Wells National Estuarine Research Reserve

Integrated Natural Resources Management Plan: Terrestrial, Freshwater, and Barrier Beach Habitats
2013 - 2023




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wellsreserve
Wells National Estuarine Research Reserve

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I. Introduction

The objective of this plan is to integrate the forest, shrubland and open field plans (referred to hereafter as the "technical plans") that currently exist for the Wells National Estuarine Research Reserve (Wells Reserve) into a single unified plan (Integrated Natural Resource Management Plan, or Integrated Plan) containing specific conservation actions and a timeline for executing them. This will allow the Wells Reserve to have a seamless document that will outline habitat management actions, be a reference for management grant applications and enable scheduling of these tasks in the most cost efficient way possible. References to the Wells Reserve Management plan will also be included.

The Integrated Plan is an integrated summary of the three technical plans applicable to the non-estuarine areas of the Reserve, but does not include all information that is currently included in the technical plans. Dune and barrier beach habitats, for which no technical written plan exists, are also included. The Integrated Plan refers the reader to the technical plans and other resources for additional materials as needed.

One of the objectives of this plan is to serve as a template for other Maine conservation organizations. The plan will generally follow the guidelines of *Open Standards for the Practice of Conservation* developed by the Conservation Measures Partnership (CMP). However, because the three technical plans that are the basis for the Integrated Plan have already been developed, many of the steps described in "Open Standards for the Practice of Conservation" have already been implemented. The Integrated Plan and its development cover Steps 1a through 3b of the CMP Open Standards. Step 3c (implementation of the plan), analysis of monitoring data, and use of the results for adaptive management and education (Steps 4-5) will be referenced in the Integrated Plan but will occur after the INRP is complete.

Reserve Mission and History

- **VISION**: Resilient estuaries and coastal watersheds where coastal communities and ecosystems thrive.

- **MISSION:** The Wells National Estuarine Research Reserve is dedicated to protecting and restoring coastal ecosystems of the Gulf of Maine through integrated research, stewardship, environmental learning, and community partnerships.

The Wells Reserve was designated a National Estuarine Research Reserve by the National Oceanic and Atmospheric Administration (NOAA) in 1984. The Wells Reserve is the only NERR in Maine and one of two NERRs located in NOAA's Acadian Biogeographic Region. It is situated on the southern Maine coast, and comprises 2,250 acres of upland fields and forests, riparian areas, salt marshes, dunes, beaches, and submerged lands within the watersheds of the Little River, Webhannet River, and Ogunquit River.

The Reserve consists of Parcels of conserved land owned by the U.S. Fish and Wildlife Service, the Town of Wells, the Maine Department of Agriculture, Conservation and Forestry and the Wells Reserve Management Authority. In addition to the conservation land, the Wells Reserve includes two building campuses that support the Reserve's mission: 1) Laudholm Farm, a cluster of buildings on the National Register of Historic Places, that serves as the center for visitors and for the research, education, and stewardship programs; and 2) the Alheim Commons, a property that includes two facilities that house visiting scientists, educators, and resource managers.

Scope

Geographic area:

- This plan covers the non-estuarine area of the reserve that is included in the forest, shrubland, and open-field plans, as well as the beach, dune, and back-dune habitats on Drakes Island (see Maps section of this report).

Resources addressed include:

- Common and rare plants and natural communities.
- Wildlife and wildlife habitats, including rare, threatened and endangered species and habitats for other focal species and species guilds of interest
- Plant and forest successional stages.
- Freshwater aquatic habitats, including streams and vernal pools, freshwater wetlands, and floodplains above mean high water.
- Beach and Dune/Back-dune System

Time frame:

- 2013-2023 for operational components of the plans; longer-term (> 10 year) objectives will be summarized where described in the technical plans.

Supporting Documents

The following technical plans and other documents have been used to develop the Integrated Plan.

Document	Date	Planning Period	Comments
Wells Reserve Plans			
Forest Habitat Assessment and Management Recommendations	2011	2012-2021	Referred to as the "Forest Plan" in this document. This technical plan covers all forested areas of the Wells Reserve, and includes recommendations for active demonstration forestry at the Yankee Woodlot, invasive species control and other forest restoration activities, and New England cottontail habitat development with forested areas.
Open Field Management Plan – Resource Management Advisory Committee	ca 2002 (undated)		This is a 3-page scanned document.
Fifteen-Year Habitat Management Plan for New England Cottontail at Wells National Estuarine Research Reserve (referred to as the "NEC Plan")	2010		Referred to in this plan as the "NEC Plan", it includes maps and narrative descriptions of NEC habitat management in shrubland and field areas. The areas and management recommendations included in this plan are the same as those in the NRCS Wildlife Habitat Incentive Plan (WHIP) and Wells Reserve's WHIP Field Tasks Excel Workbook (see below).
WHIP Field Tasks	2011 update	2008-2022	Spreadsheet with planned NRCS Field and Shrub management activities
NRCS WHIP Contract	2008	2008-2022	NRCS contract document detailing practices, year, and payment amount by location.

Wells National Estuarine Research Reserve Management Plan 2013-2018	2013 Draft	2013-2018	Overall plan for the Reserve, including strategic plans, administration, facilities needs and management, public access education and outreach, research, management and stewardship, and acquisition.
Site Profile of the Wells National Estuarine Research Reserve	2006		Description of the Wells Reserve land use history, ecological setting (physical and biological), human influences research, hand monitoring. Also includes generalized management recommendations for each subject area.
Project Canopy Tree Planting Grant	2012	2013	2012 grant for access road planting
Project canopy Education Grant			2012 grant for Yankee Woodlot educational trail, signs, and brochure
Other Plans and Supporting Documents			
Rachel Carson National Wildlife Refuge, Comprehensive Conservation Plan and Environmental Assessment	2007	2007-2022	Rachel Carson NWR CCP was approved in 2007. The CCP guides management decisions and actions on the Refuge for a 15-year period and covers both estuarine and non-estuarine ecosystems on the NWR. The Wells Reserve INRP includes two Rachel Carson NWR tracts.
Rachel Carson National Wildlife Refuge, Habitat Management Plan, Draft 1/2013	2013 Draft	2011-20126	The HMP is a step-down plan of the CCP. Habitat goals and objectives are incorporated in both the CCP and HMP. This plan focuses specifically on habitat management and restoration within the NWR. While written the Rachel Carson NWR, the habitat management goals and strategies of the HMP are highly relevant to on non-NWR lands covered by the Wells Reserve Integrated Plan.

See the Appendices for additional data sources and documents not listed above.

Management of Wells Reserve Estuarine Ecosystem

Wells Reserve Estuarine Ecosystem

Research, education, management, and other conservation activities within the estuarine ecosystem are addressed in the Wells Reserve 2013-2018 Management Plan, The Rachel Carson NWR Comprehensive Conservation Plan and Environmental Assessment (CCP), and the Rachel Carson NWR Habitat Management Plan (HMP).

The Integrated Plan focuses on the non-estuarine ecosystems within the Wells Reserve and supports the mission and goals of the NERR System and Wells Reserve's goals identified in the 2013-2018 Management Plan, as follows:

- Underlying the Integrated Plan and supporting technical plans are core goals of protecting water quality and maintaining healthy and functional terrestrial and freshwater ecosystems. These non-estuarine systems buffer the estuarine ecosystems processes and wildlife habitats, and together with the estuarine system form a health and functional coastal landscape. This directly supports the goal of a stable environment.
- Maintaining and restoring a natural landscape context for the estuarine systems provides opportunities for public education and interpretation that are not available in more developed areas.
- The Integrated Plan includes areas that may be used for research by Wells Reserve and other organizations.

Rachel Carson National Wildlife Refuge

Rachel Carson NWR owns and manages 1428 acres of estuarine habitat located within the boundary of the Wells Reserve. The Rachel Carson NWR CCP includes goals objectives, and strategies for barrier beach, estuarine, freshwater, and upland terrestrial systems found within the Refuge. The Rachel Carson NWR HMP focuses more specifically on management of wildlife habitats within the refuge. Rachel Carson NWR staff members have been involved in all of the technical plans included in the Integrated Plan, including both refuge and non-refuge lands covered by the Integrated Plan. The Integrated Plan supports the Rachel Carson NWR objectives for the refuge's focal species and habitats of concern (see Rachel Carson NWR HMP, Tables 3-1, 3-2, 3-3, and 3-4) as well as overall goals for ecosystem health.

Rachel Carson NWR High Priority Habitats addressed by this plan:

- Dune grassland, beach
- Freshwater wetlands: scrub shrub wetland, vernal pool, forested wetland
- Shrubland
- Oak-Pine Forest

Rachel Carson NWR Moderate Priority Habitats addressed by this plan:

- Freshwater rivers
- Grasslands

Integrated Plan goals and management actions benefit Rachel Carson NWR focal species found within these habitats (see HMP Table 3-4). Salt marshes and tidal rivers are also Rachel Carson NWR priority habitats. These habitats and associated focal species will benefit the Integrated Plan's goals of water quality protection by buffering estuarine habitats from human disturbance.

II. Overview of Plan Goals and Resources

Management Goals

Management goals are long-term conditions or outcomes that guide overall management and lead to specific conservation priority targets and objectives.

Wells Reserve has identified the following goals that are common to the Integrated Plan:

- Maintain, enhance and restore native ecosystem health,
- Protect water resources.
- Identify, maintain and enhance priority habitats associated with focal species.
- Reduce the impact of invasive species.
- Accommodate shifts in climate.
- Enhance the public's natural and educational experience by providing natural habitats to visit, demonstrating sound management practices, and conveying information about conservation and management of coastal ecosystems.

Conservation Priority Targets

Conservation priority targets are ecosystem elements that are the focus of management. In this plan, conservation priority targets include both priority habitats and focal species that have been identified in the technical plans and other supporting documents.

Wells Reserve Priority Habitats and Focal Species

Priority Habitats. Six broad priority habitat types are addressed by the Integrated Plan:

- dune/beach
- shrublands (including old fields)
- grasslands (primary fields)
- forest
- freshwater wetlands and associated habitats
- freshwater river

Focal Species. Achieving Wells Reserve goals, including managing for biological diversity, integrity, and environmental health can be addressed through the habitat requirements of "focal species" or species that may represent guilds that are highly associated with important attributes or conditions within habitat types. By managing for the habitat needs of these species, other species associated with these habitat types will also benefit.

Priority habitats and focal species are those identified in Wells Reserve technical plans and supporting documents and the Rachel Carson NWR Habitat Management Plan (HMP). These are summarized in the following table and shown on the Wells Reserve Priority Habitats Map.

Table 1. Priority Habitats and Focal Species

Habitat Type	Wells Reserve Technical Plan Focal Species[1]	Rachel Carson NWR Focal Species[2]	Examples of Other Benefiting Species[2]
Dune grassland, Beach	Piping plover Least tern[3]	Piping plover Least tern Semi-palmated sandpiper Willet	Roseate tern, common tern, arctic tern, purple sandpiper, other migrating shorebirds (black-bellied plover, buff-breasted sandpiper, dunlin, Hudsonian and marbled godwits, red knot, ruddy turnstone, sanderling, semi-palmated sandpiper, short-billed dowitcher, whimbrel, white-rumped sandpiper), *rare plants:* sea beach sedge, beach plum
Shrubland/old field	American woodcock New England cottontail[4]	New England cottontail Eastern towhee Prairie warbler	Willow flycatcher, American woodcock, blue-winged warbler, brown thrasher, eastern kingbird, field sparrow, gray catbird, fruit-eating fall migrants
Grassland/field	Bobolink Meadowlark Monarch butterfly[5]	Bobolink	Eastern meadowlark, horned lark
Forest: Oak-pine forest, Northern hardwood-mixed conifer forest	Hermit thrush, wood thrush, barred owl, black-throated green warbler, fisher[4]	Scarlet tanager Wood thrush Black-billed cuckoo	Baltimore oriole, rose-breasted grosbeak, black & white warbler, black-throated-green warbler, broad-winged hawk, Cooper's hawk, eastern wood pewee, great-crested flycatcher, little brown bat, eastern pippistrelle, southern flying squirrel, rare plants: white wood aster, sassafras
Freshwater: Scrub shrub wetland, Vernal pool, Forested wetland, Intermittent stream	Wood frog Spotted salamander, Wood turtle[4]	Blanding's turtle Willow flycatcher Marsh wren	Blue-spotted salamander, spotted turtle, wood turtle, wood duck, Canada warbler, red-shouldered hawk, New England cottontail, bats, rare plants: joe-pye-weed, slender blue flag iris, pale green orchids
Freshwater river	Wood duck Wood turtle[4]	Wood turtle American eel	Louisiana water thrush

Table footnotes:

1. Includes those species listed in Wells Reserve technical plans or other Wells Reserve resource plans.
2. Source: Rachel Carson NWR Habitat Management Plan, 1/ 2013. Because the Rachel Carson NWR focal species were based on a plan with a range of habitats and species occurrences greater than found on Wells Reserve, not all Rachel Carson NWR focus species are likely to be found on Wells Reserve (for example, Blandings Turtle and Prairie Warbler). Bird species are priority species identified in the North American Bird Conservation Initiative, BCR Region 30. Many of these species are also listed as Species of Greatest Conservation Need in the Maine Comprehensive Wildlife Conservation Strategy.
3. Wells Reserve Site Profile (2006)
4. Forest Habitat Assessment and Management Recommendation (Bryan 2011)

5. Open Field Management Plan (2002), Wells Reserve Site Profile (2006).

Table 2. Summary of Reference Plans by Habitat Type

Habitat	Key Reference Plans
Dune grassland, Beach,	• *Rachel Carson NWR HMP* 2013 draft
Maritime shrubland and back-dune forest	• *Forest Habitat Assessment and Management Recommendations* (Bryan 2011)
Grasslands, Fields, and Shrublands	• *Open Field Management Plan* (2002) • *Wells Reserve 2013-2018 Management Plan* (draft) • NRCS WHIP Plan • *Fifteen-Year Habitat Management* • *Plan for New England Cottontail at Wells National Estuarine Research Reserve* (2010) • *Forest Habitat Assessment and Management Recommendations* (Bryan 2011). Specifically, refer to the NEC Habitat Enhancement section, which identifies specific habitat patches to be created within the general areas labeled 2aWHIP and 2bWHIP of the WHIP and NEC plans. • *Rachel Carson NWR HMP* 2013 (draft)
Forest	• *Forest Habitat Assessment and Management Recommendations* (Bryan 2011) • *Rachel Carson NWR HMP* 2013 (draft)
Freshwater wetlands, vernal pools, and intermittent streams	• *Forest Habitat Assessment and Management Recommendations* (Bryan 2011) • Wells Reserve Site Profile (Dionne et al. 2006)
Freshwater river	• *Forest Habitat Assessment and Management Recommendations; riparian area recommendations* (Bryan 2011) • *Rachel Carson NWR HMP* 2013 (draft)

Priority Habitats: Current Condition, Threats, and Management

Landscape Context

The area encompassed by the Wells Reserve Integrated Plan includes approximately 370 acres of forest, field and shrubland plus the shrubland plus the adjacent freshwater areas of the Little River (

Table 3).

Tidal marshes of the Little River and Webhannet River estuaries are located northeast, east, and southeast of the Integrated Plan area. The upland and freshwater wetlands of the Integrated Plan function to conserve the ecological integrity of the tidal marshes by buffering the marshes from the impacts associated with human activities. Low-elevation forest and shrubland within the Integrated Plan area may serve as a location for landward migration of tidal marshes associated with predicted sea level rise. Drakes Island is a barrier beach/dune complex located immediately seaward of these tidal marshes. Most of Drakes Island is densely developed, but the undeveloped northern end is included in the Integrated Plan area.

The Wells Reserve Integrated Plan area is located in a landscape with several large forest patches (>500 acres in size) to the north, northwest, and west. Some areas within these blocks are protected by Rachel Carson NWR. While development along the Route 1 corridor and other roads affects movement of wildlife, the amount of forest in the landscape likely contributes to the presence of species typically associated with large patches of forest. Examples of these species observed during the 2011 forest assessment include black-throated green warbler, very, and hermit thrush. Species such as the northern goshawk, which typically nests in blocks of forest several hundred to thousands of acres of size, are unlikely to nest in the Wells Reserve forest, but may use the area seasonally. More extensive development is located to the southwest along the Route 1 corridor.

The forest and shrubland areas provide important resting and feeding habitat for birds that follow the coastline during migration. During these seasons location is more important than forest patch size.

New England cottontail, a Wells Reserve focal species of shrubland habitats, occurs at Wells Reserve but is isolated from other populations and other potential restoration areas by extensive, relatively-mature forest and developed areas.

Laudholm Beach Barrier Beach/Dune Complex

Current Condition

Laudholm Beach includes an open sand beach with open-ocean intertidal habitat; *Amophyla*-dominated dune grasslands, maritime shrub grasslands, and a pitch pine/red maple back dune forest. Laudholm Beach is one of the few undeveloped sand beaches remaining in Maine (Wells Reserve 2013). Focal species include piping plover and least tern. It provides similar habitat to Crescent Surf Beach, directly north of it which The Rachel Carson NWR HMP describes as follows: *Crescent Surf Beach is within this area and usually supports the largest concentration of nesting least terns in Maine. Up to 8 pairs of federally threatened piping plovers have nested on the beach and it is a staging area for the federally endangered roseate tern.* Many other species benefit from this habitat type.

Threats

Direct threats to focal wildlife and associated species include disturbance of nesting and foraging birds by humans and dogs, and native predators. Vegetated habitats are threatened by invasive plants, notably bush honeysuckle and rugosa rose; currently these are in localized patches or occur infrequently throughout. Vegetation loss due to human use, especially near the access point is also a concern (Wells Reserve 2007 plan, p. 94). Erosion of the southwest end of the beach is associated with the jetty at the Wells Harbor (Wells Reserve 2007 plan, p. 94); this and the seawalls on the developed portion of Drakes Island are a likely threat to the long-term dynamics of the barrier beach system. Long-term sea level rise is a threat to this habitat type.

General Management Strategy

The Wells Reserve 2013-2018 Management Plan identifies this as a Conservation Zone where the management regime is intended to maintain relatively natural conditions. The Wells Reserve 2013-2018 draft plan does not include management recommendations for the Laudholm Beach/Dune complex. The 2007 Management Plan references possible restoration of dune near the access point. This project was implemented but the planting failed. The 2007 plan also mentions the need for research and management to address the impacts of the Wells Harbor jetties. Least tern and piping plover nesting season monitoring and nest site protection is carried out by Rachel Carson, and there is a Beach Management Agreement with the Town of Wells. The Wells Reserve forest plan classifies the shrublands and back-dune forest as "Forever Wild" (see 2011 Forest Plan, Management Schemes, page 2 and dune area description, page 65), with management activities limited to control of invasive plants which is addressed in the invasive plant section of this report.

Grasslands (Fields)

Current Condition

The fields at Wells Reserve are a relic of Laudholm Farm's agricultural history and include a mixture of native and non-native plants. Periodic mowing (generally every other year) after the bird nesting season has been used to maintain optimal habitat for breeding bobolinks, meadowlarks, and for monarch butterflies. The fields at Wells Reserve provide habitat for grassland birds and insects not found elsewhere on the Reserve and generally limited in extent in southwestern Maine. Located adjacent to shrublands managed for New England cottontail (NEC), the field edges provide foraging habitat for NEC and other edge species.

Threats

Encroachment by invasive plants is the greatest threat to Wells Reserve's grassland habitats. Current (2010) infestation levels are moderate, and include bush honeysuckles, sheep sorrel, and Japanese barberry.

Management Strategy

The Wells Reserve 2013-2018 management plan identifies this as an Active Management Zone where the management regime is intended to maintain the visual appeal, historical value, and ecological significance of the fields. Current field plans call for mowing and prescribed burning to protect and improve habitat for grassland nesting birds, including bobolink and meadowlark, and promote milkweed for the monarch butterfly (RCWMR HMP 2013 draft). Some field areas will no longer be mowed as directed by the 2010 NEC Plan. Mowing is the principal method to control invasive plants, with spot herbicide treatments used in no-mow areas included in the NEC plan.

Shrubland and Other Early Successional Habitats

Current Condition

Shrublands broadly defined included upland types associated with old fields and field edges, scrub-shrub wetland communities, and maritime shrublands located in the Laudholm Beach dune complex. Encroaching shrub cover type dominated by alder, choke cherry, and other shrubs are found within the general boundary of the field areas. Upland shrub habitats adjacent to major fields are characterized by choke cherry, apple, hawthorn, goldenrods, bristly raspberry, and grasses. Invasive plants range from moderate to dense. These are successional habitats that will tend to revert to forest cover types over time without active management intervention. South of the main fields these old field habitats transition into a forest shrub complex with a dense understory of invasive plants dominated by bush honeysuckles and Japanese barberry. Wetland shrub types are located in transitional areas between forests and salt marshes and other open wetlands. The wetland shrub communities typically have a light canopy of red maple and other trees and more dense understory of speckled alder, winterberry, maleberry, and high-bush blueberry, cinnamon fern and sedges. Detailed maps and stand descriptions of shrublands are included in the Forest Plan, Non-Productive Forest Lands and Other Cover Types section.

"Mossy Bog". The Early Successional Habitat plan includes a no-mow area informally referred to as "the bog" by Wells Reserve staff. This area was mowed until very recently and is characterized by a mixture of sedges, grasses, and short shrubs. This area is a wetland and has mineral soils, whereas true bogs have deep organic soils. However, it has some plants associated with bogs including sphagnum moss, cranberry, cotton grass, and several species of wild orchid, including nodding ladies tresses and dragon mouth, which are similar to the "mossy bog lawn" plant community classified by the Maine Natural Areas Program. Also located in this area are two uncommon species (slender blue flag and pale green orchid) known to occur in the wet field area adjacent to Stand 25 (S. Bickford, per. com. 8/30/2011). This area is known to support special insect populations such as the bog skipper and may include the Quebec Emerald dragonfly.

Scientific Name	Common Name	State Rank	Global Rank	State Status
Iris prismatica	Slender blue flag	S2	G4G5	T
Platanthera flava	Pale green orchid	S2	G4T4Q	SC

State Rank

S2: Imperiled in Maine because of rarity (6-20 occurrences or few remaining individuals or acres) or because of other factors making it vulnerable to further decline.

Global Rank

G4: Apparently secure globally.

G5: Demonstrably **secure** globally.

State Status

T: THREATENED; Rare and, with further decline, could become endangered; or federally listed as Threatened. (State legal status)

SC: SPECIAL CONCERN; Rare in Maine, based on available information, but not sufficiently rare to be *considered Threatened or Endangered. (non-legal status)*

Note: State legal status is according to 5 M.R.S.A. 13076-13079, which mandates the Department of Conservation to produce and biennially update the official list of Maine's Endangered and Threatened plants. The list is derived by a technical advisory committee of botanists who use data in the Maine Natural Areas Program's database to recommend status changes to the Department of Conservation.

Threats

Most areas mapped as shrubland will eventually succeed to forest unless there is management intervention through periodic mowing (e.g., brush hog or larger mechanized equipment). True wetland scrub-shrub types may be the exception. Most of the shrublands outside of the field boundaries have moderate to severe infestations of invasive shrubs, which in some cases impede succession but also prevent establishment and maintenance of

native plants. Climate change is likely to affect the competitiveness of some native plants. Increase in sea level associated with climate change is likely to result in loss of scrub-shrub wetlands at the salt marsh fringe.

Mossy Bog: Encroachment by invasive plants is a concern, especially under a no-mow status. There is a high probability that succession to shrubs under a no-mow regime could result in the loss of the rare plants at this site and other plants not present elsewhere on Wells Reserve.

General Management Strategy
The primary goal is to manage upland and some drier scrub-shrub wetland, and some old field areas for New England cottontail (see WHIP/NEC plan and New England cottontail recommendations in Forest Plan). This will include a variety of treatments including periodic brush mowing, control of invasive plants, and planting shrubs. Outside of habitat patches specifically managed for New England cottontail, management will include control of invasive shrubs where feasible.

Mossy Bo. The goal is to prevent tall shrubs and other woody species not associated with bog habitats from invading the site and to maintain the open/low shrub conditions favored by the bog species that are present. Per recommendations of Don Cameron of the Maine Natural Areas Program (March 4, 2013), control of shrubs could include periodic mowing during dry periods and/or hand brush cutting.

Forest

Current Condition
There are approximately 185 acres of forest in the Integrated Plan area. This includes a mixture of upland pine-oak forest types and extensive wetland forests dominated by red maple and mixed conifers (principally red spruce and white pine). Also included within the "forest" areas are old field, shrub and sapling patches adjacent to the fields and surrounding salt marshes (see *Forest Habitat Assessment and Management Recommendations*, Cover Type and Forest Stand Map (see Map section of this plan).

The forest areas surround the large fields that form the central area of the upland portion of Laudholm Farm. The farm has been settled by Europeans since the 1600's, with commercial farming continuing until 1925 (Dionne et al., eds., 2006). Species composition, age and physical structure of the forest stands indicate that most of the forest was cleared pasture and field 100 years ago or less. Some areas were open field as little as 50 years ago, including parts of the Yankee Woodlot, young forest stands near the beginning of the Muskie Trail, and the shrublands south of the fields along the road to Laudholm Beach. Farm woodlot areas that may not have been fully cleared include portions of the Rachel Carson 2 lot and Skinner Mill 1 parcels. A demonstration harvest in the Yankee Woodlot occurred in 2012, but otherwise there is no evidence of recent timber harvesting.

Threats
Invasive plants are the major current threat. In some areas, particularly south of the main fields, invasive shrubs are so thick that natural succession to forest is being blocked, and in other areas with a forest canopy natural forest regeneration is being inhibited. Invasive insects are a potential concern. There is almost no hemlock in the forest, so hemlock wooly adelgid is not a concern. Other invasive insects are more cyclical in nature (e.g., gypsy moth, winter moth, brown tail moth) and the Wells Reserve forest should be able to recover from infestations if they occur. Climate change is a long-term threat, notably for cool-climate species such as red spruce and yellow birch. Climate change could also increase the threat of invasive plants and invasive insects. Warmer temperatures will stress some plants making them more susceptible to attack, and lower ecosystem stability will provide more opportunities for invasive plants to become established. Warmer temperatures will also allow some

invasive species that are more aggressive to the south (e.g. Japanese stiltgrass and hemlock wooly adelgid) to spread north and to become more robust.

General Management Strategy
Wells Reserve has developed four Forest Management Schemes that will be applied to different areas of the forest (see *Forest Habitat Assessment and Management Recommendations* and Forest Management Schemes map in this report).

> **Yankee Woodlot:** This is an educational demonstration area for small woodlot owners who want to manage their lands for various values, including recreation, aesthetics, wildlife, water quality, personal forest products, and commercial forest products. Includes both actively managed uplands and natural forest zone in the Little River floodplain. The woodlot is also the site for general and K-12 educational programs that focus on forest management and stewardship.
>
> **Active Management:** Areas designated for active management for specific objectives, such as early successional forest, to encourage specific suites of trees and plants, or to establish wildlife food plots. Invasive species will be suppressed but may not be eliminated. Public access, education, and research will be permitted. Active management areas are primarily shrubland and early successional forest areas adjacent to the fields.
>
> **Natural Forest:** Natural forest areas will be managed to restore mature New England coastal forest habitat. To the extent feasible, invasive plants will be eliminated or controlled. Possible non-commercial vegetation cutting will be allowed to enable movement toward the habitat goal. Public access, education, and research will be permitted.
>
> **Forever Wild:** The primary goal is to minimize human impacts. Natural ecosystem processes will be allowed to progress as they will. No plant or animal management will occur, with the possible exception of invasive species control and the steps necessary to protect the health and safety of visitors. Education, research, and public access will be allowed but will be minimized and avoided if possible.

The forest plan includes management recommendations targeted toward priority habitats and species. Most of the forest area will be managed for forest interior habitat and protection of wetlands, riparian areas, and vernal pools. A small area of the forest will be managed for New England cottontail and other early successional species.

Freshwater Ecosystems

Current Condition
Freshwater ecosystems within the Integrated Plan area include forested and scrub-shrub wetlands, vernal pools, intermittent streams, and the Little River. These areas are described in greater detail in the Forest Plan.

Threats
Invasive plants and climate change are the greatest threats to freshwater ecosystems. Threats to the Little River beyond the Integrated Plan area have not been addressed. Rising sea level associated with climate change

threatens low-lying forested wetlands and scrub-shrub wetlands. However, as noted earlier, these areas provide a place for landward migration of salt marshes as sea level rises.

General Management Strategy

Portions of the freshwater ecosystems are protected by the Town of Wells Shoreland Zoning Ordinance. Where management is planned in or near one of these ecosystems, protection of water quality and aquatic habitats takes precedence over other management objectives. Specific management recommendations for activities near water are included in the Forest Plan.

Table 3. Summary of Priority Habitat Types

Habitat Type	Description	Area (acres)
Beach	Un-vegetated beach, including intertidal	7.6
Dune grassland	Non-shrubby dune areas	5.7
Shrubland	Upland shrubland, scrub-shrub wetlands, and maritime (back dune) shrublands	94.2
Old Field	No-mow field areas	12.6
Grassland	Fields mowed periodically (typically every two years) with specific wildlife habitat objectives	52.9
Forest	All forest areas with >30% canopy density. More complete forest type descriptions and wetland/upland breakdown are included in Bryan 2011.	185.2
Freshwater River	Little River from US Rt. 1 to approximate head of tide	4.7
Open	Field mowed once or more time annually in Campus area	10.8
Developed	Core campus area	2.8
Plan Total Area		**376.4**
Overlay Habitats	The following priority habitats are displayed in this plan as overlay layers that intersect with other mapped priority habitats (see Priority Habitats Maps). The listed area (where applicable) is the overlay area.	
Freshwater wetlands	Forest and scrub wetlands	172
Vernal pools	Vernal pools are fishless ponds, typically seasonal, that provide habitat for obligate species including spotted salamander, blue spotted salamander, wood frog, and/or fairy shrimp. Other potential pools have been mapped by Wells Reserve, and systematic monitoring started in 2011. Obligate species have been found in all but one pool.	See map
Intermittent streams	Non-perennial streams, including drainage ditches within the forest area that were excavated to enhance crop production when these areas were field See Priority Habitats maps for location of vernal pools and intermittent streams.	See map

III. Integrated Implementation Plan

Integrated Plan Development Process

The Integrated Plan is based on several plans that were prepared under the broad umbrella of the overall Wells Reserve management plans (2007 and 2013 draft). Because the technical plans and other supporting documents were prepared at different times by different authors and committees the plans may sometimes recommend different activities in the same general area (e.g. the 2002 field plan and the later WHIP plan), or more commonly, map unit boundaries (GIS layers) are not consistent between the plans, sometimes resulting in overlap and other time gaps between the map units of the different plans.

Principal objectives of this process were to:

1. Join the map unit boundaries to eliminate overlap and gaps between the forest, field, and shrub plans.
2. Identify a clear management prescription for each map unit area in cases where potential conflicts occur between the various plans.
3. Develop a timeline showing all the management activities by year and task.

Integration Process:

1. The NEC plan map unit boundaries and prescriptions were given the highest priority in all decisions regarding boundaries and management prescriptions of the map management units in different plans. The NEC plan was given priority because the plan has contractual obligations with NRCS and the New England cottontail is listed as Endangered by the State of Maine and is a candidate species under the federal Endangered Species Act.
2. Current aerial photography and GIS were used to make minor corrections to the map units to make them consistent with the cover type boundaries and were corrected where the forest meets the shrub and field areas.
3. Overlap (generally minor) and gaps between the map units of the three principal plan areas were eliminated by adjusting the unit boundary to the cover type and boundary of the adjacent area.
4. A management prescription was developed for the remaining gaps (primarily small old field areas) that were not addressed in the underlying technical plans.
5. Draft maps and prescriptions were reviewed by a committee of Wells Reserve and Rachel Carson NWR staff. The resulting revised draft of the plan was sent to outside stakeholders for review and comment prior to completing the Integrated Plan.

Integrated Recommendations for Targeted Activities

The following section synthesizes and summarizes recommendations for the major management activities proposed in the various technical plans. Readers should refer to the Management Activities Schedule (see Appendices) for specific management activities and the supporting technical plans for specific details on management prescriptions.

Shrublands and other Early Successional Habitats

Shrubland and early successional management areas are shown on the New England Cottontail Management Areas and Field and Adjacent Shrubland Management Areas maps (see appendices). Management activities are summarized below.

The Wildlife Habitat Incentives Program for New England Cottontail plan (WHIP/NEC plan). This plan prescribes management activities to enhance New England cottontail habitat over a 15-year period. These include allowing some fields to revert to early successional habitats, brush-hogging some areas maintain shrubland and regenerating forest conditions, planting shrubs, controlling invasive plants, releasing apple trees from invasives, and felling trees potentially used by avian predators.

The WHIP/NEC plan and narrative describes in detail the sequence of management activities for each New England cottontail habitat patch. This plan was reviewed by the Maine Department of Inland Fisheries and Wildlife (MDIFW), which found that the plan "*would not likely negatively affect Maine's Endangered New England cottontail rabbit (Sylvilagus transitionalis) population, and that lands managed in this manner would likely benefit a number of early successional shrubland wildlife species, including the New England cottontail*" (George Matula Jr., MIDFW, letter to Paul Dest, Wells Reserve, 3/2/2010).

The WHIP/NEC plan is a USDA Natural Resource Conservation Service (NRCS) contract document that lists the tasks, amounts (acres or other units), schedule, and payment rates for management within the habitat patches described in the plan. The location of all activities was clearly mapped in the WHIP/NEC plans, with the exception of areas 2aWHIP, 2bWHIP.

Areas 2a WHIP and 2b WHIP include approximately 50 acres of old field and shrubland. The NEC/WHIP plans propose to convert 6 acres of this area to actively managed New England cottontail habitat patches by setting the successional process to an early stage and implementing other management activities described above. The specific locations of the habitat patches were not identified in the NEC/WHIP plans. The locations of these patches were subsequently identified in the 2011 Forest Plan. The number and location of the patches and patch sizes may be adjusted as needed to meet the goal of three patches totaling at least 6 acres.

The Forest Plan cautions that the extent of wetland shown on the map is approximate, subject to additional field verification. Prior to clearing, the extent of wetlands within all patches should be verified and boundaries modified as necessary to avoid wetland impacts.

Regulatory issues, principally Town of Wells Shoreland Zoning, have been resolved by having wildlife management activities added to the list of permissible activities.

Secondary New England Cottontail Patches. The Forest Plan also identifies several other "secondary" New England cottontail patches in other forest areas that could be developed by Wells Reserve and Rachel Carson NWR. These are considered optional activities and are not included in the WHIP/NEC plans. These areas are located in forested or mixed forest-scrub-shrub wetlands, but tree and shrub cutting only and no soil disturbance

is planned. However, Wells Shoreland Zoning standards apply. Wells Reserve will consult with MDIFW and USFWS before management within any secondary New England cottontail patch areas.

Partners for Wildlife. Early successional habitat management practices are being funded in the area identified as PFW-1 on the New England Cottontail management map and on the Field and Adjacent Shrubland Management Areas map (see appendices). These practices are being partially funded by grants from the US Fish and Wildlife Service "Partners for Wildlife" project. Management practices include activities such as wattle planting, bare root and container plantings and mechanical removal of invasive plants.

The New England Cottontail Habitat Management Map in this plan for an integrated map that includes all the information referenced above.

Grasslands/Fields

The basic field management regime for the named fields is to mow every other year. Integration issues identified:

- Many of the WHIP/NEC management areas are located within named fields, but these areas are not clearly delineated on the ground. Some areas designated no-mow under the WHIP/NEC plans and some planted areas have been inadvertently mowed.

- Several old field and hedgerow areas are not included in the field, WHIP/NEC, or forest plans or the New England cottontail management plan approved by Maine Department of Inland Fisheries and Wildlife with funding support from the Partners for Wildlife program of the US Fish and Wildlife Service. A description of these areas and recommended management is included below:

Map Unit	Area (acres)	Comment	Recommended Management
PFW-1	1.43	Recent activities include shrub planting and mechanical removal of invasive plants (see Shrublands and other Early Successional Habitats section above.	No mow to support New England cottontail management. Continue early successional management activities. Monitor for and control invasive plants.
Mossy Bog	5.07	Designated "No mow" in field plan but no other management or goal is referenced.	Control encroachment of tall, non-bog shrubs - see "Mossy Bog" section below
OF-1	0.32	Northeast corner of Lord 1 Field (garden area). Included in Lord 1 but is not being mowed.	Maintain as old-field patch and/or garden. Monitor for and control invasive plants.
OF-2	2.25	Old field area southwest of Monarch Field.	Maintain as old field/young shrub habitat with long interval (5-10years) between brush mowing to support New England cottontail management. Monitor for and control invasive plants.
SH-1	0.34	Hedgerow between Lord 1 and Laudholm Beach Road.	Manage in conjunction with adjacent shrub area 10a (See New England cottontail secondary patches and invasive plant treatment schedule.

SH-2	0.44	Island in Monarch Field	Manage in conjunction with Area 1 of the WHIP/New England cottontail management plan and control invasive shrubs.
---	---	Area northwest of barn owned by Wells Reserve and life estate north/northeast of barn.	Continue current management per agreement with landowner.

- Next Steps:
    - Update the field plan narrative based on this Integrated Plan and include as an addendum to this plan.
    - Develop a list of fields and record mowing and other management activities by year.
    - Use stakes and signs or other field markers to separate areas subject to special management (i.e., WHIP/NEC areas, mossy bog, and other shrub/old field zones) from areas subject to regular mowing.

A table of all field and shrubland management areas is included in the appendices.

Mossy Bog

There was no specific management plan for this site. Per recommendations of Don Cameron of the Maine Natural Areas Program, the following recommendations have been adopted for the Integrated Plan:

- Map the existing shrub line and establish a monitoring system to identify the current shrub limit, thereby defining the line beyond which bog conditions will be maintained through active management. Placing marked stakes in the field rather than relying on GPS only is recommended, as GPS has sufficient error to detect subtle encroachment of shrubs.
- If as expected shrubs start to encroach, shrubs will be controlled through mowing and/or hand brush cutting (brush saw or loppers). Mowing is an option when the soil is dry or frozen. Early to mid-summer cutting after the peak of growth will result in the least sprouting. Late summer, a dry fall, or during a snowless winter with frozen ground are other options, but sprouting will be greater due to greater reserves in the root systems. Volunteers could be considered for the hand cutting option.

Yankee Woodlot

The following table of activities is based on the Forest Plan. Refer to that plan for a detailed description of these activities.

Year	Stands	Activity	Progress
2012	1,2	Yankee Woodlot harvest	Completed 2012
2012-2013	3	Yankee Woodlot Stand 3 trail	Completed 2012
2013		Complete Yankee Woodlot demonstration plan and materials	

2013	1	Yankee Woodlot permanent wildlife opening	Completed 2012
2013	1,2,3	Yankee Woodlot Invasive plant control	
2013	1,2,3	Yankee Woodlot enhancement planting	
2013-2021	See description in Forest Plan	Boundary line maintenance	
2013-ongoing		Yankee woodlot Tours	Ongoing
2015	1 or 2	Yankee Woodlot deer exclosure	

Other Forest Areas

The following table of recommended activities is based on the Forest Plan. Refer to that plan for a detailed description of these activities and in the New England Cottontail and Invasive Plants section of the Integrated Plan.

Year	Stands	Activity	Comment
2013-2021	See description in Forest Plan	Boundary line maintenance	Place boundary markers (e.g. signs) and clear sight path along boundaries
2013-2021	---	NEC Habitat Patches	See NEC section of this Integrated Plan
2013-2021	---	Invasive Plant Management	See invasive plant section of this Integrated Plan

Laudholm Beach Barrier Beach/Dune Complex

The forest management plan includes the shrub and forest areas at Laudholm Beach. Invasive plant management is the only recommended activity (see Invasive Plant section of this Integrated Plan).

Wells Reserve has assessed the invasive plant conditions of the dune grasslands and collaborates with USFWS, MDIFW, Maine Audubon, and the Town of Wells in the management of least terns and piping plovers. However, Wells Reserve has not developed a comprehensive beach/dune/back-dune management plan.

Invasive Plant Control

Invasive plants have been identified as a concern in all Wells Reserve general and technical management plans. The WHIP/NEC plans have identified and secured funding for specific invasive plant treatments. The Forest plan prioritized invasive plant treatments for forest areas outside of those prescribed in the WHIP/NEC plans.

Treatment of the priority areas described in the Forest Plan is contingent upon funding, staff availability, and/or technical assistance from other partners such as the Maine Department of Conservation.

Because invasive plants are widespread, the need for treatments was prioritized as shown below.
In general, areas proposed for active management in the next 10 years were prioritized over areas where no management is planned. Areas with low levels of infestation were prioritized over severe infestations because of lower treatment costs, higher probability of success, and lower future costs if these areas were allowed to go untreated.

Priority	Condition
1	• WHIP/NEC Invasive plant control contract areas. • Planned site disturbing activity within next 10 years, including Yankee Woodlot harvest and New England cottontail habitat patch management, and areas with very low severity of infestation.
2	• Areas with low to moderate severity of infestation and New England cottontail secondary patches
3	• Areas with more severe infestations
Note: See discussion on conflicts between invasive plant control and NEC management, below.	

The following table summarizes proposed treatments by year. A detailed breakdown by management area is included in the appendices.

- All Priority 1 and some Priority 2 areas have been scheduled. Reserve staff should review the progress of invasive plant treatments in 2016 and develop a plan to treating additional areas.
- Implementation should include follow-up treatments 1-2 years after initial treatment.
- Only the WHIP/NEC plan areas have funding. Wells Reserve should seek funding for additional treatments.
- Wells Reserve should consider having at least one staff person licensed to apply herbicides.

Invasive plant treatment priority (acres)

Treatment Priority	2008	2012	2013	2015	2016	2017	2018	2019	TBD[1]	TOTAL
Priority 1										
Forest			32.5	39.9						72.4
WHIP, NEC	0.6	8.9	1.5	3.6	2		2	2		20.6
Priority 1 Total	**0.6**	**8.9**	**34**	**43.5**	**2**	**0**	**2**	**2**		**93**
Priority 2										
Forest						18.7			88.9	107.6
Priority 2 Total	**0**	**0**	**0**	**0**	**0**	**18.7**	**0**	**0**	**88.9**	**107.6**
Priority 3										0
Forest									100.2	100.2
Priority 3 Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**100.2**	**100.2**
TOTAL	**0.6**	**8.9**	**34**	**43.5**	**2**	**18.7**	**2**	**2**	**189.1**	**300.8**

1. Year to be determined. Reserve staff should review the progress of invasive plant treatments in 2016 and develop a plan to treating additional areas as time and funding permits.

Treatment Method

- Non-Rachel Carson NWR Lands. Because most invasive plants sprout after cutting, the primary recommended treatment method for areas not owned by Rachel Carson NWR is spot spray with low-toxicity herbicides. In some cases mechanical treatment of brush one year prior to chemical control is recommended to minimize the amount of chemicals used. However, Wells Reserve may use volunteers to hand-pull smaller plants. This is a good maintenance technique where low density infestations occur and can be used to reduce the need for herbicides by pulling plants the year before an herbicide treatment. There are several varieties of low-toxicity herbicides that are used by organizations such as The Nature Conservancy to maintain and restore natural communities. Prior to any use of herbicides Wells Reserve should consult with a licensed applicator for treatment options best suited to the species present and conservation goals for the site. See the Forest Plan for additional details and recommendations.

- Rachel Carson NWR. The use of chemical herbicides is not generally permitted on the Rachel Carson NWR, including those covered by the Integrated Plan.

Conflict between Invasive Plant Control and Early Successional Habitat Management

Many areas infested with invasive plants are also New England cottontail habitat, and if all invasive plant areas used by New England cottontail were treated in a short period of time New England cottontail habitat would be adversely affected in the short term and the species could possibly be extirpated from Wells Reserve. New England cottontail conservation will take precedence over invasive plant control. The general priority proposed for New England cottontail habitat is as follows for field, shrubland, and forest areas used by New England cottontail:

1. First, treat invasive plants within WHIP/NEC treatment areas. These are Priority 1 areas on the Invasive Plant Priority Map. These treatments have been reviewed and approved by MDIFW.
2. Next, treat invasive plants within any of the secondary New England cottontail patches that are to be created. Other New England cottontail habitat mapped as Priority 2 or 3 would only be considered for treatment after considering impacts to New England cottontail.

Recommendations and Considerations

- MDIFW approval is required for treatments not in the WHIP/NEC plans planned for areas of NEC habitat. Removal of too much cover could adversely impact New England cottontail and may actually violate the Maine Endangered Species Act.
- Wells Reserve should consult with USFWS. Invasive plant control within New England cottontail-occupied areas should be conducted on a trial basis and evaluated before additional control is undertaken. Based on the results of any trial controls and New England cottontail patch management, a long-term plan for invasive plant control within New England cottontail-occupied areas of the Wells Reserve should be developed in consultation with the wildlife agencies.
- An integrated summary of all contracted and recommended treatments is included in the Appendices.
- A template activity plan for invasive plant control treatments is included in the Appendices. A plan based on this template should be completed when herbicide use is planned for a specific site. The template includes a review of non-chemical alternatives, planned herbicide use, application method, and amount, and environmental and health considerations that need to be considered.

- Herbicide use should be recorded and monitored. The activity plan in the Appendices includes a template for recording monitoring information.
- See the Invasive Plants and Management Practices and Recommendations sections of the Forest Plan for information on invasive plants, the rationale for prioritization and treatment, and cautions on chemical herbicide use.

Deer Management

Wells Reserve has successfully reduced the white-tailed deer population and resulting browsing impacts through a controlled bow hunting program. The Reserve plans to continue the use of the bow hunt to keep pressure on the herd so they do not use the Wells Reserve as a refuge. A systematic and repeatable vegetation monitoring protocol could be used to assess impacts of deer browsing and other changes in plant communities. A deer exclosure in the Yankee Woodlot would provide educational value.

Legal Considerations

- Forestry legal requirements are described in the Forest Management Plan.
- Shoreland Zoning is summarized in the Forest Management Plan. Since the Forest Management Plan was developed the Town of Wells amended its Shoreland Zoning Ordinance to allow wildlife habitat management within the Resource Protection district at the Wells Reserve.
- Consult with USFWS and MDIFW regarding Incidental Take Permits for activities that could potentially impact New England cottontail. This would include:
    - Mowing of all field, shrub, and old-field habitats not described in the MDIFW-approved New England Cottontail Management Plan and associated approval letter from MDIFW.
    - Creation of the New England cottontail Secondary Habitat patches (see Forest Plan).
    - Herbicide treatments in potential NEC habitats.
- Sections of the Wells Reserve between Drakes Island Road and the Little River have been designated as a State Wildlife Sanctuary. No hunting or trapping can occur without the permission of the Wells Reserve and the Maine Department of Fisheries and Wildlife Commission.

Management Activities Summary

Management activities and timelines for forest, shrubland, and field areas are described in the technical plans. See Appendix II for a composite table that integrates the activity schedules for all three plans. This table will facilitate annual scheduling, coordinating similar activities recommended in the different plans (e.g., invasive plant control), and provide an overview of planned management.

Some activities in the technical plans did not have scheduled dates (for example, invasive plant control in some areas). All activities have been scheduled where possible, or a mid-plan review date 2016-2017) has been added to schedule activities for the remainder of the plan period.

Costs for many activities are rough estimates based on published sources. Actual costs will depend on final site management plans, area and intensity of management, and other factors to be considered at the time of implementation. Costs for follow-up invasive plant the treatments are nearly impossible to estimate, at the area requiring follow-up treatment and the size and density of plants to be treated cannot be determined in advance.

Please refer to the preceding sections and technical plans for management details.

IV. Education and Research Plans

The management activities in the Integrated Plan support Wells Reserve's mission of education and research.

Education

Major Wells Reserve educational activities as of 2013 are summarized below.

Laudholm Beach:

- Summer intertidal zone programs (public family programs and also summer camp activities): 12/year
- Earth Day beach clean-ups: 1/year
- Discovery Program stops here: Multitude times per year
- A picture post where periodic panoramic photos are taken and uploaded to website was located on the beach, but has been washed away. A replacement plan is pending discussion with Rachel Carson about best placement concerning the piping plover and least tern nesting site.

Upland Trails:

- Variety of public programs, school programs, camps, & teacher workshops: Multitude year-round
- Favorite trees include snags with woodpecker holes (especially on Saw-whet Trail), trees with sapsucker evidence (especially on Barrier Beach Road), and wolf pines (especially on Muskie Trail)
- Other special plants include rare orchids in bog area (this is a highlight of our annual wildflower walk in June)

Yankee Woodlot:

- Fall 2012 harvesting workshop for land trusts, conservation commissions, and landowners
- Interpretive information (signs and a brochure) and public programs will be developed.

Discovery Program: There are three activity booklets that take families, scout troops, and school groups on the trails of the Reserve. These trails are marked with numbered posts that have a mummichog, turkey, or porcupine on them. Trails include: Knight Trail, Barrier Beach Trail, Laird-Norton Trail, Cart Path, Saw-whet Owl Trail, & Farley Trail.

Bird Banding: Bird banding occurs every Wednesday morning in the summer months, followed by saw-whet owl banding in the fall. The banding station is set up under the large copper beech tree on campus. Net locations are included in the Wells Reserve GIS.

Little River Floating Lab/Dock:

- Summer kayaking programs: 14/year
- Exploring Estuaries school program in spring & fall: 10-20/year
- Summer camps: 5-15/year

Research Road Marsh:

- Microscopic Marvels school program: 4/year
- Summer camp activities: 5-15/year
- Teachers on the Estuary workshops: 1/year
- Temporary collection of mummichogs from salt pannes for school programs: 10-20 times/year
- Picture posts where periodic panoramic photos are taken and uploaded to website.

Research

A summary of research projects on the areas of the reserve include:

- Maine Medical Center: Tick borne disease research on Wells Reserve property.
- State of Maine Butterfly survey: butterfly species are captured by net, photographed and documented then released. Data is sent to Maine Inland Fisheries and Wildlife biologists.
- Beach Profile: Volunteers collect beach transect data at a variety of points along southern Maine beaches. This effort is coordinated by one of the Wells Reserve Research Staff.
- Bird Monitoring
    1. SEANET: monthly monitoring of Laudholm Beach for beached/dead birds in association with Tufts University http://www.tufts.edu/vet/seanet/
    2. Breeding Bird Survey: weekly bird survey using mist nest from Memorial Day to Labor Day as part of the MAPS project for USGS.
    3. Piping Plover/Least Tern: yearly monitoring program on Laudholm/Crescent Surf Beaches in partnership with Rachel Carson National Wildlife Refuge

V. Monitoring

Monitoring is essential to sound, long-term management. Monitoring data are necessary to track progress toward meeting goals, evaluate the success of past treatments (e.g., harvests designed to promote forest regeneration or invasive species control projects) and need for follow up, monitor for potential adverse impacts of management (e.g., soil erosion on forest access trails), and provide timely data so that the management plan can be modified to react to changing conditions.

The 2006-2011 Wells National Estuarine Research Reserve System Research and Monitoring Plan primarily addresses estuarine habitats. For non-estuarine habitats covered by the Integrated Plan, only the forest management plan and least tern/piping plover habitats have monitoring plans.

Recommendations

The following table has been adapted from the forest management plan to include monitoring recommendations for all Integrated Plan areas.

Table 4. Monitoring Recommendations

Element	Strongly Recommended	Desirable	Frequency
All Areas			
Wildlife Inventory	NEC monitoring Breeding bird inventory – track observations of Integrated Plan focal species by habitat type and location	Winter mammal tracking Owl nesting surveys Monitor other (non-focal) species as desired	Annually. Use qualified citizen scientist volunteers.
Vernal Pools	Monitor presence and abundance of obligate vernal pool species (see Maine Audubon protocol) by pool	-----	Annually. Use qualified citizen scientist volunteers.
Invasive plants	Harvest sites and other areas of mechanical disturbance: check for invasive plants before activity and develop control plan if present.	-----	Prior to harvests or other site disturbing activities.
	Location, year, type of treatment, amount and type of chemicals used, method of application, and applicator	-----	Upon completion of each treatment
	Evaluate success of treatments and prescribe follow-up control as necessary.	-----	1 year after treatment, every 5 years thereafter.
	Map extent and severity of invasive plants	Informal monitoring by Wells Reserve staff and volunteers	Mapping: every 10 years; Informal monitoring on an ongoing basis Landowner: ongoing
Rare Plant Inventory	Check with MNAP for updated rare plant and important wildlife habitat data.	-----	Every 10 years and prior to commercial harvest if more than one year since last update.
Other	-----	Wells Reserve should obtain pertinent data from other research and monitoring that occurs in the plan area	-----
Forest			

Forest Inventory	Tree species, size and density (all trees >1 in. dbh). Focus Species Ecosystem and Development Stage. *Refer to Maine Forest Service Stewardship Plan inventory requirements.*	Species distribution by canopy layer (overstory, understory, ground cover) and percent cover of each layer. Shrubs, wildflowers and other herbs, ferns and bryophytes. Snags, cavity trees, and large downed woody material.	Every 10 years.
Forest Regeneration	Quantitative or qualitative monitoring designed to see if regeneration objectives are being met.	-----	Within 3 years of a regeneration harvest and during forest inventory.
Erosion and sedimentation	Check roads, skid trails, water crossings, and landings.	Improved trail system	During harvest operations, 1 year after harvest (or sooner if very heavy rains) and within 3 years.

Incorporating Monitoring Data into Plan Updates

Monitoring data should be summarized on an ongoing basis and used to track effectiveness of management activities and trends in desired habitats or focal species. The data should be reviewed on a 5-year basis to determine if mid-course plan corrections are needed. Updated plans (e.g., every 10 years) should incorporate monitoring results.

GIS and Map Updates

- The GIS should be updated as areas are treated, including a base map with a treatment area overlay, and attribute files to include type of treatment, date, area, etc.. This should be supplemented with narrative summarizing outcomes.

VI. Other Recommendations

The forest plan and WHIP/NEC plans have the most comprehensive baseline information and management recommendations for the Integrated Plan area. In developing the Integrated Plan, several opportunities for planning and management were identified.

Laudholm Beach Barrier Beach/Dune/Back-dune Complex

- Develop a comprehensive management plan. See Forest Plan for back-dune forest and shrubland recommendations.

Field Plan

- Update the field plan narrative based on this Integrated Plan and include as an addendum to this plan.
- Develop a list of fields and record mowing and other management activities by year.
- Use stakes and signs or other field markers to separate areas subject to special management (i.e., WHIP/NEC areas, mossy bog, and other shrub/old field zones) from areas subject to regular mowing.

Invasive Plants

- Secure funding for and schedule invasive plant treatments for all Priority 1 and 2 invasive plant areas.
- Wells Reserve should consider having a staff member with a Maine pesticide applicator's license so that some invasive plant projects can be managed in-house.

Monitoring

- Use the monitoring plan to develop an annual monitoring checklist.
- Enlist qualified volunteers and implement monitoring recommendations for focal species in all priority habitat types (see Monitoring section of this plan).
- Develop a systematic and repeatable vegetation monitoring protocol to assess impacts of deer browsing and other changes in plant communities.

Project-specific Operations Plans

- For all activities, prior to activities a site specific work plan should be prepared referencing the management plan tasks, adding site-specific details and site maps as needed, and addressing potential risks. When the task is complete an update summarizing the completed activity (tables and maps showing acres, feet, amount of product used, species treated etc. as applicable to the tasks) should be prepared.

VIII. References

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Appendices

Appendix I. Maps

Legend

Barrier Beach

Beach

Dune

Forest Plan

Field Plan

WHIP - NEC Plan

Notes: This map shows the overall scope of the ***Integrated Natural Resource Plan*** (INRMP) and limits of the technical plans that are the basis of the INRMP. Field Plan and WHIP-NEC Plan base GIS layers developed by WNERR. Forest Plan layers by Forest Synthesis. See INRMP text and technical plans for details.

0 300 600 900 1200 feet

Wells Reserve

INRMP Overview Map

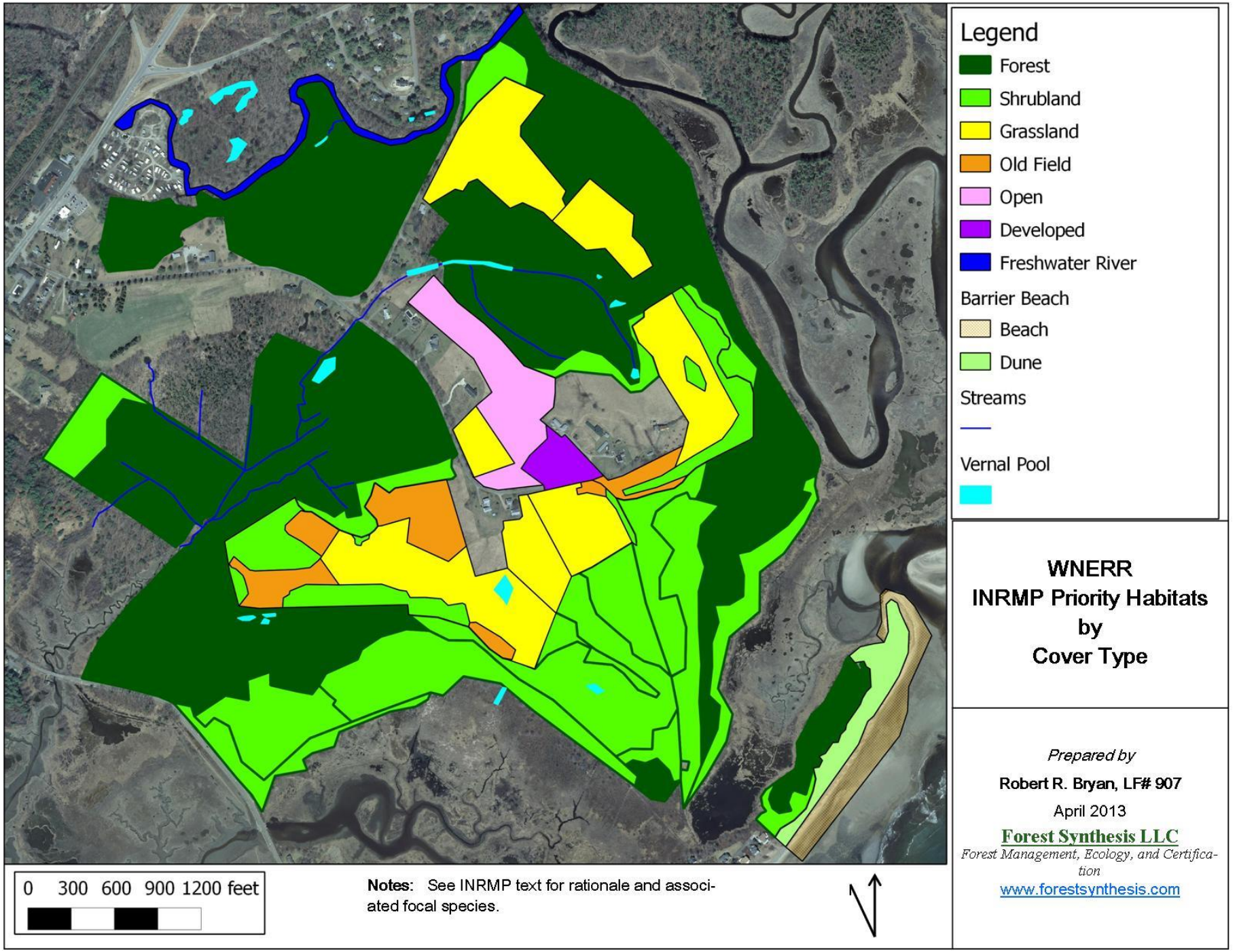
Forest Synthesis LLC

271 Harpswell Neck Road,
Harpswell, ME 04079

Forest Management, Ecology, and Certification

www.forestsynthesis.com

Prepared by:
Robert R. Bryan, LF #907
April 2013


Legend
Forest
Shrubland
Grassland
Old Field
Open
Developed
Freshwater River
Barrier Beach
Beach
Dune
Streams
Vernal Pool
0 300 600 900 1200 feet
Notes: See INRMP text for rationale and associated focal species.
WNERR
INRMP Priority Habitats
by
Cover Type
Prepared by
Robert R. Bryan, LF# 907
April 2013
Forest Synthesis LLC
Forest Management, Ecology, and Certification
www.forestsynthesis.com

Notes: Cover type ,stream and wetland identification per Forest Synthesis field reconnaissance 2011. Stream and wetland information is for natural resource planning only and not to be used for activities requiring permits. Forested wetlands and scrub-shrub wetlands are the primary freshwater wetland types (see other maps for underlying habitat types).

WNERR
INRMP Priority Habitats Freshwater Wetlands, Streams, and Vernal Pools

Prepared by

Robert R. Bryan, LF# 907

April 2013

Forest Synthesis LLC

Forest Management, Ecology, and Certification

www.forestsynthesis.com

Legend

WNERR Management Schemes

- Active Management
- Natural Forest
- Forever Wild
- Yankee Woodlot

RCNWR Active Management Overlay

0 200 400 meters

WNERR
Forrest Management Schemes

Notes: See management plan Introduction for a description of the WNERR management schemes. Yankee Woodlot includes both active management and natural forest area. Specific management activities for each area are described in the Management Practices and Recommendations section. RCNWR plans to use active management as necessary on its land as necessary to improve NEC habitat and restore NEC populations.

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Prepared by:
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December, 2011

Legend

NEC - Partners for Wildlife

NEC-Whip Grant Areas

NEC Secondary Patches

Forest Plan Habitats

Forest

Shrubland

Other Habitats

WNERR
New England Cottontail Management Areas

0 300 600 900 1200 feet

Notes: See Integrated Plan text for overview. See also NRCS NEC WHIP plan, WNERR New England Cottontail Plan, and Forest Plan for management details.

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April 2013

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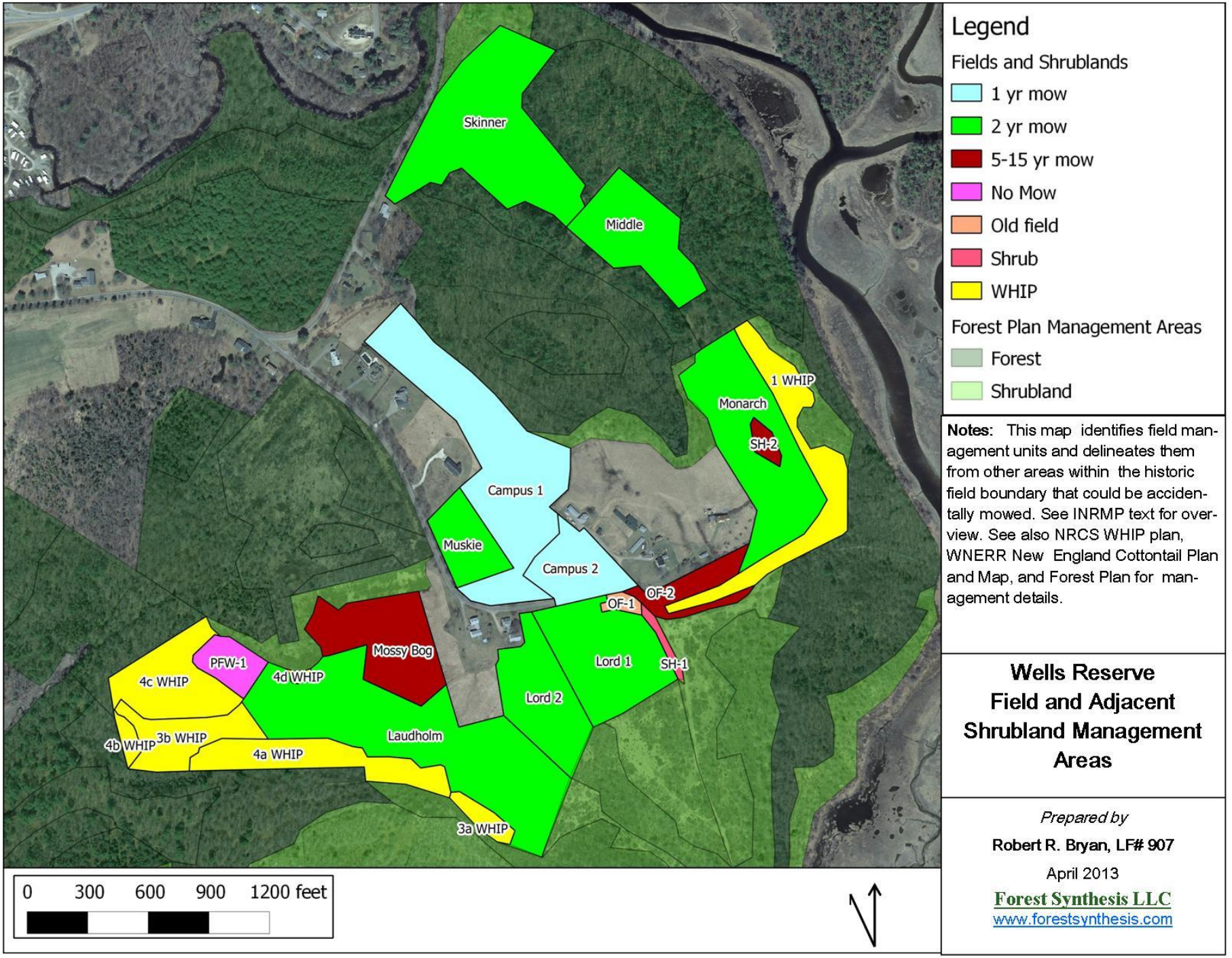
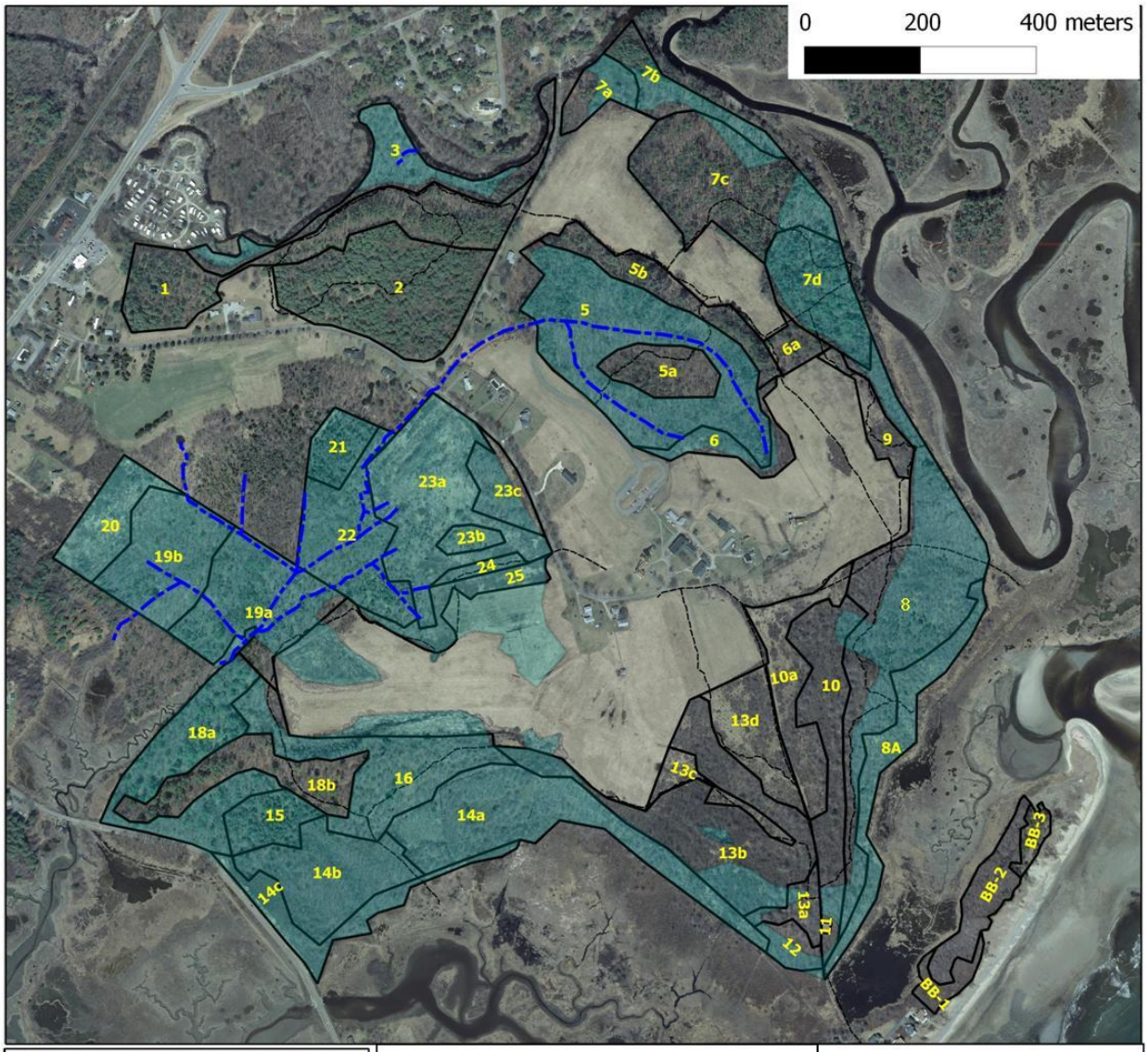

Skinner
Middle
1 WHIP
Monarch
SH-2
Campus 1
Muskie
Campus 2
OF-2
OF-1
Mossy Bog
PFW-1
4c WHIP
4d WHIP
Lord 1
SH-1
Lord 2
Laudholm
4b WHIP
3b WHIP
4a WHIP
3a WHIP
0 300 600 900 1200 feet
Legend
Fields and Shrublands
1 yr mow
2 yr mow
5-15 yr mow
No Mow
Old field
Shrub
WHIP
Forest Plan Management Areas
Forest
Shrubland
Notes: This map identifies field management units and delineates them from other areas within the historic field boundary that could be accidentally mowed. See INRMP text for overview. See also NRCS WHIP plan, WNERR New England Cottontail Plan and Map, and Forest Plan for management details.
Wells Reserve
Field and Adjacent
Shrubland Management
Areas
Prepared by
Robert R. Bryan, LF# 907
April 2013
Forest Synthesis LLC
www.forestsynthesis.com



Legend

Forest Stands and other Map Units

Steams

Wetlands

trails

Forest Cover Type and Stand Map

Notes: Refer to report text for cover type data. Aerial Imagery MEOGIS 2009. Cover type ,stream and wetland identification per Forest Synthesis field reconnaissance. Stream and wetland information is for natural resource planning only and not to be used for activities requiring permits.

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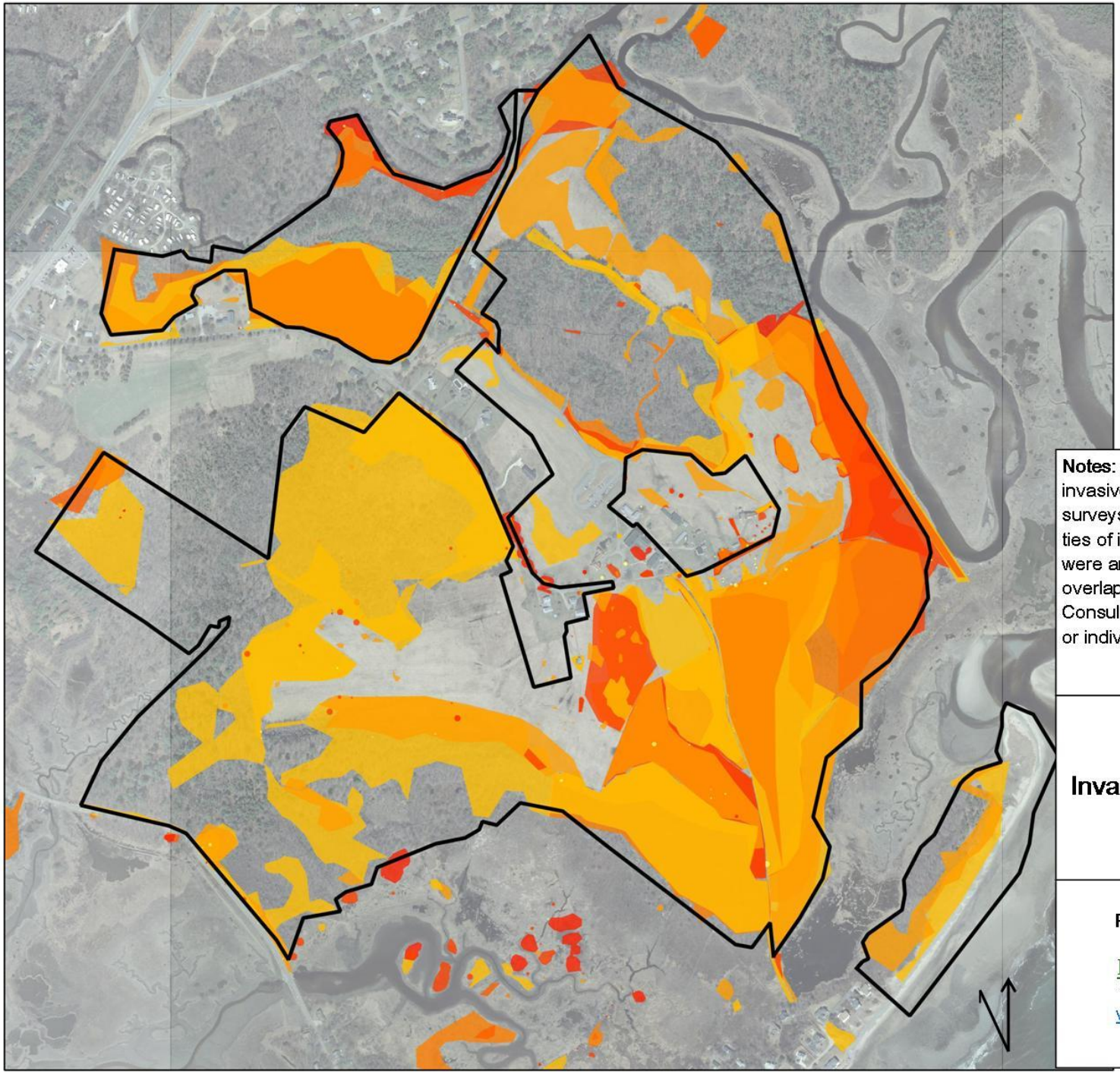
November, 2011



Legend

Invasive Plant Density

Most Dense

Least Dense

INRMP Plan Area

Notes: This map represents relative invasive plant density based on field surveys by Wells Reserve. The densities of individual species GIS files were are presented here as multiple overlapping transparent color layers. Consult WNERR source data and GIS or individual species information.

WNERR
Invasive Plant Conditions

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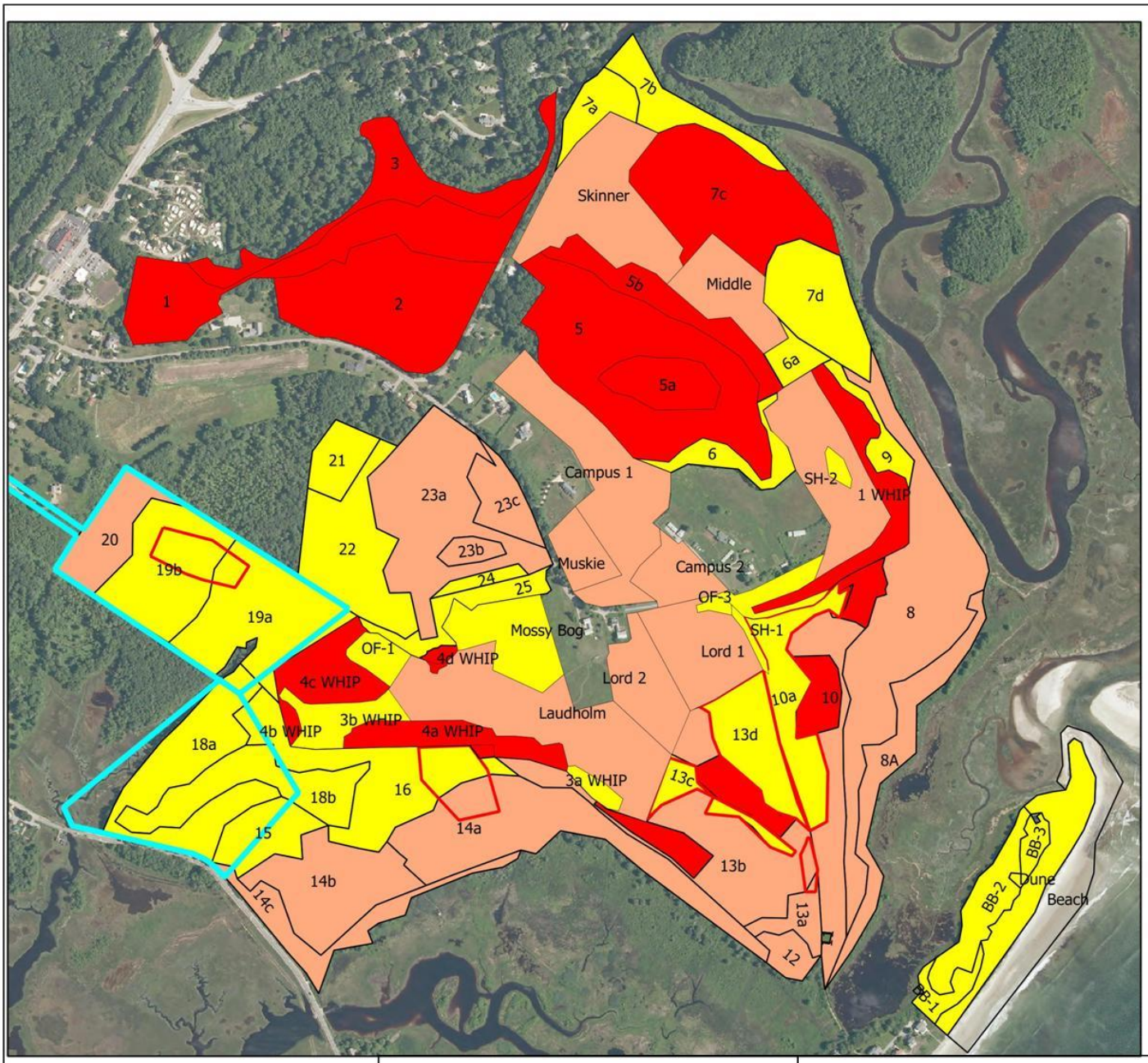

Legend

Invasive Plant Treatment Priority

- 1
- 2
- 3

NEC Secondary Patches

Rachael Carson NWR Boundary

Notes: This map shows priority of invasive plant treatments. See INRMP for treatment schedule and overview of approaches and see technical plans for details.

Any NEC Secondary Patches that are developed will be shifted to Priority 1.

Herbicides may not be used in the Rachel Carson NWR portion of the plan area.

0 100 200 300 400 Feet

Wells Reserve
Invasive Plant Priorities Map

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Prepared by:
Robert R. Bryan, LF #907
April 2013

Appendix II. Management Activities Schedule: 2012-2022

Year[1]	Plan	Plan Area[2]	NRCS Task Number	Treatment[3]	Acres	Amount[4]	Status	Comments
All	Forest	1,2,3	n/a	Yankee Woodlot Tours	---	---	--	Tours to be scheduled throughout the plan period
2008	WHIP, NEC	4b	1	Brush hog- medium mechanical	0.6	$167.68	Done	
2008	WHIP, NEC	4b	2	Spot spray invasive exotics	0.6	$85.50	Done	
2009	WHIP, NEC	2b	5	Apple tree release (8 total)	--	$156.56	Done	See Forest plan, NEC Patches 1,2,3,4
2009	WHIP, NEC	2b	6	Brush piles (6 total)	25.8	$790.47	Done	See Forest plan, NEC Patches 1,2,3,4
2009	WHIP, NEC	4b	4	Herbicide planting spots	0.6	$59.00	Done	
2009	WHIP, NEC	2b	3	Mechanically remove predator perch trees (15 total) & invasives	0.0	$249.52	Done	See Forest plan, NEC Patches 1,2,3,4
2010	WHIP, NEC	4b	8	Plant bare-root shrubs	0.6	$2,783.35	Done	
2011	WHIP, NEC	2a	12	Apple tree release (8 total)	0.1	$157.00	--	
2011	WHIP, NEC	2a	10	Brush mowing- heavy mechanical	2.0	$1,997.00	--	See Forest plan, NEC Patches 1,2,3,4
2011	WHIP, NEC	2a	13	Brush piles (5 total)	0.1	$659.00	--	See Forest plan, NEC Patches 1,2,3,4
2012	Forest	1,2	n/a	Yankee Woodlot harvest	25.8	+$4,000	Done	Completed 2012
2012	WHIP, NEC	1	18	Brush hog- medium mechanical	3.0	$839.00	--	Posts and signs to delineate from remainder of Monarch Field?
2012	WHIP, NEC	2a	19	Brush hog- medium mechanical	1.0	$280.00	--	See Forest plan, NEC Patches 1,2,3,4
2012	WHIP, NEC	4a	17	Brush hog- medium mechanical	2.4	$671.00	--	On GIS this block is 4.6 acres - only field portion to be treated? yes
2012	WHIP, NEC	4d	14	Brush hog- medium mechanical	0.5	$140.00	--	
2012	WHIP, NEC	2a	9	Brush mowing- heavy mechanical	2.0	$1,997.00	--	See Forest plan, NEC Patches 1,2,3,4
2012	WHIP, NEC	4d	16	Brush mowing- heavy mechanical	0.5	$500.00	--	
2012	WHIP, NEC	4d	23	Herbicide planting spots	0.5	$49.00	--	
2012	WHIP, NEC	2a	7	Mechanically remove predator perch trees (15 total)& invasives	0.2	$250.00	--	See Forest plan, NEC Patches 1,2,3,4
2012	WHIP, NEC	1	20	Spot spray invasive exotics	3.0	$428.00	--	
2012	WHIP, NEC	2a	11	Spot spray invasive exotics	2.0	$285.00	--	See Forest plan, NEC Patches 1,2,3,4
2012	WHIP, NEC	2a	21	Spot spray invasive exotics	1.0	$143.00	--	See Forest plan, NEC Patches 1,2,3,4
2012	WHIP, NEC	4a	22	Spot spray invasive exotics	2.4	$342.00	--	
2012	WHIP, NEC	4d	15	Spot spray invasive exotics	0.5	$72.00	--	

Year[1]	Plan	Plan Area[2]	NRCS Task Number	Treatment[3]	Acres	Amount[4]	Status	Comments
2012	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2013	Forest	1,2,3	n/a	Complete Yankee Woodlot demonstration plan and materials	N/A	See grant	--	See Project Canopy Grant information
2013	Forest	1,2,3	n/a	Yankee Woodlot Spot spray invasive exotics	32.5	$14,133	--	
2013	Forest	1	n/a	Yankee Woodlot permanent wildlife opening	0.34	See grant	--	See Project Canopy Grant information
2013	WHIP, NEC	1	24	Brush hog- medium mechanical	1.5	$420.00	--	
2013	WHIP, NEC	4a	26	Herbicide planting spots	2.4	$236.00	--	
2013	WHIP, NEC	2a	27	Plant bare-root shrubs	1.0	$4,292.00	--	See Forest plan, NEC Patches 1,2,3,4
2013	WHIP, NEC	4d	28	Plant bare-root shrubs	0.5	$2,146.00	--	
2013	WHIP, NEC	1	25	Spot spray invasive exotics	1.5	$214.00	--	
2013	Forest	3	n/a	Yankee Woodlot stand 3 trail	---	See grant	--	See Project Canopy Grant information
2012	Field/NEC	All	n/a	Mark line between mow and no-mow areas	---	Staff	---	Stake or otherwise mark boundary between biennial mowing and other shrub/field areas, including WHIP, SH, OF, and Mossy Bog map units
2013	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2013	All	All	---	Monitoring- see monitoring plan	---	---	---	
2014	WHIP, NEC	4a	29	Plant bare-root shrubs	2.4	$10,300.00	--	
2014	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2014	All	--	n/a	Follow-up invasive plant treatments as needed	*	*	*	*See Invasive Plant Treatments table
2014	All	All	---	Monitoring- see monitoring plan	---	---	---	
2015	WHIP, NEC	4c	33	Brush hog- medium mechanical	1.6	$448.00	--	
2015	WHIP, NEC	2b	30	Brush mowing- heavy mechanical	2.0	$1,997.00	--	See Forest plan, NEC Patches 1,2,3,4
2015	WHIP, NEC	2b	31	Brush mowing- heavy mechanical	2.0	$1,997.00	--	See Forest plan, NEC Patches 1,2,3,4
2015	WHIP, NEC	2b	32	Spot spray invasive exotics	2.0	$285.00	--	See Forest plan, NEC Patches 1,2,3,4
2015	WHIP, NEC	4c	34	Spot spray invasive exotics	1.6	$228.00	--	
2015	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2015	Forest	1 or 2	n/a	Yankee Woodlot deer exclosure	TBD	TBD	--	

Year[1]	Plan	Plan Area[2]	NRCS Task Number	Treatment[3]	Acres	Amount[4]	Status	Comments
2015	All	All	---	Monitoring- see monitoring plan	---	---	---	
2016	WHIP, NEC	2b	35	Brush hog- medium mechanical	2.0	$280.00	--	See Forest plan, NEC Patches 1,2,3,4
2016	WHIP, NEC	4c	37	Brush mowing- heavy mechanical	2.0	$1,997.00	--	
2016	WHIP, NEC	3a	38	Herbicide planting spots	0.7	$69.00	--	
2016	WHIP, NEC	4c	39	Herbicide planting spots	3.6	$353.00	--	
2016	WHIP, NEC	2b	36	Spot spray invasive exotics	2.0	$143.00	--	See Forest plan, NEC Patches 1,2,3,4
2016	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2016	All	--	n/a	Follow-up invasive plant treatments as needed	*	*	*	*See Invasive Plant Treatments table
2016	Forest	NEC*	n/a	Develop plan to implement NEC secondary patches	TBD	TBD		* Review progress on NEC 2a/2b patches and develop plan for other patches in second half of planning period.
2016	Forest	Inv*	n/a	Plan invasive plant treatments in all Priority 2 areas	TBD	UP to 108 acres		* Priority 2 invasive treatments: Prioritize areas within this group and develop control plan
2016	Integrated Plan	See plan	2	Plan invasive plant treatments in OF-1, OF-3, OF-4, SH-1, SH-2, and mossy bog	9.9	TBD		Priority 2 invasive treatments: Prioritize areas within this group and develop control plan
2016	All	All	---	Monitoring- see monitoring plan	---	---	---	
2017	WHIP, NEC	2b	40	Plant bare-root shrubs	2.0	$4,292.00	--	See Forest plan, NEC Patches 1,2,3,4
2017	WHIP, NEC	3a	41	Plant bare-root shrubs	0.7	$3,004.00	--	
2017	WHIP, NEC	4c	42	Plant bare-root shrubs	3.6	$15,449.00	--	
2017	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2017	Integrated Plan	OF & SH	n/a	Mow shrubs if needed- OF-1, OF-3, OF-4, SH-1, SH-2, mossy bog				Consider period shrub mowing on 5-15 year cycle to maintain shrub habitat for NEC
2017	Integrated Plan	Mossy Bog	n/a	Mow or cut shrubs if needed				Mow on dry or frozen ground only. See this report for details.
2017	Forest	*	n/a	Boundary line maintenance	TBD	TBD	--	*Refer to forest plan
2017	All	All	---	Monitoring- see monitoring plan	---	---	---	
2018	WHIP, NEC	2b	43	Brush mowing- heavy mechanical	2.0	$1,997.00	--	See Forest plan, NEC Patches 1,2,3,4
2018	WHIP, NEC	2b	44	Brush mowing- heavy mechanical	2.0	$1,997.00	--	See Forest plan, NEC Patches 1,2,3,4
2018	WHIP, NEC	2b	45	Spot spray invasive exotics	2.0	$285.00	--	See Forest plan, NEC Patches 1,2,3,4

Year[1]	Plan	Plan Area[2]	NRCS Task Number	Treatment[3]	Acres	Amount[4]	Status	Comments
2018	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2018	All	--	n/a	Follow-up invasive plant treatments as needed	*	*	*	*See Invasive Plant Treatments table
2018	All	All	---	Monitoring- see monitoring plan	---	---	---	
2019	WHIP, NEC	2b	47	Brush hog- medium mechanical	2.0*	$280.00	--	See Forest plan, NEC Patches 1,2,3,4
2019	WHIP, NEC	2b	48	Spot spray invasive exotics	2.0*	$143.00	--	See Forest plan, NEC Patches 1,2,3,4
2019	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2019	All	All	---	Monitoring- see monitoring plan	---	---	---	
2020	WHIP, NEC	2b	50	Plant bare-root shrubs	2.0**	$4,292.00	--	See Forest plan, NEC Patches 1,2,3,4
2020	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2020	All	--	n/a	Follow-up invasive plant treatments as needed	*	*	*	*See Invasive Plant Treatments table
2020	All	---	n/a	Consider feasibility of treating invasive plant Priority 3 areas	*	*	*	*See Invasive Plant Treatments table
2020	All	All	---	Monitoring- see monitoring plan	---	---	---	
2021	WHIP, NEC	3b	46	Herbicide planting spots	2.7	$265.00	--	
2021	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2021	All	All	---	Monitoring- see monitoring plan	---	---	---	
2022	WHIP, NEC	3b	49	Plant bare-root shrubs	2.7	$11,587.00	--	
2022	Integrated Plan	OF & SH	n/a	Mow shrubs if needed- OF-1, OF-3, OF-4, SH-1, SH-2				Consider period shrub mowing on 5-15 year cycle to maintain shrub habitat for NEC
2022	Integrated Plan	Mossy Bog	n/a	Mow or cut shrubs if needed				Mow on dry or frozen ground only. See this report for details.
2022	Field	All	n/a	Biennial mowing per plan schedule	---	Staff	---	Track mowing by field and year
2022	All	--	n/a	Follow-up invasive plant treatments as needed	*	*	*	*See Invasive Plant Treatments table
2022	All	All	---	Monitoring- see monitoring plan	---	---	---	

Table footnotes:

1. Year: for WHIP, "Year" is Year listed on contract document.

2. Plan map unit: refer to maps from referenced plan for area number and location. Note that in some cases the WHIP/NEC plan and the forest plans use the same map unit number for different areas.
3. For treatment details, refer to technical plan and WHIP contract for detailed objectives and procedures.
4. WHIP costs based on NRCS contract. Estimated cost of invasive plant treatment in forest areas based on WHIP rate - actual costs to be determined by consulting with contractors.

- Invasive Plants – See Invasive Plants Treatments table

TBD: To be determined. A mid-plan check (2016) is planned to prioritize and schedule "TBD" tasks.

** NRCS Contract says 1.0 acres, Wells Reserve internal spreadsheet says 2.0 acres.

Appendix III. Shrubland and Field Management Table

Area	Integrated Plan Habitat	Acres	Management
Fields			
Laudholm	Grassland	13.58	Mow every other year
Lord 1	Grassland	5.89	Mow every other year
Lord 2	Grassland	4.50	Mow every other year
Middle	Grassland	4.85	Mow every other year
Monarch	Grassland	11.14	Mow every other year
Muskie	Grassland	2.39	Mow every other year
Skinner	Grassland	10.52	Mow every other year
Old Field and Shrubland			
Mossy Bog	Old Field	5.07	Mow periodically to control shrubs and maintain open/low-shrub conditions for bog plants
PFW-1	Old Field	1.43	No mow to support New England Cottontail management. Early successional management practices as funds allow.
OF-1	Old Field	0.32	Maintain as old-field patch and/or garden
OF-2	Old Field	2.25	Maintain as old field/young shrub habitat with long interval (5-10years) between brush mowing to support New England Cottontail management.
SH-1	Shrubland	0.34	Manage in conjunction with adjacent shrub area 10a (See New England Cottontail secondary patches and invasive plant treatment schedule.
SH-2	Shrubland	0.44	Manage in conjunction with Area 1 of the WHIP/New England Cottontail management plan and control invasive shrubs.
Campus			
Campus 1	Open	10.81	Annual mowing
Campus 2	Developed	2.82	Mow as needed. Develop long-term plan to replace Norway maples with native species.
WHIP/NEC Habitats			
1 WHIP	Shrubland	11.14	WHIP/NEC Plan
3a WHIP	Old Field	0.56	WHIP/NEC Plan
3b WHIP	Old Field	2.47	WHIP/NEC Plan
4a WHIP	Shrubland	4.10	WHIP/NEC Plan
4b WHIP	Shrubland	0.40	WHIP/NEC Plan
4c WHIP	Shrubland	4.05	WHIP/NEC Plan
4d WHIP	Shrubland	0.10	WHIP/NEC Plan
2a WHIP and 2b WHIP	Shrubland	6	WHIP/NEC Plan and Forest Plan
Secondary NEC Patches	Shrubland and Forest	---	WHIP/NEC Plan and Forest Plan

Appendix IV. Invasive Plant Treatments

See footnotes for explanations.

Year	Plan	Plan Area	Priority	Treatment	Acres	Rate	Amount	Completed?
2008	WHIP, NEC	4b	1	spot spray	0.6		$85.50	Yes
2012	WHIP, NEC	1	1	spot spray	3.0		$428.00	
2012	WHIP, NEC	2a	1	spot spray	2.0		$285.00	
2012	WHIP, NEC	2a	1	spot spray	1.0		$143.00	
2012	WHIP, NEC	4a	1	spot spray	2.4		$342.00	
2012	WHIP, NEC	4d	1	spot spray	0.5		$72.00	
2013	Forest	1	1	spot spray	12.1	434.86	$5,262	
2013	Forest	2	1	spot &mist spray	13.7	434.86	$5,958	
2013	Forest	3	1	spot spray	6.7	434.86	$2,914	
2013	WHIP, NEC	1	1	spot spray	1.5		$214.00	
2015	WHIP, NEC	2b	1	spot spray	2.0		$285.00	
2015	WHIP, NEC	4c	1	spot spray	1.6		$228.00	
2015	Forest	4, 5a, 5b, 7c, 24	1	spot spray	39.9	434.86	$17,351	
2016	WHIP, NEC	2b	1	spot spray	2.0		$143.00	
2017	Forest	6, 6a, 7a, 7b, 9	2	Mechanical & spray TBD	18.7	989.41	$18,502	
2018	WHIP, NEC	2b	1	spot spray	2.0		$285.00	
2019	WHIP, NEC	2b	1	spot spray	2.0		$143.00	
2016 Plan	Forest	10a	2	spot spray	6.1	434.86	$2,653	
2016 Plan	Forest	13b	2	spot spray	11.6	989.41	$11,477	
2016 Plan	Forest	13c	2	spot spray	1.8	989.41	$1,781	
2016 Plan	Forest	13d	2	spot spray	5.1	434.86	$2,218	
2016 Plan	Forest	15	2	spot spray & mechanical	3.1	434.86	$1,348	
2016 Plan	Forest	16	2	Spot, mechanical,& mist	9.9	434.86	$4,305	
2016 Plan	Forest	18a	2	mechanical	9.6	686.83	$6,594	
2016 Plan	Forest	18b	2	mechanical	6.4	686.83	$4,396	

Year	Plan	Plan Area	Priority	Treatment	Acres	Rate	Amount	Completed?
2016 Plan	Forest	19a	2	mechanical	10.0	686.83	$6,868	
2016 Plan	Forest	19b	2	mechanical	8.4	686.83	$5,769	
2016 Plan	Forest	21	2	spot spray	2.6	434.86	$1,131	
2016 Plan	Forest	22	2	spot spray	8.3	434.86	$3,609	
2016 Plan	Forest	25	2	spot spray	3.0	434.86	$1,305	
2020 Plan	Forest	8	3	spot spray	19.6	989.41	$19,393	
2020 Plan	Forest	08A	3	spot spray	5.8	434.86	$2,522	
2020 Plan	Forest	10	3	spot spray	5.0	989.41	$4,947	
2020 Plan	Forest	12	3	spot spray	1.5	434.86	$652	
2020 Plan	Forest	13a	3	spot spray	1.8	989.41	$1,781	
2020 Plan	Forest	14a	3	spot spray	12.9	434.86	$5,610	
2020 Plan	Forest	14b	3	spot spray	8.4	434.86	$3,653	
2020 Plan	Forest	14c	3	spot spray	4.1	434.86	$1,783	
2020 Plan	Forest	20	3	spot spray	4.9	989.41	$4,848	
2020 Plan	Forest	23a	3	spot spray	12.7	434.86	$5,523	
2020 Plan	Forest	23b	3	spot spray	1.0	434.86	$435	
2020 Plan	Forest	23c	3	spot spray	2.9	434.86	$1,261	
2020 Plan	Forest	BB-1	3	spot spray	1.4	434.86	$609	
2020 Plan	Forest	BB-2	3	spot spray	4.0	434.86	$1,739	
2020 Plan	Forest	BB-3	3	spot spray	1.0	434.86	$435	
2020 Plan	Forest	NEC Secondary Patches	3	spot spray	10.0	434.86	$4,349	
2014-2022	All	All	---	Follow-up treatments as needed	TBD	See note	See note	

Table Footnotes

- See Forest Plan, NEC Patches 1,2,3,4 for location of these treatment areas
- Acres per applicable plan (Forest, WHIP/NEC)
- Rates:
    - WIP/NEC rates per WHIP grant. Forest plan rates per 2013 NRCS Maine EQIP rate table. EQIP payment rates are 70% of NRCS estimated total costs. NRCS estimated total costs were used for this table. Actual rates may vary.
    - Spot spray treatment costs are based on NRCS “Chemical Moderate with Follow-up” and “Chemical Difficult with Follow-up.” RCNWR rate based on NRCS “Medium mechanical”. This rates assume a follow-up treatment.
- 2016 Plan. Prioritize remaining Priority 2 treatment areas within this group and develop control plan. Total acres to be determined based on Priority 2 control plan. Total costs will vary accordingly.
- 2020 Plan. Consider treating Priority 3 areas only Priority 1 and 2 areas have been treated and monitored with follow-up as needed. . Total acres to be determined based on Priority 3 control plan. Total costs will vary accordingly.
- 2014-20122 Follow-up treatments. Treated areas are likely to need some sort of follow-up treatment. The location and extent can only be determined by monitoring effectiveness of controls. All Forest Plan rates used in the table assume one follow-up treatment. WHIP/ NEC Plan does not include follow-up.
- TBD: To be determined
- See Forest Plan, NEC/WHIP, and Integrated Plan for details.

Appendix V. Activity Plan Template – Forest, Shrub, and Field Habitats

Use this template for all management, education, and research activities other than herbicide control of invasive plants. It is recommended that Wells Reserve copy this template and adapt the format and content as needed.

Date:

Prepared by: **Reviewed by**:

Planned Activity: **Extent** (acres, linear feet, number, etc.):

Location (Plan name and Map unit number):

Briefly describe how this fits in with planned activities in the Integrated Natural Resource Management Plan or supporting technical plan, including:

a) Specific recommendations for this area included in the plans:

b) How this will maintain, restore, or enhance priority habitats and species identified in the Integrated Plan. :

Checklist of resources of concern (complete)

Check if Present	**Resource of Concern**	**Describe:**	**Conservation measures to be applied** (add narrative below as needed)
	Rare, threatened or endangered species or habitat		
	Stream		
	Vernal pool within 400 ft.		
	Wetland		
	Research area		
	Public use area		
	Rachel Carson NWR lands		
	Other		
	Invasive plants		

Maine or Federal Endangered Species Act review needed? (For example: activities in/near New England cottontail habitat that are included in current Incidental Take review or other approvals)

Town or State permits or review needed? (For example: Shoreland Zoning, Natural Resource Protection Act, forestry stream crossing, forestry timber harvest notification, etc.):

Should neighbors or other stakeholders be consulted?

If invasive plants are present, describe how activity will attempt to minimize spread and any control measures that will be needed:

Detailed description of planned management (method, materials, season, skills needed, desired outcome, etc.):

Who will do this work (e.g., staff, contractor, trained volunteer, etc.):

Precautions to address sensitive features or impacts to abutters or other human uses:

Monitoring plan (during and after management):

Long-term monitoring needed:

Attach photos- before, during, and at completion of activity.

Attach map: attach a map of the plan area showing extent of activities and sensitive sites.

Appendix VI. Activity Plan Template – Herbicide Use for Invasive Plant Control

This template includes information that should be recorded when planning and monitoring use of herbicides for control of invasive plants. It is recommended that Wells Reserve copy this template and adapt the format and content as needed.

Date:

Prepared by: **Reviewed by**:

Planned activity: **Planed treatment extent (acres):**

Location (Map name and Map unit number):

Briefly describe how this fits in with planned activities in the Integrated Natural Resource Management Plan or supporting technical plan, including:

a) Specific recommendations for this area included in the plans:

b) How this will maintain, restore, or enhance priority habitats and species identified in the INTEGRATED PLAN:

Alternatives to herbicide use considered:

Are these the least toxic chemicals that can be feasibly used? Explain.

Prescription (briefly describe):

Summary of planned chemical use:

Product Name[1]	Active ingredient	Active ingredient percent[2]	Application rate[3]	Target Species	Method (e.g., foliar spray, but stem, basal bark)	Total Area Planned

1. Product name. This is the "brand name." Be specific as to which version (for example, there are many varieties of "Roundup."
2. Percent of active ingredient in the "product."
3. Application rate. Percent mix of product (not active ingredient) with carrier. If broadcast spraying, (not backpack or hand spraying) total per acre planned if broadcast spray (not applicable for backpack or hand spraying).

Checklist of resources of concern (complete):

Check if Present	Resource of Concern	Describe:	Conservation measures to be applied (add narrative below as needed)
	Rare, threatened or endangered species or habitat		
	Stream		
	Vernal pool within 400 ft.		
	Wetland		
	Research area		
	Public use area		
	Rachel Carson NWR lands		
	Other		

Maine or Federal Endangered Species Act review needed? (For example: activities in/near New England cottontail habitat that are included in current Incidental Take review or other approvals)

Town or State permits or review needed? (For example: Shoreland Zoning, Natural Resource Protection Act, forestry stream crossing, forestry timber harvest notification, etc.):

Should neighbors or other stakeholders be consulted?

Who will do this work (e.g., staff, licensed contractor, trained volunteer, etc.):

Precautions to address sensitive features or impacts to abutters or other human uses:

Describe number and type of follow-up treatments expected (number of years, acres, etc.):

Monitoring plan (during and after management):

Map: attach a map of the plan area showing extent of activities and sensitive sites.

Appendix VII. Herbicide Use Monitoring Form

Site: Applicators:

Date	Begin/End Time	Wind/Weather	Product Name[1]	Active ingredient	Active ingredient percent[2]	Application rate[3]	Method (e.g., foliar spray, but stem, basal bark)	Amount of Product Used	Total Area Treated

1. Product name. This is the "brand name." Be specific as to which version (for example, there are many varieties of "Roundup."
2. Percent of active ingredient in the "product."
3. Application rate. Percent mix of product (not active ingredient) with carrier. If broadcast spraying, (not backpack or hand spraying) total per acre planned if broadcast spray (not applicable for backpack or hand spraying).

Spills, worker exposure to chemicals, etc.:

Attach a map of the treated area.

Optional: Photos before, during, and at completion of activity.

Other Comments: