Natural Resource Inventory

Conservation Lands, Sears Island
Searsport, Maine

For:
Friends of Sears Island
c/o Marietta Ramsdell
PO Box 222, Searsport 04974
Ph. 207 548-0142 mramsdell4@roadrunner.com

By:

Alison C. Dibble, Ph.D.
Stewards LLC
P.O. Box 321
Brooklin, ME 04616
Ph. 207 359-4659 adibble2@gmail.com

Jake Maier
JM Forestry
6 Lower Falls Road
Orland, ME 04472
Ph. 207 469-0231 j.m@jmforestry.com
http://jmforestry.com

18 January 2011

SUMMARY

During the growing season in 2010, Stewards LLC and JM Forestry conducted at Sears Island a natural resource inventory of the new 601-ac conservation easement, held by Maine Coast Heritage Trust. This is located in the lower Penobscot River in Searsport, Waldo County, Maine. As of the 1970s, several large industrial development schemes were proposed for Sears Island. Since the 1990s the island has belonged to the state of Maine. A paved causeway constructed in the 1980s provides year-round access to a gate at the north end of the island. In January 2009 the Friends of Sears Island (FOSI), a nonprofit organization, assumed responsibility for stewardship of the conservation area and this inventory is part of the management planning process. A 70-acre portion of the conservation area includes a vernal pool and a potential building site intended for a future education/ visitor center. The remaining acreage is former farm fields, mature and successional forest, wet forest, streams, and tidal shore. An archaeological site at the north end of the island was documented with an extensive report in 1983. Historic land uses included agriculture and seasonal residences, but no structures remain. Today, non-motorized four season recreation, especially walking and bicycling, are the main uses, with authorized vehicular access for management of natural resources and a communications tower.

We used standard methods of field survey to provide baseline information for the management plan. We recognized six natural communities, of which one, the Coastal Dune Grassland, is ranked S2, state rare, and is especially vulnerable to sea level rise. We found 267 plant species, none of which is listed as rare. Sixty two species are nonnative, and of these 8 are invasive, including Japanese barberry, Oriental bittersweet, and purple loosestrife. Other weedy plants can also be problematic. Condition of the vegetation is good, despite some evidence of insect pests and disease, and presence of invasive plants. Large trees are valuable as wildlife habitat and can be points of interest along existing trails. Management considerations include especially the control of invasive plants, for which we recommend a program of management activities and monitoring, most of which can be done by volunteers. Persistent, ongoing efforts could help assure that native vegetation will continue to dominate the island. Some mature stands should be left alone as wildlife habitat. There is potential for sustainable timber harvest in some other areas, perhaps as part of a demonstration. The north field and homestead openings require mowing if they are to be retained as early successional habitats. Fern meadows could persist for many years as openings but appear to be minimally used by wildlife. Each of numerous ravines and gullies has a unique plant assemblage and microhabitats; because of slope and erodible soils, any trails should not be routed near them except perhaps out along the rocky shoreline. An emergency plan is needed given that maritime traffic, large oil tanks, and chemical manufacture are nearby. We established ten monitor plots to enable following of major changes over time. We conclude that potential is excellent at Sears Island for a sustainable balance between the (1) protection of biodiversity, physical features, and other aesthetic qualities, and (2) various types of low impact recreation intended by the FOSI. This report includes data stored in a GIS, with maps of the communities, soils, geology, topography, drainages, sensitive features, and points of interest. Many high-resolution digital images accompany the report on DVD.

Cover illustration: V*iew toward the Penobscot River from within a gully at the east shore of Sears Island, 2 June 2010, A.C. Dibble photo*

TABLE OF CONTENTS

Introduction	1
Methods	1
Results, in the form of a Landscape Analysis	3
Land use history	4
Archaeological site	4
Historical land use	4
Current land uses	4
Topography, drainage, and watershed	5
Geology	5
Soils	6
Vegetation, overview and species diversity	6
Natural communities	6
Rare plants	9
Wildlife habitats	9
Management Concerns and Threats	10
Management Recommendations	11
Conclusions	15
Acknowledgments	16
References Cited	16
Table 1. Soils at Sears Island – highlights from descriptions of Hedstrom (n.d.)	17
Table 2. Natural communities, their dominant vegetation, and how they differ at Sears Island from descriptions in Gawler and Cutko 2010.	22
Table 3. Natural communities, their state rank, threats at Sears Island, and potential rare plants and animals associated with them elsewhere but not yet found at Sears Island.	25
Figure 1. Locator map and Google Earth overlay of Sears Island.	26
Figure 2. Natural communities and other vegetation types	28
Figure 3a. Topography, drainage and wetlands (includes gullies and vernal pools.)	30
Figure 3b. National Wetlands Inventory map.	32
Figure 4. Bedrock geology based on Osberg et al (1985)	34
Figure 5. Soils (see also Table 1)	36
Figure 6. Special or sensitive features, wildlife habitat features, unusual plant diversity	38
Figure 7. Management concerns and representative populations of invasive plants, wells, dumps, monitor points, photo points	40
Figure 8. Trails, features of interest for recreation	42
Appendix I – Recommendations for control of invasive plants	44

Appendix II – Vascular plants observed during the inventory	46
Appendix III – Incidental observations of animals	54
Appendix IV – Incidental observations of lichens, liverworts, and mosses	56
Appendix V – Data for 10 monitor points, and table of coordinates – latitude and longitude -- for locations of 15 photo points (which have photos only, no data)	58
Appendix VI – Database entries provided by Maine Department of Inland Fisheries and Wildlife regarding wildlife and habitat features at and near Sears Island, in a map.	69

Introduction

Sears Island is a 936-ac island off the west shore of the Penobscot River, in Searsport, Waldo County, Maine. It has belonged to the state of Maine since the 1990s. Prior to that, it was owned by various private owners, including the Bangor and Aroostook Railroad, and was used mostly for farming and hunting. Since the 1970s the island has been proposed for industrial development, including a nuclear power plant, a liquefied natural gas terminal, and as a site for one of a trio of cargo ports. A paved road, now called Sears Island Road, was built in the 1980s to an intended port site on the western shore. Also at this time a mitigated wetlands and a stump dump were built. A survey was finalized June 25, 2008 (see locator map and aerial photo in Fig. 1). In January 2009, 601 ac of the total were protected under a conservation easement held by the Maine Coast Heritage Trust. Also at that time, Maine Coast Heritage Trust designated the Friends of Sears Island (FOSI), a non-profit organization, to be primary stewards supporting sustainable management of the Conservation Area. Members of the FOSI envision a small education/visitor center within 25 ac near the northeast end of the island, and the group is working to ensure appropriate public use for the Conservation Area. A portion of the 601-ac area is at the northwest part of the island, on the west and north sides of Sears Island Road, and does not extend to the shore (this area is referred to in accompanying photo labels as the "Northwest Sector"). The remaining 335 ac have been reserved for the State of Maine.

In March 2010, the FOSI contracted Stewards LLC and JM Forestry to conduct a natural resource inventory for the newly protected Conservation Area. Their stated purpose for the NRI is "…to augment and update the existing data on plant and animal habitats for the purpose of developing a management plan for sustainable recreational and educational uses (e.g., creation and/or relocation of trails, construction of a visitor/education center); to provide baseline data for future monitoring, especially of sensitive areas." The inventory includes the 601-ac Conservation Area only. We documented the vegetation, its diversity and condition, and sought any rare plants, unusual habitats, representative populations of invasive plants, wildlife habitats, features of interest, and management concerns. Emphasis was placed on protecting key ecological features while allowing the public appropriate types of recreation so that human enjoyment of the island has minimal negative impact. We were alert to opportunities to leave some relatively less-disturbed forest alone as wildlife habitat, and wondered if a major trail is too close to a vernal pool. Management challenges such as invasive plants and sustainability of ecological features were a priority. A secondary goal was to develop recommendations for safe, enjoyable recreational and educational uses of the property that might help the FOSI carry out their mission while attracting new members and providing enrichment to the public. Marine biota were not a focus of this survey; reports on marine aspects at Sears Island are summarized by the Maine Natural Area Program, or MNAP (2007).

Methods

We used standard methods that we have used in numerous other natural resource inventories in Maine. In preparing field observations, we included meander surveys, transects at the longest and widest parts of the property, and trails and boundaries, which we walked one or more times. Field work began with detailed study of aerial imagery as a starting point for locating boundaries of distinct natural communities and other vegetation types. From this, we formulated hypotheses that we tested on the ground throughout the property, though we did not cover every square foot

of ground. We made plant lists as we proceeded, and prepared lists by natural community or other vegetation type. We used two Garmin Cx60s handheld GPS units to record waypoints and tracks. We also used aerial photography in combination with the GPS function on a smartphone to pinpoint our location for immediate access to Google Earth imagery when questions arose in the field.

Personnel involved in the inventory were Dibble and Maier, assisted by subcontractors Georgia Hall (June 19, Aug 24), who prepared plant lists for open habitats, and Sheila Heneise (Aug 6), who helped set up a monitor plot and who queried state agencies for the project. Keith Dibble volunteered his time in assisting with a monitor point. We visited the property on April 8 (ACD, JM), May 10 (ACD, JM), June 2 (ACD, JM), June 18 (ACD, Georgia Hall), Aug 6 (ACD, Sheila Heneise), Aug 24 (Georgia Hall), Sept 11 (ACD), Oct 5 (ACD) and Oct 10 (ACD, Keith Dibble). We visited many times over the growing season so that (1) vernal pools could be recognized from chorusing amphibians and egg masses, and their management issues could be addressed, (2) early, mid- and late-flowering plants could be documented, and (3) visitor use could be assessed with regard to ecological features. All habitat types on the property were investigated and representatives of each type were documented with monitor points, vegetation data and photos. Because invasive plants were found, we prepared a list of such plants with some basic management recommendations (Appendix I). The overall plant list (Appendix II) was prepared by natural community and by other features such as openings, gullies, roadsides and trails. Plant names follow the Natural Resource Conservation Service nomenclature as found in 2010 at http: www.usdaplants.gov, and *The Flora of Maine* (Haines and Vining 1989), and the upcoming Flora Novae-Angliae (www.arthurhaines.com/flora_novae_angliae.htm*)* according to widely accepted use of such names by Maine botanists. Incidental observations of animals (Appendix III), and of common lichens, liverworts and mosses (Appendix IV) are included in this report. Monitor points were established so that comparisons can be made over time regarding obvious changes in vegetation (locations in Fig. 7; data in Appendix V). Concurrent with field observations, we gathered data from state agencies relevant to the land use history, topography, soils, wetlands, rare species or natural community types (Maine Natural Areas Program database), and significant wildlife habitats (Maine Department of Inland Fisheries and Wildlife, map in Appendix VI).

At the startup of the project, Heneise queried MNAP, Maine Department of Inland Fisheries and Wildlife (MDIFW), and the Maine Historic Preservation Commission (MHPC) regarding records in the state databases for rare plants or natural communities, listed wildlife and sensitive habitats, and archaeological sites, respectively. MNAP reported on 18 May 2010 by email that "There are no MNAP features …at the gps point you indicate" (Lisa St. Hilaire, Information Manager, Maine Natural Areas Program, 17 Elkins Lane, 93 State House Station, Augusta, ME 04333, lisa.st.hilaire@maine.gov, (207) 287-8046, (207) 287-8040 FAX). She included a copy of a report we cite as MNAP (2007), along with reconnaissance data for two points that fall within the Conservation Area.

The response from the MDIFW (Mr. Steve Timpano, MDIFW, 270 Lyons Rd., Sidney, ME 04330) was in the form of a hard copy map (Appendix VI) indicating a bald eagle nest site east of Sears Island at Cape Jellison, and a ribbon snake report from Sears Island, located east of the North Meadow.

From MHPC, Mr. Kirk F. Mohney, Deputy State Historic Preservation Officer, wrote on 7 July 2010, "Regarding prehistoric and historic archaeological resources, please see the enclosed book on Sears Island which contains all the information that is known for that site [this is Speiss and Hedden 1983]…Regarding above ground architectural resources, I have concluded that there are no National Register listed or known National Register eligible properties on or adjacent to (the site). However, no architectural survey of the project (area) has ever been conducted. We would recommend soliciting comments from local historical societies or other interested parties regarding the presence of historic structures in the project area." (For further assistance contact Ms. Robin Stancampiano, Maine Historic Preservaton Commission, 55 Capitol Street, 65 State House Station, Augusta, ME 04333 Ph. 207- 287-2132).

We delineated natural communities using Gawler and Cutko (2010), with additional types where human activity has led to development of some recognizable category (e.g., field). Any special features such as rare plants, invasive plant populations, unusual or representative habitat features, patches of diseased or insect-infested trees, or other points of interest were integrated into the GIS. Additional aspects of the vegetation were included. For nonnative invasive plants, representative populations were georeferenced, and we prepared recommendations, by species, for approaches to control them, with emphasis on nontoxic control. There could be some patches of invasive plants that are not reflected in our maps; we did not provide a 100% inventory. Observations regarding tree regeneration, tree health, weather-related conditions (ice damage) and habitat features such as legacy trees were recorded. We georeferenced wildlife habitat features that we happened upon such as large snags, logs, dens, and productive mast trees, but again, this inventory is representative, not comprehensive. We sought any American beech free of disfigurement from beech bark scale disease.

To facilitate future monitoring we established ten georeferenced circular monitor points (Fig. 7), mentioned above. We sought to site these in the major natural communities and vegetation types (mapped in Fig. 2). Each is 24 ft in radius (estimated), with dominant plants recorded by percent cover and a complete plant list noted. We measured the largest trees for each species on some of these monitor points. The design for the monitor points is modified from the Forest Health Monitoring Program of the U.S. Forest Service. Monitor points include photos in four cardinal directions, a description of conditions, notes about threats, and management recommendations. Data are in Appendix V. Fifteen photo points were also established to facilitate monitoring; most of these consist of four photos – one in each cardinal direction – at a georeferenced point, but no accompanying data (locations shown in Fig. 7, and coordinates given in Appendix VII). Photo point 15 consists of one photo only.

Maps were prepared using ArcMap (© ESRI), including overlays on aerial imagery dated 20 May 2004 and available from Web Mapping Services (WMS) online at http://www.maine.gov/geolib/wms.htm. We included wetlands, soils, and other features mapped by the USDA Soil Survey, and features and boundaries based on our field observations. These are presented as boundaries (Fig. 1), natural communities (Fig. 2), topography, drainages and wetlands including vernal pools (Fig. 3a and 3b), bedrock geology (Fig. 4), soil drainage classes (Fig. 5), special features including legacy trees, wildlife habitats, and unusual plant diversity (Fig. 6), management concerns including wells, farm dumps, and representative populations of invasive plants, with 10 monitor points and 15 photo points (Fig. 7), and trails and other recreation features (Fig. 8). We included units in metric on maps, and to increase user-access, in

English for areal sizes, elevation, and tree dimensions. The format of this report approximately follows an outline developed by staff at Coastal Mountains Land Trust.

LAND SCAPE ANALYSIS

Land use history – Archaeological studies from the early 1980s indicate that Sears Island, sometimes referred to as Wassumkeag, was used seasonally by Native Americans who fished off the bar upon which the causeway has been constructed (Spiess and Hedden 1983). Details and discussion of historical land use are provided by Spiess and Hedden (1983, see especially pp. 8-16), and by MNAP (2007), and will not be summarized here. We found abundant evidence of farming activities, especially toward the northern end of Sears Island where stone walls were built of granite erratics, which are boulders moved from elsewhere especially from the northeast by the last glacier. The size of stones – few larger than about 3 feet long or high -- made into walls suggests that oxen or horses might have been used to move stones out of plowed fields. Today those fields are largely grown up to mid-successional forest. Wells are present at several homestead sites at the northeast and southern end of the Conservation Area. Softwood stumps, and stump sprouts – multiple trunks arising from a single base of a maple, birch or oak – can be found throughout much of the forest, especially at the northern end; these suggest frequent entry for harvest of firewood and timber over the past century. Possibly at one time most or all of the forest was cut off; this was typical along the coast especially in the mid 19th century at the height of the lime industry, when fuelwood for the lime kilns in the Rockport area was in high demand (Grindle 1971). Historical use also includes summer homes and camps from the mid 1800s well into the 1900s. No structures remain from these earlier farms and summer residences, though most cellar hole locations have been identified by the FOSI and some have been assigned names based on ownership records and historical accounts.

In the 1970s the Sears Island Dry Cargo Terminal was proposed for development at Sears Island. In 1988, a causeway was constructed that connected Kidder Point to the northern end of the bar at Sears Island. In conformance with requirements of the National Environmental Policy Act, as preparation for construction of the intended cargo port in the early 1990s, Normandeau Associates, Environmental Consultants, were hired to conduct a baseline inventory of marine resources (Normandeau Associates 1994a). The concentration of observations were at the northwest shoreline of Sears Island. Normandeau Associates also prepared a baseline wildlife and wetland study (Normandeau Associates 1994b). The high intensity study area in that report is located in the vicinity of Monitor Point 10 (Fig. 7) of this study. A low intensity study area in that report is near the north end of the Loop Trail (see Fig. 27 in Normandeau Associates 1994b). A rare plant, seabeach sedge (*Carex silicea)*, was reported by Normandeau Associates 1994b (Fig. 27) at the Coastal Dune Grassland on the northeast shore. Additional valuable information about the history, biota, and physical features at Sears Island was compiled by Lisa St. Hilaire (MNAP 2007). We used her report and others cited here to develop this inventory in light of what had already been studied on the property.

Current use includes (1) commercial access along the Tower Road to maintain the communications tower at the southeast end of the island, and (2) recreation at the Sears Island Road, at trails restored and maintained by the FOSI, and on beaches and surrounding waters. Recreation activities include: hiking, bicycling, horseback riding, beach use, cross country skiing

and snowshoeing, hunting, clamming, kayaking, dog walking and wildlife observation. During the growing season in 2010, the FOSI erected a kiosk near the recently built steps to the shore at the north end of the Homestead Trail. A portable toilet at the gate, provided by the Town of Searsport, and other improvements by the FOSI are appreciated by the visitors. Trash is minimal, and there appear to be few complications arising from multiple users. No unauthorized motorized vehicles are allowed. Camping and fires are not permitted.

Topography and watershed features – the property is entirely within the Penobscot River drainage, where Sears Island is a prominent feature near the mouth of the river and head of Penobscot Bay. With Cape Jellison, Sears Island protects the harbor at Stockton Springs. Topography (Fig. 3a) is more-or-less flat with the highest elevation at 200 feet on the Tower road south of the center of the island. Another high point is along the northwest boundary of the Conservation Area in the Northwest Sector. There are steep bluffs more than 75 feet high at the southwest and west shore. These are mostly wooded and are too steep for hiking trails. They are interrupted occasionally by ravines and gullies (Fig. 3a, numbered for easy reference), which we recognized as a special type of feature in the Conservation Area.

Drainage classes are shown in Fig. 3a. Rain and meltwater run off to the shore in gullies, which are most numerous at the west shore. Though the gullies are riparian they are not dominated by wetland plants. A permanent stream (see solid blue line in Fig. 8) is at the northwest end in a section separated from the rest of the Conservation Area by the Sears Island Road. A culvert at the road enables water to flow northwestward into that stream. Numerous temporary streams are also present (dashed lines in Fig. 8), and some of these enter the Penobscot River at the gullies. Wetlands consist of conifer-dominated wet forest, seeps, gullies, two vernal pools -- one is in a foundation of an old homestead -- and a stream. Alder thickets are on moist ground and could qualify as forested wetlands.

The National Wetland Inventory (http://137.227.242.85/wetland/wetland.html; see Fig. 3b) includes 11 wet areas, including a mitigated wetland built in the 1990s in response to a suit brought by the Sierra Club. We have called this mitigated wetland the South Opening; it is located at the west side of the Tower Road about a third of the way from the south tip of the island. Two of the eleven wetlands are in the state reserved area. No riparian wetlands are mapped or indicated as such. An estuarine wetland completely surrounds Sears Island.

Geology was interpreted from the bedrock geologic map of Maine (Osberg et al 1985; see Fig. 4), with guidance from Henry N. Berry of the Maine Geologic Survey. The bedrock, called Penobscot formation, is dominant in coastal Waldo Co. and is mapped for Moody Mountain and other mountains in the vicinity from the Penobscot Narrows Bridge south into Camden. This Ordovician metamorphic rock contains iron and sulfites; in some places it may have considerable graphite and thin layers of granite that enable break up into thin slabs. The rock appears reddish in some places, but can weather to gray or blackish depending on the graphite content. The bedrock has an acidifying effect on soils. Also possible are intrusions of gneiss, schist and marble. We found no examples of exposed bedrock at Sears Island. Glacial erratics on the property are few and appear to be mostly a somewhat fine-grained, light-colored granite. We saw a few boulders of quartzite (example at stone wall, see Fig. 8). The surficial geology is shown as thin drift and till.

Soils – Twenty soils are mapped for Sears Island based on the online USDA Soil Survey mapping facility, which allows estimation of area occupied by each soil type (Table 1, Fig. 5). Descriptions for soils are summarized from Hedstrom (n.d.) which provides additional detail. Only Masardis Variant fine sandy loam forms an extensive deposit in the vicinity of Tower Road and the mitigated wetland. Other types are present in patches up to about 50-ac, while some are only in small patches. Most are best-suited to woodland, though a few are suitable for agriculture, especially pasture but not row crops. Erosion hazard for most soils is indicated as only slight to moderate, but in a few cases is severe (e.g., Marlow fine sandy loam, Tunbridge-Lyman complex). Depth of the soils may be atypical for coastal Maine, given that we saw no exposed bedrock. This suggests that tree growth may benefit from unusually deep root penetration, compared to other coastal sites, in some places. Conifers on wet soils have exposed roots lying over the ground suggesting that the soils do not uniformly drain well. This can be problematic for trail maintenance because exposed roots are subject to injuries that become points of entry for disease.

Vegetation – Sears Island is largely forested with native trees, shrubs and understory plants. The vegetation reflects land use since early settlement with cutting of trees for fuel, timber, and to make openings for growing crops and for pasture. The forest that has grown back probably differs from the presettlement forest in most parts of the island in tree composition and stand age. However, there are stands currently on the property that suggest similarities to a forest that could have been seen by the first settlers upon their arrival in the late 1600s or early 1700s. We lack any records about that forest, but assume there were similar types to those found today, especially the Maritime Spruce-Fir Forest. Numerous large oaks and spruce continue to stand today despite storms, fire, insect pests, disease, and harvest activities.

We found 267 plant species at Sears Island (Appendix II), of which all but 62 are native. The number of species found in more than 600 acres represents moderate to good diversity of native plants. The habitat with the highest number of species is roadsides and trails. No listed rare plants were seen. Of the 62 nonnative plants, most are not considered pests, but 8 are known invasive plants and one, bull thistle, is a noxious weed. Some of these, such as Japanese barberry, Oriental bittersweet, and purple loosestrife, require active control as a top management priority or they will spread and outcompete native vegetation, with potential to overtake the forest or dune grassland. Invasive plants can be subtle features, defying even the alert botanist. Until recently European tufted hairgrass was not recognized as a nonnative invasive plant; this species can spread in moist ground in the shade in coastal Maine and should be dug out if possible. Other weedy, nonnative grasses including fine-leaved sheep fescue – which is common along roads and in the open fields -- and reed canarygrass at the southwest shore, are not easily controlled. Efforts to pull or dig them out could be fruitless or might even exacerbate erosion. These two species might be limited in the impacts they could have on surrounding vegetation as they do not usually form dense patches in shady forests in midcoast Maine. A native plant that presents a safety issue is cow parsnip (*Heracleum maximum*), which is abundant near the causeway gate. The juice of this plant contains a phytotoxin that in the presence of sunlight on the skin of susceptible people can cause a poison-ivy like reaction and even scarring.

Almost all the trees are native, with two noteworthy exceptions – apple, which is not native in Maine, and an introduced cherry that attains tree height and is dominant in the tree canopy at the northwest boundary near and along Sears Island Road. The leaves of the cherry resemble those of *Prunus padua*, European bird cherry, but the tree is larger and the bark lighter in color

(grayish-tan) than for that species. The underside of the leaves has a double row of rusty hairs along the midvein; this feature is present in native black cherry, *Prunus serotina*. There could be dozens of possibilities for identification of this plant; for this report we refer to it as Avian or bird cherry. It presumably attracts birds and other wildlife when its fruits are ripe, and could have valuable timber but its ability to persist and spread suggests its potential as an invasive plant.

Condition of the vegetation – The vegetation is largely in good to excellent condition. There are many signs of past land use, including tree harvesting, which is evident in the presence of some old cut stumps and an abundance of stump sprout hardwoods, which are recognizable by multiple trunks arising from a single base. The vegetation could be influenced by the populations of nonnative invasive plants, and there are impacts to balsam fir due to a nonnative insect pest, the Balsam Woolly Adelgid (*Adelges piceae*), of central Europe, a tiny sucking insect that can kill a large balsam fir tree in just a few years and that also impacts fir seedlings. We saw too few American beech to suggest that there are any free of beech bark scale disease, a disease complex that is prevalent in eastern Maine. Native understory plants appear to be thriving in the mesic soils. Some ferns are doing especially well, including the hay-scented fern (*Dennstaedtia punctilobula*), which fills the understory in openings that might have been remnant old fields from earlier times. This fern is thought to be allelopathic, meaning it produces a chemical inhibitor that reduces competition from other plants by reducing seed germination rate and growth within its sphere of influence, especially its root zone and its blanket of rotting leaves. Fern meadows dominated by hay-scented fern are likely to remain as such for many years. Their habitat quality for wildlife is questionable because hay-scented fern is probably a poor food for deer and other animals.

NATURAL COMMUNITIES – According to descriptions of Gawler and Cutko (2010), six natural communities are prominently represented in the vegetation at Sears Island. We recognized an additional four vegetation types which are not considered natural communities but are obvious on the landscape. All are summarized in Table 2, along with the ways in which they might differ from descriptions of Gawler and Cutko (2010). State rank, potential threats at Sears Island, and potential rare plants and animals that have been found in these communities elsewhere (though not yet at Sears Island), are in Table 3. At Sears Island, the types include the following:

Maritime Spruce Fir Forest – attains especially fine mature development in several places, including the Northwest Sector, the south section north of the Tower, and patchily elsewhere. Trees might be about 200 years old in some places, based on our experience with coring red spruce in other projects (e.g., Dibble et al 1999). We did not core trees at Sears Island. Invasive plants are not present, the forest floor is carpeted with bryophytes in a characteristic assemblage, and in all the condition of the community is excellent.

Northern Red Oak - Northern Hardwoods – this represents some of the oak-dominated stands on the property. In most cases, it appears that the community has grown back on cutover forest, but the forest composition and closed multi-strata canopy are good habitat and a fine feature at Sears Island.

Hardwood Seepage Forest – this community at Sears Island is given by Gawler and Cutko (2010) as an example of the type. We identified vegetation at the south end of the island as fitting this type, though we saw it in patches and not as a contiguous unit. It is threatened at Sears

Island by rapid spread of nonnative invasive plants, especially Japanese barberry and nearby multiflora rose.

Spruce-Northern Hardwoods – this resembles the mixed mid-successional forest but is dominated especially by red spruce. We saw this at the south eastern part of Sears Island where it forms a mature stand with pileated woodpecker sign on snags.

Alder Thicket – this natural community is dominated by tall shrubs and is on poorly-drained ground; an unusual diversity of herbs is often present. At Sears Island, we saw this especially near the south end and along the east part of the island, in patches. It is threatened by Japanese barberry, which is spreading nearby at the south end of the island.

Coastal Dune Grassland – this natural community is ranked S2, a state priority signifying its relative rarity in Maine. It is present as only a small patch at Sears Island (at the northeast shore). It is threatened in two ways – (1) beach erosion due to sea level rise, which might involve shift of the sand and gravel material to another part of the shore or downriver, and (2) invasive plants – we saw purple loosestrife and Norway maple at this community. The latter is less of a problem than purple loosestrife, as the maple is not known to be especially salt-tolerant.

The following types are not listed as natural communities in Gawler and Cutko (2010):

Mixed mid-successional forest – this describes vegetation that could have resulted from forest regeneration on farm fields upon cessation of agricultural activities, or these could be woodlots from which the best-formed and largest trees were repeatedly removed. Dominant tree species include red maple, yellow birch, balsam fir, and red spruce, with occasional northern red oak, white pine, and paper birch. The diversity of trees is good, and there are many wildlife habitat features such as large living and dead trees. The understory vegetation is not diverse, and includes hay-scented fern, wild sarsaparilla, low sweet blueberry, and other plants that have a wide niche. Within this type, east of the Homestead, we found a small patch of Red Maple-Sensitive Fern Swamp, but considered it too small to be mapped.

Fern Meadow – We saw patches of ground densely covered with hay-scented fern at the south and eastern part of the island, and at the boundary with the state reserved area near the northwest part of the Conservation Area. Origin could be as pasture land, or burned ground. The fern might be allelopathic, meaning that it inhibits forest regeneration and seed/spore germination for understory plants. It perpetuates its own favored habitat, and such patches could remain unchanged for many years to come. We have seen this type on coastal islands elsewhere in Hancock and Waldo Counties.

Ravines and Gullies – At least seven ravines and gullies were checked, mostly along the east shore. To facilitate planning, we numbered all gullies discernible in the topographic map (Fig. 3a). Seasonal and storm drainage from the upland portions of the island meet the Penobscot Bay at these points. Some are steep ravines up to about 15 feet deep, while others are relatively shallow seasonal streams. None have been recognized as riparian wetlands in the National Wetlands Inventory. These gullies are distinctive from each other and they are special features on the property as they contain populations of plants not seen much elsewhere on Sears Island. The vegetation cover, which includes mosses and liverworts, contributes to good water quality in the Penobscot River by reducing siltation. Each gully we checked appears to be highly erodible, and should not be subjected to trail building or routing of hiker traffic through these fragile

habitats. Wildlife might come here to drink, and migrating birds could use these sheltered, often shrubby ravines. The gullies represent wildlife habitat that is somewhat unusual at Sears Island.

Upland Openings – These are old fields, and share enough plant diversity with the roadsides and trails that it might be unnecessary to make a distinction. The fields will become forest unless they are mowed regularly. The fields are open habitat that could be used by grassland birds such as prairie warbler (not heard or seen in 2010), a bird that is increasing its range to the north and east, and is known from Belfast. These openings benefit insect diversity including pollinators such as bees and butterflies, of which we photographed just a few. A praying mantis was seen and photographed in the North Meadow in 2010.

Shores – the Penobscot River shore is relatively low in vegetation diversity due to the high intensity of tidal, wind, and ice influences. Slumping of the banks at the shore exposes the erodible soils and provides an opportunity for some early-colonizing plants. Purple loosestrife, a highly invasive nonnative species, is present at the west, east and northeast parts of the shore in small, sparse populations of only a few plants in each patch, suggesting that control could be made easier by this low population density. The shores offer habitat used by shorebirds and other animals, and are a spectacular recreational resource for the public. .

Rare plants – seabeach sedge (*Carex silicea*) is a plant that has been considered for listing as rare in Maine (Special Concern), and has been reported for Sears Island at the Coastal Dune Grass community. We sought but did not find this, though this does not mean it is no longer present. Otherwise, we saw no listed rare plants at Sears Island. Apart from the state-listed species, there are some plants that are apparently "rare" at Sears Island and worth noting as we encountered some only once and others only a few times in our survey (Appendix II). These include autumn coral-root, one-flowered broomrape (robust population at an old well in the Homestead), purple-fringed orchis (found by members of the FOSI at the Blue Trail at south end), and twinflower.

Wildlife habitats – the wild animals at Sears Island benefit from vast areas that are not frequented by human visitors or their pets. Large areas of unbroken forest canopy and shrub thickets provide stopovers and nest habitat for neotropical songbirds. Large trees and large logs are especially fine features at Sears Island. The fringe of tidal shore that completely encircles the island is excellent for migrating shorebirds, and at the causeway, we saw a great blue heron feeding in the mud. Harbor seals, loons, ducks and gulls frequent the rocky south shore, where the seals haul out on the southwest ledges during low tide. An osprey was seen near the northeast end of the property. Although no eagle or osprey nests were encountered, frequent sightings of both birds are reported by the FOSI and other visitors. A bald eagle nest is mapped for Cape Jellison. Deer tracks and scat are evident throughout, with well-travelled game trails that could be used by coyote and fox. We saw a porcupine den in a large oak in the northwest corner of the property, and abundant red squirrels but not gray squirrels. Apple trees associated with the old homesteads and farms (structures no longer present) appear to attract wildlife, but we did not see any deer. Visitors told us of some of their exciting wildlife sightings at Sears Island Road, also. A list of incidental wildlife observations is in Appendix III.

We measured some of the larger trees as we came across them, to provide a baseline that could be useful in the future. Within a given stand these appeared to be the larger trees of their species on the property. Measurements are in inches at 4.5 ft above the ground, and include yellow birch

18.4, 20.5, 24.8, 31.3; paper birch 23.4, 25.0; American beech 19.1 (dead); red maple, 21.2, 23.8, 24.2, 32.7 (510134E, 4521680N); striped maple 10.5; sugar maple 17.4 (only one seen, at UTM coordinates 19T 509321E, 4919913N); red spruce 15.0, 17.0, 18.4, 19.0, 19.3, 19.6, 20.3, 21.7, 24.9; white ash 35.0, 39.0; northern red oak 26.0, 30.0, 22.0; balsam fir 16; eastern white pine 20.4, 36.0; Avian cherry 17.1. Locations of some of these trees are indicated in Fig. 6.

MANAGEMENT CONCERNS AND THREATS

Management concerns can be considered in three categories – (1) those that affect natural communities, wildlife and plants at Sears Island, (2) those that affect visitors, and (3) threats to the Sears Island ecosystems from external sources. In the first case, invasive plants are a distinct threat to the natural communities and other vegetation types, but their population density is not yet to the extent that they are obviously altering ecosystem function, changing wildlife feeding behavior, or usurping habitat needed by native species. Additional information and recommendations are elsewhere in this report. Threats to the forest from pests and disease appear to be mostly minimal but balsam woolly adelgid is a concern. Its spread in North America has been limited by cold temperatures but with global warming, the range and seriousness of this pest could increase. It is likely to continue to attack balsam fir at Sears Island.

Threats to shellfish from overharvesting could not be determined for this report; we saw clammers at work in the managed shellfish bed at the northeast shore of Sears Island. Threats to wildlife from dogs appear to be minimal as long as the visitors keep their dogs on leash and clean up after their pets. Threats to water quality from human and pet waste were not apparent but this should be considered, especially at the western end of Sears Island Road where there is not yet any facility at the shore. Many visitors use the shore as their turnaround point; this is outside of the Conservation Area but has implications for the resource protected by undeveloped parts of Sears Island and managed by the FOSI. Threats to the deer population by over-hunting seem possible; we did not count deer, but evidence of their presence was noticeably less abundant than in some other areas along mid-coast Maine where we have worked. Threats due to sea level rise affect slumping of banks at the shore and exposure of rocky ground where formerly there was sand; this has consequences for vegetation, water quality, and some recreation interests.

In the second category, we consider threats to visitors by other people. This includes unleashed dogs, though there does not appear to be a problem with current use. The FOSI cannot provide the presence needed to enforce every rule day and night, but visitors could be encouraged with a few more well-placed signs to please comply with the leash rule so that dog bites to people or their pets will be minimized. Another threat to visitors is by people conducting target practice near the Homestead (5 October 2010). It appears there is no designated place for this activity at Sears Island, and there is little/no supervision or oversight. The noise involved might seem to be warning enough to other visitors to stay away, yet a bullet can travel a considerable distance beyond its intended target. Hunting, as regulated by the state, is allowed at Sears Island. We found several tree stands which have been left up, unsigned, year round; the FOSI could implement a registration policy for such structures. Hunting should be assessed with additional observations and in compliance with state regulations.

An evaluation of potential threats to Sears Island from external sources is not within the scope of this inventory. We suggest that threats could include leaking septic fields, heating oil storage, road salts and other runoff pollutants, and spills from industrial oil tanks, tanker ships, and

chemical plants. Most or all of these sources are within the watershed near Sears Island. Storage tanks at Mack Point Marine Intermodal Cargo Terminal at Mack Point, Searsport, and industrial facilities at GAC Chemical Corporation on Kidder Point, Searsport, are examples of neighbors that have potential to impact Sears Island. Spills seem unlikely but are not trivial, given the 2010 major oil spill in the Gulf of Mexico due to the British Petroleum Deep Water Horizon underwater explosion. Such potential threats should be kept in mind by those planning and managing resources in the Conservation Area.

MANAGEMENT RECOMMENDATIONS

The principle challenge on many conservation lands is to find a balance between the stated purpose of protecting wildlife habitats and natural communities, while providing safe, pleasant, fulfilling access for people and, in some cases, their pets. Because the visitors support the conservation lands in many ways, they are an integral part of the picture and to meet their needs for recreation and open space is crucial. Responsible people would not want to degrade habitats by overriding needs of wildlife for the sake of human access. The balance at Sears Island by our assessment of 2010 conditions appears to be reasonably well-met. Our management recommendations reflect only a few major challenges for the near and long term. Most of the property appears to be in good to excellent condition with few cases of visitor impact or need for restoration. Exceptions are the invasive plants, which are present at a low enough density that there is still time to make a significant difference if a control program is implemented. Fortunately there is a role for the public in addressing this concern. This is described in more detail below.

INVASIVE PLANTS -- Control of nonnative invasive plants can be summarized by the adage that “an ounce of prevention is worth a pound of cure”. By addressing the invasive plants promptly, often, and persistently, a major control effort can be avoided, but strategy and tenacity are key. After remaining at a low population level for some years, some invasive plants will spread quickly and might fill the available habitat. This has not yet happened much at Sears Island, though Japanese barberry on the Blue Trail at the south end, off the Tower Road, has started to encroach. Oriental bittersweet near the causeway gate, farther south on the Sears Island Road, and to the east of the Homestead in otherwise less-disturbed forest, also appears to be spreading rapidly. Purple loosestrife at the shore is in low enough population density and in soft ground so that it might be hand-pulled. Set up an invasive plant control program that involves specific goals for treating certain known patches of invasive plants, then revisit these later according to a schedule -- treat again if necessary. Thereafter, monitor yearly. Include searches for new populations of invasive plants off trail. Invite casual visitors to “go deeper into learning the ecosystem” of Sears Island by signing up as volunteers who will attend work parties. Make the work parties fun by encouraging teamwork, jokes and camaraderie, by having contests that include small prizes, by providing bagels and coffee, and by recognizing volunteers at awards ceremonies and in the press. Keep careful track of all the volunteers and get their contact information; offer them honorary membership in the FOSI for one year, if possible. A special benefactor might be found to sponsor the expenses involved in these activities, and that person’s or family’s name could be featured in brochures. In the process of building up a community of dedicated invasive plant volunteers and sponsors, the FOSI might find new committee members and prospective board members among committed individuals who care about Sears Island. Additional recommendations for invasive plant control by species are offered in Appendix I.

The Visitor's Center site, as proposed by the FOSI, appears to be practical and sustainable in that it is located on former agricultural land, and includes a former farmstead (no buildings present), with well-drained soils, mature oaks, and openings that can be maintained by mowing. There is at least one old well (location in Fig. 8) that is a hazard to visitors and should be capped to prevent an accident. Because there is a population of an unusual plant, one-flowered broomrape, at a well, seek to make any changes when the ground is mostly frozen.

Vernal pools -- Habitat protection for the two vernal pools differs according to proximity of a trail. At the northern vernal pool, the larger of the two, the trail is too close and could impact migration of the amphibians to and from the pool. We recommend prioritizing a buffer around the pool, and relocating the trail at least 100 feet from the pool. Within the buffer, allow logs to accumulate as trees fall over. To use the pool as an education opportunity, harden the access by developing a single spur to the pool with a small dock or observation platform that allows people to go partway into the pool but does not involve trampling the vegetation or impacting water quality at the pool. Keep the buffer otherwise trail-free. The other vernal pool, which is in an old foundation hole with cut granite slabs around some of the edges, is remote enough and off any trail so that it is not likely to be impacted by activities of people and can be left as is.

Sears Island Road -- Under existing conditions, the Sears Island Road is used mostly by walkers and bike riders. A notice at the gate reminds dog walkers to keep their dogs on leashes and clean up after them, using bags and a barrel that are provided. Compliance appears to be mostly good. Although a portable toilet is provided near the gate, another toilet could be necessary farther along in the trail system if members of the FOSI notice unsanitary garbage. Eventually a sidewalk may be deemed necessary for public safety.

Limit the trail network – The existing trail system, as found in 2010, includes excellent recreation opportunities. Habitat protection for animals and plants might be more a matter of what *not* to do, rather than active management. By limiting the trail network, the FOSI: (1) leaves more of the property as remote habitat preferred by the many wild animals that do not want to interact with people, dogs or firearms; (2) saves time and money in trail building and maintenance; and (3) helps assure a wilder, more isolated character to the landscape, and this is much appreciated by many hikers and wildlife watchers. In particular, refrain from routing a trail along the length of the east shore. This route was suggested in a March 2004 planning document available from the Maine Department of Transportation, but we recommend that by leaving this section trail-free, the FOSI could protect erodible slopes, ravines and gullies, assure remoteness of some prime habitats, avoid the need to raise money to construct such a trail, and reduce the burden of future trail maintenance. Visitors who want to walk along the east side of the island can time their hike with a falling tide, follow the Homestead Trail, go onto the shore (perhaps south of the Dune Grassland, to de-emphasize visiting of that habitat) and then pursue their adventure along the shore without any maintained trail. "Ledge Trail", which is not mapped or marked, may become problematic in that it proceeds westward onto state reserve land. Consider re-routing the Ledge Trail so that it loops back onto the Sears Island Road rather than continuing west to the shore. Throughout the Conservation Area, de-emphasize access outside the Conservation Area – except at the Sears Island Road -- as much as possible.

Maintain old forest -- Allow trees to grow large and die, fall over, and remain as large logs. This is a passive management strategy that will continue to increase habitat quality for certain animals that associate with old growth, including fisher, owls, and woodpeckers. There are relatively few

other places in Waldo County that are managed as old forest, and this is a special feature that Sears Island can continue to offer with no expense or activity on the part of the FOSI, with the exception of monitoring.

Set up a demonstration forest -- Protection of old forest is not necessary over the entire forested part of the Conservation Area. In some parts of the landscape, there are opportunities for sustainable timber harvest, which can be conducted to maximize growth of high quality trees. The purpose is to provide the public with a chance to better understand sustainable forest practices. Woodlot owners might choose to try some techniques that would be presented through such a demonstration. Should the FOSI decide to pursue this, the organization will benefit from guidance of a licensed forester and a dedicated advisory committee. Monitoring and measurable goals regarding sustainability would be part of such a project. Some aspects include interpretive signs that enable casual visitors to understand the process of forest regeneration, the many values of a renewable resource, and wildlife habitat qualities. Animals that use early-successional habitats could be encouraged by leaving piles of brush, snags, and some large logs. This endeavor might be undertaken in partnership with agencies, academic institutions, and professional organizations that could amplify research support and opportunities for young scientists. It may also be possible to emphasize demonstration forestry in a learning project with schools, and tailor aspects of the demonstration to learning results. To address balsam woolly adelgid as part of the demonstration, balsam fir should slowly be reduced regarding its proportion in the stand because of increased problems in the future.

Sea level rise and management of the Coastal Dune Grassland community – There is little to be done to reduce the effects of storm tides, high winds, and erosion at the shore. Trees will continue to fall into the river and steep, eroding banks will continue to contribute to siltation in the river. Eventually the Coastal Dune Grassland might succumb to sea level rise. Habitat protection for this unique feature at Sears Island might be moot as there is little or nothing to do to protect it from sea level rise, except to refrain from routing any trail through the vegetation. Over time, the sand could shift to another part of the shore. It is probably best to not draw attention to the community given that some plants were found there and not elsewhere on the property. Control of purple loosestrife will probably be necessary at the Coastal Dune Grassland community. Invasive Norway maple should be cut down and controlled wherever found at Sears Island. Continue to watch for seabeach sedge, which was found here in the 1990s but not relocated in 2010.

The mitigated wetland, or South Opening, is an opening at the Tower Road south of the larger meadow. It is not a “natural” feature and could have some unusual plant assemblages, assuming that plant material was brought from elsewhere to create this feature. Wildlife could benefit from this wet site. Monitor for purple loosestrife and other invasive plants as those are likely to appear in wet soils, though none were seen in 2010. In the plant list (Appendix II), this wetland and the vernal pools have been combined but a separate list is available from A. C. Dibble.

To manage physical features such as erosion that affect biota, focus especially on the gullies which harbor unusual diversity and microhabitats. Avoid routing any trails through or near them, and instead route trails all the way around on high ground, or route the trail along the rocky or gravelly shore. By not installing any trail that runs parallel to the east shore such impacts will be reduced. Monitor the eroding banks at the shore though little can be done about these except to avoid sending hikers up and down them. If vegetation is altered here, as in controlling invasive

shrubs, it should be done with caution to prevent further erosion and siltation. Check the culvert partway along the Sears Island Road regularly to make sure it is functioning properly and at the downstream end is not so high that fish cannot pass upstream.

Openings that are desired as such will need to be mowed to prevent forest from developing. Places such as at the Homestead grounds and the North Meadow are examples where values for pollinators and other wildlife should be a high priority. Mowing is needed along the Tower Road every few years to keep it from closing in, and clipping back some vegetation along trails could become necessary, especially if the overstory is disturbed and light increases at a trail. Monitoring and control of invasive plants is necessary (Appendix I).

Over much of the Conservation Area, to assure high quality habitats into the future, especially regarding protection of biodiversity and sustainable forest management, the recommendation is to simply allow forest succession to take place. This is a low cost management strategy but should be accompanied by a monitoring program that will help catch problems that arise, such as spread of invasive plants into areas in which such plants had not yet become established.

There are many creative ways to bring the public onto the property in safe, sustainable ways so that there is minimal disturbance to sensitive natural features. (1) Some of the large trees could be featured as points of interest along existing trails, with numbered stops and a brochure that enables hikers to learn more about the trees and to help monitor them; (2) A series of regular outdoor programs – such as every first Saturday -- will attract those who want to learn more about Sears Island, and some of those people might be willing to volunteer in the invasive plant control efforts, or with trail maintenance, monitoring, and other activities of the FOSI; (3) Involvement of some local schools could help young people connect with the outdoors through their experiences at Sears Island, and they might become regular participants in volunteer activities at the Conservation Area.

To enhance education and management activities, and to increase knowledge about the natural resources at the Conservation Area, the FOSI can invite groups of scientists and avid amateurs to conduct surveys that focus on birds, vascular plants (e.g., ferns, grasses, asters, etc.), mosses, lichens, fungi, insects, marine organisms, other biota, and physical features (soils, tides, wind, water quality, etc.) at Sears Island. The FOSI could request that each group will provide back to the FOSI, within a reasonable timeframe, species lists or summaries of what they found, with coordinates for any sensitive species or habitats, and notes about the methods for documenting what was found (e.g., photo given to the FOSI, herbarium specimen deposited at an academic institution, data maintained by a laboratory, etc.). Further, if scientific papers are published that include data collected on Sears Island, the authors should know they are expected to send the FOSI copies of such articles (or pdf files). Beginners, including young people, are usually welcome on such field trips. By encouraging local supporters to join in professional-level and advanced-amateur study of the plants, animals, and physical features at Sears Island, the FOSI nurtures coming generations of dedicated volunteers who could eventually take leadership roles in the organization because they know and care about features protected on the island. In an iterative approach to science-based outreach to the public, the documentation of large trees near trails, which the FOSI is currently considering, could be a start toward getting some monitoring activities in place. This would include establishing a repository for data and the reports and lists that the above-mentioned groups will generate.

Finally but not least, develop an emergency plan that might consist of a to-do list in the event of an oil or chemical spill, fire, or other catastrophe. Obtain advice from the Department of Environmental Protection regarding the best way to do this. Know which agencies to contact, and have the contact information ready and stored in multiple places, then update contacts yearly. Be sure that Sears Island is on a list kept by state and federal agencies of high priority conservation concerns in the event of a spill. Include an evacuation plan with the realization that some visitors could be distant from their vehicle when an untoward event might take place. By having a plan in place, the FOSI could help avert at least some potential damage. Such a plan might never be needed, but preparations could lead to ideas for aspects of protection of the Conservation Area that have not yet been explored.

CONCLUSIONS

The portion of Sears Island that is the new Conservation Area is a mostly intact, high quality forest ecosystem with a wide variety of successional stages, natural communities, other vegetation types, and habitat features. The vegetation and soils have been influenced by earlier activities, including agriculture and seasonal residences. Development activities from the 1970s through the 1990s have influenced one stream, which passes under the Sears Island Road through a culvert (location shown in Fig. 8) back onto the northwest sector of the Conservation Area, and an area that appears to be a stump dump. Studies conducted since the 1970s provide an excellent background for the work of the FOSI, especially regarding archaeological and natural resources, and the older reports and summaries will continue to be valuable as the work of stewardship unfolds. We sought to provide baseline data and management recommendations that will be used in a management plan. To protect an under-recognized sensitive feature -- a series of ravines and gullies at the shore -- refrain from routing hikers along the east side of the island except on the tidal shore. The biggest management challenge is control of the invasive plants, the spread of which could be reduced through early intervention, monitoring, and perseverance. Exemplary mature stands of red spruce were found in several places, and these lack invasive plants. By leaving mature forest in place, many management goals can be met that benefit wildlife and protect other features. Not all the forest needs to be left unharvested, however; there is a distinct opportunity to develop a demonstration forest so that the public can better understand sustainable forest practices. The existing trail network at Sears Island appears to be well-positioned to receive increasing hiking pressure, but we found a few places that should not have any new trails built to or through them, including steep slopes, ravines, and gullies near the shore. Old forest can be allowed to develop and persist in many places, while in other places successional forest presents an opportunity for sustainable timber harvest, perhaps as part of a demonstration forest. Recreational use appears to be on the increase, with much potential for high quality outdoor experiences and environmental education. The most popular of all uses we saw in 2010 were walking and bicycling along Sears Island Road. A good balance between protection of wildlife habitats and recreational access for people appears to be attainable at Sears Island long into the future, given the size of the Conservation Area, a limited trail network, and low impact uses it is likely to see.

Acknowledgments

We appreciate help in the field from Robert and Marietta Ramsdell, Jan Flint, Susan White, Georgia Hall, Sheila Heneise, and Keith Dibble. Thank you to staff at state agencies who responded to our queries, including Lisa St. Hilaire (Maine Natural Areas Program), Kirk F. Mohney, Deputy State Historic Preservation Officer (Maine Historic Preservation Commission), Steve Timpano (Maine Department of Inland Fisheries and Wildlife), and Larry Harwood (Maine Geographic Information Systems).

References Cited

Dibble, A. C., J. C. Brissette, and M. L. Hunter, Jr. 1999. Putting community data to work: Some understory plants indicate regeneration habitat for red spruce. Forest Ecology and Management 114: 275-291.

Gawler, Susan C., and Andrew Cutko. 2010. Natural landscapes of Maine: a classification of vegetated natural communities and ecosystems. Maine Natural Areas Program, Department of Conservation, Augusta, ME.

Glime, Janice M. 2007. *Bryophyte Ecology*. Volume 1. Physiological Ecology. Ebook sponsored by Michigan Technological University and the International Association of Bryologists. Accessed on 30 Dec 2010 at <http://www.bryoecol.mtu.edu/>.

Grindle, R. L. 1971. Quarry and Kiln: The story of Maine's Lime Industry. The Courier-Gazette, Inc., Rockland, ME. 331 p.

Haines, Arthur, and Thomas F. Vining. 1989. Flora of Maine, a manual for identification of native and naturalized vascular plants of Maine. V. F. Thomas Co., Bar Harbor, ME. 837 p.

Hedstrom, Gary T. No date. Soil Survey of Knox and Lincoln Counties. U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the Maine Agricultural Experiment Station and the Maine Soil and Water Conservation Conservation Commission.

Hinds, James W., and Patricia L. Hinds. 2009. The Macrolichens of New England. The New York Botanical Garden Press, Bronx, NY. 584 p.

Lincoln, Mary S. G. 2008. Liverworts of New England. The New York Botanical Garden Press. Bronx, NY. 161 p.

Maine Natural Areas Program. 2007. Sears Island, Searsport, Maine. A Report Prepared for Sears Island Joint Use Planning Committee. Author: Lisa St. Hilaire. Maine Natural Areas Program, Augusta, ME. 14 p.

Osberg, Philip H., Arthur M. Hussey II, and Gary M. Boone. 1985. Bedrock Geologic Map of Maine. Department of Conservation, Augusta, ME. (map)

Speiss, Arthur E., and Mark H. Hedden. 1983. Kidder Point and Sears Island in Prehistory. Occasional Publications in Maine Archaeology, Number Three. The Maine Historic Preservation Commission. Augusta, ME.

Table 1. Soils at Sears Island (map in Fig. 5), with approximate acreage in the 601-ac Conservation Area, and estimated proportion of land cover occupied by a given soil type, data from USDA Soil Survey, with highlights from descriptions of Hedstrom (n.d.).

Soil code	Soil name, acreage, proportion in 601-ac Conservation Area	Highlights from description of Hedstrom (n.d.)	Suitability and limitations
Be	Beaches 2.4 acres (0.4%)	Linear areas of sand, gravel, cobbles	At Sears Island, beaches are tidal, and suitable for recreation and wildlife.
BoB	Boothbay silt loam, 3-8 percent slopes 13.8 (2.0%)	Gently sloping, deep, and moderately well drained to somewhat poorly drained. Available water capacity high; seasonal high water table. Surface runoff moderate, erosion hazard moderate.	Fair suitability for farming, limited because of seasonal high water table. The soil is sticky when wet, dries slowly in spring and after heavy rains. Cover crops and contour plowing help control erosion, and green-manure crops such as alfalfa.
BoE3	Boothbay silt loam, 25-45 percent slopes, severely eroded 3.6 (0.5%)	Found on marine terraces, composed of fine silt, with 1-2 ft depth to water table.	Well-drained, too steep for farming, may be acceptable for woodland but harvesting could expose soils to erosion.
BoC	Boothbay silt loam, 8-15 percent slopes 8.4 (1.2%)	Sloping, deep, moderately well drained to somewhat poorly drained	Poorly suited to farming of most cultivated crops, but fair suitability for silage corn and potatoes, hay and pasture, and for woodland. Erosion is a hazard on skid trails and access roads.
BvB	Brayton fine sandy loam, 0-8 percent slopes 36.7 (5.4%)	Flat ground to gentle slopes, deep, somewhat poorly to poorly drained, few stones. Surface runoff slow or medium.	Hay, pasture, woodland, or silage corn. High water table, restricted rooting, excessively wet, best suited to shallow-rooted conifers rather than hardwoods.

Soil code	Soil name, acreage, proportion in 601-ac Conservation Area	Highlights from description of Hedstrom (n.d.)	Suitability and limitations
EIB	Eldridge fine sandy loam, 3-8 percent slopes 5.6 (0.8%)	Rapid permeability in upper layers, slight erosion hazard, but the substratum is erodible and can be impacted during construction.	Woodland, hay, pasture, avoid grazing during wet periods.
MbB	Marlow fine sandy loam, 3-8 percent slopes 16.9 (2.5%)	Gently sloping, deep, well drained. Surface runoff medium, erosion hazard moderate.	Well-suited for pasture and hay. Some compaction if soil is grazed when wet; overgrazing causes erosion. Woodland, especially eastern white pine, eastern hemlock. White spruce, balsam fir, most northern hardwoods.
MbC	Marlow fine sandy loam, 8-15 percent slopes 11.8 (1.7%)	Sloping, deep, well-drained, mostly above 300 ft elevation. Severe erosion hazard. Perched water table in spring, and restricted rooting depth.	Woodlands, especially conifers and shallow-rooted hardwoods. Also, hay, pasture, crops.
MeB	Marlow very stony fine sandy loam, 3-8 percent slopes 41.0 (6.1%)	Deep, well-drained; moderate water capacity; surface runoff medium; erosion hazard slight	Woodland, especially eastern white pine, white spruce, balsam fir, northern hardwoods; restricted root depth not conducive for oaks. Poorly suited to farming because of stones on surface.
MeC	Marlow very stony fine sandy loam, 8-15 percent slopes 59.7 (8.8%)	Sloping, deep, well drained. Available water capacity moderate. Surface runoff is medium or rapid, erosion hazard is moderate.	Woodland, improved pasture; very poorly suited to farming because of stoniness. This soil is compacted if grazed when wet, and overgrazing causes erosion.

Soil code	Soil name, acreage, proportion in 601-ac Conservation Area	Highlights from description of Hedstrom (n.d.)	Suitability and limitations
MeD	Marlow very stony fine sandy loam, 15-25 percent slopes 16.2 (2.4%)	Deep, well-drained, on moderately steep slopes. Moderate permeability above substratum and slow permeability below the brittle substratum. Seasonally high, perched water table, restricted rooting depth.	Too stony for farming. Woodland, especially conifers and northern hardwoods.
MkB	Masardis fine sandy loam, 0-8 percent slopes 6.7 (1.0%)	Flat to gentle slopes, somewhat excessively drained, with moderately rapid permability in surface layer. Droughty in growing season.	Woodland, especially for red pine. Good source of gravel, roadfill. Not suitable for farming.
MrB	Masardis Variant fine sandy loam, very rocky, 3-8 percent slopes 86.8 (12.8%)	Gently sloping, moderately deep, somewhat excessively drained. On terraces on offshore islands. Bedrock exposures, droughty.	Poorly suited to northern hardwoods, better suited to white and red pine, balsam fir, white spruce.
PaB	Peru fine sandy loam, 3-8 percent slopes 47.2 (7.0%)	Gently sloping, deep, moderately well-drained, with a thick layer of fine sandy loam.	Used for hay, pasture, possibly for row crops, and especially for woodland (eastern white pine, white spruce, balsam fir, and less suitable for northern hardwoods). Restricted rooting depth.
PaC	Peru fine sandy loam, 8-15 percent slopes 23.5 (3.5%)	Sloping, deep, moderately well-drained.	Fair suitability for hay, pasture, woodland, but too erodible for most crops.

Soil code	Soil name, acreage, proportion in 601-ac Conservation Area	Highlights from description of Hedstrom (n.d.)	Suitability and limitations
PbB	Peru very stony fine sandy loam, 3-8 percent slopes 78.5 (11.6%)	Gently sloping, deep, moderately well-drained. Erosion hazard slight. Too stony for farming. Restricted rooting depth.	Woodland, especially for white pine, white spruce, balsam fir, and less so for northern hardwoods.
PbC	Peru very stony fine sandy loam, 8-15 percent slopes 104.0 (15.4%)	Sloping, deep, and moderately well drained. On side slopes of hills and drumlin-shaped ridges. Available water capacity is moderate. Erosion hazard is slight to moderate.	Mostly used for woodland, unimproved pasture, blueberries. Skid trails and access roads should be on the contour.
TrB	Tunbridge-Lyman complex, 3-8 percen slopes 23.4 (3.5%)	On gentle slopes, a combination of 55 percent moderately deep, well drained Tunbridge soils and 25 percent shallow, somewhat excessively drained Lyman soils. Low to moderate available water capacity, surface runoff slow to medium. Erosion hazard slight to moderate.	Mostly used for woodland, with possibilities in some cases for hay, pasture, cultivated crops, lowbush blueberries, silage corn, potatoes, small gardens.
TrC	Tunbridge-Lyman complex, 8-15 percent slopes 16.9 (2.5%)	On slopes, a combination of 50 percent moderately deep, well drained Tunbridge soils and 35 percent shallow, somewhat excessively drained Lyman soils. Low to moderate available water capacity, surface runoff medium. Erosion hazard moderate to severe.	Used for woodland, and too droughty for most cultivated crops, but potential for hay, pasture, cultivated crops, lowbush blueberries, silage corn, potatoes, small gardens.

Soil code	Soil name, acreage, proportion in 601-ac Conservation Area	Highlights from description of Hedstrom (n.d.)	Suitability and limitations
Sw	Swanville silt loam 13.3 (2.0%)	Nearly level, deep, poorly drained, in low-lying areas near the coast. High water table.	Woodland, but poor drainage, slow drying in spring, wind throw hazard.

Table 2. Natural communities and other vegetation types at Sears Island, dominant vegetation as described by Gawler and Cutko (2010), and notes especially regarding how vegetation differs from the descriptions of Gawler and Cutko (2010). Approximate acreage within the Conservation Area for each type is shown in Fig. 2.

Community and page in G&C 2010	Diagnostic and characteristic species as described by Gawler and Cutko (2010)	How this differs at Sears Island, and other notes
Coastal dune grassland, or Dune Grassland (pp. 178-179)	On sand and gravel, dominated by salt-tolerant grasses and forbs.	This type appears to match the description well. It was known to MNAP since the 1990s (MNAP 2007).
Hardwood seepage forest (pp.142-143)	Dominant canopy trees include white ash, yellow birch, and maples. The mesic soils support a diversity of herbs.	This type is given in Gawler and Cutko 2010 as an example that can be seen at Sears Island, though the location on the island is not noted. We recognized this at the Blue Trail near the south end. Elsewhere small patches of it integrate with Alder Thicket, fern meadow, and mixed mid-successional forest.
Maritime spruce-fir forest (pp. 84-85)	Dominant canopy trees are red spruce, white spruce, balsam fir and /or larch. Composition is variable; white cedar or hemlock are rarely co-dominant. Canopy gaps may contain red maple or paper birch. Spruce and fir regeneration is common. Herbs and dwarf shrubs are <10% cover each, bryoid layer is >15% cover.	Mostly as described, though we saw few northern white cedars and few hemlocks. White spruce was sometimes present but not dominant.
Alder shrub thicket (pp. 206-207)	Shrub dominated wetlands with dense growth of alder. Red maple, gray birch, or other trees may be scattered sparsely above the shrubs. Herb layer >35% cover, with forbs, graminoids, and ferns. Bryoids patchy, with peat mosses.	As described, with speckled alder dominant in low mesic sites near the shore, and occasional hardwoods and softwoods nearby. An especially diverse understory, with skunk cabbage and orchids not found elsewhere on the property.

Community and page in G&C 2010	Diagnostic and characteristic species as described by Gawler and Cutko (2010)	How this differs at Sears Island, and other notes
Red Oak-Northern Hardwood – White Pine Forest (pp. 94-95)	Red oak 25-85% cover, American beech less than half the cover of red oak. "Large red oaks are prominent." Red maple is frequent. Sugar maple is often diagnostic. Shrubs and saplings < 25%, or can be up to 50% cover, Herbs <10%, or can be 20-50% cover. Lowbush blueberry is about the only shrub, bryoids few.	We found only one sugar maple in all of Sears Island, and almost no American beech. Otherwise the type at Sears Island is a reasonable fit with the description.
Spruce-northern hardwoods (pp. 112-113)	Red spruce, yellow birch, white pine, possibly with sugar maple, red maple or beech. Occasional supercanopy white pines. Balsam fir and paper birch common, hemlock. Sapling/shrub layer 20-40%, with striped maple and tree saplings. Herb layer > 15% cover, dwarf shrubs lacking. Spinulose wood fern is diagnostic in the understory. Three-lobed bazzania is a frequent bryophyte.	This type has been influenced at Sears Island by timber harvest and might have regenerated on former farm fields. Sugar maples are all but lacking (only one seen). The supercanopy white pines are few. Three lobed bazzania is occasional, but is not "frequent". We encountered spinulose wood fern occasionally.
Mixed mid-successional forest	Not recognized as a natural community.	Regenerating mixed woods were placed in this category; prevalent on old fields and cutover woodlots, typically having hardwoods that are stump sprout-origin, evidenced from multiple trunks arising from a single spot.
Pine-old field	Not recognized as a natural community.	Stone walls line the stand, along the Tower Road. This could once have been plowed ground on the deeper, well-drained soils; the pines seeded back in after the fields were abandoned and are now a forest.

Community and page in G&C 2010	Diagnostic and characteristic species as described by Gawler and Cutko (2010)	How this differs at Sears Island, and other notes
Upland opening	Not recognized as a natural community.	This former hay field appears to have had some topsoil removed in at least one small patch. The hay is of poor quality, and woody plants are coming in. Mow once every year or two in early September to retain this as a field. Some invasive grasses might be problematic here.
Mitigated wetland	Not recognized as a natural community.	The South Opening was built in the 1990s as part of the mitigation for wetlands inadequately mapped in an earlier version of the cargo port development. Watch for weedy plants here.
Gullies	Not recognized as a natural community.	Small ravines and gullies at Sears Island each harbor a unique plant assemblage. They also differ in amount of exposed rock, depth of gullying, and shade environment. The vegetation protects against some erosion and siltation into the Penobscot River. Monitor for invasive plants, and minimize hiker traffic. These are probably important wildlife habitats for birds, mammals, and possibly reptiles and amphibians.

Table 3. Natural community types at Sears Island, their state rank, potential threats, potential rare plants and rare wildlife as described in Gawler and Cutko (2010). None of the potential associated rare plants and wildlife was found in the inventory.

Community name	State rank	Threats and management notes	Associated rare plants	Associated rare wildlife
Coastal dune grassland	S2	Beach erosion threatens this community. Unless deposits of sand are brought through tidal action (not by people) this will disappear gradually. Purple loosestrife is nearby and could take over.	Beach plum, coast-blite goosefoot, seabeach sedge (reported for Sears Island but not seen in 2010)	Piping plover, least tern, laughing gull, short-eared owl
Hardwood seepage forest	S3	Invasive plants, especially Japanese barberry	Spicebush, swamp saxifrage	Northern spring salamander, nemourid stonefly
Maritime spruce-fir forest	S4	Few or no invasive plants were seen in this community. The type is represented well at Sears Island, and is present as mature, especially well-grown trees near the south end of the state reserve lands. Balsam woolly adelgid impacts balsam fir.	Swarthy sedge, White adder's-mouth	Northern goshawk
Alder shrub thicket	S5	Invasive plants threaten this type, especially Japanese barberry	Bog bedstraw, Northern bog sedge	Blanding's turtle, spotted turtle, wood turtle
Red Oak-Northern Hardwood – White Pine Forest	S4	Invasive plants could alter this type, especially Japanese barberry and Oriental bittersweet	American chestnut, Mountain laurel, Nantucket shadbush, Ram's head ladyslipper	Red-winged sallow, Early hairstreak butterfly, whip-poor-will,
Spruce-northern hardwoods	S5	Invasive plants form patches here and there and need to be searched and controlled.	Giant rattlesnake plantain	Early hairstreak butterfly

Figure 1. Location of Sears Island in the context of the lower Penobscot River Valley (inset) and showing major features of the island as represented in aerial imagery of 20 May 2004.


0 2.5 5 10 15 20
km
Belfast
Lighthouse
Turtle Head
Lighthouse
ISLESBORO
ISLAND
Sears Island
Locator Map
Visitor center boundary
Boundary Industrial/Conservation

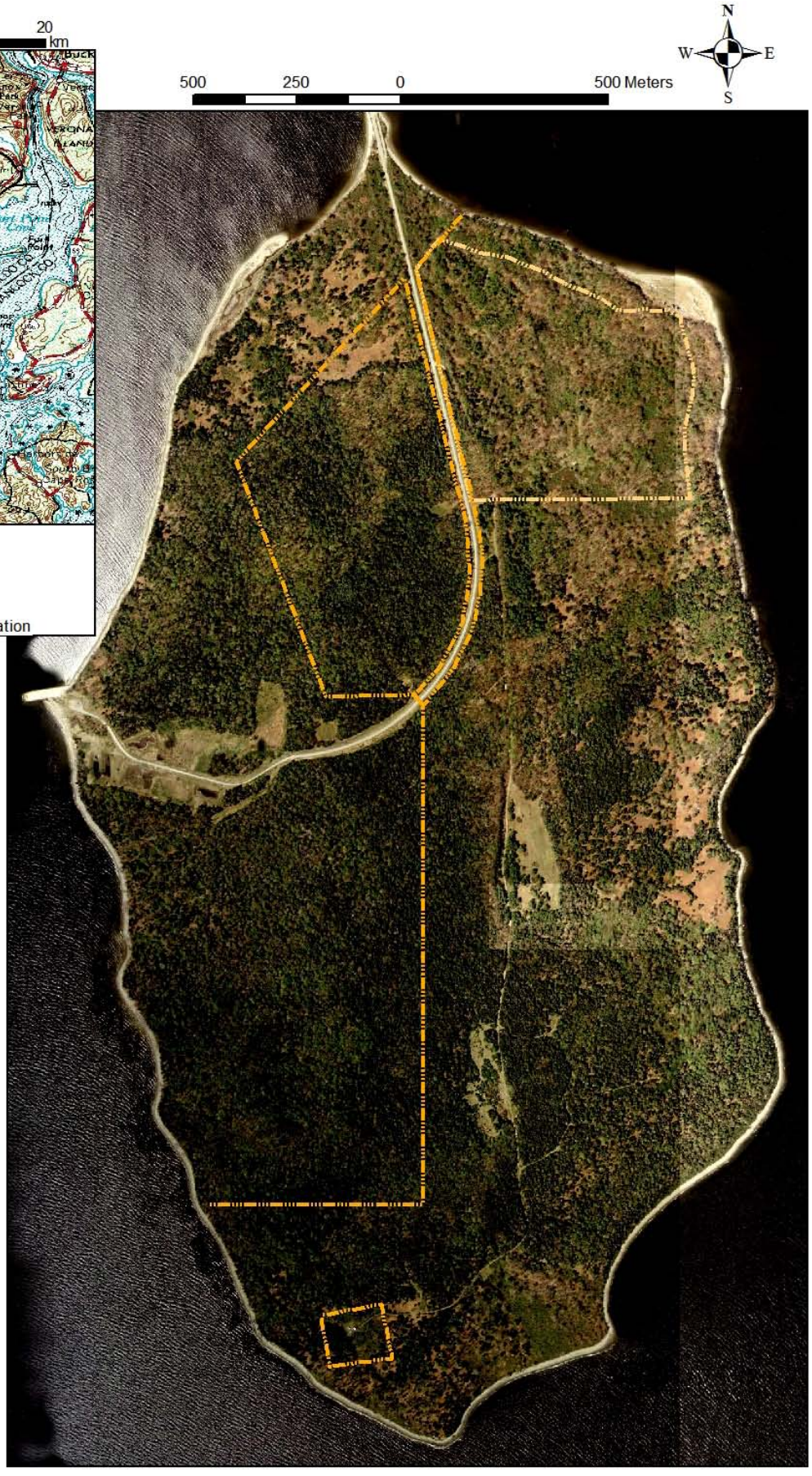
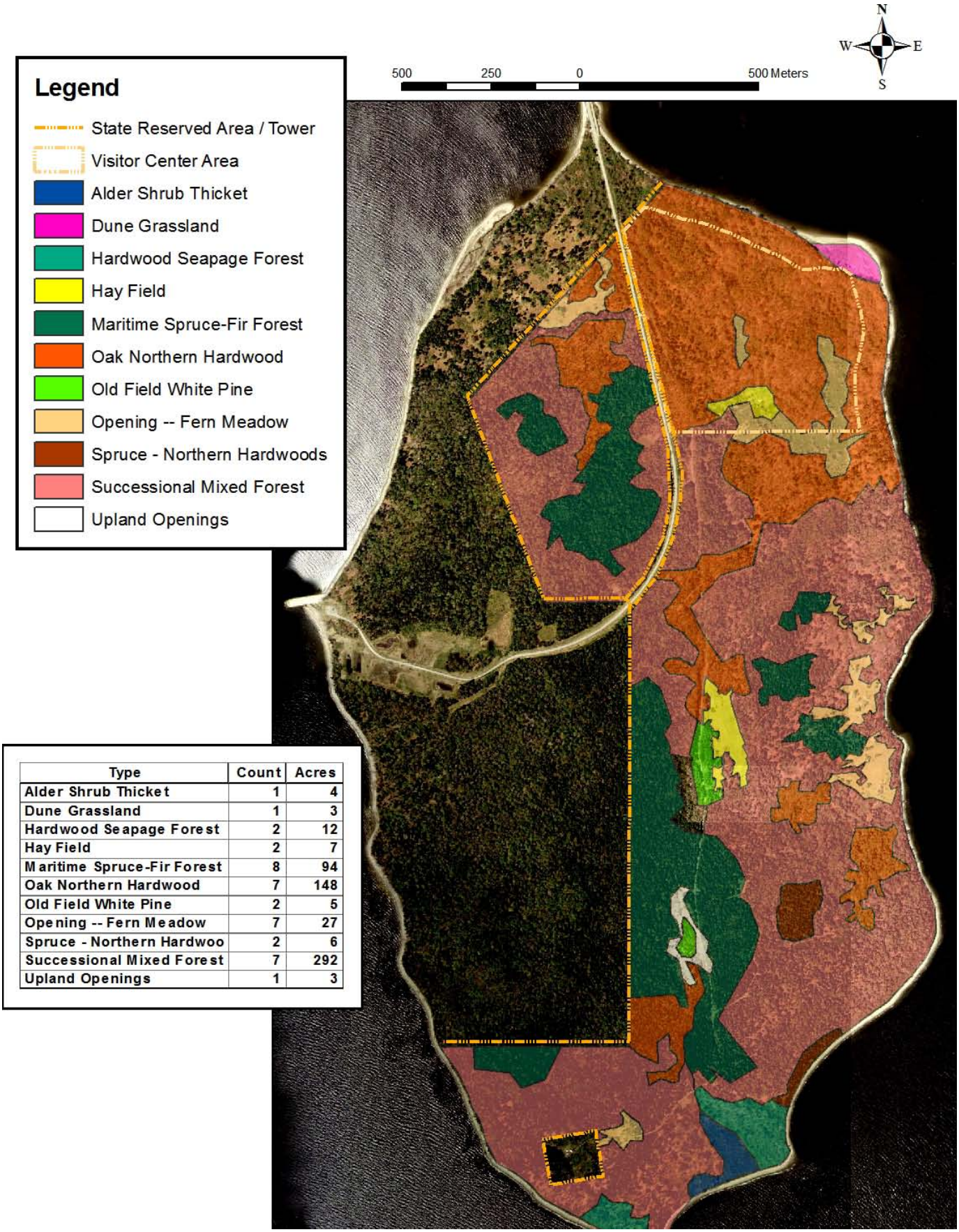

N
W
E
S
500 250 0 500 Meters

Figure 2. At Sears Island, natural communities as described by Gawler and Cutko (2010) and other vegetation types, with approximate acreage per type, overlayed on aerial image from 20 May 2004.



Type	Count	Acres
Alder Shrub Thicket	1	4
Dune Grassland	1	3
Hardwood Seapage Forest	2	12
Hay Field	2	7
Maritime Spruce-Fir Forest	8	94
Oak Northern Hardwood	7	148
Old Field White Pine	2	5
Opening -- Fern Meadow	7	27
Spruce - Northern Hardwoo	2	6
Successional Mixed Forest	7	292
Upland Openings	1	3

Figure 3a. Sears Island topography, drainage and wetlands, with gullies given unique numbers for planning purposes, and two known vernal pools. Information from the USDA Soil Survey and from field observations is overlayed on the 7.5 min. USGS topographic map.

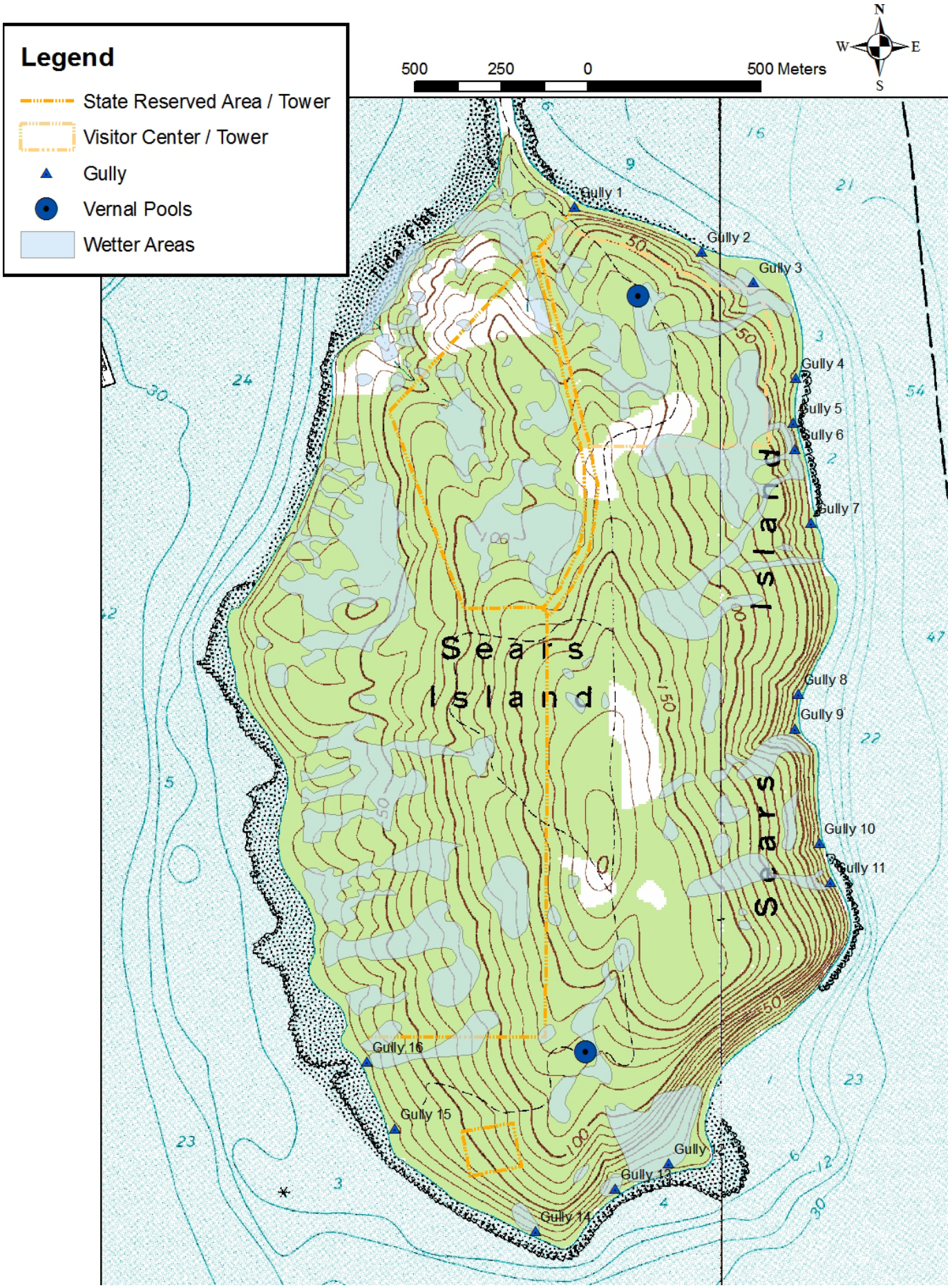

Legend
State Reserved Area / Tower
Visitor Center / Tower
Gully
Vernal Pools
Wetter Areas
500
250
0
500 Meters
N
W
E
S
Sears Island
Sears Island
Gully 1
Gully 2
Gully 3
Gully 4
Gully 5
Gully 6
Gully 7
Gully 8
Gully 9
Gully 10
Gully 11
Gully 12
Gully 13
Gully 14
Gully 15
Gully 16

Figure 3b. National Wetlands Inventory map as downloaded from the U.S. Fish and Wildlife Service databases.


Legend
State Reserved Area / Tower
Visitor Center Area
Forested Wetland
Freshwater Pond
500
250
0
500 Meters
N
W
E
S

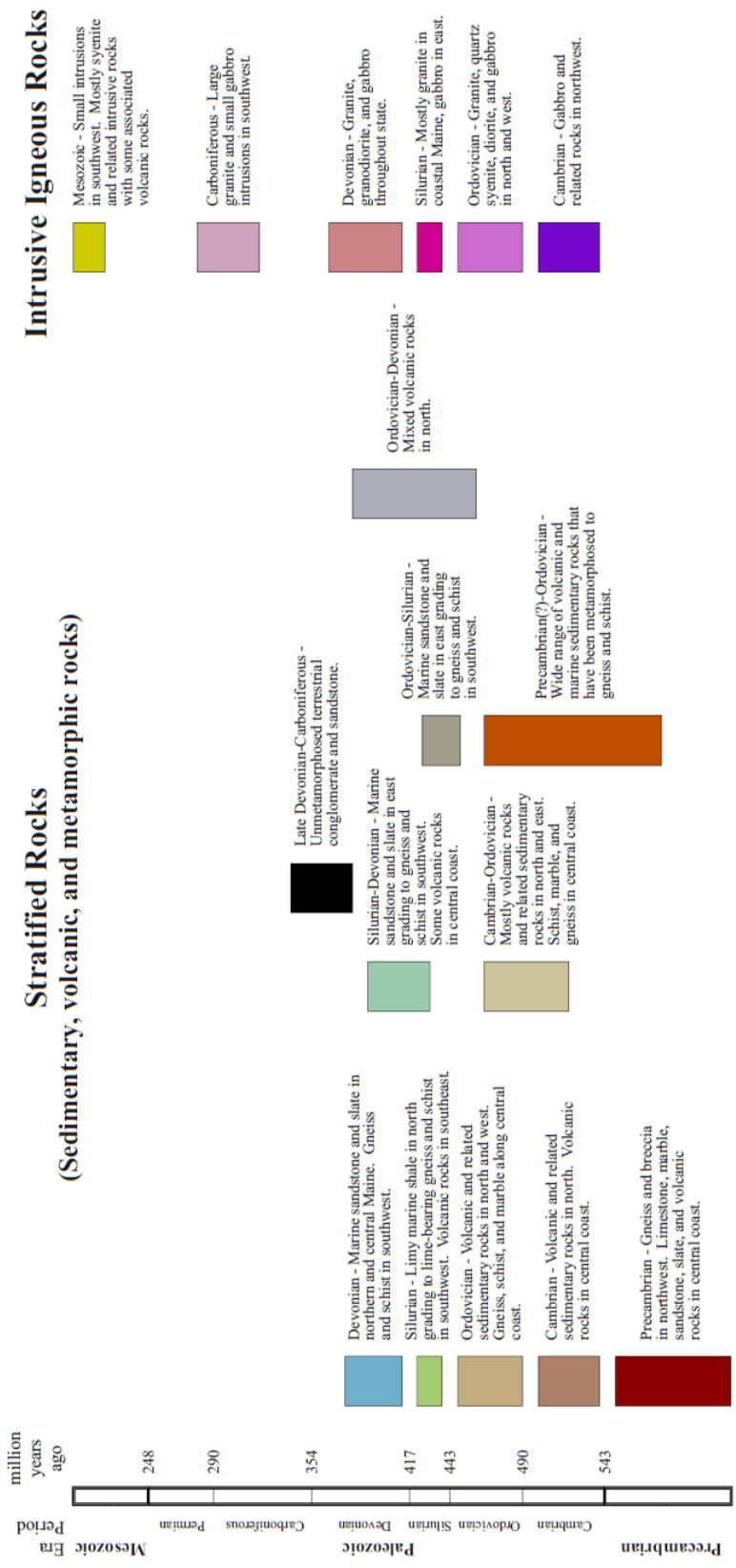


Figure 4. Bedrock geology of Maine, relevant to Sears Island, from Osberg et al 1985. LEGEND

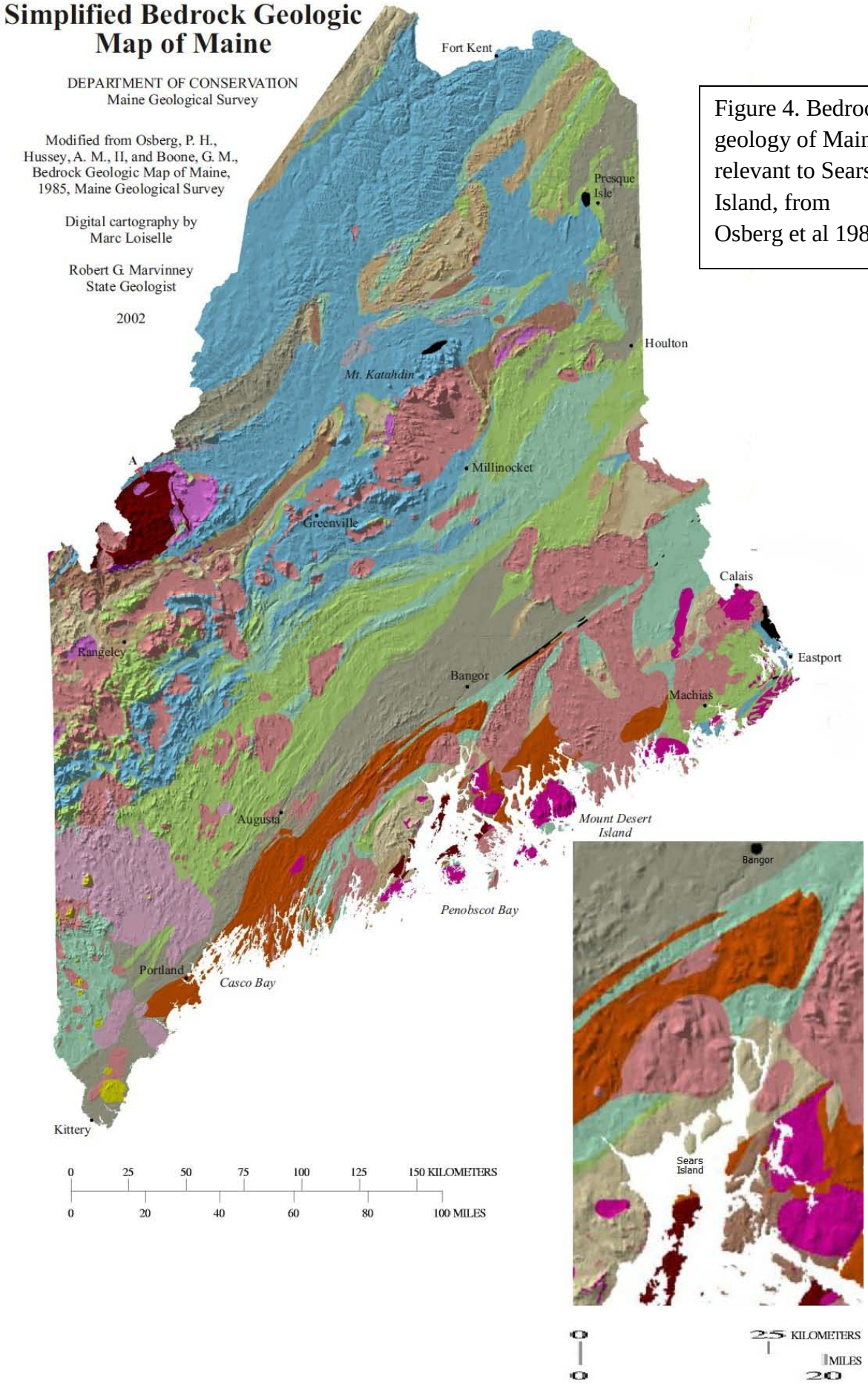


Figure 4. Bedrock geology of Maine, relevant to Sears Island, from Osberg et al 1985.

Figure 5. Soils of Sears Island, based on USDA Natural Resources Conservation Service data for Waldo County. Soil types are described in the text of this report.

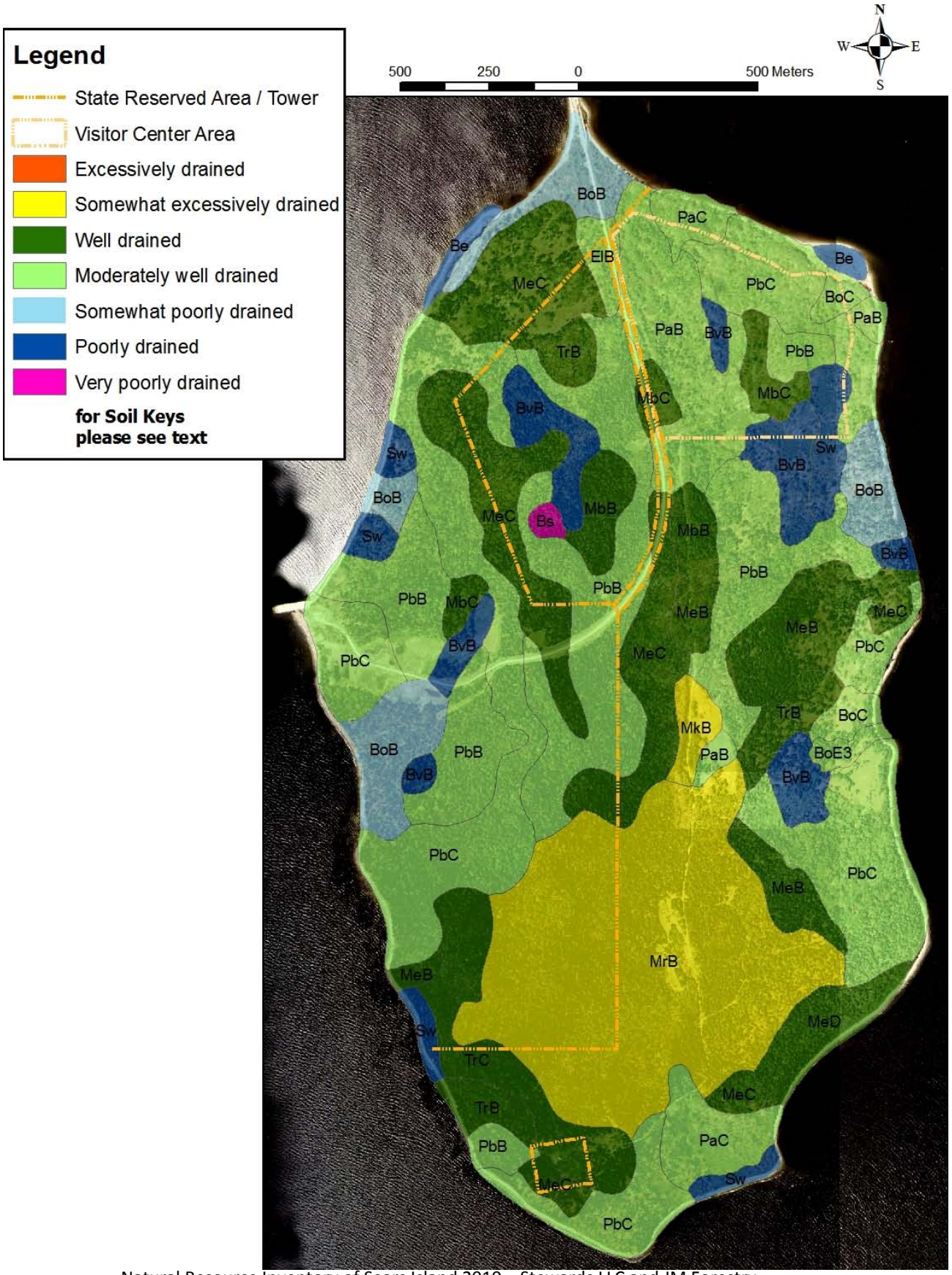

Legend
State Reserved Area / Tower
Visitor Center Area
Excessively drained
Somewhat excessively drained
Well drained
Moderately well drained
Somewhat poorly drained
Poorly drained
Very poorly drained
for Soil Keys
please see text
500
250
0
500 Meters
N
W
E
S
BoB
PaC
Be
ElB
MeC
PbC
BoC
PaB
BvB
TrB
PbB
MbC
Sw
MbB
Bs
MeB
MkB
BoE3
MrB
MeD
TrC

Figure 6. Special or sensitive features, wildlife habitat features, and places with unusual plant diversity at Sears Island. .

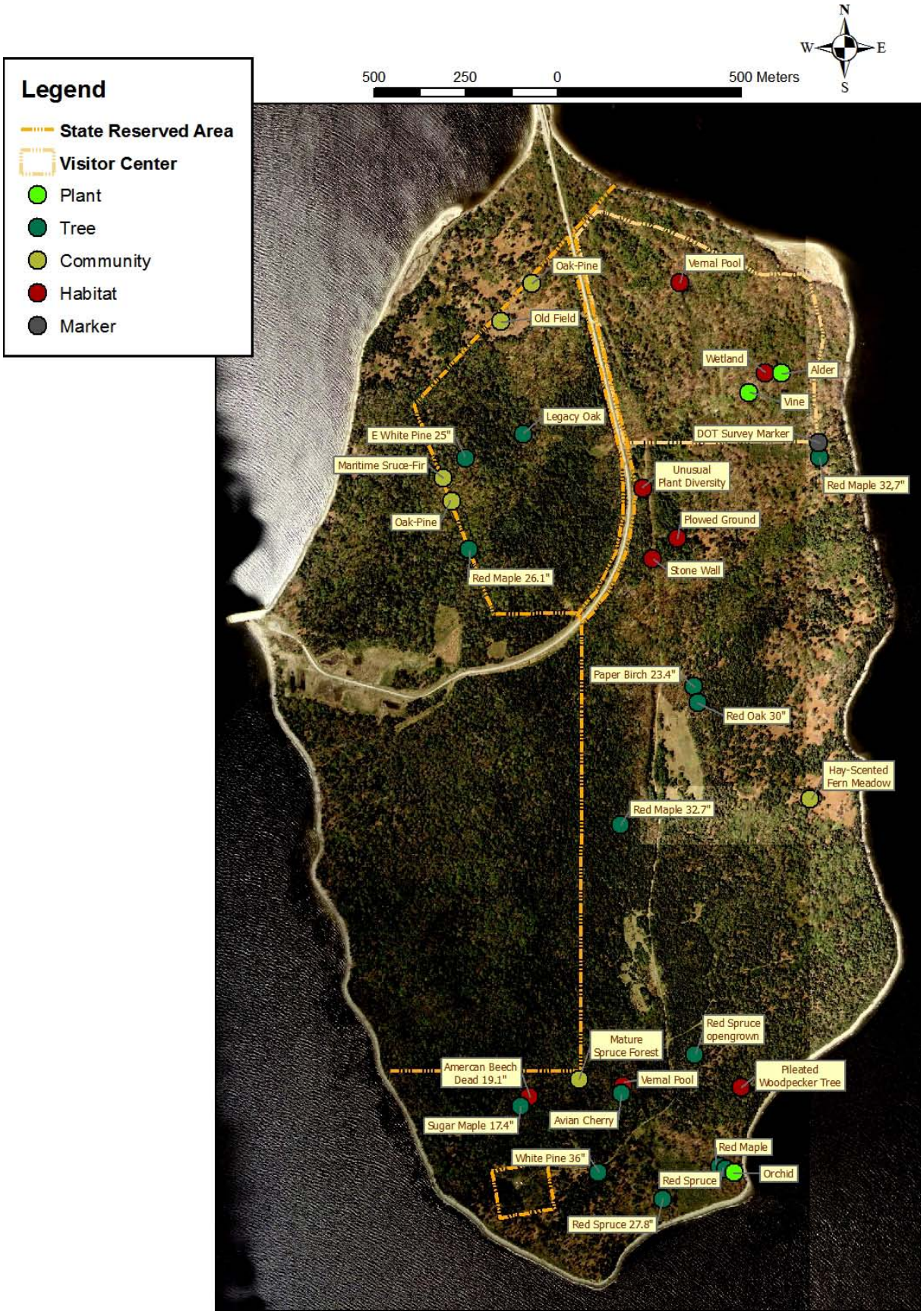

Legend
State Reserved Area
Visitor Center
Plant
Tree
Community
Habitat
Marker
500
250
0
500 Meters
N
W
E
S
Oak-Pine
Vernal Pool
Old Field
Wetland
Alder
Vine
Legacy Oak
E White Pine 25"
DOT Survey Marker
Maritime Sruce-Fir
Unusual Plant Diversity
Red Maple 32,7"
Oak-Pine
Plowed Ground
Stone Wall
Red Maple 26.1"
Paper Birch 23.4"
Red Oak 30"
Hay-Scented Fern Meadow
Red Maple 32.7"
Red Spruce opengrown
Mature Spruce Forest
American Beech Dead 19.1"
Vernal Pool
Pileated Woodpecker Tree
Sugar Maple 17.4"
Avian Cherry
Red Maple
White Pine 36"
Orchid
Red Spruce
Red Spruce 27.8"

Figure 7. Management concerns at Sears Island (including representative populations of invasive plants, plus several wells and dumps) and monitor points (data in Appendix V) and photo points, each of which has four photos, one in each cardinal direction.

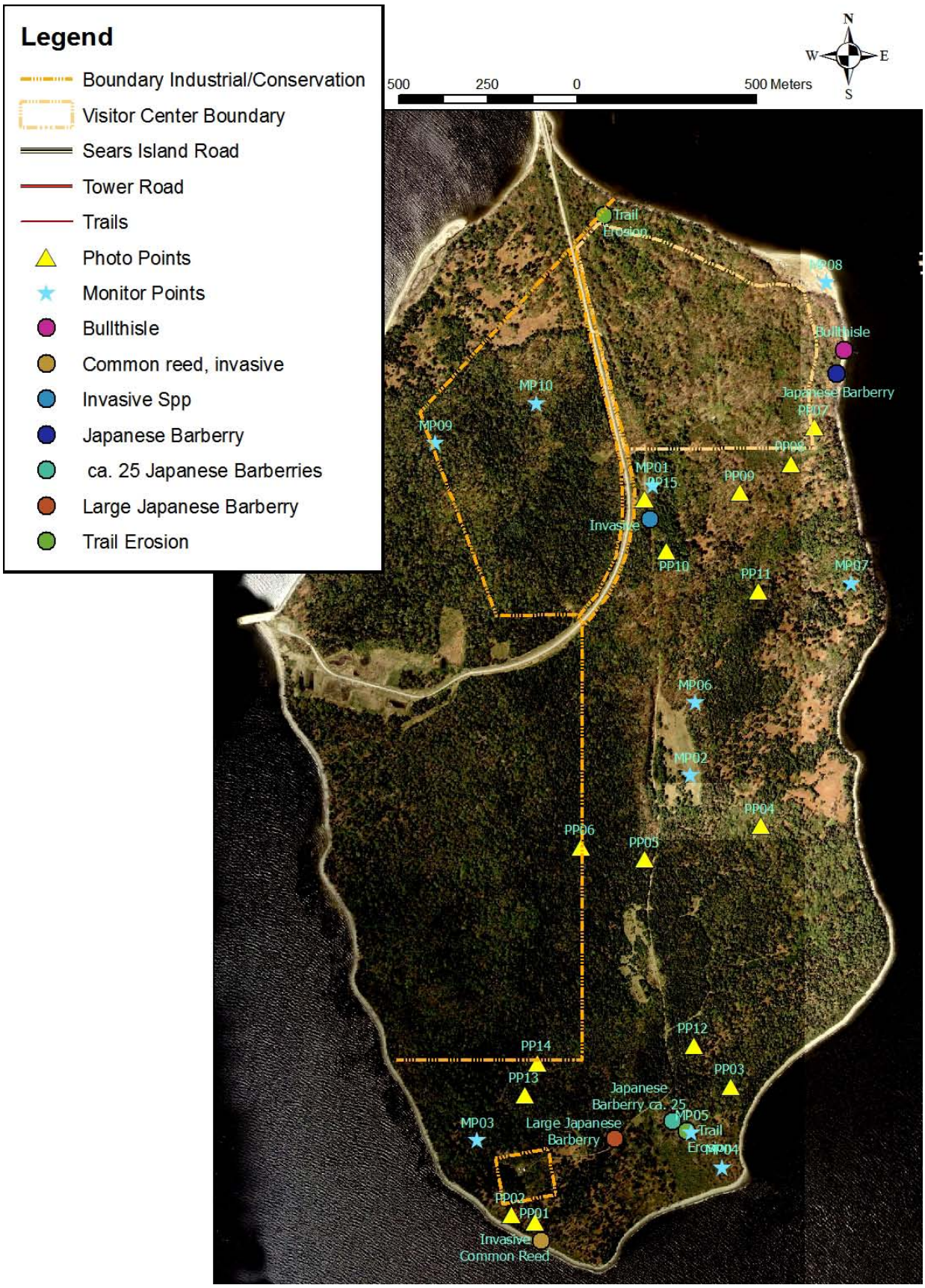
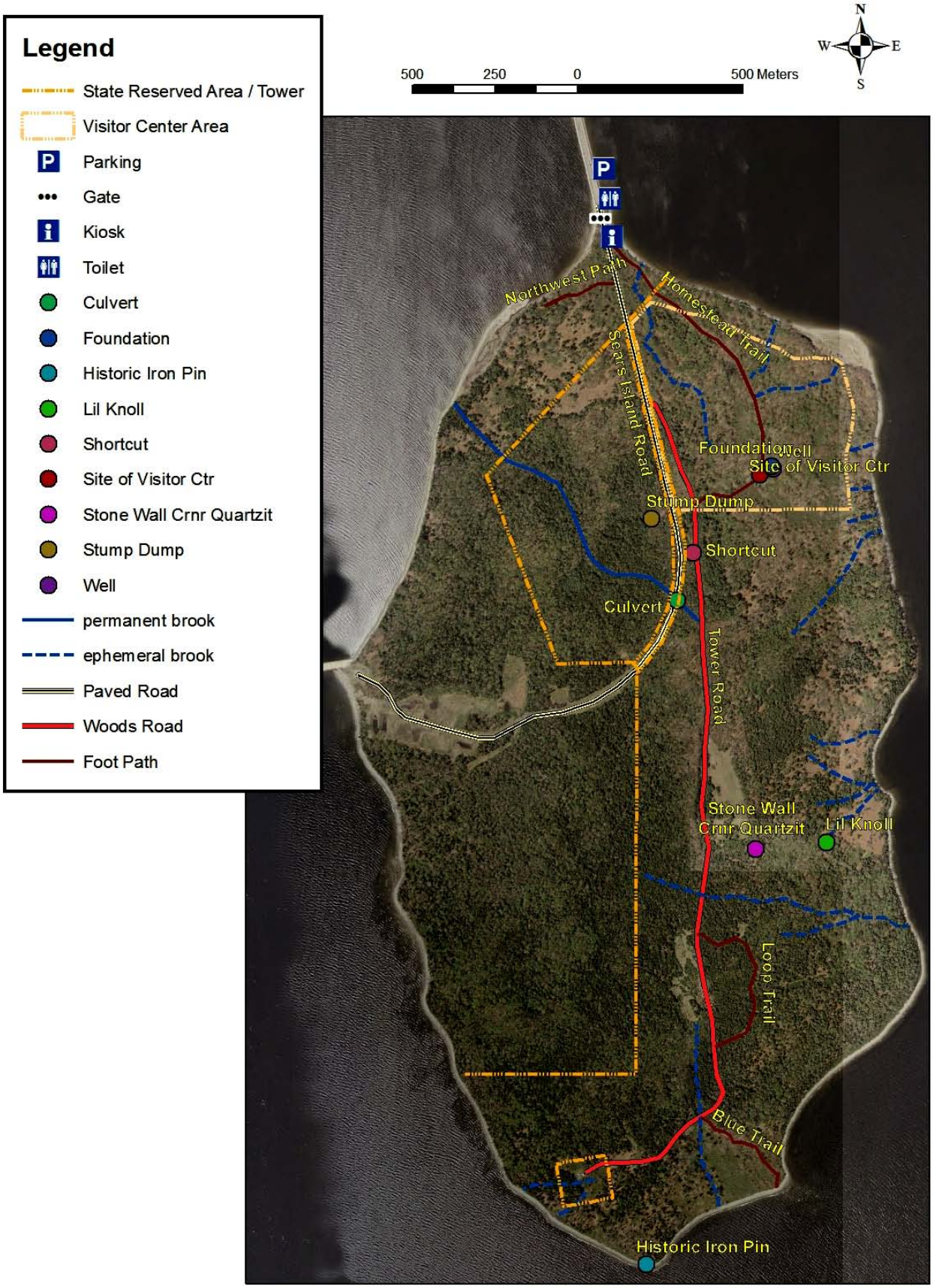

Legend
Boundary Industrial/Conservation
Visitor Center Boundary
Sears Island Road
Tower Road
Trails
Photo Points
Monitor Points
Bullthisle
Common reed, invasive
Invasive Spp
Japanese Barberry
ca. 25 Japanese Barberries
Large Japanese Barberry
Trail Erosion
N
W
E
S
500
250
0
500 Meters
Trail Erosion
MP08
Bullthisle
Japanese Barberry
PP07
PP08
MP10
MP09
MP01
PP15
PP09
Invasive
PP10
PP11
MP07
MP06
MP02
PP04
PP06
PP05
PP12
PP14
PP13
PP03
Japanese Barberry ca. 25
MP05
Trail Erosion
MP04
MP03
Large Japanese Barberry
PP02
PP01
Invasive Common Reed

Figure 8. Trails and features of interest for recreation at Sears Island.


Legend
State Reserved Area / Tower
Visitor Center Area
Parking
Gate
Kiosk
Toilet
Culvert
Foundation
Historic Iron Pin
Lil Knoll
Shortcut
Site of Visitor Ctr
Stone Wall Crnr Quartzit
Stump Dump
Well
permanent brook
ephemeral brook
Paved Road
Woods Road
Foot Path
500
250
0
500 Meters
N
W
E
S
Northwest Path
Homestead Trail
Sears Island Road
Foundation
Well
Site of Visitor Ctr
Stump Dump
Shortcut
Culvert
Tower Road
Stone Wall
Crnr Quartzit
Lil Knoll
Loop Trail
Blue Trail
Historic Iron Pin

Appendix I. Invasive plants at Sears Island, listed by suggested priority for control, with common and scientific name, locations of representative populations, suggestions for control methods that do not involve herbicides, and some other comments.

Plant common name and scientific name	Locations or habitats where representative populations can be found	Ideas for nontoxic control and other comments
Japanese barberry, *Berberis thunbergii*	Tower Road gate, Blue Trail loop at south end, and downslope to east of Homestead, plus some other sites	Cut shrubs down any time, but especially before fruits ripen as berries are spread by the birds. Pull roots with a weed wrench.
Oriental bittersweet, *Celastrus orbiculata*	Along Sears Island Road	Cut stems near the ground; hand pull seedlings.
Purple loosestrife, *Lythrum salicaria*	Coastal dune grassland, occasional along shore at west and east sides	Cut it back before it flowers, hand pull. Monitor and keep after it.
European tufted hairgrass, *Deschampsia caespitosa* subspecies *parviflora*	Moist, shady ground at 44◦ 26.914N, 68◦ 52.714 W; not seen elsewhere. Spreads along trails, woods roads in moist shady spots. Handsome, but it takes over.	Hand pull, dig it out. Monitor, repeat as necessary. In July and August, this is a robust, 3 ft tall, tuft-forming grass with stiff, shiny leaves about 1/3 inch wide, with rough margins.
Garden heliotrope, *Valeriana officinalis*	A few plants seen along Sears Island Road near Tower Road junction, also near Communications Tower	Fine, wind-borne seeds are easily spread. Watch for and pull it out as soon as it is noticed.
Bittersweet nightshade, *Solanum dulcamara*	Gullies, streams, wet areas	Cut down, especially before fruits ripen; hand pull where possible
Sheep sorrel, *Rumex acetosella*	North Meadow, east end of Ledge Trail; this can degrade lichen habitat over bedrock but this was not observed at Sears Island.	Try hand-pulling but fragments regenerate, so return and repeat. Cover treated area with wood chips to prevent erosion.
Wall hawkweed, *Hieracium murorum*	Small population along Tower Road in shade near Homestead	Not recognized as invasive in Maine but noted elsewhere as such. Fine seeds wind-dispersed. Hand pull.
Helleborine, *Epipactis helleborine*	Occasional in mesic soils, throughout	Hand pull if encountered, spreads readily in a shady understory but does not appear to usurp much habitat.
Common speedwell, *Veronica officinalis*	Numerous sites, especially at trails and roadsides, often in shade of closed tree canopy	Try digging it out wherever it is seen. Seems to spread readily with trail usage, tolerates shade and persists for many years in otherwise excellent forest conditions.

Plant common name and scientific name	Locations or habitats where representative populations can be found	Ideas for nontoxic control and other comments
Cow parsnip, *Heracleum maximum*	At causeway gate, abundant near the new kiosk and in roadside ditches nearby	Cover skin well (rubber gloves, maybe a raincoat) when working near or handling this plant, to prevent skin dermatitis reaction. Cut it down, pull it up, and/or use it to educate visitors.
Bull thistle, *Cirsium vulgare*	Encountered along Tower Road, just a few plants.	Handle when wearing thick leather gloves. Dig it out, try to get it before the seeds ripen. At least cut off flowers repeatedly until you can get back to it. Fine wind-borne seeds spread on the wind.
Wood bluegrass, *Poa nemoralis*	Ledge Trail, near Tower Road	Try hand pulling, but this could increase erosion on sloping ground. Hard to control, and may not be a priority compared to Japanese barberry and Oriental bittersweet
Common reed, *Phragmites australis*	Southwest shore	Consider digging it out while patches are small. If it appears in mitigated wetland (South Opening), consider digging it out or perhaps even chemical control; can take over completely.
Reed canarygrass, *Phalaris arundinacea*	Tower Road, near Homestead area, plus North Meadow at S end	Mow; consider digging it out if it is near a desired patch of native plants but that will not be easy and repeated effort might be required.
Fine-leaved sheep fescue, *Festuca filiformis*	North Meadow, roadsides and trailsides, upper shore	Hand pull if this is forming patches near desirable herbaceous vegetation. Might not take over habitat, so could be a lower priority. Alters fuel characteristics in some forests by increasing fine fuels that allow wild fire to spread in dry conditions.

Appendix II. Vascular plants seen at Sears Island, Searsport, Maine between April 8 – October 20, 2010, by natural community, vegetation type or habitat feature. In the species column, "*" = nonnative in northeastern North America, "**" means listed invasive or generally considered by botanists to be invasive in Maine.

genus	species	common name	form	maritime spruce-fir	spruce NHW	oak-pine	hardwood seepage	dune grassland	alder thicket	fern meadow	mixed forest	fields	pools	gullies	shores	roads, trails
FERNS AND FERN ALLIES																
Athyrium	*filix-femina*	lady fern	fern										1	1		1
Dennstaedtia	*punctilobula*	hay-scented fern	fern	1		1	1			1			1	1		1
Dryopteris	*carthusiana*	spinulose wood fern	fern							1				1		
Dryopteris	*cristata*	crested woodfern	fern											1		
Dryopteris	*intermedia*	evergreen wood fern	fern	1		1	1							1		
Equisetum	*arvense*	common horsetail	fern										1		1	
Equisetum	*pratense*	meadow horsetail	fern ally						1							
Gymnocarpium	*dryopteris*	oak fern	fern		1		1							1		
Lycopodium	*annotinum*	stiff clubmoss	fern ally	1							1					
Lycopodium	*complanatum*	groundcedar	fern ally	1	1											
Lycopodium	*obscurum*	princess-pine	fern ally	1	1	1										
Onoclea	*sensibilis*	sensitive fern	fern	1		1	1						1			1
Osmunda	*cinnamomea*	cinnamon fern	fern			1	1				1		1	1		1
Osmunda	*claytoniana*	interrupted fern	fern			1	1			1			1	1		1
Osmunda	*regalis*	royal fern	fern				1		1							1
Phegopteris	*connectilis*	long beech fern	fern	1	1	1								1		
Polystichum	*acrostichoides*	Christmas fern			1	1					1					
Pteridium	*aquilinum var. latiusculum*	bracken fern	fern	1		1	1		1			1	1	1		1
Thelypteris	*noveboracensis*	New York fern	fern										1			1
GRASSES, SEDGES AND RUSHES																
Agrostis	*perennans*	autumn bentgrass	gram				1									
Agrostis	*stolonifera**	creeping bentgrass	gram				1									
Agrostis	*gigantea**	redtop/creeping bentgrass	gram					1					1			1
Ammophila	*breviligulata*	American beachgrass	gram					1							1	
Anthoxanthum	*odoratum**	sweet vernal grass	gram								1	1	1	1		1
Arrhenatherum	*elatius**	tall oatgrass	gram				1					1				1
Brachyeletrum	*erectum*	bearded shorthusk	gram		1											
Bromus	*inermis**	smooth brome	gram													1
Calamagrostis	*canadensis*	big blue stem	gram						1							

genus	species	common name	form	maritime spruce-fir	spruce NHW	oak-pine	hardwood seepage	dune grassland	alder thicket	fern meadow	mixed forest	fields	pools	gullies	shores	roads, trails
Carex	*annectens*	sedge	gram													1
Carex	*arctata*	northern clustered sedge	gram						1							
Carex	*brunnescens*	brownish sedge	gram										1			
Carex	*communis*	fibrous-sooted sedge	gram	1												
Carex	*crinita*	drooping sedge	gram			1							1			1
Carex	*comosa*	longhair sedge	gram										1			
Carex	*debilis*	white-edged sedge	gram			1					1					
Carex	*deflexa*	northern sedge	gram						1							
Carex	*gracillima*	graceful sedge	gram													1
Carex	*gynandra*	nodding sedge	gram										1			
Carex	*intumescens*	greater bladder sedge	gram								1					
Carex	*leptonervia*	woodland nerveless sedge	gram								1					
Carex	*lucorum*	Blue Ridge sedge	gram								1					
Carex	*lurida*	shallow sedge	gram				1						1			
Carex	*nigra*	smooth black sedge	gram										1			
Carex	*pallescens*	pale sedge	gram										1			1
Carex	*projecta*	necklace sedge	gram											1		1
Carex	*scoparia*	broom sedge	gram	1									1			1
Carex	*scabrata*	eastern rough sedge	gram								1					
Carex	*scoparia*	broom sedge	gram										1			1
Carex	*tenera*	quill sedge	gram								1					1
Carex	*stipata*	awlfruit sedge	gram										1			1
Carex	*vulpinoidea*	fox sedge	gram										1			
Cinna	*latifolia*	drooping woodreed	gram								1					
Dactylis	*glomerata**	orchard grass	gram									1				1
Danthonia	*spicata*	poverty oatgrass	gram	1									1			1
Deschampsia	*flexuosa*	wavy hairgrass	gram	1												1
Deschampsia	*cespitosa* subspecies *parviflora***	European tufted hairgrass	gram													1
Dichanthelium	*boreale*	northern panic grass	gram										1			
Elymus	*virginicus*	Virginia wild rye	gram					1								
Festuca	*filiformis***	fine-leaved sheep fescue	gram	1			1					1	1			1
Festuca	*rubra**	red fescue	gram	1								1	1			1
Glyceria	*canadensis*	rattlesnake mannagrass	gram				1									
Glyceria	*striata*	fowl mannagrass	gram				1									
Holcus	*lanatus**	common velvet grass	gram										1			

genus	species	common name	form	maritime spruce-fir	spruce NHW	oak-pine	hardwood seepage	dune grassland	alder thicket	fern meadow	mixed forest	fields	pools	gullies	shores	roads, trails
Juncus	*effusus*	soft rush	gram										1			1
Juncus	*tenuis*	path rush	gram										1			1
Juncus	*balticus var. littorlias*	wire rush	gram					1								
Juncus	*gerardii*	saltmeadow rush/black-grass	gram					1								
Leymus	*mollis*	American dunegrass	gram					1								
Luzula	*acuminata*	woodrush	gram							1				1		
Luzula	*multiflora*	common woodrush	gram								1	1	1			1
Phalaris	*arundinacea***	reed canarygrass	gram									1	1			1
Phleum	*pratensis**	timothy	gram				1									1
Phragmites	*australis***	common reed	gram												1	
Poa	*annua**	annual bluegrass	gram													1
Poa	*nemoralis***	wood bluegrass	gram													1
Poa	*pratensis**	Kentucky bluegrass	gram									1	1			
Scirpus	*cyperinus*	woolgrass	gram										1			
Scirpus	*hattorianus*	mosquito bulrush	gram										1			1
Scirpus	*maritimus*	saltmarsh bullrush	gram					1								
Scirpus	*microcarpus*	panicled bulrush	gram										1			
Spartina	*patens*	saltmeadow cordgrass	gram					1								
Spartina	*pectinata*	prairie cordgrass	gram					1								
HERBS																
Achillea	*millifolium**	yarrow	herb									1		1		1
Ambrosia	*artemisiifolia**	annual ragweed	herb					1								1
Anaphalis	*margaritacea**	pearly everlasting	herb										1			
Antennaria	*neglecta*	field pussytoes	herb									1				
Apocynum	*androsaemifolium*	dogbane	herb													1
Arctium	sp.*	burdock														1
Arisaema	*triphyllum*	Jack-in-the-Pulpit	herb	1		1				1			1	1		1
Asclepias	*syriaca*	common milkweed	herb					1				1				1
Atriplex	*prostrata*	triangle orache	herb					1								
Cakile	*edentula*	American sea-rocket	herb					1								
Calystegia	*sepium*	hedge false bindweed	herb					1							1	
Chamerion	*angustifolium*	fireweed	herb													1
Chenopodium	*berlandieri var. macrocalycium*	pitseed goosefoot	herb					1								
Cicuta	*maculata*	water hemlock	herb												1	1
Circaea	*alpina*	alpine enchanter's nightshade	herb						1					1		

genus	species	common name	form	maritime spruce-fir	spruce NHW	oak-pine	hardwood seepage	dune grassland	alder thicket	fern meadow	mixed forest	fields	pools	gullies	shores	roads, trails
Cirsium	*vulgare***	bull thistle	herb													1
Coptis	*trifolia*	three-leaf goldthread	herb	1					1							
Corallorhiza	*maculata*	summar coral-root	herb													1
Daucus	*carrota**	Queen Anne's lace	herb									1	1			1
Doellingeria	*umbellata*	tall flat-topped white aster	herb	1		1	1	1				1	1	1		1
Erythronium	*americanum*	trout lily	herb											1		
Euphrasia	*nemerosa*	common eyebright	herb													1
Eurybia	*macrophylla*	big-leaf aster	herb			1					1			1		1
Fragaria	*virginiana*	wild strawberry	herb			1	1						1			1
Galium	*mollugo**	white bedstraw	herb									1	1			1
Galium	*trifidum*	threepetal bedstraw	herb									1				
Galium	*vernum**	yellow spring bedstraw	herb									1	1			
Galeopsis	*tetrahit**	brittlestem hempnettle	herb													1
Heracleum	*maximum*	cow parsnip	herb													1
Hieracium	*aurantiacum**	orange hawkweed	herb				1					1	1			1
Hieracium	*caespitosum**	meadow hawkweed	herb	1								1				
Hieracium	*pilosella**	mouse-ear hawkweed	herb										1			1
Houstonia	*caerulea*	bluets	herb									1	1			1
Hypericum	*punctatum*	spotted St. Johnswort	herb													1
Impatiens	*capensis*	jewelweed	herb					1								1
Iris	*versicolor*	blueflag iris	herb						1							
Lathyrus	*japonicus*	beach pea	herb					1								
Leontodon	*autumnalis*	fall dandelion	herb													1
Leucanthemum	*vulgare**	oxeye daisy	herb									1	1			1
Ligusticum	*scoticum*	Scotch lovage	herb					1								
Limonium	*carolinianum*	sea lavender	herb					1								
Lotus	*corniculatus**	bird's-foot trefoil	herb									1	1			1
Lycopus	*americanus*	American water-horehound	herb										1			1
Lycopus	*uniflorus*	northern bugleweed	herb										1			
Lysimachia	*quadrifolia*	whorled yellow loosestrife	herb									1				1
Lysimachia	*terrestris*	swamp candles	herb						1							
Lythrum	*salicaria***	purple loosestrife	herb					1							1	
Maianthemum	*canadense*	Canada mayflower	herb	1		1					1					1
Medeola	*virginiana*	Indian cucumber root	herb	1			1									
Melampyrum	*lineare*	cow-wheat	herb													1
Mohringia	*lateriflora*	grove sandwort	herb								1					1

genus	species	common name	form	maritime spruce-fir	spruce NHW	oak-pine	hardwood seepage	dune grassland	alder thicket	fern meadow	mixed forest	fields	pools	gullies	shores	roads, trails
Monotropa	*hypopithys*	Indian pipe	herb	1												
Oclamena	*acuminata*	white whorled wood aster	herb	1	1	1										1
Odontites	*vernum**	red bartsia	herb									1				
Oenothera	*biennus*	common evening-primrose	herb													1
Oenothera	*perennis*	little evening primrose	herb									1	1			
Oxalis	*montana*	wood sorrel	herb	1	1											
Oxalis	*stricta*	common yellow wood-sorrel	herb													1
Plantago	*major**	common plantain	herb													1
Plantago	*maritima*	goose tongue	herb					1								
Polygonum	*asarifolium*	halberd-leaved tearthumb	herb						1							
Polygonum	*cilinode*	fringed black bindweed	herb					1								1
Potentilla	*simplex*	old-field cinquefoil	herb									1	1			1
Potentilla	sp.	cinquefoil	herb													1
Prenanthes	sp.	wild lettuce	herb						1							
Prunella	*vulgaris**	heal-all	herb										1			1
Ranunuculus	*acris**	tall buttercup	herb										1			1
Ranunuculus	*repens**	creeping buttercuup	herb			1						1		1		1
Raphanus	*raphanistrum**	wild radish	herb					1								1
Rhinanthus	*minor*	yellow rattlebox	herb									1	1			1
Rumex	*acetosella**	sheep sorrel	herb	1												1
Salicornia	*depressa*	Virginia glasswort	herb					1								
Scutellaria	*galericulata*	marsh skullcap	herb					1						1		
Sisyrinchium	*angustifolim*	narrowleaf blue-eyed grass	herb										1			1
Sisyrinchium	*montanum var. crebum*	strict blue-eyed grass	herb										1			
Sium	*suave*	hemlock/waterparsnip	herb					1								
Solidago	*bicolor*	silverrod	herb				1									1
Solidago	*canadensis*	Canada goldenrod	herb				1									1
Solidago	*puberula*	downy goldenrod	herb				1									
Solidago	*rugosa*	wrinkle-leaf goldenrod	herb				1		1	1		1	1	1		1
Sonchus	*asper**	spiny sowthistle	herb					1								
Stellaria	*graminea**	common stitchwort	herb									1	1			
Suaeda	*maritima*	white seab-blite	herb					1								
Suaeda	*linearis*	southern sea-blite	herb					1								
Symphyotrichum	sp.	aster sp.	herb				1									
Symphyotrichum	*cordifolius*	common blue wood-aster	herb													1
Symphyotrichum	*lateriflorum*	calico aster	herb				1									1

genus	species	common name	form	maritime spruce-fir	spruce NHW	oak-pine	hardwood seepage	dune grassland	alder thicket	fern meadow	mixed forest	fields	pools	gullies	shores	roads, trails
Symphyotrichum	*novi-belgii*	New York aster	herb					1						1		
Symplocarpus	*foetidus*	skunk cabbage	herb	1	1				1	1						
Tanacetum	*vulgare**	common tansy	herb													1
Taraxacum	*officinalis**	common dandelion	herb				1					1				
Teucrium	*canadensis*	Canadian germander	herb					1								
Tragopogon	*pratensis**	meadow salsify	herb													1
Triadenum	*virginicum*	marsh St. Johnswort	herb										1			
Trientalis	*borealis*	northern star flower	herb			1					1			1		1
Trifolium	*aureum**	golden clover	herb									1				
Trifolium	*campestre**	field clover	herb									1	1			
Trifolium	*hybridum**	alsike clover	herb										1			
Trifolium	*pratense**	red clover	herb				1					1	1			1
Trifolium	*repens**	white clover	herb				1					1				1
Triglochin	*maritimum*	seaside arrowgrass	herb					1								
Tussilago	*farfara**	coltsfoot	herb													1
Typha	*latifolia*	cattail	herb									1	1			
Typha	*angustifolia*	common cat-tail	herb					1								
Valeriana	*officinalis**	garden heliotrope	herb													1
Veratrum	*viride*	false hellebore	herb						1							
Verbena	*hastata*	blue vervain	herb										1			
Veronica	*officinalis**	common speedwell	herb	1		1				1			1			1
Vicia	*cracca**	cow vetch	herb										1			1
Viola	*macloskeyi*	small white violet	herb						1				1			
Viola	*soraria*	northern blue violet	herb								1					1
SHRUBS, SUBSHRUBS and VINES																
Alnus	*incana ssp. rubra*	speckled alder	shrub			1	1	1	1	1			1	1	1	
Amelanchier	sp.	shadbush	shrub	1		1					1			1		1
Aralia	*nudicaulis*	wild sarsaparilla	subshrub			1					1					1
Berberis	*thunbergii***	Japanese barberry	shrub	1					1	1		1	1	1		1
Celastrus	*orbiculata***	Oriental bittersweet	shrub					1								1
Clematis	*virginiana*	virgin's bower	vine						1							
Comptonia	*peregrina*	sweet fern	shrub									1				1
Corylus	*cornuta*	beaked hazelnut	shrub								1			1		
Cornus	*alternifolia*	alternate-leaved dogwood	shrub							1	1			1		1

genus	species	common name	form	maritime spruce-fir	spruce NHW	oak-pine	hardwood seepage	dune grassland	alder thicket	fern meadow	mixed forest	fields	pools	gullies	shores	roads, trails
Cornus	*canadensis*	bunchberry	subshrub	1		1	1			1			1	1		1
Diervilla	*lonicera*	bush-honeysuckle	shrub													1
Gaultheria	*procumbens*	winterberry	subshrub	1												1
Ilex	*verticillata*	winterberry	shrub					1	1	1			1	1		1
Juniperus	*communis*	common juniper	shrub	1								1	1			1
Kalmia	*angustifolia*	sheep laurel	shrub										1			
Linnaea	*borealis*	twinflower	subshrub	1												
Morella	*pennsylvanica*	barberry	shrub					1				1	1			1
Nemopanthus	*mucronata*	mountain holly	shrub	1												
Prunus	*virginiana*	chokecherry	shrub					1			1		1			1
Prunus	*pennsylvanica*	pin cherry	shrub							1						1
Rhododendron	*canadense*	rhodora	shrub	1												
Ribes	*glandulosum*	skunk currant	shrub											1		1
Rosa	*rugosa**	rugosa rose	shrub					1							1	
Rosa	*virginiana*	Virginia rose	shrub									1	1			1
Rubus	*alleghaniensis*	blackberry	shrub			1	1					1		1		1
Rubus	*flagellaris*	northern dewberry	shrub													1
Rubus	*hispidus*	bristly dewberry	subshrub	1								1	1	1		1
Rubus	*idaeus*	red raspberry	shrub			1	1			1		1		1		1
Rubus	*pubescens*	dwarf raspberry	shrub						1					1		
Rubus	*setosus*	Setose blackberry	shrub									1				
Salix	*bebbiana*	Bebb's willow	shrub					1					1			
Salix	*discolor*	pussy willow	shrub										1			
Salix	*petiolaris*	meadow willow	shrub										1			
Salix	sp.	willow	shrub				1									
Sambucus	*canadensis*	common elder	shrub													1
Sambucus	*racemosa spp. pubens*	red-berried elder	shrub											1		
Solanum	*dulcamara***	bittersweet nightshade	vine					1	1							1
Spiraea	*alba var. latifolia*	meadowsweet	shrub							1		1	1	1		1
Spiraea	*tomentosa*	steeplebush	shrub									1	1			1
Toxicodendron	*rydbergii*	western poison ivy	shrub					1								
Vaccinium	*angustifolia*	low sweet blueberry	shrub	1							1	1	1			1
Vaccinium	*corymbosum*	highbush blueberry	shrub	1												

genus	species	common name	form	maritime spruce-fir	spruce NHW	oak-pine	hardwood seepage	dune grassland	alder thicket	fern meadow	mixed forest	fields	pools	gullies	shores	roads, trails
Vaccinium	*myrtilloides*	velvet-leaf blueberry	shrub	1												1
Vaccinium	*vitis-idaea var. minus*	mountain cranberry	subshrub	1												
Viburnum	*acerifolium*	maple-leaved viburnum	shrub			1										
Viburnum	*cassinoides var. nudum*	witherod	shrub											1		
Viburnum	*recognitum*	arrowwood	shrub										1	1		1
TREES																
Abies	*balsamea*	balsam fir	tree	1	1	1			1	1	1	1	1	1		1
Acer	*pennsylvanica*	striped maple	tree	1		1		1		1	1			1		1
Acer	*platanoides***	Norway maple	tree					1								
Acer	*rubrum*	red maple	tree	1	1	1		1	1	1	1	1	1	1		1
Acer	*spicatum*	mountain maple	tree			1				1	1			1		1
Betula	*alleghaniensis*	yellow birch	tree	1	1	1	1				1			1		
Betula	*cordifolia*	heart-leaved paper birch	tree								1					
Betula	*papyrifera*	paper birch	tree	1	1	1				1	1	1				1
Betula	*populifolia*	gray birch	tree			1			1		1	1				1
Fagus	*grandifolia*	American beech					1									
Fraxinus	*americana*	white ash	tree	1					1	1	1			1		
Larix	*laricina*	eastern larch	tree	1												
Malus	sp.*	apple	tree								1					1
Picea	*glauca*	white spruce	tree			1		1	1		1	1	1			
Picea	*rubens*	red spruce	tree	1	1	1				1	1	1	1	1		
Pinus	*mugo**	mugo pine	tree									1				
Pinus	*strobus*	eastern white pine	tree	1		1					1		1			1
Populus	*grandidentata*	bigtooth aspen	tree							1						
Populus	*tremuloides*	quaking aspen	tree								1		1			1
Prunus	*serotina*	black cherry	tree								1					1
Prunus	sp.**	bird cherry	tree								1					
Quercus	*rubra*	northern red oak	tree	1	1	1			1	1	1	1		1		1
Sorbus	*americana*	American mountain ash	tree								1					1
Thuja	*occidentalis*	northern white cedar	tree								1					
Tsuga	*canadensis*	Eastern hemlock			1											
			Subtotal by type	49	16	38	36	47	28	25	42	56	89	48	8	134
267	Total number of taxa															

Appendix III. Incidental observations of animals at Sears Island that were seen, heard, or recognized from evidence such as scat, tracks, bones or feathers during the growing season in 2010, with an anecdotal observation by a visitor (moose in 2009).

Type of animal	Common name	Evidence
Birds	American crow	Seen
	American robin	Seen
	Black and white warbler	Heard
	Black-capped chickadee	Seen
	Black-throated green warbler	Heard
	Black-throated blue warbler	Heard
	Chestnut-sided warbler	Heard
	Magnolia warbler	Heard
	Northern parula	Heard
	Blue-headed vireo	Heard
	Pileated woodpecker	Heard, pecked holes
	Hairy woodpecker	Seen
	Hermit thrush	Heard
	Blue jay	Heard
	Ovenbird	Heard
	Great blue heron	Seen, photo
	Common raven	Seen
	Golden-crowned kinglet	Heard
	Mourning dove	Heard
	Phoebe	Heard
	Eastern wood peewee	Heard
	Herring gull	Heard
	Red-breasted merganser	Seen
	Common eider	Seen
	Red-winged black bird	Seen
	Ruffed grouse	Heard
	Slate-colored junco	Scat
	Yellow-rump warbler	Heard
	White-throated sparrow	Heard
	Osprey	Seen
Mammals	Harbor seal	Seen
	Red squirrel	Seen
	White-tailed deer	Seen, scat, tracks
	Eastern coyote	Scat
	Raccoon	Scat, tracks
	Porcupine	Scat, den in hollow tree

Type of animal	Common name	Evidence
Amphibians and reptiles	Garter snake	Seen
	Wood frog	Seen
	Spotted salamander	Egg masses seen

N.B. A moose was seen by Fay Gaul, early autumn 2009.

Not seen during this inventory in 2010: ribbon snake, which has been reported by MDIFW for Sears Island (see Appendix VI).

Appendix IV. Incidental observations of common mosses, liverworts and lichens by A. C. Dibble at Sears Island during the growing season, 2010. Numerous species are yet to be documented.

Type of cryptogam	Scientific name	Common name*	Habitat Notes
Lichens	*Evernia mesomorpha*	Boreal oakmoss lichen	Common on conifer twigs
	Flavoparmelia caperata	Common greenshield	Adhering to tree bark
	Hypogymnia physodes	Monk's hood lichen	Common on conifer twigs
	Hypogymnia krogiae	Freckled tube lichen	On conifer twigs
	Usnea strigosa	Bushy beard lichen	Upper branches of mature hardwoods
Liverworts	*Bazzania trilobata*	Three-lobed bazzania	On moist ground under conifers
	Ptilidium ciliare	Hairy palmate liverwort	Over rotting logs and on conifer branches
	Radula complanata	Flat-leaved liverwort	On boles of hardwood trees
Mosses	*Dicranum montanum*	Mountain fork-moss	On boulders in shade
	Dicranum polysetum	Wavy broom moss	On the ground in mature spruce-fir
	Dicranum viride	Wood broom moss	Bases of trees
	Hedwigia ciliata	Common tiger-tail moss	On boulders, stone wall
	Hylocomium splendens	Stairstep moss	On moist ground near streams and seeps
	Hypnum imponens	Flat-tufted feather moss	Over rock, logs
	Mnium hornum	Forest-star moss	At edges of streams
	Neckera pennata	Feathered neckera	On bark of hardwoods within about 10 ft of the ground
	Platygerium repens	Trailing bark creeper	Bark of hardwoods
	Pleurozium schreberi	Big red stem feather moss	Over needle litter and humus, under conifers
	Polytrichum commune	Common hair cap moss	Forms patches on the ground where leaf litter does not smother it

Mosses, cont.	*Rhytidiadelphus triquetris*	Shaggy moss	Moist ground, in shade; richer habitats
	Sphagnum spp.	Sphagnum	Moist ground, sun or shade; numerous species to consider
	Tetraphis pellucida	Four-tooth moss	On hardwood stumps, sometimes on logs, in shade
	Thuidium recognitum	Common fern moss	On moist ground, usually near streams, seeps
	Ulota crispa	Crisped weissia	On bark of hardwoods
	Ulota hutchinsiae	American weissia	On rock, stone walls

*Common names for lichens are from Hinds and Hinds 2009, for liverworts are from Lincoln 2010, and for mosses are from unpublished data compiled by Janice Glime (see also Glime 2007).

Appendix V. Data for ten monitor points, by point, and on p. 68, a list of 15 photo points and their locations.

Site: Sears Island Conservation Area, Searsport, Maine Monitoring Point __1_, MP1

Community: Old field white pine	Location: UTM, 19T, using NAD 83 509684E, 4921620N
Date: 6 August 2010	Elevation 36 m Aspect : 89 deg. Slope: 1-3 deg.
Soil texture and color: Fine-textured silt loam	Observer: Alison C. Dibble, assisted by Sheila Heneise
Location (e.g., distance from obvious landmarks): At east side of Tower Road, 0.68 mi. to south of causeway gate, near height of land, to south of Homestead Trail, with stone wall to west	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	Eastern white pine	*Pinus strobus*	90
	Red spruce	*Picea rubens*	7
Saplings	Striped maple	*Acer pennsylvanicum*	17
	Northern red oak	*Quercus rubra*	2
	Red spruce	*Picea rubens*	t
	Red maple	*Acer rubrum*	10
	Eastern white pine	*Pinus strobus*	5
Tree seedlings	Northern red oak	*Quercus rubra*	7
	Eastern white pine	*Pinus strobus*	<5
	Striped maple	*Acer pennsylvanicum*	15
	Red maple	*Acer rubrum*	20
Shrubs	Low sweet blueberry	*Vaccinium angustifolium*	<5
	Bristly dewberry	*Rubus hispidus*	<5
	Meadowsweet	Spiraea alba	<5
	Choke cherry	*Prunus virginiana*	<5
	Shadbush	*Amelanchier sp.*	<5
Herbs	Canada mayflower	*Maianthemum canadense*	<5
	Tall white aster	*Doellingeria umbellata*	t
Bryoids (dominant)			
Other notable species			

Condition of vegetation and soils	Good.
Threats and potential threats	Invasive plants – beware Asian shrub honeysuckle, which is nearby and spreading; could be *Lonicera morrowii*; Balsam woolly adelgid could affect the balsam fir trees here.
Animals seen or evidenced	goldfinch heard, trail nearby with what could be coyote
Management notes	Monitor for invasive plants. Large oaks nearby contribute to oak regeneration and thriving seedlings here.
Large trees	Eastern white pine 26.0”, 25.7”, northern red oak 1.5”

Sears Island Conservation Area, Searsport, Maine Monitoring Point __2_, MP2

Community: Hayfield	Location: UTM, 19T, using NAD 83 509790E, 4920809N
Date: 11 September 2010	Elevation 48 m Aspect : 30 deg. Slope: 0-3 deg.
Soil texture and color: Fine silt	Observer: Alison C. Dibble
Location (e.g., distance from obvious landmarks): 1.18 mi. south of causeway gate, North Field, at Tower Road.	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	(none)		
Saplings	(none)		
Tree seedlings	Eastern white pine	*Pinus strobus*	18%
Shrubs	Steeplebush	*Spiraea tomentosa*	<5
Herbs	Red raspberry	*Rubus idaeus*	<5
	Bristly dewberry	*Rubus hispidus*	<5
	Bentgrass*	*Agrostis sp.*	20
	Fescue*	*Festuca sp.*	5%
	Goldenrods	*Solidago rugosa, bicolor, canadensis, and puberula*	20
	Pearly everlasting*	*Anaphalis margaritacea*	<5
	Reed canarygrass**	*Phalaris arundinacea*	7
Bryoids (dominant)	None obvious		
Other notable species	Red bartsia	*Odontites vernum*	5

Condition of vegetation and soils	Moderate to good. It looks as though some soil was removed from this field at the north end within the past few decades. The habitat for pollinators is excellent, with exposed, well-drained soil and copious flowers in a succession of bloom.
Threats and potential threats	Invasive plants – beware Reed canarygrass, fine-leaved sheep fescue.
Animals seen or evidenced	Sparrow (undetermined), black-capped chickadee, blue-headed vireo, red squirrel, praying mantis, crickets, native wild bees.
Management notes	Monitor for invasive plants, be aware that horses might bring weed seeds in mud on their feet. Mow once a year (possibly every other year) in early autumn.

Sears Island Conservation Area, Searsport, Maine Monitoring Point __3_, MP3

Community: Maritime Spruce-Fir	Location: UTM, 19T, using NAD 83 509198E, 4919789N
Date: 11 September 2010	Elevation 13 m Aspect : 260 deg. Slope: 0-3 deg.
Soil texture and color: Deep humus, rich dark brown, fine-textured	Observer: Alison C. Dibble
Location (e.g., distance from obvious landmarks): At southern end of Sears Island, to southwest of communications tower	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	Red spruce	*Picea rubens*	5
	Yellow birch	*Betula alleghaniensis*	45
	Red maple	*Acer rubrum*	35
	Balsam fir	*Abies balsamea*	20
Saplings	Red spruce	*Picea rubens*	20
	Balsam fir	*Abies balsamea*	10
Tree seedlings	(None > 5%)		
Shrubs	Striped maple	*Acer pennsylvanicum*	<5
Herbs	Hay-scented fern	*Dennstaedtia punctilobula*	80
	Northern star flower	*Trientalis borealis*	10
Bryoids (dominant)	Stair step moss	*Hylocomium splendens*	
	Common hair cap moss	*Polytrichum commune*	
	Three-lobed bazzania	*Bazzania trilobata*	
Other notable species		*Oxalis montana*	
	Oak fern		
Other notable species	Wood sorrel (*Oxalis montana*), Oak fern (*Phegopteris connectilis*), Bunchberry (*Cornus canadensis*), Jack-in-the-pulpit (*Arisaema triphyllum*), sedge (*Carex lucorum*)		

Condition of vegetation and soils	Very good.
Threats and potential threats	Invasive plants are nearby at the Tower Road. Beware Japanese barberry, which is spreading nearby.
Animals seen or evidenced	Ovenbird, yellow rump warbler, red squirrel
Management notes	Control invasive plants nearby. Soft soils could be impacted by hikers here, so if a trail comes through this area, be sure to spread wood chips or provide a raised walkway of some kind.
Tree diameter at 4.5 ft above the ground	Yellow birch 24.8”

Sears Island Conservation Area, Searsport, Maine Monitoring Point __4_, MP4

Community: Alder Shrub Thicket	Location: UTM, 19T, using NAD 83 509878E, 4919712N
Date: 11 September 2010	Elevation 6 m Aspect : 180 deg. Slope: 5-8 deg.
Soil texture and color: Fine-textured muck with thick humus layer	Observer: Alison C. Dibble
Location (e.g., distance from obvious landmarks): At southeast end of Sears Island, to southeast of Loop Trail near the shore.	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	Red maple	*Acer rubrum*	10
Saplings	None obvious		
Tree seedlings	None obvious		
Shrubs	Speckled alder	*Alnus incana ssp. rubra*	98
	Red raspberry	*Rubus idaeus*	t
	Bristly dewberry	*Rubus hispida*	5
Herbs	Mountain wood fern	*Dryopteris campyloptera*	t
	Sensitive fern	*Onoclea sensibilis*	90
	Lady fern	*Athyrium filix-femina*	t
	Wrinkle-leaf goldenrod	*Solidago rugosa*	t
Other notable species	Jack-in-the-pulpit (*Arisaema triphyllum*), northern bugleweed (*Lycopus uniflorus*), wood horsetail (*Equisetum sylvaticum*), skunk cabbage (*Symplocarpus foetida*). In vicinity to the east, purple-fringed orchid, *Platanthera* cf. *grandiflora*, seen by Susan White and perhaps by other members of the FOSI when in flower.		

Condition of vegetation and soils	Good. It seems possible that this was once a clearing, used perhaps as sheep pasture, but there are no clues such as fencing that might suggest this.
Threats and potential threats	Invasive plants are nearby at the Tower Road. Beware Japanese barberry, which is spreading nearby. Also be aware of erosion problems as sea level rise continues to undermine banks along the shore.
Animals seen or evidenced	None seen or heard here today.
Management notes	Control invasive plants nearby. Soft soils could be impacted by hikers here, so if a trail comes through this area, be sure to spread wood chips or provide a raised walkway of some kind.
Tree diameter at 4.5 ft above the ground	None noted.

Sears Island Conservation Area, Searsport, Maine Monitoring Point __5_, MP5

Community: Hardwood Seepage Forest	Location: UTM, 19T, using NAD 83 509791E, 4919810N
Date: 11 September 2010	Elevation 21 m Aspect : 180 deg. Slope: 5-8 deg.
Soil texture and color: Very thick humus layer covers silt layer	Observers: Alison C. Dibble, with help from Jake Maier, Susan White, Marietta and Bob Ramsdell
Location (e.g., distance from obvious landmarks): At southeast end of Sears Island, along Blue Trail, which passes through the plot.	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	Yellow birch	*Betula alleghaniensis*	60
	White ash	*Fraxinus americana*	10
	Paper birch	*Betula papyrifera*	15
	Red spruce	*Picea rubens*	27
	Red maple	*Acer rubrum*	20
Saplings	White spruce	*Picea glauca*	10
	Red spruce	*Picea rubens*	20
Tree seedlings	Red spruce	*Picea rubens*	12
	Northern red oak	*Quercus rubra*	t
	Balsam fir	*Abies balsamea*	t
	Striped maple	*Acer pennsylvanicum*	<5
Shrubs	Low sweet blueberry	*Vaccinium angustifolium*	<5
Herbs	Canada mayflower	*Maianthemum canadense*	t
	Cinnamon fern and interrupted fern	*Osmunda cinnamomea and O. claytoniana*	20
	New York fern	*Thelypteris noveboracensis*	5
Bryoids (dominant)	Big red stem feather moss, common hair cap moss, broom moss, Brachythecium moss		
Other notable species	Poverty oat grass (*Danthonia spicata*), Jack-in-the-pulpit (*Arisaema triphyllum*), wrinkle-leaf goldenrod (*Solidago rugosa*)		

Condition of vegetation and soils	Mostly, good. The protection from wind at this spot, and mesic soils, seem to contribute to a high diversity of plants, some of which were not found elsewhere on Sears Island. The Blue Trail here has tree roots exposed, suggesting that the erodible soils will need protection in the form of wood chips or some other arrangement if visitor use increases.
Threats and potential threats	Invasive plants are nearby and spreading, especially Japanese barberry, which could take over the vegetation completely here over time.
Animals seen or evidenced	None noted.
Management notes	Control invasive plants nearby. Monitor for invasive plants into perpetuity.
Tree diameter at 4.5 ft above the ground	Red spruce 11.5", yellow birch 15.5", red maple 17.0", paper birch 12.6", white ash 16.4"

Sears Island Conservation Area, Searsport, Maine Monitoring Point __6_, MP6

Community: Oak – Northern Hardwoods	Location: UTM, 19T, using NAD 83 509803E, 4921012N
Date: 11 September 2010	Elevation 41 m Aspect : 90 deg. Slope: 5-8 deg.
Soil texture and color: Fine loam, boulder, with very deep humus layer	Observers: Alison C. Dibble
Location (e.g., distance from obvious landmarks): 1.08 mi. south of causeway gate, in forest to northeast of North Meadow, ca. 150 ft into the forest from edge of field, at stone wall with conifers beyond to east	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	Northern red oak	*Quercus rubra*	95
	Red maple	*Acer rubrum*	40
	Balsam fir	*Abies balsamea*	10
	Red spruce	*Picea rubens*	15
	Yellow birch	*Betula alleghaniensis*	8
Saplings	Red spruce	*Picea rubens*	8
	Balsam fir	*Abies balsamea*	<5
Tree seedlings	Striped maple	*Acer pennsylvanicum*	<5
	Northern red oak	*Quercus rubra*	<5
	Red spruce	*Picea rubens*	10
Shrubs	Shadbush	*Amelanchier sp.*	<5
Herbs	Canada mayflower	*Maianthemum canadense*	t
	Bunchberry	*Cornus canadensis*	t
	Hay-scented fern	*Dennstaedtia punctilobula*	t
Bryoids (dominant)	Pinnate hypnum (*Hypnum imponens*)		
Other notable species	Common speedwell (*Veronica officinalis*), Autumn bentgrass (*Agrostis perennans*)		

Condition of vegetation and soils	Very good. Boulders on uphill side suggest the conifer stand was plowed at the other side of this stone wall, not this side of the wall, though perhaps this was cleared as pasture at one time.
Threats and potential threats	Invasive plants are nearby on the property, be alert for Oriental bittersweet and Japanese barberry here. Control common speedwell as there is time and interest.
Animals seen or evidenced	None seen or heard. Deer habitat.
Management notes	Avoid routing any trail over the roots of a quite large oak here. Control invasive plants nearby. Monitor for invasive plants into perpetuity.
Tree diameter at 4.5 ft above the ground	Northern red oak 30.0”, red maple 6.8” ; nearby red spruce is 18.1”

Sears Island Conservation Area, Searsport, Maine Monitoring Point __7_, MP7

Community: Fern meadow	Location: UTM, 19T, using NAD 83 510239E, 4921346N
Date: 11 September 2010	Elevation 7 m Aspect : 90 deg. Slope: 8-10 deg.
Soil texture and color: Fine loam, boulder, with very deep humus layer	Observers: Alison C. Dibble
Location (e.g., distance from obvious landmarks): Near the Penobscot River shore on the east side	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	Yellow birch	*Betula alleghaniensis*	15
Saplings	None seed		
Tree seedlings	Red maple	*Acer rubrum*	<5
Shrubs	Blackberry	*Rubus alleghaniensis*	5
	Alternate-leaved dogwood	*Cornus alternifolia*	t
	Bracken fern	*Pteridium aquilinum*	85
	Hay-scented fern	*Dennstaedtia punctilobula*	90
	Violet	*Viola sp.*	t
	sedge	*Carex debilis*	t
Bryoids (dominant)	None obvious		
Other notable species			

Condition of vegetation and soils	Good? But compared to what? This seems like an anomalous vegetation type in that it could be a result of fire or clearing, and the ferns prevent forest succession through supposed allelopathy. No erosion seen.
Threats and potential threats	Perhaps the fern behaves as a native invasive plant in that it holds the site in an early-successional stage and prevents tree regeneration.
Animals seen or evidenced	Black-capped chickadee. No animal trails seen in the dense fern cover.
Management notes	Beware erodible soils near the shore. Monitor for invasive plants even in this type of habitat. Balsam woolly adelgid evidence on balsam fir seen at edge of opening.
Tree diameter at 4.5 ft above the ground	Paper birch 14.6”

Sears Island Conservation Area, Searsport, Maine Monitoring Point __8_, MP8

Community: Dune Grassland	Location: UTM, 19T, using NAD 83 510168E, 4922188N
Date: 11 September 2010	Elevation 0.5 m Aspect : 0 deg. Slope: 0 deg.
Soil texture and color: Sand	Observers: Alison C. Dibble
Location (e.g., distance from obvious landmarks): At northeast shore; this sand deposit is a unique feature at this part of the island, can be seen from the causeway	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	none		
Saplings	none		
Tree seedlings	none		
Shrubs	Rugosa rose*	*Rosa rugosa*	(vicinity)
	Red raspberry	*Rubus idaeus*	10
Herbs	Beach pea	*Lathyrus japonicus*	5
	Redtop/creeping bentgrass	*Agrostis gigantea*	20
	American dunegrass	*Leymus mollis*	5
	saltmeadow cordgrass	*Spartina patens*	10
	American sea-rocket	*Cakile esculenta*	t
Bryoids (dominant)	None obvious		
Other notable species	Purple loosestrife present as a trace amount		

Condition of vegetation and soils	Very good. This rare community is subject to sea level rise.
Threats and potential threats	Invasive plants already here include purple loosestrife and rugosa rose.
Animals seen or evidenced	Osprey
Management notes	Avoid routing hiker traffic here. Seek to control invasive plants.
Tree diameter at 4.5 ft above the ground	Not applicable

Sears Island Conservation Area, Searsport, Maine Monitoring Point __9_, MP9

Community: Maritime Spruce-Fir	Location: UTM, 19T, using NAD 83 509075E, 4921739N
Date: 10 October 2010	Elevation 21 m Aspect : 300 deg. Slope: 3-5 deg.
Soil texture and color: Silt loam	Observer: Alison C. Dibble, assisted by Keith Dibble
Location (e.g., distance from obvious landmarks): At northeast shore; this sand deposit is a unique feature at this part of the island, can be seen from the causeway	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	Red spruce	*Picea rubens*	90
	Red maple	*Acer rubrum*	20
Saplings	Red spruce	*Picea rubens*	15
	Balsam fir	*Abies balsamea*	20
Tree seedlings	Red spruce	*Picea rubens*	8
	Northern red oak	*Quercus rubra*	t
	Balsam fir	*Abies balsamea*	<5
	Red maple	*Acer rubrum*	t
Shrubs	Shadbush	*Amelanchier sp.*	t
	American mountain ash	*Sorbus americana*	t
Herbs	Canada mayflower	*Maianthemum canadense*	<5
	Bunchberry	*Cornus canadensis*	6
	Indian cucumber	*Medeola virginiana*	<5
	Hay-scented fern	*Dennstaedtia punctilobula*	<5
	Northern star flower	*Trientalis borealis*	<5
	Goldthread	*Coptis trifolia*	<5
Bryoids (dominant)	None obvious		
Other notable species	Tree ground pine (*Lycopodium dendroides*)		

Condition of vegetation and soils	Very good. Mature conifers, undisturbed soil, no problems obvious.
Threats and potential threats	Invasive plants spread by birds are possible here.
Animals seen or evidenced	Red-breasted nuthatch, red squirrel.
Management notes	A hands-off approach could work here, but do monitor for invasive plants.
Tree diameter at 4.5 ft above the ground	

Sears Island Conservation Area, Searsport, Maine Monitoring Point __10_, MP10

Community: Maritime Spruce-Fir	Location: UTM, 19T, using NAD 83 509356E, 4921847N
Date: 10 October 2010	Elevation 31 m Aspect : 260 deg. Slope: 3-5 deg.
Soil texture and color: Very thick humus layer over silt loam	Observer: Alison C. Dibble, assisted by Keith Dibble
Location (e.g., distance from obvious landmarks): At 0.5 mi. from causeway gate, in untrailed part of the forest to west of Sears Island Road. We accessed this area along the northwest boundary.	

Stratum (dominant plants)	Common name	Latin name	Percent cover within estimated 24 ft radius
Trees	Red spruce	*Picea rubens*	5
	Red maple	*Acer rubrum*	10
	Yellow birch	*Betula alleghaniensis*	70
	Northern red oak	*Quercus rubra*	30
Saplings	Balsam fir	*Abies balsamea*	8
Tree seedlings	Striped maple	*Acer pennsylvanicum*	12
	Red spruce	*Picea rubens*	6
	Balsam fir	*Abies balsamea*	<5
	Eastern white pine	*Pinus strobus*	t
Shrubs	Low sweet blueberry	*Vaccinium angustifolium*	t
	Shadbush	*Amelanchier sp.*	t
	Mountain holly	*Nemopanthus mucronata*	t
Herbs	Indian cucumber	*Medeola virginiana*	t
	Northern star flower	*Trientalis borealis*	t
Bryoids (dominant)	Hypnum imponens, Neckera on oak (unusual!, would be more typical on white ash bark)		
Other notable species			

Condition of vegetation and soils	Very good. Mature mixed forest, no soil disturbance evident, some stump sprouts but the stems are quite large so harvest appears to have been long ago.
Threats and potential threats	Invasive plants were not seen here, but those spread by birds are possible in future. Balsam woolly adelgid could impact balsam fir.
Animals seen or evidenced	Porcupine den and recent scat.
Management notes	Leave mature forest unharvested here. A hands-off approach could work here, and is recommended given that wildlife use this spot. Do monitor for invasive plants.
Tree diameter at 4.5 ft above the ground	Northern red oak 23.6” (above a scar), red maple 11.4”, 10.6”, yellow birch 10.3”, red spruce 7.5”, 12.0”

Appendix V, Continued. Locations of 15 photo points, by latitude and longitude. Most of these photo points consist of four photos, one in each of the cardinal directions; see accompanying CD. They can be used to document baseline conditions, monitor changes, and give an overall impression of the Conservation Area. They might be most effective where major changes have taken place -- after timber harvest, ice storm, wind storm or forest fire -- or to compare extent of spread of invasive plants such as Japanese barberry.

Photo point number	Latitude, degrees N	Longitude, degrees W
PP01	44.4292	-68.8825
PP02	44.4294	-68.8833
PP03	44.4327	-68.8756
PP04	44.4392	-68.8745
PP05	44.4384	-68.8786
PP06	44.4387	-68.8808
PP07	44.4493	-68.8726
PP08	44.4484	-68.8734
PP09	44.4476	-68.8752
PP10	44.4462	-68.8778
PP11	44.4451	-68.8746
PP12	44.4337	-68.8769
PP13	44.4325	-68.8828
PP14	44.4333	-68.8824
PP15	44.4475	-68.8786

Appendix VI. Maine Department of Inland Fisheries and Wildlife database entries relevant to wildlife and habitat features at and near Sears Island as of May 2010, represented in a map.