

Invasive Plant Species and Habitat Management Plan for Boston Harbor Islands National Recreation Area

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Executive Summary

This management plan:

- 1) describes the process to prioritize habitat management zones and invasive species treatments in Boston Harbor Islands National Recreation Area (a.k.a. National and State Park),
- 2) determines park-specific priorities for invasive species management, and
- 3) provides detailed recommendations for the implementation of invasive species management in the park.

Invasive Plant Species and Habitat Management Plan for Boston Harbor Islands National Recreation Area

Invasive plants threaten the natural and cultural resources of Boston Harbor Islands . These unwelcome invaders reduce native biodiversity, alter forest structure, suppress tree regeneration, degrade wildlife habitat, and pose significant threats to the long-term condition of parks' natural and cultural resources. A recent analysis by NPS scientists of 12 years' worth of data collected from over 1,400 forest plots in 39 eastern national parks indicate that invasive plants are a large and, literally, growing problem for many national parks (Miller et al. 2021).

Boston Harbor Islands National Recreation Area consists of 34 islands and peninsulas that have endured centuries of human use (Figure 1). Resource management at BOHA has done extensive work trying to manage the invasives throughout the park, including treatments, revegetation projects and data collection on species composition and vegetation communities among the islands. Recent compilation of BOHA's data along with EDDMap and iNaturalist data showed nonnative plants have been detected on most of the islands/peninsulas within the park. The most frequent observations in BOHA were shrubs, such as multiflora rose (*Rosa multiflora*), Asian bittersweet (*Celastrus orbiculatus*), bush honeysuckle (*Lonicera* spp.), and glossy buckthorn (*Frangula alnus*). Effective management of these species is challenging, as invasive plants are inherently difficult to control once established and access to islands can be difficult.

This plan recommends a three-pronged approach to managing invasive species in BOHA:

1. early detection and rapid response;
2. release of approved biological controls;
3. strategically treating invasive species to protect the park's special places.

Boston Harbor Islands National Recreation Area 2022



Figure 1. Islands and peninsulas making up Boston Harbor Islands National Recreation Area.

Early Detection and Rapid Response

The most cost-effective and ecologically viable method to control invasive species is to stop invasive species from becoming established and widespread in a park. The Northeast Temperate Inventory and Monitoring Network (NETN) maintains a target list of invasive species for early detection and rapid response. The list for BOHA has been adapted and updated for this project from the EDRR list by Wheeler and Miller 2014 (Table 1). However, this list requires further review by park staff. These species may be present at very low levels or are not yet established in the park and are likely to invade given their regional distribution. The park's resource management staff treats invasives and keeps track of any early detection species observed during their work. For more information about species detection or an updated target list, contact Marc Albert, BOHA Integrated Resource Management Program Manager (marc_albert@nps.gov) or Rachel Vincent, Biological Science Technician, (rachel_vincent@nps.gov).

We encourage park staff to refer to this table and to update it as needed based on updated early detection species for eastern Massachusetts. It is important to revisit the areas that have been treated to determine whether the species are still under control and to document any emerging species occurring throughout the park. Maintaining updated spatial data (through ArcGIS, iNaturalist or EDDMaps) on invasive presence will be beneficial for updating this plan in the future.

Biological Controls

For invasive plants that are widespread, biological controls (also known as biocontrols) are often the only realistic management options for species that are highly invasive and well-established. Biocontrols are host-specific insects or pathogens that feed only on a particular invasive plant species. The biocontrols weaken the target invasive plant, limiting its spread and its ability to displace nearby native plants. The use of biocontrols is strictly regulated and guided by federal and state laws, an International Code of Best Practices, and specific protocols that are all designed to ensure the safety and effectiveness of biocontrol programs.

The biological control of purple loosestrife (*Lythrum salicaria*) illustrates how biocontrols can successfully reduce the abundance of highly invasive species to a tolerable level at which they coexist with native plant communities and may be beneficial for the control of loosestrife populations at BOHA. From the mid-1990s until the mid-2010s, the Massachusetts Division of Ecological Restoration (DER), Massachusetts Audubon, and partner organizations in the Sudbury-Assabet-Concord Cooperative Invasive Species Management Area released two loosestrife beetles (*Galerucella californiensis* and *Galerucella pusilla*) that have controlled the spread and abundance of purple loosestrife. Similar efforts have occurred in Connecticut and the state of Connecticut currently has approved the release of four insects as biological controls for the species: *Hylobius transversovittatus*, *Galerucella californiensis*, *Galerucella pusilla*, and *Nanophyes marmoratus*. For more information about biological controls of purple loosestrife contact Donna Ellis at the University of Connecticut (donna.ellis@uconn.edu).

Additionally, there are other promising biocontrols for several species of concern in the Northeast region, which occur or could become more established in BOHA. The weevil, *Rhinoncomimus latipes*, feed specifically on mile-a-minute (*Persicaria perfoliata*), an EDRR species at BOHA and is being used to help control populations throughout Connecticut. Another insect that is currently being reared at Philip Alampi Beneficial Insect Rearing Laboratory in New Jersey is the moth *Hypena opulenta*, that feeds on leaves, flowers, and seed pods of swallowwort, *Vincetoxicum nigrum*. This may be useful for managing swallowwort populations.

Table 1. Working target early detection and rapid response (EDRR) species list Boston Harbor Islands National Recreation Area organized by islands. An X indicates the species may be present at very low levels or is not yet established on the island. This list needs further review by park staff. For an updated list contact Marc Albert, BOHA Integrated Resource Management Program Manager (marc_albert@nps.gov) or Rachel Vincent, Biological Science Technician, (rachel_vincent@nps.gov).

Scientific Name	Common Name	Bumpkin	Calf	Georges	Grape	Great Brewster	Langlee	Little Brewster	Lovell's	Peddock's	Snake	Spectacle	Thompson	Webb	World's End
<i>Ailanthus altissima</i>	tree-of-heaven		X	X		X		X			X			X	
<i>Alliaria petiolata</i>	garlic mustard		X	X		X		X			X			X	
<i>Ampelopsis brevipedunculata</i>	porcelainberry	X	X	X		X	X	X	X	X	X	X	X		X
<i>Berberis thunbergii</i>	Japanese barberry		X	X		X		X	X		X	X	X	X	
<i>Cardamine impatiens</i>	narrowleaf bittercress	X	X	X	X	X		X	X	X	X	X	X	X	X
<i>Carex kobomugi</i>	Japanese sedge	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Centaurea stoebe</i>	spotted knapweed		X	X			X	X	X		X			X	
<i>Eleagnus umbellata</i>	autumn olive		X			X	X	X	X	X					
<i>Euonymus alatus</i>	winged burning bush		X	X		X	X	X	X		X	X		X	
<i>Fallopia japonica</i>	Japanese/giant knotweed	X	X	X		X	X	X	X		X	X	X		X
<i>Lepidium latifolium</i>	pepperweed	X		X			X	X		X					X
<i>Lonicera japonica</i>	Japanese honeysuckle		X	X		X		X			X	X		X	
<i>Lonicera</i> spp.	bush honeysuckle		X	X	X	X	X	X			X	X		X	
<i>Microstegium vimineum</i>	Japanese stiltgrass	X	X	X		X	X	X	X	X	X	X	X	X	X
<i>Opismenus hirtellus</i> ssp. <i>undulatifolius</i>	wavyleaf basketgrass	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Persicaria perfoliata</i>	mile-a-minute	X	X	X		X	X	X	X	X	X	X	X	X	
<i>Phellodendron amurense</i>	Amur corktree	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Populus alba</i>	white poplar	X	X		X		X			X	X	X	X	X	X
<i>Pueraria montana</i> var. <i>lobata</i>	kudzu	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Vincetoxicum</i> spp.	swallowworts	X		X		X	X	X		X	X	X		X	
<i>Wisteria</i> spp.	wisteria	X	X	X	X	X	X	X	X	X	X		X	X	X

Strategically Manage BOHA's Special Places

Managing invasive plant species can seem like an endless and insurmountable challenge, so focusing limited time and resources where they can be most effective is key to successfully tackling the invasives problem. By strategically focusing treatments on their special places, parks can efficiently treat invasive plants in areas that are most important to preserve.

This management plan provides that strategic focus by identifying the places and invasive species within BOHA that are highest priority for invasive species treatment. This plan was created using the

Invasive Plant Species and Habitat Management Planning Process developed by Art Gover at Penn State's Wildland Weed Management Unit (Gover, 2016). This planning process is based on several important principles:

- Parks have finite resources that can only be directed to a small portion of potential natural resource needs.
- We can use park-specific data to make informed strategic decisions with limited resources. Strategic management is effective by protecting natural resources without wasted effort.
- Protecting the best sites within a park maximizes the benefit to park natural resources per person-hour expended on invasive species management.

While there has been effort at BOHA to manage invasive plant species, not all areas of the park have received the same level of attention and inaction in some areas can have negative impacts. This process considered all areas of the park, including levels of infestation and importance of the resource to the park, to prioritize the most important areas and species for management.

The Invasive Plant Species and Habitat Management Planning Process involves three steps: 1) defining habitat management zones, 2) prioritization, and 3) prescription.

Define Habitat Management Zones

To determine which areas of the park are highest priority, we assembled a team knowledgeable about BOHA's invasive species. This team included the park's resource manager and two of the park's biological science technicians, the regional Invasive Plant Management Team (IPMT) Lead, two vegetation monitoring specialists from NETN, the regional Natural Resource Specialist, Ecologist from Eastern Rivers and Mountains and an invasive species specialist from the Schoodic Institute. This team met virtually to delineate Habitat Management Zones (HMZ) within BOHA (Figure 2-4). Habitat Management Zones are discrete areas of the park that are ecologically or culturally valuable and where invasive species management is operationally feasible.

The Habitat Management Zones were delineated based on four criteria:

- 1) Areas containing high priority invasive species, including Japanese Barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), pepperweed (*Lepidium latifolium*) and many others;
- 2) Ecologically and/or culturally significant areas;
- 3) Wetlands and riparian areas;
- 4) Use existing management boundaries where possible to align with other management efforts.

Through this process, we identified 46 habitat management zones, ranging in size from 0.22 to 98.9 acres across 14 of the 34 islands/peninsulas making up BOHA. Stewardship Index based on the ecological value of the zone's resources, and an Outreach Index that captured the value of the zone to the park's interpretation and outreach goals were assigned to each HMZ (for further details see Gover 2016).

IPM Planning Boston Harbor Islands National Recreation Area Habitat Management Zones 2022

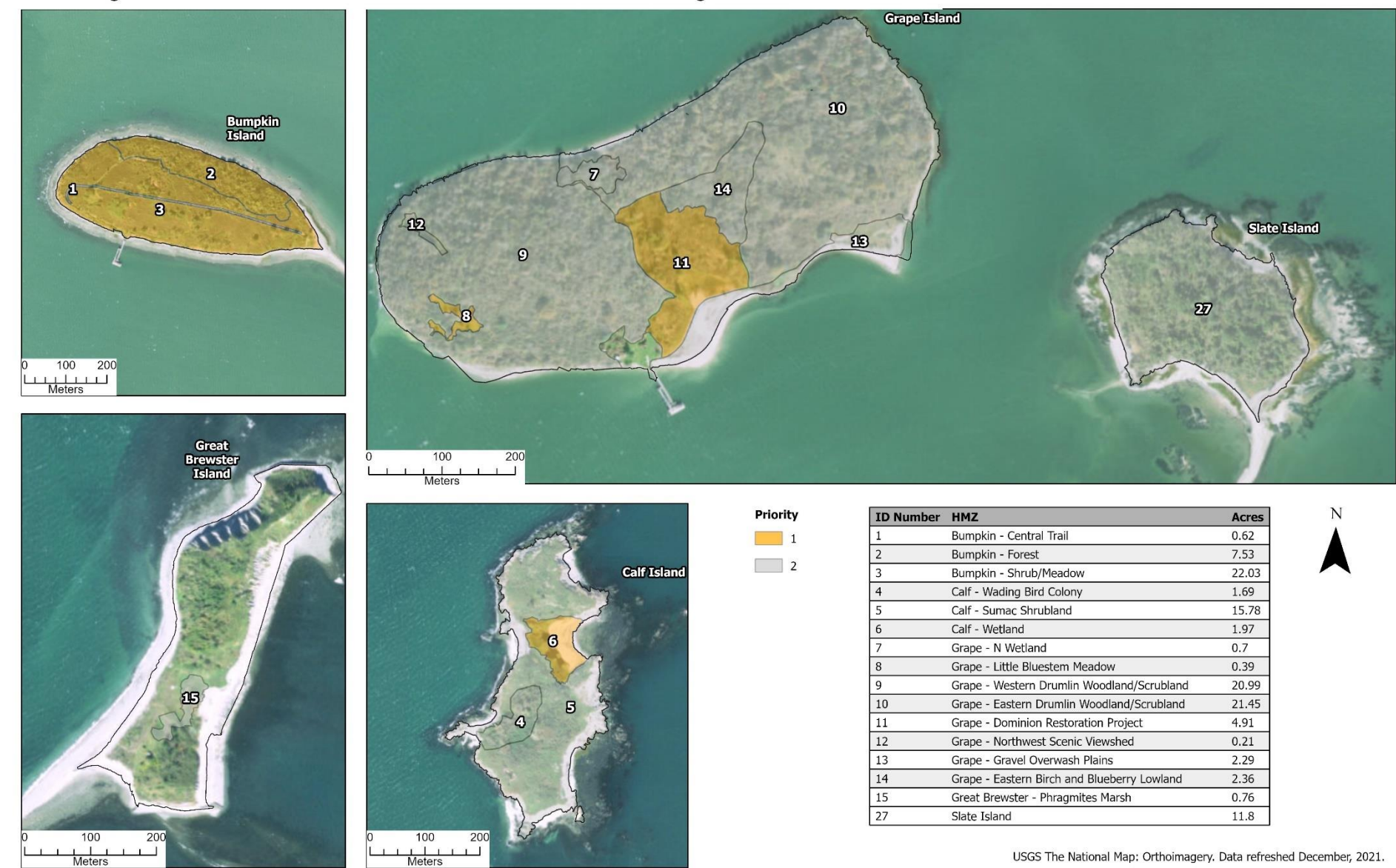


Figure 2. Habitat Management Zones 1-15 and 27 for the treatment of invasive plants at Boston Harbor Islands National Recreation Area.

IPM Planning Boston Harbor Islands National Recreation Area Habitat Management Zones 2022

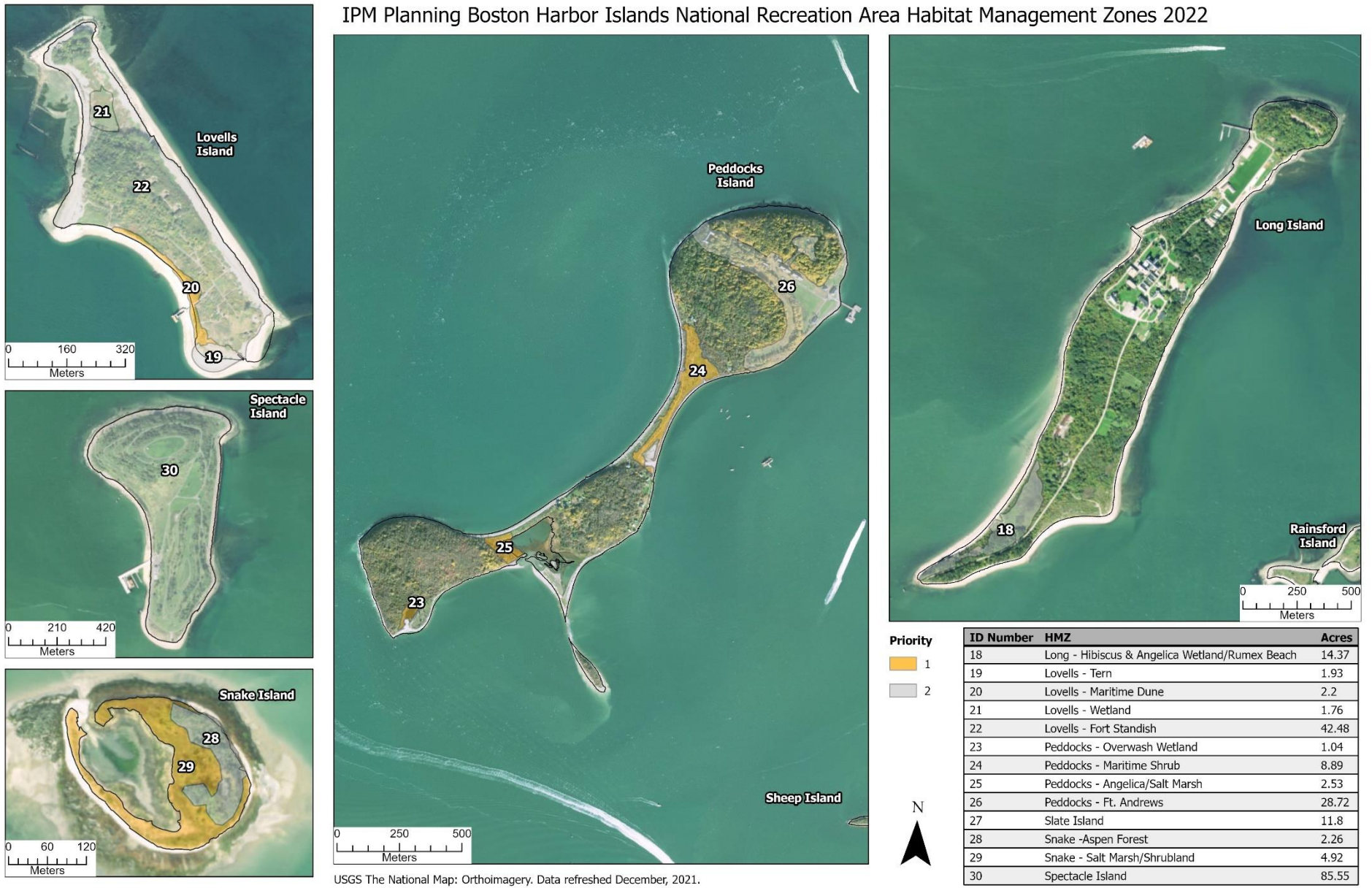


Figure 3. Habitat Management Zones 18- 30 for the treatment of invasive plants at Boston Harbor Islands National Recreation Area.

IPM Planning Boston Harbor Islands National Recreation Area Habitat Management Zones 2022

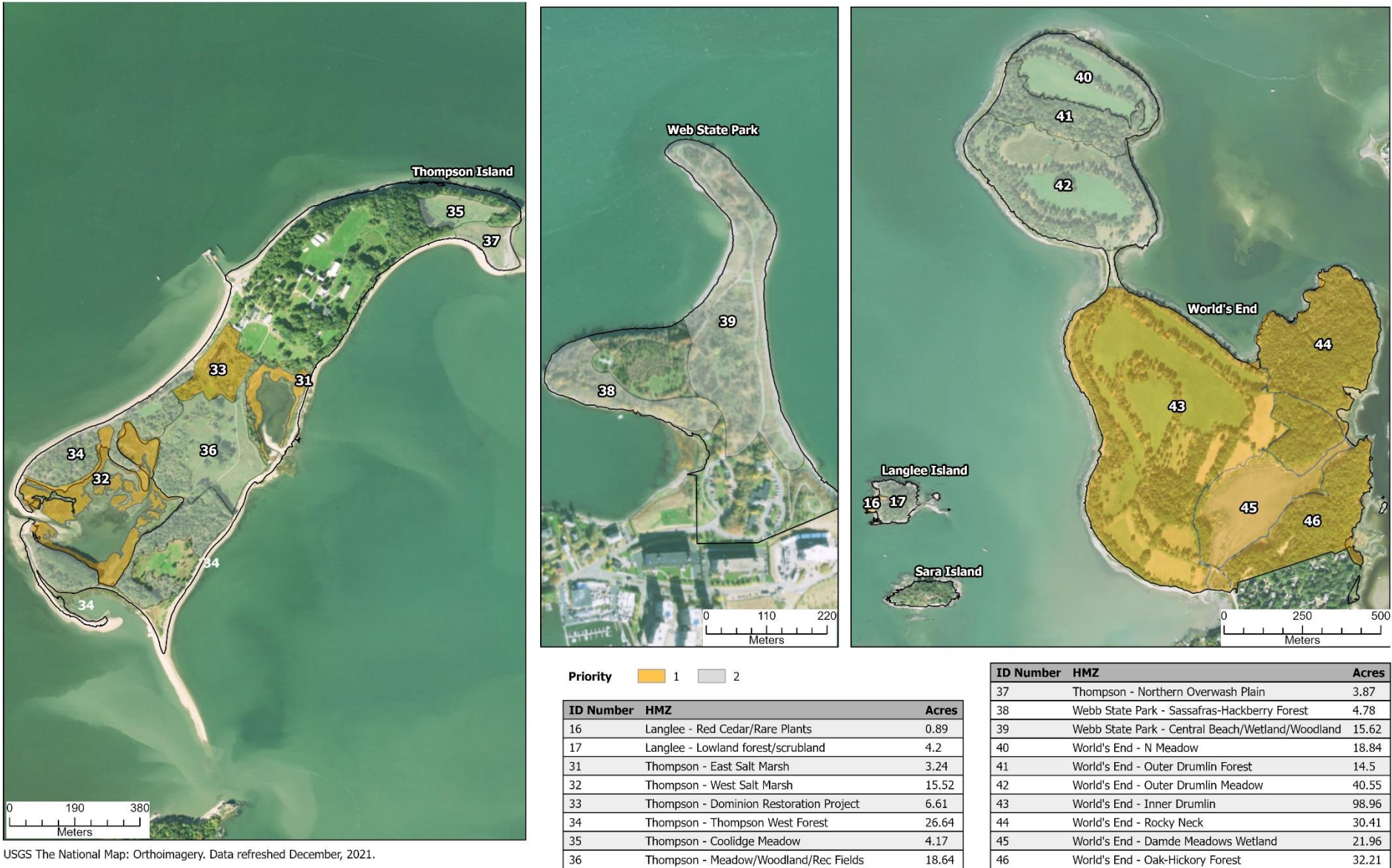


Figure 4. Habitat Management Zones 16, 17 and 32-46 for the treatment of invasive plants at Boston Harbor Islands National Recreation Area

Prioritization

We then used a prioritization tool (Gover 2016) housed in a Microsoft Excel workbook to prioritize which Habitat Management Zones and which invasive species should be managed to maximize the benefit to park natural resources. First, data on invasive species were collected from:

- Treatment and Survey data collected by BOHA Resource Management staff (2017 – 2022)
- Publicly available data from iNaturalist and EDDMaps (2017 – 2022)
- Exotic survey data collected by Elliman in 2016 (Elliman, *in prep*)

The list of invasive or non-native plant species occurring in BOHA can be found in Appendix A. From those data, we identified the invasive species known to occur in or within 5 m of the 46 habitat management zones, then categorized the species into three groups:

1. Weedy non-native species that can act invasively (e.g., ground-ivy (*Glechoma hederacea*)) but do not cause as much ecological harm, relative to other invasive species which are known be problematic in the park. These species were excluded from the prioritization tool.
2. “Super Bad” invasive species that cause significantly greater negative impact to park resources (e.g., Japanese barberry (*Berberis thunbergii*), bittersweet (*Celastrus orbiculatus*), wineberry (*Rubus phoenicolasius*), and others). These species were given higher priority by the tool (Appendix A, Table 2).
3. The remaining invasive species known to occur in the Habitat Management Zones were included in the prioritization tool as “regular” invasive species (see Gover 2016 for more details) but were weighted lower than the "super bad" species (Appendix A, Table 2).

Because of the large number of priority species, we further grouped the super bad and regular species into groupings with similar treatment prescriptions. For instance, most shrubs share similar treatment prescriptions and tend to co-occur; therefore, all shrubs with the same treatment prescriptions were grouped under “invasive shrubs”. This list of categories with the list of each species within each category can be found in Appendix A: Table 3.

Next, we quantified the level of infestation of each invasive plant species per zone, the potential impacts of those invasive species on the habitats, the difficulty of managing those invasives, and the restoration effort required in each habitat. The prioritization tool ranks and weights all these inputs and creates a prioritization matrix (Table 2) that provides strategic direction for managers to protect the best sites within the park. Of the 46 habitat management zones, 20 zones were identified as being operationally manageable in a 5-year time and of highest priority to management. Species identified within these zones as high priority for management are highlighted in red, orange and yellow in Table 2, and treatment prescriptions for these zones and species are included in Appendix B.

The remaining 26 zones were lower priority and were not included in the prescription phase of the planning tool. However, the species found in these lower priority habitat zones are also present in at least one of the higher priority habitat zones, and their prescriptions can be easily applied to lower priority zones.

Prescription

Last, we described how strategic invasive species management will be implemented in the park. The prescription specifies: **who** will be doing the work, **how** the invasives will be managed, and **when** the management should be conducted for only the habitat management zones that were identified as the three highest priorities (i.e., the 20 zones labeled Priority 1 in Figure 1) and for only those invasive species that were identified as priorities in Table 2. Habitat Management Zones should be treated in order by priority (i.e., treat all HMZ in Priority 1 before treating HMZ in Priority 2).

Other invasive species not specified by this plan may be treated while crews are in the Habitat Management Zones targeting priority species. Thus, species with lower ranks (e.g., 4, 5, 6) in Table 2 can also be treated when operationally efficient. For example, all invasive shrubs should be treated at the same time within a priority zone, even if the various shrub species received different priority rankings.

Appendix B contains the invasive species management prescriptions for the high priority zones and species. There are many opportunities for volunteers and park partners to play an important role in invasive species management in BOHA. Also, many invasive management prescriptions require a Certified Applicator, someone who has completed the required trainings to use herbicides. Certified Applicators can be park staff, NPS Invasive Plant Team members, contractors or volunteers who have undergone training and licensing.

Restoration

Planting native plants in areas where invasive species have been removed can help restore habitats dominated by native species. Tables 3 and 4 provide native species that could be used for restoration, along with some habitat preferences. For restoration efforts, specific species should be vetted by park staff as occurring in the park. In addition, most of the properties with high priority HMZs are part of the National Register Archeological District for Native American sites, and thus review and approval by the State Archeologist is required for any ground disturbance, and consultation with affiliated Tribal Nations is recommended. The Focal Vegetation GIS data collected and compiled by BOHA in 2022 and Vascular Flora and Plant Communities of the Boston Harbor Islands (Elliman 2005) should be referenced for community specific species. A site visit may also be needed to determine species composition for potential revegetation efforts.

Table 2. Priority habitat management zones (darker green indicates higher priority) and priority invasive species (high number indicates higher priority) for Boston Harbor Islands National Recreation Area.

	HMZ Name	Bumpkin - Forest	Bumpkin - Shrub/Meadow	Calf - Wetland	Grape - Dominion Restoration Project	Grape - Eastern Birch and Blueberry Lowland	Grape - Gravel Overwash Plains	Grape - Little Bluestem Meadow	Langlee - Red Cedar/Rare Plants	Lovells - Maritime Dune	Lovells - Tern	Peddocks - Angelica/Salt Marsh	Peddocks - Maritime Shrub	Peddocks - Overwash Wetland	Snake - Salt Marsh/Shrubland	Thompson - Dominion Restoration Project	Thompson - East Salt Marsh	Thompson - West Salt Marsh	World's End - Damde Meadows Wetland	World's End - Oak-Hickory Forest	World's End - Rocky Neck	Calf - Sumac Shrubland	Grape - N Wetland	World's End - Inner Drumlin	World's End - North Meadow	World's End - Outer Drumlin Forest	World's End - Outer Drumlin Meadow	Bumpkin - Central Trail	Calf - Wading Bird Colony	Grape - Eastern Drumlin Woodland/Scrubland	Grape - Northwest Scenic Viewshed	Grape - Western Drumlin Woodland/Scrubland	Great Brewster - Phragmites Marsh	Langlee - Lowland forest/scrubland	Long - Hibiscus & Angelica Wetland/Rumex Beach	Lovells - Fort Standish	Lovells - Wetland	Peddocks - Ft. Andrews	Slate Island	Snake -Aspen Forest	Spectacle Island	Thompson - Coolidge Meadow	Thompson - Meadow/Woodland/Rec Fields	Thompson - Northern Overwash Plain	Thompson - West Forest	Webb State Park - Sassafras-Hackberry Forest	Webb State Park -Central Beach/Wetland/Woodland				
	Stewardship Index	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	1	1	0	1	1	1	2	0	1	1	1	1	1	0	1	1	1	1	1	1	1	
	Outreach Index	1	1	2	2	1	2	2	1	1	2	1	1	1	1	2	2	2	2	2	2	2	1	2	2	2	2	2	1	1	1	2	1	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
Common Name	Scientific Name																																																		
garlic mustard	<i>Alliaria petiolata</i>	6	6	0	7	6	0	0	6	0	0	0	0	0	0	0	0	0	7	8	8	0	0	6	0	0	6	5	0	0	0	0	0	0	5	0	4	4	5	6	0	4	0	5	5	5	0	0			
beach wormwood/mugwort	<i>Artemisia</i> spp.	0	0	9	7	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0			
spotted knapweed	<i>Centaurea stoebe</i>	0	0	0	0	0	5	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	7	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4	0	0	3	0	0	0	0	0			
Canada thistle	<i>Cirsium arvense</i>	5	5	0	6	0	5	0	0	5	0	5	0	0	0	6	0	0	0	0	0	5	0	5	0	0	5	4	4	4	0	4	3	0	0	3	4	0	3	0	3	6	4	5	0	0	0				
Japanese knotweed	<i>Fallopia</i> spp.	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	4	0	0	0	0	0	0	0	0	0	5				
pepperweed	<i>Lepidium latifolium</i>	0	0	7	6	0	6	0	0	0	0	5	0	5	6	7	0	0	0	0	0	5	0	5	0	0	0	0	4	4	0	4	4	0	0	3	5	0	3	3	3	0	4	6	4	5	5				
purple loosestrife	<i>Lythrum salicaria</i>	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	5	0	0	0	0	5	0	4	0	0	0	0	0	5	0	0	0	0	3	4	4	5	4	0	0					
invasive root-suckering (clonal) trees	many	6	6	0	7	6	0	0	6	6	0	0	6	0	0	7	7	8	8	0	0	0	6	0	0	0	0	5	0	5	0	5	0	5	0	4	0	5	4	0	4	0	5	0	5	0	0				
invasive trees	Many	7	7	0	0	0	0	0	0	0	0	0	0	0	0	8	7	0	8	9	9	0	0	7	0	8	7	0	0	6	6	6	6	0	6	5	5	0	6	0	0	5	7	6	7	6	0	0			
invasive shrubs	Many	7	7	0	8	7	7	8	7	7	8	7	7	7	7	8	8	9	9	9	9	7	7	7	8	8	7	6	6	6	6	6	0	6	6	5	0	6	5	5	5	7	6	7	6	7	7				
invasive woody vines	Many	6	6	7	7	6	0	7	6	6	0	6	6	6	0	7	0	8	8	8	8	0	6	6	7	7	6	5	5	5	5	5	4	5	5	4	0	5	4	0	4	6	5	0	5	6	6				
invasive non-woody vines	Many	7	7	0	8	0	0	0	0	7	0	0	0	0	7	8	8	0	9	9	9	0	0	7	0	8	7	6	0	0	6	0	0	6	6	5	6	6	0	0	5	7	0	0	6	7	0				
invasive perennial	Many	7	7	8	8	0	0	0	0	0	0	0	0	0	7	8	8	8	0	0	0	7	0	7	0	0	0	0	0	6	0	0	5	0	0	0	0	0	0	0	0	6	6	0	6	0	6				
invasive annual	Many	0	0	0	0	0	6	0	0	0	0	6	0	0	0	7	7	0	0	0	0	6	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	5	0	4	0	0	0	5	6	5	0	0			
invasive biennial	Many	5	5	0	6	5	6	0	0	0	7	5	5	0	0	6	7	8	8	0	0	5	0	5	0	0	0	4	0	4	0	4	4	0	0	3	5	4	3	0	3	5	4	6	4	5	0				
Japanese stiltgrass	<i>Microstegium vimineum</i>	0	0	0	6	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
mile-a-minute	<i>Persicaria perfoliata</i>	0	0	0	6	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
reed canarygrass	<i>Phalaris arundinacea</i>	0	0	0	0	0	0	0	0	0	0	5	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	3	0	0	0	0	0				
common reed	<i>Phragmites australis</i> ssp. <i>australis</i>	5	5	0	6	0	0	0	0	0	0	5	6	5	6	7	0	7	6	6	5	0	0	0	0	0	4	5	0	0	0	3	0	0	3	4	0	0	3	3	4	4	5	0	0	0					
swallowwort	<i>Vincetoxicum</i> spp.	0	0	0	0	6	0	0	0	0	0	6	0	0	0	7	0	0	0	0	6	0	6	0	0	6	0	7	5	0	5	0	5	4	4	0	0	4	0	0	0	0	5	0	5	0	0				

Table 3. Native woody species to be considered for restoration in Boston Harbor Islands National Recreation Area adapted from Minute Man National Historic Park Invasive Plant Management Plan and Massachusetts Coastal Landscaping Plant List (Perles 2021, Mass.gov 2023). For restoration efforts, species planted should reflect the vegetation communities in the area and historic species composition of the park. Individual species and genotypes should be vetted by park staff.

Layer	Scientific Name	Common Name	Wetland Edge	Upland	Coastal
Canopy	<i>Acer rubrum</i>	red maple	X	X	
	<i>Acer saccharinum</i>	silver maple	X	X	
	<i>Acer saccharum</i>	sugar maple	X	X	
	<i>Betula alleghaniensis</i>	yellow birch	X	X	
	<i>Betula lenta</i>	sweet birch	X	X	
	<i>Betula papyrifera</i>	white birch	X	X	
	<i>Betula populifolia</i>	gray birch	X	X	
	<i>Carya glabra</i>	pignut hickory		X	
	<i>Carya ovata</i>	shagbark hickory		X	
	<i>Liriodendron tulipifera</i>	tulip tree		X	
	<i>Pinus rigida</i>	pitch pine		X	
	<i>Pinus strobus</i>	white pine		X	
	<i>Prunus serotina</i>	black cherry		X	
	<i>Quercus alba</i>	white oak	X		
	<i>Quercus coccinea</i>	scarlet oak		X	
	<i>Quercus palustris</i>	pin oak	X		
	<i>Quercus prinus</i>	chestnut oak		X	
	<i>Quercus rubra</i>	red oak	X	X	
	<i>Quercus velutina</i>	black oak		X	
	<i>Tilia Americana</i>	basswood	X	X	
Subcanopy	<i>Amelanchier arborea</i>	Downy serviceberry	X	X	
	<i>Carpinus caroliniana</i>	American hornbeam	X	X	
	<i>Chamaecyparis thyoides</i>	Atlantic white cedar	X	X	
	<i>Cornus florida</i>	flowering dogwood	X	X	
	<i>Crataegus mollis</i>	downy hawthorn		X	
	<i>Ilex opaca</i>	American holly		X	
	<i>Juniperus virginiana</i>	Eastern redcedar		X	
	<i>Nyssa sylvatica</i>	swamp tupelo	X	X	
	<i>Salix nigra</i>	black willow	X		
	<i>Sassafras albidum</i>	sassafras		X	
	<i>Alnus incana</i>	speckled alder	X		
	<i>Arctostaphylos uva-ursi</i>	Bearberry			X
Shrub	<i>Aronia arbutifolia</i>	Red chokeberry	X	X	
	<i>Ceanothus americanus</i>	New Jersey tea	X	X	
	<i>Cephalanthus occidentalis</i>	buttonbush	X		
	<i>Clethra alnifolia</i>	sweet pepper bush	X		
	<i>Comptonia peregrina</i>	Sweet fern		X	
	<i>Cornus amomum</i>	silky dogwood	X		
	<i>Cornus racemose</i>	gray dogwood		X	
	<i>Hamamelis virginiana</i>	witch hazel	X		
	<i>Hudsonia tomentosa</i>	Beach heather			X
	<i>Ilex verticillata</i>	winterberry	X	X	
	<i>Iva frutescens</i>	Marsh elder			X
	<i>Kalmia latifolia</i>	mountain laurel	X	X	
	<i>Myrica pensylvanica</i>	Northern bayberry		X	X
	<i>Potentilla fruticosa</i>	Shrubby cinquefoil		X	X
	<i>Prunus maritima</i>	Beach plum			X
	<i>Rhus typhina</i>	staghorn sumac		X	
	<i>Rosa virginiana</i>	Virginia rose		X	
	<i>Rubus allegheniensis</i>	common blackberry		X	
	<i>Rubus occidentalis</i>	black raspberry		X	
	<i>Sambucus nigra</i>	black elderberry	X		
	<i>Spiraea alba</i>	white meadowsweet	X	X	
	<i>Vaccinium angustifolium</i>	Lowbush blueberry	X	X	
	<i>Vaccinium corymbosum</i>	highbush blueberry	X	X	
	<i>Viburnum dentatum</i>	Arrowwood viburnum		X	
	<i>Viburnum lentago</i>	Nannyberry	X	X	
	<i>Ilex glabra</i>	Inkberry	X	X	

Table 4. Native herbaceous and graminoid species to be considered for restoration in Boston Harbor Islands National Recreation Area adapted from Minute Man National Historic Park Invasive Plant Management Plan and Massachusetts Coastal Landscaping Plant List (Perles 2021, Mass.gov 2023). For restoration efforts, species planted should reflect the vegetation communities in the area and historic species composition of the park. Individual species and genotypes should be vetted by park staff.

Species Name	Common Name	Light Tolerance			Habitat Value
		Sun	Semi Shade	Shade	
<i>Agrostis perennans</i>	Autumn bentgrass	X	X		Bird, Mammal
<i>Ammophila breviligulata</i>	American beachgrass	X			Dune stabilization
<i>Andropogon gerardii</i>	Big Bluestem	X			Bird, Mammal, Pollinator habitat
<i>Andropogon glomeratus</i>	Bushy Bluestem	X			Bird, Insect, Pollinator habitat
<i>Asclepias syriaca</i>	Common Milkweed	X			Insect, Pollinator food
<i>Asclepias tuberosa</i>	Butterfly Milkweed	X			Insect, Pollinator food
<i>Aster laevis</i>	Smooth Blue Aster	X			Mammal, Pollinator food
<i>Baptisia australis</i>	Wild Blue Indigo	X			Bird, Mammal, Pollinator food
<i>Bouteloua curtipendula</i> 'Butte'	Side-oats Grama 'Butte'	X			Bird, Mammal
<i>Cakile edentula</i>	Sea rocket	X			pollinator food
<i>Carex appalachica</i>	Appalachian Sedge		X	X	Bird, Mammal, Pollinator habitat
<i>Carex crinita</i>	Fringed Sedge	X	X		Bird, Mammal, Pollinator habitat
<i>Carex eburnea</i>	Bristle-leaved Tickseed	X	X	X	Insect, Pollinator food
<i>Carex pensylvanica</i>	Pennsylvania sedge	X	X	X	animal forage
<i>Chamaecrista fasciculata</i>	Partridge Pea	X	X		Bird, Mammal, Pollinator food
<i>Chelone glabra</i>	White Turtlehead		X	X	Pollinator food
<i>Comptonia peregrina</i>	Sweet Fern	X	X		Bird, Insect, Pollinator habitat
<i>Coreopsis rosea</i>	Pink tickseed	X			pollinator food, bird seed
<i>Coreopsis verticillata</i>	Thread-leaved Tickseed	X	X		pollinator food, bird seed
<i>Deschampsia flexuosa</i>	Wavy hairgrass	X	X		bird seed, animal habitat
<i>Distichlis spicata</i>	Saltgrass	X			animal nesting habitat
<i>Echinacea purpurea</i>	Eastern Purple	X	X		Pollinator food
<i>Elymus virginicus</i>	Virginia Wildrye		X		Bird, Mammal, Pollinator habitat
<i>Eragrostis spectabilis</i>	Purple Lovegrass	X			Insect
<i>Eryngium yuccifolium</i>	Rattlesnake-master	X			Insect
<i>Eupatorium hyssopifolium</i>	Hyssop-leaved Boneset	X			Bird
<i>Eupatorium perfoliatum</i>	Boneset Thoroughwort		X		Bird, Insect, Pollinator food
<i>Eurybia divaricata</i>	White Wood Aster			X	Insect, Pollinator food
<i>Eurybia spectabilis</i>	Eastern showy aster	X	X		pollinator food, bird seed
<i>Eutrochium maculatum</i>	Spotted Joe-Pye Weed	X			Insect, Pollinator food
<i>Festuca rubra</i>	Red fescue	X			Bird, Insect, Pollinator habitat
<i>Helianthus divaricatus</i>	Woodland Sunflower	X	X	X	Bird
<i>Heliopsis helianthoides</i>	Sunflower Everlasting	X			Pollinator food
<i>Honckenya peploides</i>	Seabeach sandwort	X			beach and dune stabilization, dune formation
<i>Ionactis linariifolius</i>	Stiff Aster	X	X	X	Mammal, Pollinator food
<i>Juncus gerardii</i>	Black grass	X			erosion control
<i>Lathyrus japonicus</i>	Beach pea	X			animal forage, pollinator food
<i>Leymus mollis</i>	American dunegrass, sea lyme grass	X			Dune stabilization, food forage
<i>Liatris novae-angliae</i>	Northern Blazing Star	X			Insect, Pollinator food
<i>Liatris spicata</i>	Marsh Blazing Star	X			Pollinator food
<i>Limonium carolinianum</i>	Sea lavender	X			pollinator food
<i>Monarda fistulosa</i>	Wild Bee-balm	X	X		Bird, Pollinator food
<i>Monarda virgatum</i>	Spotted Bee-balm	X			Insect, Pollinator food
<i>Panicum amarum</i> var. <i>amarulum</i>	Coastal panic grass	X			Dune stabilization
<i>Panicum virgatum</i>	Switchgrass	X	X		Bird, Insect, Pollinator habitat
<i>Pentstemon digitalis</i>	Foxglove Beardtongue			X	Pollinator food
<i>Pycnanthemum incanum</i>	Hoary Mountainmint	X	X		Pollinator food
<i>Pycnanthemum tenuifolium</i>	Narrow Leaf Mountainmint	X	X		Bird, Insect, Pollinator food
<i>Rudbeckia fulgida</i>	Showy Coneflower	X			Bird
<i>Rudbeckia hirta</i>	Black-eyed Susan	X			Bird, Mammal, Pollinator food
<i>Rudbeckia triloba</i>	Brown-eyed Susan	X			Bird
<i>Schizachyrium scoparium</i>	Little Bluestem	X	X		Bird, Mammal, Pollinator habitat
<i>Senna hebecarpa</i>	Wild Senna	X			Bird, Mammal, Pollinator food
<i>Senna marilandica</i>	Maryland Senna	X			Bird, Mammal, Pollinator food
<i>Solidago caesia</i>	Blue-stemmed Goldenrod	X	X		Bird, Insect, Pollinator food
<i>Solidago juncea</i>	Early Goldenrod	X	X	X	Pollinator food
<i>Solidago nemoralis</i>	Gray Goldenrod	X	X	X	Bird, Insect, Pollinator food
<i>Solidago odora</i>	Licorice Goldenrod		X	X	Bird, Pollinator food
<i>Solidago sempervirens</i>	Seaside goldenrod	X			pollinator food, animal forage
<i>Sorghastrum nutans</i>	Indian Grass				Bird, Mammal, Pollinator habitat

Species Name	Common Name	Light Tolerance			Habitat Value
		Sun	Semi Shade	Shade	
<i>Spartina alterniflora</i>	saltmarsh cordgrass	X			shoreline protection, tidal marsh restoration, animal forage
<i>Spartina patens</i>	Saltmeadow cordgrass	X			sand dune stabilization, animal forage, animal habitat
<i>Symphotrichum laeve</i>	Smooth American Aster	X			Insect, Pollinator food
<i>Symphotrichum novaeangliae</i>	New England Aster	X	X		Bird, Mammal, Pollinator food
<i>Symphotrichum novi-belgii</i>	New York American Aster	X			Insect, Pollinator food
<i>Tradescantia ohiensis</i>	Ohio Spiderwort		X		Pollinator food
<i>Verbena hastata</i>	Blue Vervain	X	X		Pollinator food, Bird seed
<i>Vernonia noveboracensis</i>	New York Ironweed	X			Pollinator
<i>Veronicastrum virginicum</i>	Culver's Root	X	X		Insect, Pollinator food

Strategic Management Protects Park Resources

Invasive species management is crucial to protecting Boston Harbor Islands National Recreation Area's important natural and cultural resources. Inaction will result in continued declines in the park's forests and other habitats, overall biodiversity, and the integrity of key cultural landscape features. The strategic prescriptions presented in this report direct scarce resources to the areas of the park where invasive species management will most benefit the park's cultural and natural resources.

This plan can be updated every 4 – 5 years, to determine progress on containing priority species in habitat management zones and re-evaluate park priorities considering staffing and funding levels. The latest monitoring data and new observations from the Invasive Species Early Detection / Rapid Response Program can also be incorporated into the updated plan. However, the Microsoft Excel workbook prioritization tool can be updated at any time (e.g., new invasive species found, land parcel newly acquired by the park, etc.), to evaluate evolving management priorities.

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APPENDIX A Invasive Species Tables

Table 1. Non-native species documented at Boston Harbor Islands National Recreation Area through the 2022 IPM planning process. For a more complete flora, see Elliman 2005.

Scientific Name	Common Name
<i>Acer platanoides</i>	Norway maple
<i>Acer pseudoplatanus</i>	sycamore maple
<i>Aesculus hippocastanum</i>	horse-chestnut
<i>Ailanthus altissima</i>	tree-of-heaven
<i>Alliaria petiolata</i>	garlic mustard
<i>Allium tuberosum</i>	garlic chives
<i>Allium vineale</i>	wild garlic
<i>Alnus glutinosa</i>	common alder
<i>Ampelopsis brevipedunculata</i>	porcelain berry
<i>Anthoxanthum odoratum</i>	sweet vernal grass
<i>Anthriscus sylvestris</i>	cow parsley
<i>Aquilegia vulgaris</i>	common columbine
<i>Arctium</i> spp.	burdock
<i>Artemisia stellariana</i>	artemesia 'silver brocade'
<i>Artemisia absinthium</i>	wormwood
<i>Artemisia vulgaris</i>	common mugwort
<i>Asparagus officinalis</i>	wild asparagus
<i>Atriplex patula</i>	common orache
<i>Barbarea vulgaris</i>	bitter wintercress
<i>Bassia scoparia</i>	summer-cypress
<i>Berberis</i> spp.	Japanese barberry
<i>Berteroa incana</i>	hoary alyssum
<i>Betula pendula</i>	silver birch
<i>Bromus inermis</i>	smooth brome
<i>Bromus tectorum</i>	cheatgrass
<i>Campanula rapunculoides</i>	creeping bellflower
<i>Celastrus orbiculatus</i>	oriental bittersweet
<i>Centaurea stoebe</i>	spotted knapweed
<i>Cerastium fontanum</i>	mouse-ear chickweed
<i>Chelidonium majus</i>	greater celandine
<i>Cichorium intybus</i>	chicory
<i>Cirsium arvense</i>	creeping thistle
<i>Cirsium vulgare</i>	bull thistle
<i>Clematis terniflora</i>	autumn clematis
<i>Codium fragile</i>	dead man's fingers
<i>Commelina communis</i>	Asiatic dayflower
<i>Convallaria majalis</i>	European lily of the valley
<i>Convolvulus arvensis</i>	field bindweed
<i>Coreopsis tinctoria</i>	plains coreopsis
<i>Crataegus monogyna</i>	common hawthorn
<i>Dactylis glomerata</i>	orchard grass
<i>Datura stramonium</i>	jimsonweed
<i>Daucus carota</i>	wild carrot
<i>Dianthus armeria</i>	deptford pink
<i>Draba verna</i>	common whitlowgrass
<i>Elaeagnus umbellata</i>	autumn olive
<i>Epilobium hirsutum</i>	great willowherb
<i>Epipactis helleborine</i>	broad-leafed helleborine
<i>Euonymus</i> spp.	winged euonymus
<i>Euphorbia cyparissias</i>	cypress spurge
<i>Fagus sylvatica</i>	European beech
<i>Fallopia convolvulus</i>	black-bindweed
<i>Fallopia japonica</i>	Japanese knotweed
<i>Frangula alnus</i>	alder buckthorn
<i>Galium mollugo</i>	hedge bedstraw
<i>Geranium robertianum</i>	herb robert
<i>Glechoma hederacea</i>	ground-ivy
<i>Gleditsia triacanthos</i>	honey locust
<i>Hedera helix</i>	common ivy
<i>Hemerocallis fulva</i>	orange day-lily
<i>Hibiscus syriacus</i>	common hibiscus
<i>Humulus lupulus</i>	common hops
<i>Hypericum perforatum</i>	common St. John's-wort

Scientific Name	Common Name
<i>Hypochaeris radicata</i>	common cat's-ear
<i>Kochia scoparia</i>	kochia
<i>Lactuca serriola</i>	prickly lettuce
<i>Lamium amplexicaule</i>	henbit deadnettle
<i>Lamium purpureum</i>	red deadnettle
<i>Lapsana communis</i>	nipplewort
<i>Larix decidua</i>	European larch
<i>Lathyrus sylvestris</i>	narrow-leaved everlasting-pea
<i>Lathyrus tuberosus</i>	tuberous pea
<i>Leonurus cardiaca</i>	common motherwort
<i>Lepidium campestre</i>	field peppergrass
<i>Lepidium latifolium</i>	broadleaved pepperweed
<i>Leucanthemum maximum</i>	max chrysanthemum
<i>Leucanthemum vulgare</i>	oxeye daisy
<i>Ligustrum</i> spp.	common privet
<i>Linaria vulgaris</i>	common toadflax
<i>Lonicera japonica</i>	Japanese honeysuckle
<i>Lonicera</i> spp.	bush honeysuckle
<i>Lotus corniculatus</i>	bird's-foot trefoil
<i>Lotus tenuis</i>	narrow-leaf bird's-foot trefoil
<i>Lunaria annua</i>	annual honesty
<i>Lysimachia arvensis</i>	scarlet pimpernel
<i>Lysimachia nummularia</i>	creeping jenny
<i>Lysimachia punctata</i>	dotted loosestrife
<i>Lythrum salicaria</i>	purple loosestrife
<i>Malus</i> spp.	apple and crabapple
<i>Malva neglecta</i>	dwarf mallow
<i>Matricaria discoidea</i>	pineapple-weed
<i>Medicago lupulina</i>	black medick
<i>Medicago sativa</i>	alfalfa
<i>Melilotus albus</i>	white sweetclover
<i>Melilotus officinalis</i>	yellow sweetclover
<i>Microstegium vimineum</i>	Japanese stiltgrass
<i>Morus alba</i>	white mulberry
<i>Narcissus pseudonarcissus</i>	wild daffodil
<i>Nepeta cataria</i>	catnip
<i>Onopordum acanthium</i>	cotton thistle
<i>Pastinaca sativa</i>	wild parsnip
<i>Persicaria longiseta</i>	low smartweed
<i>Persicaria maculosa</i>	spotted lady's thumb
<i>Persicaria perfoliata</i>	mile-a-minute weed
<i>Phalaris arundinacea</i>	reed canarygrass
<i>Phragmites australis</i>	common reed
<i>Picea abies</i>	norway spruce
<i>Pilosella aurantiaca</i>	orange hawkweed
<i>Pilosella caespitosa</i>	meadow hawkweed
<i>Pinus nigra</i>	black pine
<i>Pinus sylvestris</i>	scots pine
<i>Pinus thunbergii</i>	japanese black pine
<i>Plantago lanceolata</i>	ribwort plantain
<i>Plantago major</i>	greater plantain
<i>Populus alba</i>	white poplar
<i>Portulaca oleracea</i>	common purslane
<i>Potentilla argentea</i>	silverleaf cinquefoil
<i>Potentilla recta</i>	sulphur cinquefoil
<i>Prunus avium</i>	wild cherry
<i>Prunus cerasifera</i>	cherry-plum
<i>Pyrus calleryana</i>	callery pear
<i>Quercus cerris</i>	turkey oak
<i>Quercus robur</i>	pedunculate oak
<i>Quercus robur</i>	english oak
<i>Ranunculus acris</i>	meadow buttercup

Table 1 (cont). Non-native species documented at Boston Harbor Islands National Recreation Area through the 2022 IPM planning process. For a more complete flora, see Elliman 2005.

Scientific Name	Common Name
<i>Ranunculus repens</i>	creeping buttercup
<i>Raphanus raphanistrum</i>	jointed charlock
<i>Rhamnus cathartica</i>	common buckthorn
<i>Robinia hispida</i>	bristly locust
<i>Robinia pseudoacacia</i>	black locust
<i>Rosa canina</i>	dogrose
<i>Rosa multiflora</i>	multiflora rose
<i>Rosa rugosa</i>	rugosa rose
<i>Rubus armeniacus</i>	Armenian blackberry
<i>Rubus laciniatus</i>	cutleaf blackberry
<i>Rubus</i> spp.	blackberry
<i>Rumex acetosella</i>	Sheep's sorrel
<i>Rumex crispus</i>	curled dock
<i>Rumex obtusifolius</i>	broad-leaved dock
<i>Salix</i> × <i>fragilis</i>	hybrid crack willow
<i>Salix babylonica</i>	weeping willow
<i>Salix cinerea</i>	Grey Willow
<i>Salix</i> spp.	willow species
<i>Sambucus nigra</i>	European black elderberry
<i>Saponaria officinalis</i>	common soapwort
<i>Securigera varia</i>	purple crownvetch
<i>Sedum acre</i>	biting stonecrop
<i>Senecio vulgaris</i>	common groundsel
<i>Silene latifolia</i>	white campion
<i>Silene vulgaris</i>	bladder campion
<i>Solanum carolinense</i>	Carolina horsenettle
<i>Solanum dulcamara</i>	bittersweet nightshade
<i>Solidago sempervirens</i>	northern seaside goldenrod
<i>Sonchus oleraceus</i>	Common Sow-thistle
<i>Sorbus aucuparia</i>	European mountain ash
<i>Stellaria media</i>	common chickweed
<i>Syringa vulgaris</i>	common lilac
<i>Tanacetum vulgare</i>	tansy
<i>Taraxacum erythrospermum</i>	red-seeded dandelion
<i>Taraxacum officinale</i>	common dandelion
<i>Taxus baccata</i>	common yew
<i>Thlaspi arvense</i>	field pennycress
<i>Tragopogon dubius</i>	Yellow Salsify
<i>Trifolium</i> spp.	clover
<i>Tussilago farfara</i>	colt's-foot
<i>Ulmus pumila</i>	Siberian elm
<i>Verbascum</i> spp.	mullein
<i>Veronica arvensis</i>	corn speedwell
<i>Vicia cracca</i>	tufted vetch
<i>Vinca minor</i>	lesser periwinkle
<i>Vincetoxicum</i> spp.	swallowworts
<i>Vitis</i> spp.	grape
<i>Wisteria floribunda</i>	Japanese wisteria
<i>Xanthium</i> spp.	rough cocklebur

Table 2. Species or species categories run through the Invasive Species Management Plan Tool. Species identified as “Super Bad” invasives for each habitat are indicated with a 1 and species identified as “regular” invasives are indicated as a 0 for each habitat (Gover 2016). See Table 3 for list of species included in grouped categories (e.g., invasive trees)

Common Name	Scientific Name	Meadow/Field	Coastal/Riparian	Forest	Wetland
garlic mustard	<i>Alliaria petiolata</i>	0	0	1	0
beach wormwood/mugwort	<i>Artemisia spp.</i>	1	1	1	1
spotted knapweed	<i>Centaurea stoebe</i>	1	0	1	0
Canada thistle	<i>Cirsium arvense</i>	1	0	1	0
Japanese knotweed	<i>Fallopia spp. (SYN. Reynoutria, Polygonum)</i>	0	1	0	1
pepperweed	<i>Lepidium latifolium</i>	1	1	1	1
purple loosestrife	<i>Lythrum salicaria</i>	0	1	0	1
invasive root-suckering (clonal) trees	many	1	1	1	1
invasive trees	many	1	1	1	0
invasive shrubs	many	1	1	1	1
invasive woody vines	many	1	1	1	1
invasive non-woody vines	many	1	1	1	1
invasive perennial	many	1	1	1	1
invasive annual	many	0	0	0	0
invasive biennial	many	0	1	0	1
Japanese stiltgrass	<i>Microstegium vimineum</i>	1	1	1	1
mile-a-minute	<i>Persicaria perfoliata</i>	1	1	1	0
reed canarygrass	<i>Phalaris arundinacea</i>	0	1	0	1
common reed	<i>Phragmites australis ssp. australis</i>	0	1	0	1
swallowwort	<i>Vincetoxicum spp.</i>	1	0	1	0

Table 3. Priority invasive species present at Boston Harbor Islands National Recreation Area

Species Group	Species Sub-group	Common Name	Scientific Name
Trees	invasive root-suckering (clonal) trees	tree-of-heaven white poplar black locust	<i>Ailanthus altissima</i> <i>Populus alba</i> <i>Robinia pseudoacacia</i>
	invasive trees	Norway maple European alder white mulberry callery pear	<i>Acer platanoides</i> <i>Alnus glutinosa</i> <i>Morus alba</i> <i>Pyrus calleryana</i>
Shrubs	invasive shrubs	European alder Japanese barberry autumn olive euonymus glossy buckthorn privet shrub honeysuckle common buckthorn beach rose multiflora rose invasive blackberry	<i>Alnus glutinosa</i> <i>Berberis thunbergii</i> <i>Elaeagnus umbellata</i> <i>Euonymus</i> spp. <i>Frangula alnus</i> <i>Ligustrum</i> spp. <i>Lonicera</i> spp. <i>Rhamnus cathartica</i> <i>Rosa rugosa</i> <i>Rosa multiflora</i> <i>Rubus</i> spp.
Vines	invasive woody vines	Asiatic bittersweet porcelainberry English ivy wisteria	<i>Celastrus orbiculatus</i> <i>Ampelopsis brevipedunculata</i> <i>Hedera helix</i> <i>Wisteria</i> spp.
	individual species	swallowworts	<i>Vincetoxicum</i> spp.
	invasive non-woody vine	Japanese honeysuckle bittersweet nightshade	<i>Lonicera japonica</i> <i>Solanum dulcamara</i>
Herbs	individual species	garlic mustard mugwort Beach wormwood spotted knapweed Canada thistle Japanese knotweed pepperweed purple loosestrife Japanese stiltgrass mile-a-minute reed canarygrass common reed	<i>Alliaria petiolata</i> <i>Artemisia vulgaris</i> <i>Artemisia stelleriana</i> <i>Centaurea stoebe</i> <i>Cirsium arvense</i> <i>Fallopia</i> spp. (SYN. <i>Reynoutria</i> , <i>Polygonum</i>) <i>Lepidium latifolium</i> <i>Lythrum salicaria</i> <i>Microstegium vimineum</i> <i>Persicaria perfoliata</i> <i>Phalaris arundinacea</i> <i>Phragmites australis</i> ssp. <i>australis</i>
	invasive annual herbs	jimsonweed spotted lady's thumb/smart weed hedge mustard	<i>Datura stramonium</i> <i>Persicaria maculosa</i> <i>Sisymbrium officinale</i>
	invasive biennial herbs	burdock bull thistle stinking willie mullein	<i>Arctium</i> spp. <i>Cirsium vulgare</i> <i>Senecio jacobaea</i> <i>Verbascum</i> spp.
	invasive perennial herb	ground elder hedge bindweed sericea lespedeza wild parsnip tansy	<i>Aegopodium podagraria</i> <i>Calystegia sepium</i> <i>Lespedeza cuneata</i> <i>Pastinaca sativa</i> <i>Tanacetum vulgare</i>

APPENDIX B Invasive Species Treatment Prescriptions by Habitat Management Zones

Treatment Prescription Key (Adapted from Gover 2016)

Action	Description
Lead Worker	The available personnel determine what operations you can conduct.
Volunteer	As a <i>lead</i> worker, volunteers are limited to manual methods, and whatever equipment they are qualified/permitted to use. Volunteers may apply pesticides if they have a MA Pesticide license.
Certified Applicator	A <i>certified applicator</i> is someone who has completed the required trainings to use herbicides. Certified Applicators licensed in Massachusetts can be park staff, NPS Invasive Plant Team members, contractors or volunteers who have undergone training and licensing.
Treatment Method	
Pull	Remove plant from soil by pulling or digging it from the soil using manual equipment.
Cut	Remove top growth using hand-held or motorized tools. Typically directed towards woody plants, including vines.
Biological Control	Classical biological control is the release of an organism that impacts one specific host. This is most commonly accomplished with insects. In Pennsylvania, the purple loosestrife beetle and mile-a-minute weevil have been released to specifically suppress those weeds.
Foliar-AirStrike	An herbicide application to target plant foliage. 'AirStrike' is a label for <i>glyphosate</i> plus <i>triclopyr</i> , a non-selective mixture used for most spot treatments.
Foliar-Broadleaf	An herbicide application to target plant foliage. 'Broadleaf' is a label for <i>triclopyr</i> plus <i>2,4-D</i> is a selective mixture to control broadleaved weeds without injuring grasses.
Foliar-Specialized	An herbicide application to target plant foliage. 'Specialized' refers to any herbicide or mixture that is not 'AirStrike' or 'Broadleaf' and is used for a specific target species. Examples include <i>quizalofop-P</i> to treat Japanese stiltgrass, or <i>aminopyralid</i> or <i>aminocyclopyrachlor</i> to treat Canada thistle.
Stem-hack	Woody species can be stem-treated. Hack and squirt is a concentrated mixture applied to fresh, spaced cuts made in the bark.
Stem-basal	Woody species can be stem-treated. Basal bark is an oil-based mixture applied to the lower portion of intact stems.
Stump-aqueous	Non-suckering woody plants can be cut and stump-treated to prevent regrowth. Water-based mixtures can be applied to freshly cut stumps.
Stump-oil	Non-suckering woody plants can be cut and stump-treated to prevent regrowth. Oil-based mixtures can also be applied to previously cut stumps by treating the remaining bark as well
PRE	A preemergent herbicide can be applied to prevent annual species, such as Japanese stiltgrass or mile-a-minute, from germinating.
	Treatment period
	Preferred treatment period

Boston Harbor Islands Invasive Priority Tool Notes:

Completed December 2022

General:

- I wrote these prescriptions as if to a small park with limited staff and invasive plant management experience, and not specifically to those who helped develop this plan. More experienced managers and contactors can modify the treatments to fit their operations.
- I labeled any staff or contractors with pesticide licenses as “Certified Applicators” rather than “Staff” or “Registered Technicians”. Any non-licensed staff can be lumped in with “Volunteers”.
- I didn’t include scenarios where volunteers or non-certified staff apply herbicides. If they are trusted and supervised by an applicator, then you can treat them as “Certified Applicators”.
- I went heavy on manual and mechanical treatments for BOHA and tried to include a couple non-chemical volunteer options for each species. Usually this was helping cut or hand-pulling species.
- The treatment calendar generated is the tool’s suggested ideal time frame. Many of the treatments can be expanded beyond the given range. For example, all shrub species dictate foliar spraying starting mid-June, when many of these species are at full leaf-out a month earlier. I left the calendar as is since it covers the core season but be aware there is some flexibility.

Treatment Prescriptions:

Treatment methods I did not include but could be implemented:

- Methods like tarping, mulching, and similar. The tool doesn’t include these, but they can be utilized for small, developed sites.
- Revegetation options or monitoring. The first can be used when needed and the later should be done whenever possible. I didn’t want to clutter the document by adding this to every species in every zone.
- Hack and squirt and basal bark methods I limited to larger shrub and tree species. I left them off the shrubs and woody vines categories, but they could be used on any of these if they are large enough.
- Heavy equipment treatments like mastication or brush hogging.
- Prescribed fire or biocontrol releases.

Chemical Selections:

- Some treatments could be modified slightly from the prescription (for example, using a lower herbicide mix rate for certain species). I tried to provide a range of application rates so some

adjustments could be made depending on the variety of different species being treated at the same time.

- I limited the number of different chemical options and didn't include tank mixes to keep things simple. There are many other herbicide active ingredients that can be used. Some species in the lumped categories (such as "Invasive Perennial") may have specialty rates or preferred herbicides beyond those listed.
- I included common chemical trade names to provide a reference to my mixing recommendations (not as a specific product recommendation). For example, I used Roundup Custom to represent all aquatic glyphosate concentrates having 5.4 lbs. active ingredient per gallon (53.8% active ingredient). There are many other brands that are equivalent, such as Rodeo. There are also lower strength glyphosate concentrates and ready to use products. These work but you might need to adjust application rates according to the label.
- There was limited information on a couple species, specifically beach wormwood and perennial pepperweed, so I prescribed their treatments based on similar relatives. It may be worth monitoring these in the future so adjustments can be made if needed.

Contact the NE Invasive Plant Management Team (NE IPMT) to discuss these treatments or any other invasive plant or restoration needs:

NE IPMT

Delaware Water Gap NRA
1978 River Rd.
Bushkill, PA 18324
Office: 570-588-0534

Emily Booth
Liaison
Email: Emily_booth@nps.gov
Cell: 570-832-3743

Nicholas Stevenson
Team Lead
Email: nicholas_stevenson@nps.gov
Cell: 267-896-0135

Treatment Prescription for Bumpkin - Forest

[illegible]

[illegible]

Treatment Prescription for Bumpkin – Shrub/Meadow

[illegible]

[illegible]

Treatment Prescription for Calf - Wetland

[illegible]

Treatment Prescription for Grape – Dominion Restoration Project

[illegible]

[illegible]

[illegible]

Treatment Prescription for Grape – Gravel Overwash Plains

[illegible]

Treatment Prescription for Grape – Eastern Birch and Blueberry Lowland

[illegible]

[illegible]

Treatment Prescription for Grape – Little Bluestem Meadow

[illegible]

Treatment Prescription for Langlee – Red Cedar/Rare Plants

[illegible]

Treatment Prescription for Lovell's - Tern

[illegible]

Treatment Prescription for Peddocks - Overwash Wetland

[illegible]

[illegible]

Treatment Prescription for Peddocks – Angelica/Salt Marsh

[illegible]

[illegible]

Treatment Prescription for Snake – Salt Marsh/Shrublands

[illegible]

[illegible]

[illegible]

Treatment Prescription for Thompson – East Salt Marsh

[illegible]

[illegible]

Treatment Prescription for Thompson - West Salt Marsh

[illegible]

Treatment Prescription for World's End – Damde Meadows Wetland

[illegible]

[illegible]

Treatment Prescription for World's End – Inner Drumlin

[illegible]

[illegible]

Treatment Prescription for World's End – Oak-Hickory Forest

[illegible]

[illegible]

Treatment Prescription for World's End – Rocky Neck

[illegible]

[illegible]