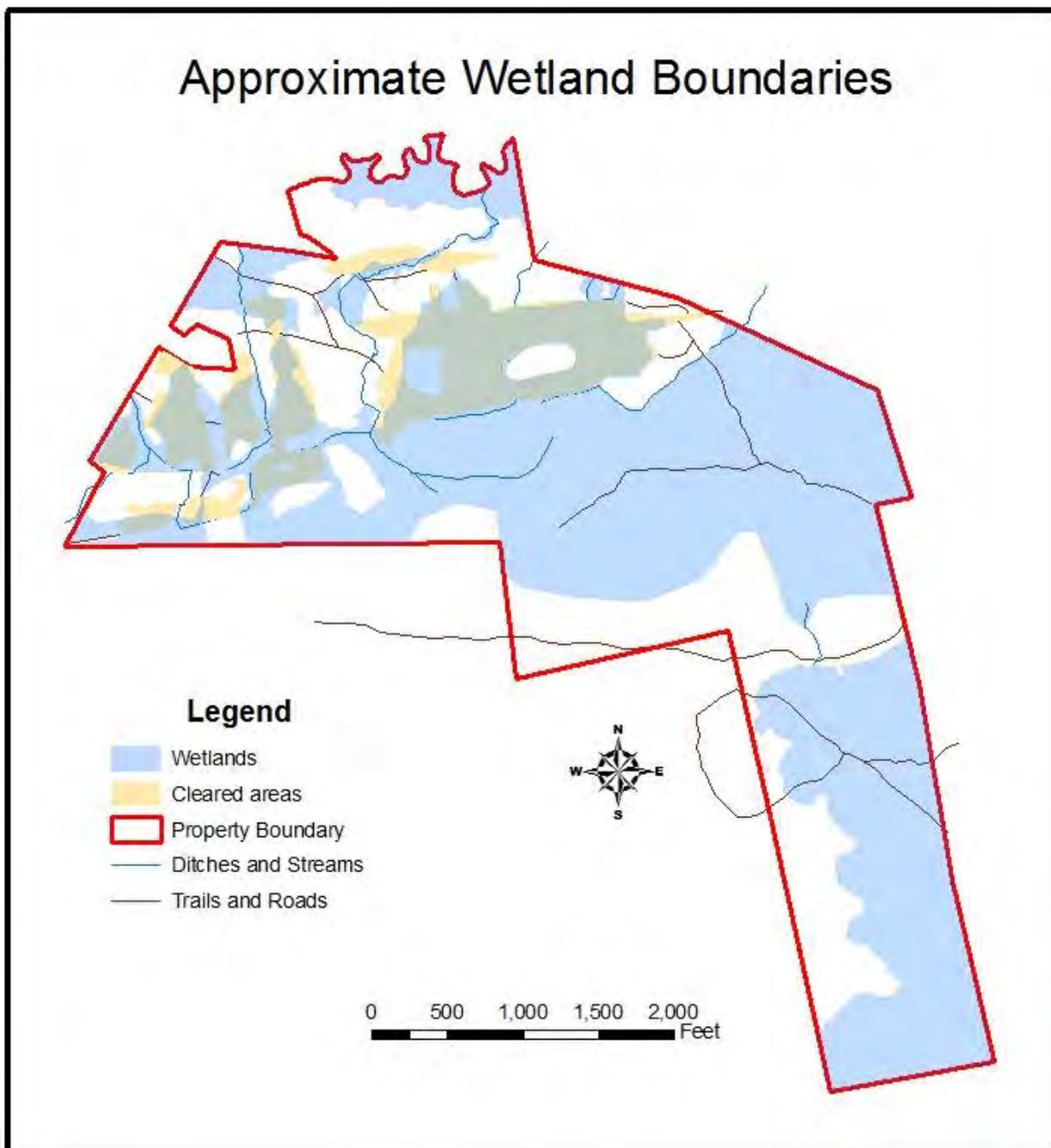


Figure 6. Approximate wetland boundaries at the Warren Woods property.

**Terrace dry forest:** The upland areas on the southern terrace are primarily white pine forest, with undulating pit and mound topography. Even where white pine is dominant, the forest has many shallow, wet pits that support wetland vegetation (primarily shrubs and ferns). As described in the property history section, it is likely that some of the currently dry areas were wetter in the past, as evidenced by pitch pine in the tree stratum, and as noted on old maps that show Scottow Bog extending further south

and west than its current extents. A few existing trails traverse through portions of the upland and wetland forests on the terrace, connecting to the Scarborough Downs property to the south.



Figure 7. Scottow Bog.

**Scottow Bog:** Scottow Bog is a large, perched bog dominated by black spruce and pitch pine trees. Hydrology for the bog comes primarily from rain and snowmelt, and is contained within the bog by a hardpan, cemented layer of sand (a.k.a. “ortstein”). The shrub stratum is very thick, and includes high-bush blueberry, winterberry, maleberry, sheep laurel, and rhodora. Sphagnum moss is nearly ubiquitous throughout the bog. In some areas, small depressions host floating mats of sphagnum and cranberries. Despite the seasonal inundation and coverage of moss, there is a relatively shallow layer of peat in the wetland -- between 6 and 12 inches in most places.

Surface flow from the bog is drained in several locations by small streams and drainages that run to the north and south. Some of these drainages appear human-caused (due to intentional ditching or erosion from forestry and road-building in the distant past). These drainages may shorten the saturation periods of the bog and have presumably helped reduce the extent of the wetland. Given that it is a unique community with an interesting history, it would be interesting project to research the bog’s past and its ecological trajectory. Figures 8 through 11 provide a history of the mapped topography of the site.

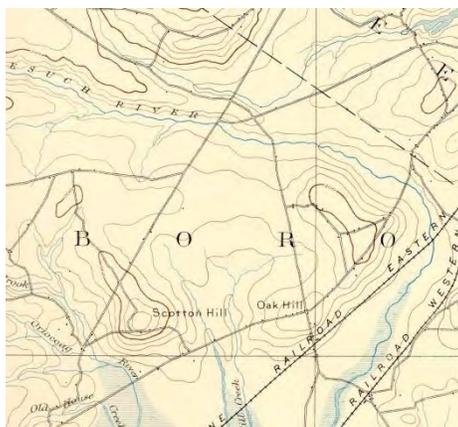


Figure 8. 1890s topo map of area.

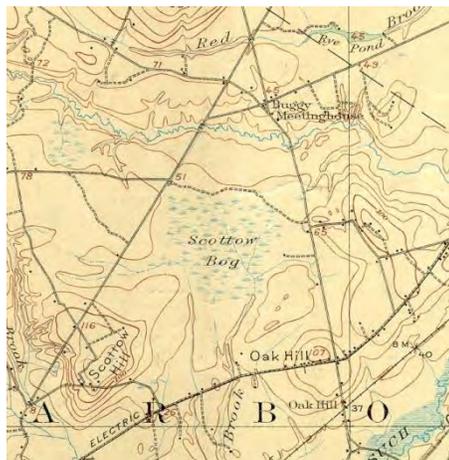


Figure 9. 1916 topo map of area.

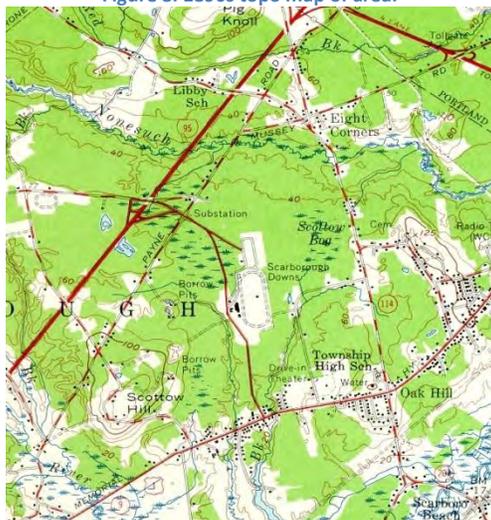


Figure 10. 1950s topo map of area.

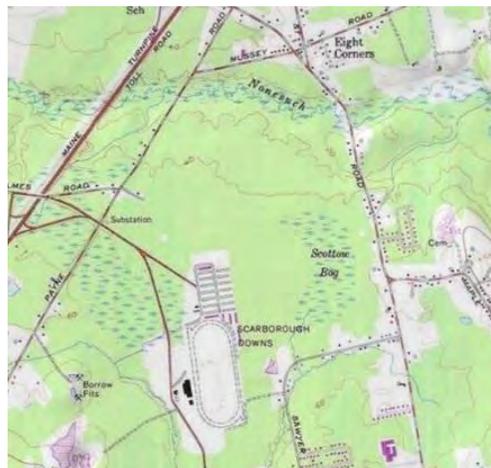


Figure 11. 2012 topo of area.

## Botanical Survey



The plant species at Warren Woods reflect the variety of habitats, soils and recent and past disturbance history of the site. The property contains a fairly wide range of habitats and correspondingly has a large diversity of plant species. The botanical survey conducted in the summer of 2012 identified 151 species of plants, spanning 57 families. Appendix 2 provides a complete list of the plants found. The botanist who conducted the survey (Kelsey Kaufman) noted that this list does not provide a comprehensive inventory of all species that could be found on the site. Including ephemeral and seasonally-occurring plants, aquatic plants, and other species just not observed, she estimates that there could be over 300 species of plants present on the property.

### Unique/Interesting Botanical Features

#### *Bog Plants in the Cleared Areas*

One particularly interesting element to the Warren property is the prevalence of bog-loving plants found in the cleared fields. Shrubs of the family Ericaceae, including sheep laurel, Labrador tea, cranberry, blueberry, and American wintergreen, as well as herbaceous species like orchids and cotton-grass, grow throughout the wetter portions of the regenerating fields. It appears that some of the fields may have been boggy wetlands that were partially drained and scraped for creation of the recreational lands. Others may have become wetter over the years as the Scottow Bog has been directing some drainage through and across the property toward the Nonesuch River. Either way, the bog plants are regenerating well throughout the wetter portions of the fields. Their presence points to a local seed source and suitable growing conditions (low-nutrient soils and plenty of sunlight). While bogs and bog plants, in general, are not rare in southern Maine, it is fairly unique to find these species in regenerating fields.

#### *Pitch Pine Bog (Scottow Bog)*

Within the Warren parcel, roughly 15 acres of Scottow Bog meets the vegetative standards to be listed with MNAP as a “pitch pine bog”. This plant community is considered rare in Maine (a state rarity rank of ‘S2’). MNAP Ecologist Kristen Puryear visited the site in July, 2012 to document the bog. MNAP will provide SLT with a follow-up report regarding the official listing of this rare community in 2012.

#### *Wild Leek*

Wild leek (*Allium tricoccum*), a *Species of Special Concern* in Maine (G5/S3), has been documented upstream along the Nonesuch River, and could potentially exist on the Warren property. Boyle Associates surveyed portions of the Warren Woods floodplain with the ecologist from MNAP in July,

2012. They searched for dried seed stalks, but did not find any leeks. It is most effective to survey for this species in early spring, as it dies back to the ground in summer after the trees leaf out; reviewers should search the site again during the spring to look for occurrences of this rare plant.

### Invasive Species

Another unique and important feature of the Warren Woods parcel, and despite the historic disturbances and proximity of the site to development, is that there are very few occurrences of invasive plant species on the site. SLT is strongly encouraged to develop a site inspection and invasive species control plan as soon as possible in order to keep current invasive species in check and to prevent new infestations from becoming large scale threats to the property. While control of invasive plant species at their current levels is entirely possible, plants will continue to establish from seeds and fragments deposited onsite from upstream sources, wind, birds, and contaminated equipment brought onsite by recreationalists. Maintaining a low level of invasive species on the site will require long term management.

Of those plants currently found on the site, glossy buckthorn, multiflora rose, and Oriental bittersweet are of the highest concern. Individual buckthorn plants were observed in several of the cleared areas and along the eastern property boundary. The buckthorn seedlings were less than one meter tall and entire plants and root systems were fully removed upon discovery in 2012. Small pockets of multiflora rose were also found within the cleared areas. These are harder to remove by hand, and should be dug out and removed as soon as possible. One small cluster of bittersweet vines was noted within the floodplain of the Nonesuch River. Bittersweet should also be removed as soon as possible. Due to the low level of infestation, chemical control (*i.e.* herbicide) is the best means of eradication for this tenacious invasive; however, aggressive mechanical control on an annual basis can effectively control all of the invasive plants found on the site. A complete list of invasive species observed on the Warren property is included as Table 1.

Table 1. Invasive plant species observed on Warren property in 2012.

Family	Scientific name	Common name
Berberidaceae	<i>Berberis thunbergii</i>	Japanese barberry
Caprifoliaceae	<i>Lonicera</i> sp.	honeysuckle
Celastraceae	<i>Celastrus orbiculatus</i>	Oriental bittersweet
Elaeagnaceae	<i>Elaeagnus umbellata</i>	autumn olive
Poaceae	<i>Phalaris arundinacea</i>	reed canary grass
Rhamnaceae	<i>Frangula alnus</i>	glossy buckthorn
Rosaceae	<i>Rosa multiflora</i>	multiflora rose

### Wildlife

Providing a rich mix of wildlife habitat types, the Warren property provides or has the potential to provide for a wide array of wildlife species. The prevalence of large interior forests, water bodies, open fields, shrub-lands, and extensive edge habitat allows the site to provide food and shelter to a variety of resident and migrant species. Additionally, forested wetlands adjacent to and aquatic habitats within the Nonesuch River undoubtedly provide a corridor for large and small mammals, birds and amphibians to gain access to the Warren property and to reach other protected sites along the river. A game camera set up for 3 days within one of the strips of trees between the fields (see Figure 16), captured photos of a raccoon, a chipmunk, an ovenbird, two hermit thrushes, a red squirrel, and a short tailed weasel.

Table 2 provides a listing of the wildlife observed on the site during a few, brief field visits in 2012. This is by no means an exhaustive listing of the species that may live or travel through the property. Presumably, the site is an important breeding and forage habitat for migrating birds. Additionally, large predatory mammals such as bobcats, fisher, grey fox, and black bear may traverse the property in search of food and habitat. River otters, beaver and mink presumably use the floodplain during the summer for travel and food and the Nonesuch River provides habitat to many species of game and non-game fish. Finally, the river and wetlands have the ability to host a range of waterfowl and wading birds.



Figure 16. Game camera photos taken in one of the treed areas between the fields in July 2012; photos are raccoon, red squirrel, and a short-tailed weasel.

### *New England Cottontail Rabbit*

The Warren Woods parcel is located within the current range of the New England Cottontail (*Sylvilagus transitionalis*). New England Cottontail (NEC) is listed as an endangered species by the State of Maine, and is listed federally as a candidate species for protection under the Endangered Species Act. According to the US Fish & Wildlife Service (USFWS), “Candidate species are plants and animals for which the US Fish & Wildlife Service has enough information on their status and the threats they face to propose them as threatened or endangered, but developing a proposed listing rule is precluded by higher priority listing actions” (<http://www.fws.gov/endangered>). NECs are dependent on dense shrublands and regenerating thickets for habitat. NECs are rare due primarily to loss of habitat and fragmentation of habitat areas (e.g. loss of corridors between breeding groups or habitat patches).

Due to its re-growing cleared and cutover forest areas, the Warren property may provide habitat for NEC. The areas previously cleared for use as a golf course are regenerating with patches of thick, native shrubs. Additionally, several canopy openings in the forested portions of the property house thick stands of trees and shrubs that could provide NEC habitat. In 2012, a local land surveyor working on the property provided a good description of his recent encounter with a presumed cottontail within a regenerating thicket in the forest near the south/southeastern boundary of the site. Twig and herbaceous browse in the area indicate the presence of rabbits or hares (ends snapped at a roughly 45-degree angle – Figure 17). Additional investigation, including placement of game cameras and/or winter track and pellet surveys, would help determine whether NEC is currently living on the Warren property. Planned management of the field habitats - designed to maintain thick, native shrub cover - would enhance the existing habitat for NEC should a population make its way to the site or if they already inhabit the area.



Figure 17. Twig browse in forested thicket.

Table 2. Warren Woods wildlife observations – July-August, 2012

<b>Birds</b>		<b>Mammals</b>	
<b>Common name</b>	<b>Observation Type</b>	<b>Common name</b>	<b>Observation Type</b>
American crow	observe	chipmunk	observe
American goldfinch	observe	coyote	observe
black and white warbler	call	deer	observe
black throated blue warbler	call	ermine	observe
black throated green warbler	observe	gray squirrel	observe
blue jay	observe	moose	skull found
broad-wing hawk	observe	possum	tracks
Catbird	observe	raccoon	observe
cedar waxwing	observe	red fox	tracks
Chickadee	observe	red squirrel	observe
chipping sparrow	observe	skunk	tracks
common yellowthroat	observe	white-tailed deer	observe
eastern phoebe	observe		
eastern wood peewee	call	<b>Amphibians</b>	
great blue heron	observe	<b>Common name</b>	<b>Observation Type</b>
hermit thrush	observe	bull frog	observe
northern parula	call	green frog	observe
Ovenbird	observe	spring peeper	heard
red-tailed hawk	observe	wood frog	observe
ruffed grouse	drumming	American toad	heard
Robin	observe	grey treefrog	heard
rose-breasted grosbeak	observe	snapping turtle	observe
turkey vulture	observe		
Veery	observe		
wild turkey	observe		
winter wren	observe		
wood thrush	call		
Woodcock	observe		

## Conservation, Enhancement and Recreational Opportunities

### New England Cottontail Habitat Enhancement and Maintenance

There is a good opportunity to manage the open areas on the Warren property for NEC habitat. Not having been mowed for several years, many of the fields are regenerating with thick cover of small trees and shrubs. Additionally, the forest edges around the fields are growing thickly due to sun exposure provided by the openings. These thickets of vegetation create suitable forage and refuge habitats for NEC.

Boyle Associates met with biologists from MDIFW and USFWS in July 2012 to assess the site for suitability for NEC. The biologists agreed the site is a good candidate to provide NEC habitat. They suggested removal of several of the treed islands between some of the western fields, in order to open more understory habitat for NEC. Figure 18 includes photographs from two of the regenerating fields. Figure 19 depicts a sketch of the suggested clearing and management areas for NEC.

Limited clearing (approximately 7.3 acres) could provide connections between several of the existing, regenerating fields and create and link approximately 30 contiguous acres of potential cottontail habitat. Once the fields are connected, a rotational brush-hogging effort would maintain the habitat for the long term. This would entail mowing patches of the management areas every 5-15 years, depending on productivity and speed of the growth, in order to maintain primary successional growth and a thick density of plants in the fields.

MDIFW and USFWS, along with help from the Natural Resource Conservation Program (NRCS), the Cumberland County Soil and Water Conservation District, Partners for Fish and Wildlife, National Fish and Wildlife Foundation, Wildlife Management Institute, and other groups may provide technical and financial assistance for acquisition, planning and monitoring for a cottontail habitat enhancement and management project at the Warren property. Site monitoring on a semi-annual basis, especially immediately following mowing sessions, would be required to monitor and remove any new occurrences or infestation of invasive species.



Figure 18. Examples of thickly regenerating fields, taken at two open areas on the eastern side of the site.

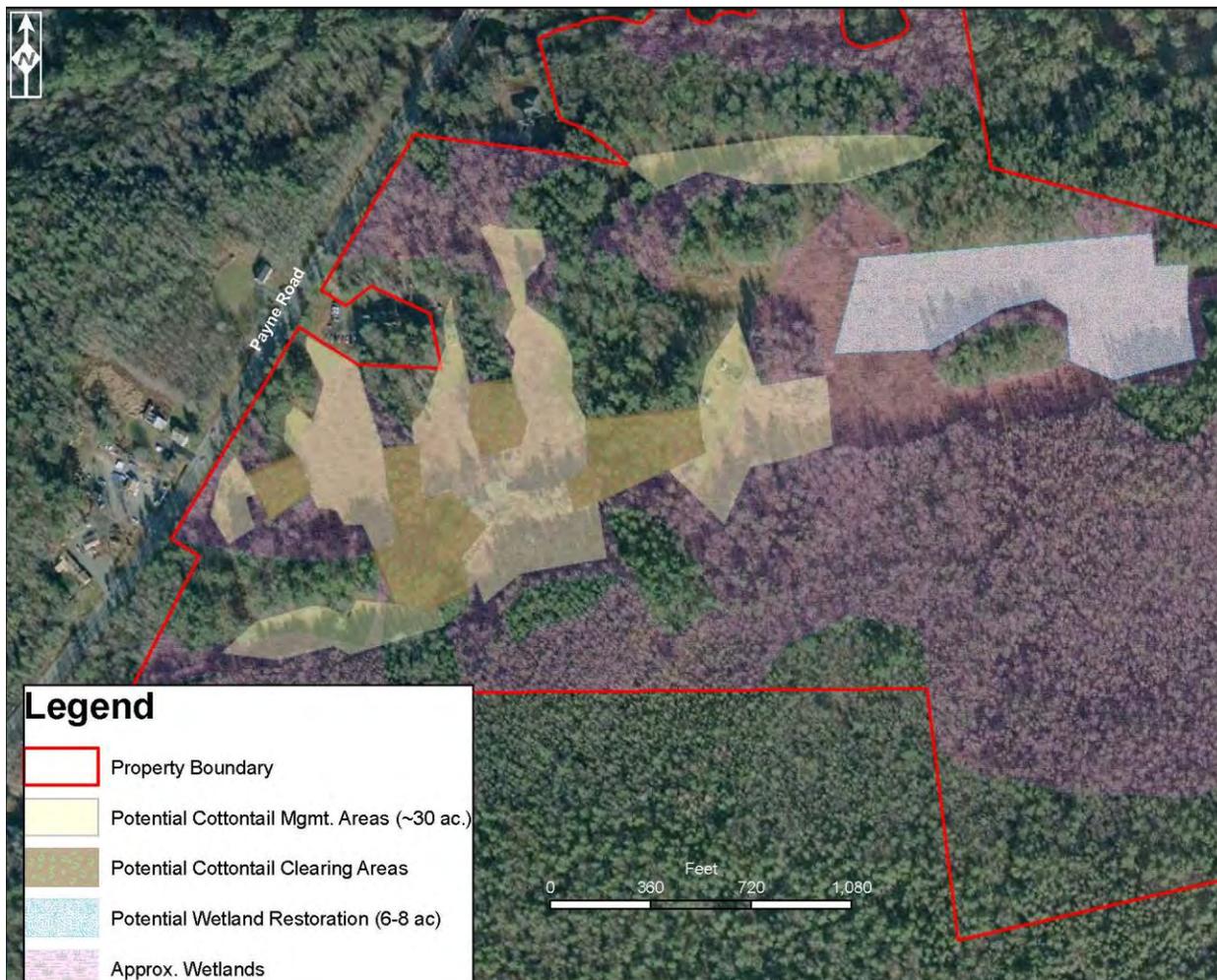


Figure 19. Depiction of potential NEC clearing and management areas in and between existing fields.

## Wetland Enhancement and Restoration in the Cleared Areas

Several of the field areas have been drained by a series of manmade, interconnecting drainage ditches and an underground culvert (or culverts). The drainages are shown in Figure 6. Plants in many of these areas, although hydrophytic (*i.e.* typically found in wetlands) are often short and stunted, reflecting perhaps an artificially shortened period of saturation exacerbated by the drainage features. Additionally, in many of these areas, it appears that much of the native topsoil has been bulldozed and removed. This is evidenced both by large topsoil piles naturalizing on the skirts of the cleared areas and an overall thin topsoil horizon found throughout portions of the fields. Due presumably to the apparent drainage, scraping, and shortened hydroperiod, some of the areas of the fields do not currently meet the three factors to be classified as wetland<sup>1</sup>. Restoring longer periods of saturation to these areas would restore

<sup>1</sup> It should be noted that federal wetland delineation guidelines allow for some drained and man-altered wetlands sites to be considered jurisdictional wetland even if they lack one or more of the factors if the alterations were not permitted and the alterations took place after the adoption of the Clean Water Act (CWA); the alterations at Warren Woods took place prior to the adoption of the CWA.

some current upland to its presumed wetland state, and enhance the existing but drying wetlands to a wetter and more productive state.

In the largest field, the field with the former Ultralight runway, it appears there is a strong potential for restoring hydrology to six to eight acres of the field through some minor tweaking of the drainage. Restoring hydrology to these wetland and former wetland areas, through blockage/destruction of some of the drains that lead off site (to the north) and through strategically-placed lateral drainages designed to spread out hydrology from currently wet areas, would restore longer periods of hydrology to a large section of the field. The plant community is already made up predominantly of wetland plants, including bog species, thus replanting would not be necessary. Instead, increasing and restoring the native hydrology in this area would help the existing plant community to thrive, eventually trending toward a thick-growing shrub bog and lowland wetland forest, dominated by ericaceous shrubs and wetland trees. This could also lead to additional NEC habitat.

Any restoration/enhancement work in this area should tread lightly and consist of as little earthwork as possible. This will accomplish two goals: first, it will help maintain the existing seed bank of wetland plants that are striving to grow in the drying fields, and it will reduce the risk of creating a lot of exposed soil – a potential breeding ground for invasive plant species. For all work areas, topsoil should be segregated and restored to any disturbed area. If an earthen dam is designed for the northern boundary of the field – *e.g.* to slow surface runoff from the field – it should be designed to serve triple-duty as an earthen dam, a level-spreader for overflow, and the base for an eventual footpath. Fill materials for any planned mounds or dams should come from the existing soil stockpiles found adjacent to the field.

Planning for this wetland restoration/enhancement project would entail an on-the-ground delineation of the jurisdictional wetland boundaries, a topographic survey of the field to determine subwatershed drainages and direction of surface flow, mapping of the existing drainage (above- and below-ground), design of long-term monitoring plan, and a detailed plan for the actual construction work.



Figure 20. Drainage pipe outlet under runway in large field.

**APPENDIX 1. NRCS Medium-Intensity Soil Survey information**



## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Units

### Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot
-  Spoil Area
-  Stony Spot

 Very Stony Spot

 Wet Spot

 Other

### Special Line Features

-  Gully
-  Short Steep Slope
-  Other

### Political Features

 Cities

### Water Features

 Streams and Canals

### Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

## MAP INFORMATION

Map Scale: 1:15,700 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 Coordinate System: UTM Zone 19N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cumberland County and Part of Oxford County, Maine  
 Survey Area Data: Version 7, Jan 8, 2009

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Cumberland County and Part of Oxford County, Maine (ME005)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Au	Au Gres loamy sand	57.3	9.4%
DeA	Deerfield loamy sand, 0 to 3 percent slopes	5.5	0.9%
DeB	Deerfield loamy sand, 3 to 8 percent slopes	0.1	0.0%
EmB	Elmwood fine sandy loam, 0 to 8 percent slopes	27.7	4.5%
HIB	Hinckley gravelly sandy loam, 3 to 8 percent slopes	2.7	0.4%
Ls	Limerick-Saco silt loams	38.6	6.3%
Md	Made land	49.2	8.0%
Py	Podunk fine sandy loam	7.1	1.2%
Sd	Saugatuck loamy sand	93.6	15.3%
Sn	Scantic silt loam	0.4	0.1%
So	Scarboro sandy loam	6.6	1.1%
Sp	Sebago mucky peat	3.2	0.5%
SuC2	Suffield silt loam, 8 to 15 percent slopes, eroded	4.9	0.8%
Sz	Swanton fine sandy loam	118.0	19.3%
WmB	Windsor loamy sand, 0 to 8 percent slopes	195.1	31.9%
WmC	Windsor loamy sand, 8 to 15 percent slopes	1.3	0.2%
<b>Totals for Area of Interest</b>		<b>611.4</b>	<b>100.0%</b>

**APPENDIX 2. List of Plants Observed During June-August Field Visits to Warren Woods Property**

Plant species observed on the Warren Woods property during summer 2012			
Form	Family	Scientific name	Common name
Trees	Betulaceae	<i>Betula alleghaniensis</i>	yellow birch
	Betulaceae	<i>Betula papyrifera</i>	paper birch
	Betulaceae	<i>Betula populifolia</i>	gray birch
	Fagaceae	<i>Fagus grandifolia</i>	beech
	Fagaceae	<i>Quercus rubra</i>	red oak
	Oleaceae	<i>Fraxinus</i> sp.	ash
	Pinaceae	<i>Abies balsamea</i>	balsam fir
	Pinaceae	<i>Larix laricina</i>	tamarack
	Pinaceae	<i>Picea mariana</i>	black spruce
	Pinaceae	<i>Picea rubens</i>	red spruce
	Pinaceae	<i>Pinus rigida</i>	pitch pine
	Pinaceae	<i>Pinus strobus</i>	white pine
	Pinaceae	<i>Tsuga canadensis</i>	hemlock
	Rosaceae	<i>Prunus serotina</i>	black cherry
	Salicaceae	<i>Populus grandidentata</i>	bigtooth aspen
	Salicaceae	<i>Populus tremuloides</i>	aspen
	Sapindaceae	<i>Acer rubrum</i>	red maple
Shrubs	Adoxaceae	<i>Sambucus nigra</i>	black elderberry
	Adoxaceae	<i>Viburnum dentatum</i>	southern arrowwood
	Adoxaceae	<i>Viburnum lantanoides</i>	hobblebush
	Adoxaceae	<i>Viburnum nudum</i> L. var. <i>cassinoides</i>	withe-rod
	Anacardiaceae	<i>Toxicodendron radicans</i>	poison ivy
	Berberidaceae	<i>Berberis thunbergii</i>	Japanese barberry
	Betulaceae	<i>Alnus incana</i> ssp. <i>Rugosa</i>	speckled alder
	Caprifoliaceae	<i>Diervilla lonicera</i>	northern bush honeysuckle
	Caprifoliaceae	<i>Lonicera</i> sp.	honeysuckle
	Celastraceae	<i>Celastrus orbiculatus</i>	Oriental bittersweet
	Cupressaceae	<i>Juniperus communis</i>	common juniper
	Elaeagnaceae	<i>Elaeagnus umbellata</i>	autumn olive
	Ericaceae	<i>Kalmia angustifolia</i>	sheep laurel
	Ericaceae	<i>Ledum groenlandicum</i>	bog Labrador tea
	Ericaceae	<i>Lyonia ligustrina</i>	male berry
	Ericaceae	<i>Rhododendron canadense</i>	rhodora
	Ericaceae	<i>Vaccinium angustifolium</i>	low-bush blueberry
	Ericaceae	<i>Vaccinium corymbosum</i>	high-bush blueberry
	Hamamelidaceae	<i>Hamamelis virginiana</i>	witch hazel
	Myricaceae	<i>Comptonia peregrina</i>	sweet fern
	Myricaceae	<i>Morella pensylvanica</i>	northern bayberry
	Rhamnaceae	<i>Frangula alnus</i>	glossy buckthorn
	Rosaceae	<i>Amalanchier</i> sp.	june berry
	Rosaceae	<i>Aronia melanocarpa</i>	chokeberry
	Rosaceae	<i>Crataegus</i> sp.	hawthorn
	Rosaceae	<i>Ilex mucronata</i>	mountain holly

Appendix 2: Plant list

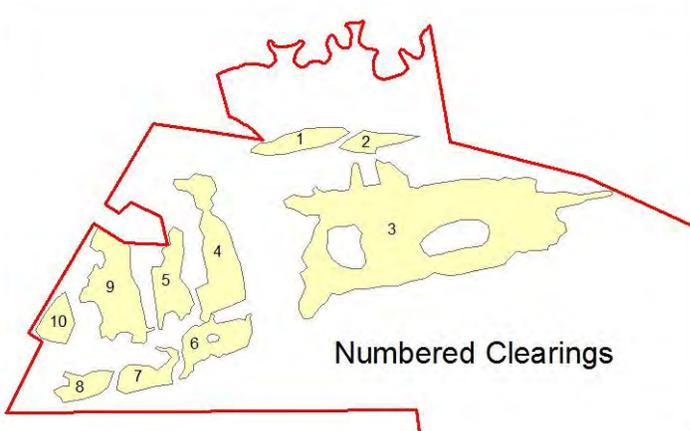
Shrubs	Family	Scientific name	Common name
	Rosaceae	<i>Ilex verticillata</i>	winterberry
	Rosaceae	<i>Rosa multiflora</i>	multiflora rose
	Rosaceae	<i>Rubus idaeus</i>	raspberry
	Rosaceae	<i>Rubus allegheniensis</i>	blackberry
	Rosaceae	<i>Spiraea alba var. alba</i>	meadowsweet
	Salicaceae	<i>Salix</i> sp.	willow
Herbaceous plants	Apiaceae	<i>Aralia nudicaulis</i>	wild sarsaparilla
	Apiaceae	<i>Cicuta maculata</i>	spotted water hemlock
	Araceae	<i>Arisaema triphyllum</i>	jack in the pulpit
	Araceae	<i>Symplocarpus foetidus</i>	skunk cabbage
	Asteraceae	<i>Achillea millefolium</i>	yarrow
	Asteraceae	<i>Aster</i> sp.	aster
	Asteraceae	<i>Hieracium aurantiacum</i>	orange hawkweed
	Asteraceae	<i>Hieracium caespitosum</i>	yellow hawkweed
	Asteraceae	<i>Oclemena acuminata</i>	whorled wood aster
	Asteraceae	<i>Solidago</i> sp.	goldenrod
	Asteraceae	<i>Symphyotrichum novi-belgii</i>	New York aster
	Balsaminaceae	<i>Impatiens capensis</i>	jewelweed
	Campanulaceae	<i>Lobelia cardinalis</i>	cardinalflower
	Caprifoliaceae	<i>Linnaea borealis</i>	twinflower
	Caryophyllaceae	<i>Arenaria lateriflora</i>	sandwort
	Cornaceae	<i>Cornus canadensis</i>	bunchberry
	Droseraceae	<i>Drosera intermedia</i>	spatulate-leaf sundew
	Droseraceae	<i>Drosera rotundifolia</i>	round-leaf sundew
	Ericaceae	<i>Epigaea repens</i>	trailing arbutus
	Ericaceae	<i>Gaultheria hispidula</i>	creeping wintergreen
	Ericaceae	<i>Gaultheria procumbens</i>	wintergreen
	Ericaceae	<i>Pyrola americana</i>	American wintergreen
	Ericaceae	<i>Vaccinium macrocarpon</i>	cranberry
	Fabaceae	<i>Securigera varia</i>	crown vetch
	Gentianaceae	<i>Gentiana linearis</i>	narrow-leaved gentian
	Iridaceae	<i>Iris versicolor</i>	blue flag iris
	Iridaceae	<i>Sisyrinchium</i> sp.	blue-eyed grass
	Lamiaceae	<i>Lycopus</i> sp.	waterhorehound
	Lamiaceae	<i>Prunella vulgaris</i>	common selfheal
	Lamiaceae	<i>Scutellaria</i> sp.	skullcap
	Liliaceae	<i>Clintonia borealis</i>	blue-bead lily
	Liliaceae	<i>Medeola virginiana</i>	indian cucumber root
	Liliaceae	<i>Polygonatum pubescens</i>	Solomon's seal
	Melanthiaceae	<i>Trillium</i> spp.	trillium, at least two species
	Monotropaceae	<i>Monotropa uniflora</i>	Indianpipe
	Myrsinaceae	<i>Lysimachia ciliata</i>	fringed yellow-loostrife
	Myrsinaceae	<i>Lysimachia terrestris</i>	swamp candle
	Myrsinaceae	<i>Trientalis borealis</i>	starflower
	Onagraceae	<i>Circaea alpina</i>	enchanter's nightshade

Appendix 2: Plant list

Herbaceous plants	Family	Scientific name	Common name
	Onagraceae	<i>Oenothera perennis</i>	little evening primrose
	Orchidaceae	<i>Calopogon tuberosus</i>	grass pink
	Orchidaceae	<i>Cypripedium acaule</i>	pink lady's slipper
	Orchidaceae	<i>Pogonia ophioglossoides</i>	rose pogonia
	Oxalidaceae	<i>Oxalis montana</i>	mountain woodsorrel
	Polygalaceae	<i>Polygala sanguinea</i>	blood milkwort
	Ranunculaceae	<i>Anemone quinquefolia</i>	wood anemone
	Ranunculaceae	<i>Clematis</i> sp.	clematis
	Ranunculaceae	<i>Coptis trifolia</i>	goldthread
	Ranunculaceae	<i>Thalictrum pubescens</i>	meadow rue
	Rosaceae	<i>Fragaria</i> sp.	wild strawberry
	Rosaceae	<i>Geum</i> sp.	avens
	Rosaceae	<i>Rubus hispidus</i>	dewberry
	Rosaceae	<i>Sibbaldiopsis tridentata</i>	three-toothed cinquefoil
	Rubiaceae	<i>Houstonia caerulea</i>	bluets
	Rubiaceae	<i>Mitchella repens</i>	partridge berry
	Ruscaceae	<i>Maianthemum canadense</i>	Canada mayflower
	Saxifragaceae	<i>Tiarella cordifolia</i>	heartleaf foamflower
	Scrophulariaceae	<i>Mimulus ringens</i>	Allegheny monkeyflower
	Solanaceae	<i>Solanum dulcamara</i>	climbing nightshade
	Typhaceae	<i>Typha latifolia</i>	cattail
	Urticaceae	<i>Laportea canadensis</i>	Canadian woodnettle
	Urticaceae	<i>Urtica dioica</i>	stinging nettle
	Violaceae	<i>Viola lanceolata</i>	bog white violet
	Violaceae	<i>Viola</i> sp.	violet
Grasses and grass-like plants	Cyperaceae	<i>Carex atlantica</i>	wiry bog sedge
	Cyperaceae	<i>Carex canescens</i>	silvery sedge
	Cyperaceae	<i>Carex folliculata</i>	sedge
	Cyperaceae	<i>Carex gynandra</i>	sedge
	Cyperaceae	<i>Carex intumescens</i>	sedge
	Cyperaceae	<i>Carex lurida</i>	sedge
	Cyperaceae	<i>Carex ormostachya</i>	sedge
	Cyperaceae	<i>Carex scoparia</i>	broom sedge
	Cyperaceae	<i>Carex trisperma</i>	sedge
	Cyperaceae	<i>Carex utriculata</i>	sedge
	Cyperaceae	<i>Eleocharis</i> sp.	spikerush
	Cyperaceae	<i>Eriophorum</i> sp.	cottongrass
	Cyperaceae	<i>Eriophorum virginicum</i>	tawny cottongrass
	Cyperaceae	<i>Scirpus microcarpus</i>	panicked bulrush
	Cyperaceae	<i>Scirpus cyperinus</i>	woolgrass
	Juncaceae	<i>Juncus</i> sp.	rush
	Juncaceae	<i>Luzula multiflora</i>	wood rush
	Poaceae	<i>Dactylis glomerata</i>	orchard grass
	Poaceae	<i>Danthonia spicata</i>	poverty oat grass
	Poaceae	<i>Dichanthelium</i> sp.	panicum

Grasses and grass-like plants	Family	Scientific name	Common name
	Poaceae	<i>Glyceria striata</i>	grass
	Poaceae	<i>Holcus lanatus</i>	velvet grass
	Poaceae	<i>Oryzopsis asperifolia</i>	rice grass
	Poaceae	<i>Phalaris arundinacea</i>	reed carary grass
	Poaceae	<i>Schizachyrium scoparium</i>	little bluestem
Ferns and fern allies	Dennstaedtiaceae	<i>Pteridium aquilinum</i>	bracken fern
	Equisetaceae	<i>Equisetum sylvaticum</i>	horsetail
	Lycopodiaceae	<i>Lycopodiella</i> sp.	bog spikemoss
	Lycopodiaceae	<i>Lycopodium annotinum</i>	bristly clubmoss
	Lycopodiaceae	<i>Lycopodium clavatum</i>	common clubmoss
	Lycopodiaceae	<i>Lycopodium digitatum</i>	southern ground cedar
	Lycopodiaceae	<i>Lycopodium obscurum</i>	princess pine
	Onocleaceae	<i>Onoclea sensibilis</i>	sensitive fern
	Osmundaceae	<i>Osmunda cinnamomea</i>	cinnamon fern
	Osmundaceae	<i>Osmunda regalis</i>	royal fern
	Thelypteridaceae	<i>Phegopteris connectilis</i>	beech fern
	Thelypteridaceae	<i>Thelypteris noveboracensis</i>	New York fern
	Woodsiaceae	<i>Athyrium filix-femina</i>	lady fern

### **APPENDIX 3. Photographs**

 <p style="text-align: center;">Numbered Clearings</p>	<p><b>The following photos of the clearings refer to their location by these numbers.</b></p>
	<p><b>Location:</b> Clearing number 1, looking east along path.</p> <p><b>Description:</b> Thick blueberries and some pine seedlings.</p> <p>2012 June 13 REJ</p>
	<p><b>Location:</b> Clearing number 2, looking west.</p> <p><b>Description:</b> The trees in the right half of this photo are a narrow stand of maples along a ditch that separates clearings 1 and 2.</p> <p>2012 July 31, KFK</p>

	<p><b>Location:</b> Clearing number 2, looking east.</p> <p><b>Description:</b> Abundant blueberries and some ferns.</p> <p>2012 July 31, KFK</p>
	<p><b>Location:</b> Clearing 3, west end looking north.</p> <p><b>Description:</b> Old buildings at end of the airstrip.</p> <p>2012 June 8, KFK</p>
	<p><b>Location:</b> Clearing 3, looking east.</p> <p><b>Description:</b> Airstrip bog.</p> <p>2012 June 21, KFK</p>



**Location:**  
Clearing 3, looking west.

**Description:**  
Airstrip bog with grass pinks.

2012 June 21, KFK



**Location:**  
Clearing 3, looking west from very end of the airstrip, near a trail that leads to the river.

**Description:**  
Low blueberries and cranberries.

2012 June 27, KFK

	<p><b>Location:</b> Clearing 3, SE corner looking west.</p> <p><b>Description:</b> Saturated, boggy area.</p> <p>2012 June 8, KFK</p>
	<p><b>Location:</b> Clearing 4, looking north.</p> <p><b>Description:</b> Blueberries and bayberry.</p> <p>2012 June 21, KFK</p>

	<p><b>Location:</b> Clearing 4, looking north.</p> <p><b>Description:</b> Low blueberries with taller patches of bayberry.</p> <p>2012 June 27, KFK</p>
	<p><b>Location:</b> Clearing 5, looking north.</p> <p><b>Description:</b> Low blueberries with taller patches of bayberry. Very similar vegetation to clearings 4 and 9.</p> <p>2012 July 31, KFK</p>
	<p><b>Location:</b> Clearing 6, looking northeast.</p> <p><b>Description:</b> Boggy area, with cattails in background.</p> <p>2012 June 8, KFK</p>

	<p><b>Location:</b> Clearing 6, looking west.</p> <p><b>Description:</b> Boggy area where drainage has failed.</p> <p>2012 June 8, KFK</p>
	<p><b>Location:</b> Clearing 6, looking east</p> <p><b>Description:</b> Thick low shrubs and red maple seedlings.</p> <p>2012 June 27, KFK</p>
	<p><b>Location:</b> Clearing 7, looking east.</p> <p><b>Description:</b> Swale with cranberries in center of photo.</p> <p>2012 June 27, KFK</p>

	<p><b>Location:</b> Clearing 7.</p> <p><b>Description:</b> Blueberries and red maple seedlings.</p> <p>2012 June 8, KFK</p>
	<p><b>Location:</b> Clearing 8, looking east.</p> <p><b>Description:</b> Sensitive fern and goldenrod.</p> <p>2012 June 27, KFK</p>
	<p><b>Location:</b> Clearing 8, looking north.</p> <p><b>Description:</b> Grassy area on north edge of clearing and extending under the trees.</p> <p>2012 June 27, KFK</p>

	<p><b>Location:</b> Clearing 9, looking north.</p> <p><b>Description:</b> Low blueberries and cranberries with taller islands of bayberry. The cars are parked at a business along Payne Road.</p> <p>2012 July 31, KFK</p>
	<p>Clearing 9, looking south.</p> <p><b>Description:</b> Tall row of white pines bordering clearings 7 and 8. Meadowsweet flowers in foreground.</p> <p>2012 July 31, KFK</p>
	<p><b>Location:</b> Clearing 10, looking south.</p> <p><b>Description:</b> Speckled alder marsh with bulrushes.</p> <p>2012 June 27, KFK</p>

	<p><b>Location:</b> North of clearings</p> <p><b>Description:</b> Tannic stream flowing to Nonesuch from ditches around clearings.</p> <p>2012 June 27, KFK</p>
	<p><b>Location:</b> Floodplain</p> <p><b>Description:</b> Floodplain woodland with red maple and sedges.</p> <p>2012 June 27, KFK</p>
	<p><b>Location:</b> Nonesuch River</p> <p><b>Description:</b> River channel with vegetated banks and overhanging trees.</p> <p>2012 July 31, KFK</p>



**Location:**

Forested wetland, south of clearings.

**Description:**

Red maple swamp, with cinnamon fern and skunk cabbage

2012 June 8, KFK



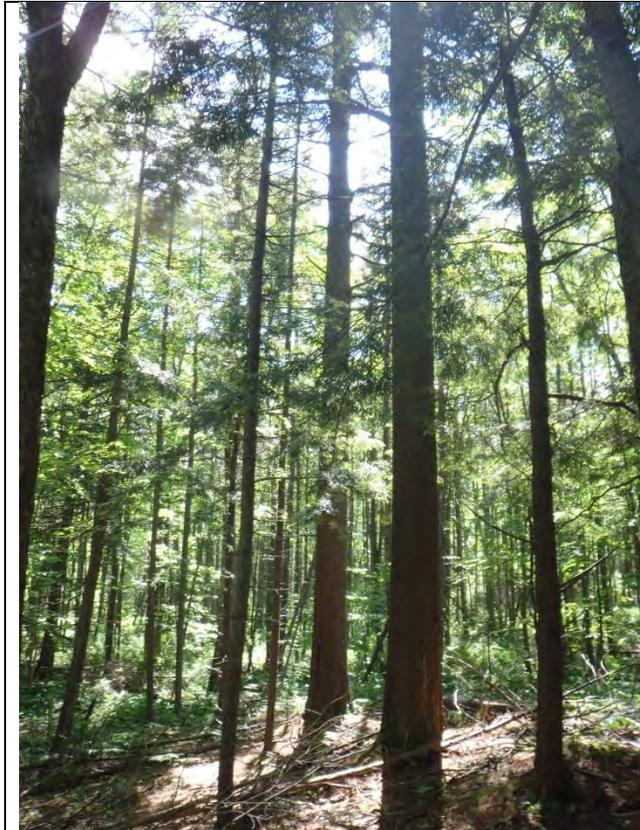
**Location:**

Not far from Payne Road, near the southern part of the road frontage.

**Description:**

Stream leading to ditch along Payne Road.

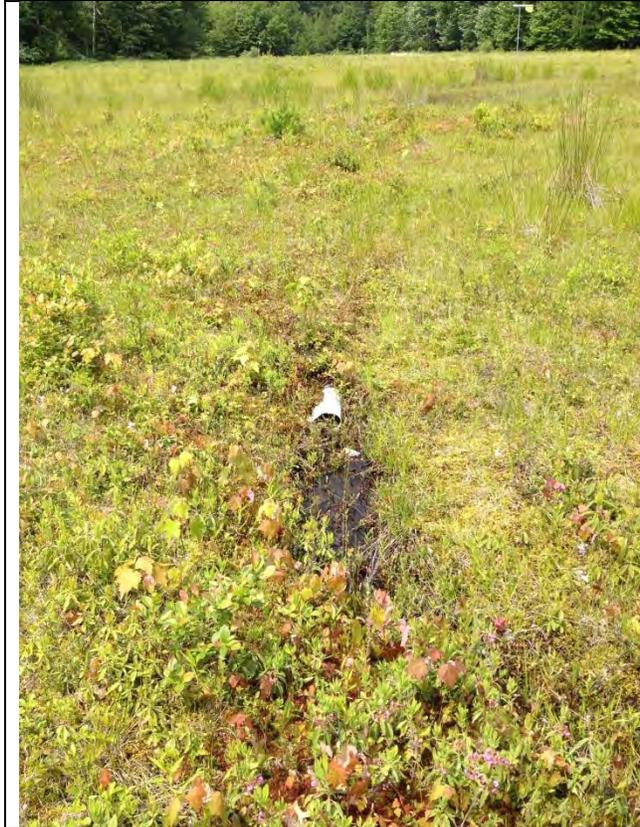
2012 June 8, KFK



**Location:**  
Near the south-central property boundary

**Description:**  
Upland grove of white pines and hemlock with ladyslippers (not pictured).

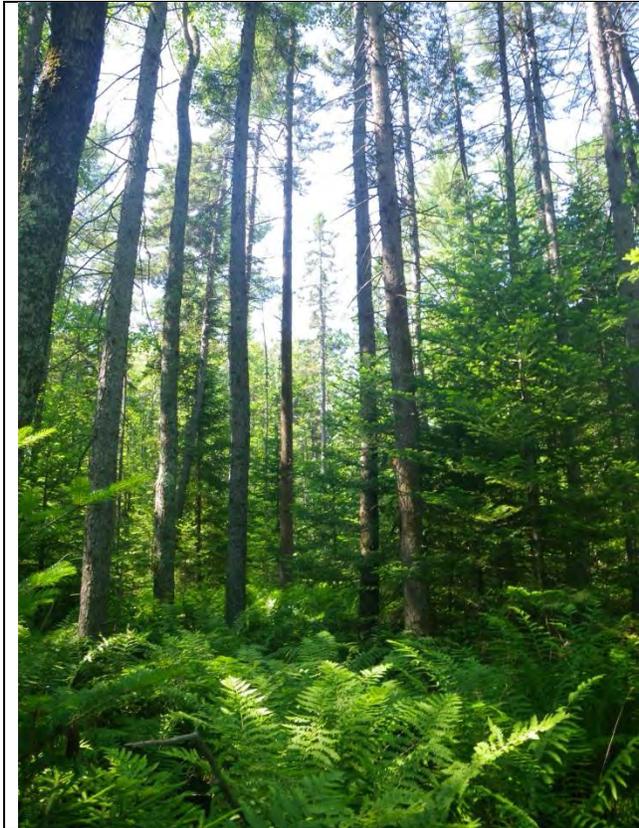
2012 June 8, KFK



**Location:**  
Clearing 3.

**Description:**  
Buried drain pipe.

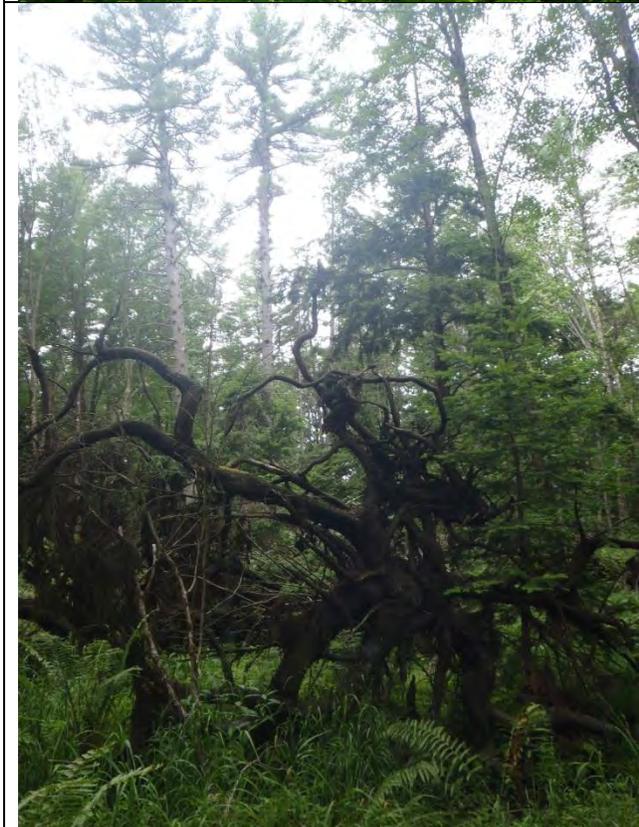
2012 June 12, REJ



**Location:**  
Forested wetland south of clearings.

**Description:**  
Black spruce swamp.

2012 June 21, KFK



**Location:**  
Floodplain

**Description:**  
Shallow roots of floodplain trees.

2012 June 27, KFK

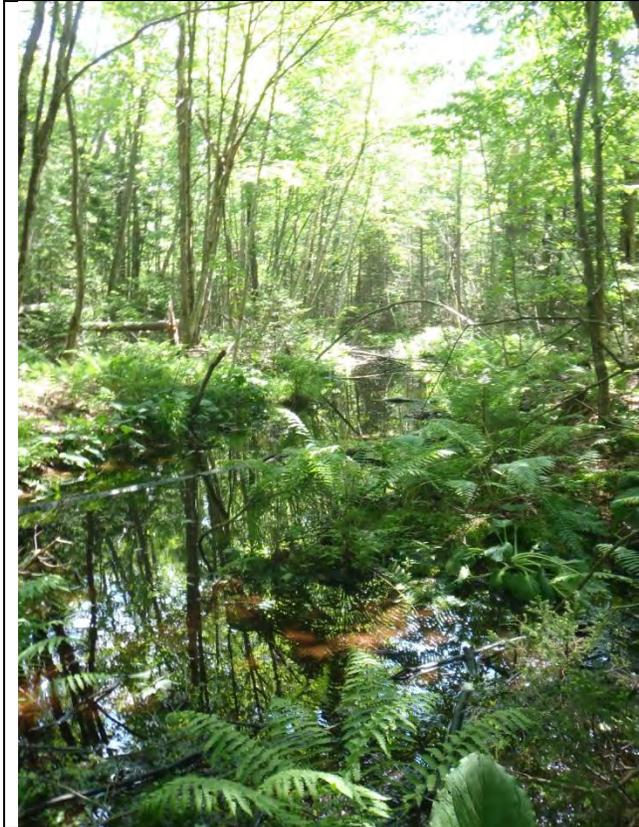
	<p><b>Location:</b> Scottow Bog</p> <p><b>Description:</b> Biologist in bog</p> <p>2012 June 12, REJ</p>
	<p><b>Location:</b> Scottow Bog</p> <p><b>Description:</b> Thick shrubs</p> <p>2012 June 12, REJ</p>
	<p><b>Location:</b> Scottow Bog</p> <p><b>Description:</b> Pitch pine bog</p> <p>2012 June 22, KFK</p>

	<p><b>Location:</b> Scottow Bog</p> <p><b>Description:</b> Pitch pine bog with cranberries and rhodora</p> <p>2012 June 22, KFK</p>
	<p><b>Location:</b> Terrace at south end of property.</p> <p><b>Description:</b> Dirt bike trail with deep puddles.</p> <p>2012 June 12, REJ</p>



**Location:**  
Scottow Bog  
**Description:**  
Cranberries on Sphagnum lawn in pitch pine bog

2012 June 28, KFK



**Location:**  
Forested wetland south of clearing 3.  
**Description:**  
Potential vernal pool 3, stagnant ditch.

2012 June 8, KFK



**Location:**  
Near edge of terrace, north of Scottow Bog.

**Description:**  
Terrace dry forest, with pine, red oak and blueberries.

2012 June 27, KFK



**Location:**  
Between the southern ends of clearings 3 and 4.

**Description:**  
Potential vernal pool 1. Wood frog tadpoles were observed at the time of this photo.

2012 June 12, KFK



**Location:**  
SW corner of property, close to Payne Road.

**Description:**  
Potential vernal pool 2, tadpoles present.

12 June 27, KFK



**Description:**  
Pink ladyslipper orchids  
*Cypripedium acaule*

2012 June 8, KFK



**Description:**  
Grass pink orchid  
*Calopogon tuberosus*

2012 June 21, KFK



**Description:**  
Bunchberry, cinnamon fern and red oak  
seedlings.  
*Cornus canadensis*  
*Osmunda cinnamomea*  
*Quercus rubrus*

2012 June 8, KFK



**Description:**  
Round-leaf sundew  
*Drosera rotundifolia*

2012 June 8, KFK



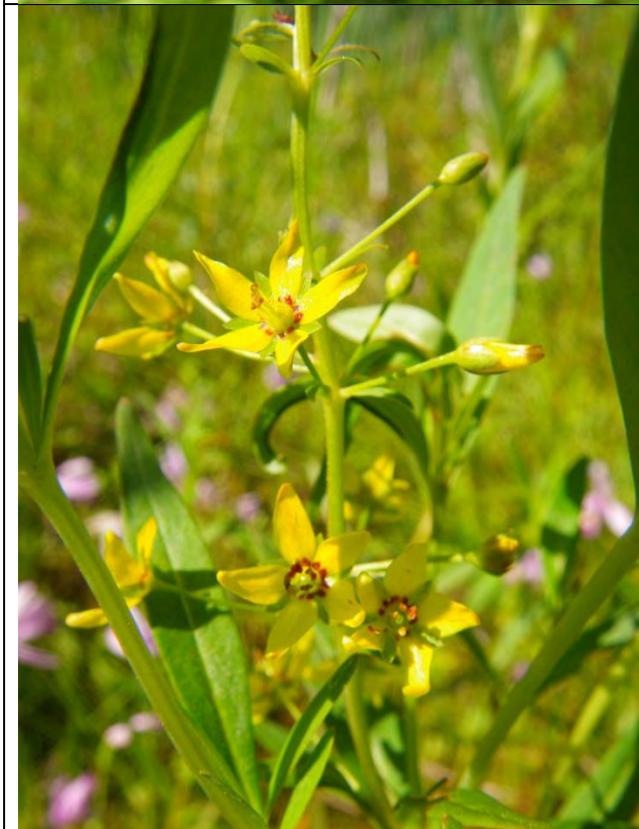
**Description:**  
Spatulate-leaved sundew  
*Drosera intermedia*

2012 June 21, KFK



**Description:**  
Rhodora  
*Rhododendron canadense*

2012 June 12, KFK



**Description:**  
Swamp candle  
*Lysimachia terrestris*

2012 June 21, KFK



**Description:**  
Sheep laurel  
*Kalmia angustifolia*

2012 June 8, KFK



**Description:**  
Cardinal flower along Nonesuch River  
*Lobelia cardinalis*

2012 July 31, KFK



**Description:**  
Cranberry  
*Vaccinium macrocarpon*

2012 June 21, KFK



**Description:**  
Bog spikemoss  
*Lycopodiella* sp.

2012 June 21, KFK



**Description:**  
Tamarack along south edge of airstrip  
clearing.  
*Larix laricina*

2012 July 6, KFK



**Description:**  
Indianpipe  
*Monotropa uniflora*

2012 July 6, KFK



**Description:**  
Bog copper butterfly  
*Lycaena epixanthe*

2012 June 27, KFK



**Description:**  
Dragonfly

2012 June 27, KFK



**Description:**  
Dragonfly

2012 June 12, KFK



**Description:**  
Damselfly adult emerging

2012 June 8, KFK



**Description:**  
Calico pennant dragonfly  
*Celithemis elisa*

2012 June 28, KFK



**Description:**  
12-spot skimmer dragonfly  
*Libellula pulchella*

2012 July 6, KFK



**Description:**  
Wood frog tadpoles from potential vernal pool number 1.

2012 June 12, KFK



**Description:**  
Soil core from near Scottow Bog.

2012 June 12, KFK



**Description:**  
Soil core from Scottow Bog.

2012 June 12, KFK



**Description:**  
Moose skull from forested wetland south of clearings.

2012 June 12, KFK