



Invasive Species Early Detection in the Northeast Temperate Network

2012 Summary Report

Natural Resource Data Series NPS/NETN/NRDS—2013/470



ON THE COVER

Glossy buckthorn (*Frangula alnus*) seedlings in Acadia National Park
Photograph by: Jesse S. Wheeler, National Park Service

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Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Executive Summary

The 2012 field season marked the third year of the Northeast Temperate Network (NETN) implementing an invasive species early detection (ISED) program in 12 national park units. The ISED program was designed to facilitate detection of priority pests and exotic plants at early stages of establishment while the costs of eradication are still low and the chances of successful eradication are high. The major components of the ISED program include 1) a target list of early detection species for each park, 2) laminated field guides for each park containing the target list and identification cards for each target species, 3) a reporting plan to ensure park managers and NETN staff are informed quickly of detections, and 4) data management and annual reporting of early detection and invasive species data.

Over the last year, NETN provided several parks with updated laminated ISED field guides, offered training to NETN field staff and interested parks, and noted 17 new detections in five parks by NETN and park staff. ISED target species lists were also reviewed and updated in seven parks and aquatic species lists were created for Marsh-Billings-Rockefeller National Historical Park, Saint-Gaudens National Historic Site and Weir Farm National Historic Site. As part of the ISED target list review, we looked for species where annual control measures and repeated detections indicated that a species was more established than previously thought. Examples include Japanese knotweed (*Polygonum cuspidatum*) in Acadia National Park, and Siebold's arrowwood (*Viburnum sieboldii*) in Morristown National Historical Park, and in most cases, these species were removed from the ISED target lists. We also looked for new species to add to target lists that have high invasive potential and are being found closer to park boundaries. These include Japanese honeysuckle (*Lonicera japonica*) near Saratoga National Historical Park, and perennial pepperweed (*Lepidium latifolium*) near Minute Man National Historical Park.

In addition to reporting on early detections in NETN parks, we provide a brief summary of the routine inventory and management efforts with established invasive plants that were conducted by park staff, cooperators, and the Northeast Exotic Plant Management Team (NEEPMT) at each park during 2012. Species of bush honeysuckle (*Lonicera* spp.), Japanese stiltgrass (*Microstegium vimineum*), and glossy buckthorn (*Frangula alnus*) were some of the most established and widespread invasive species treated in NETN parks in 2012.

Acknowledgements

The Invasive Species Early Detection protocol that the Northeast Temperate Network is implementing was developed by Jennifer Stingelin Keefer of the Eastern Rivers and Mountains Network. We are grateful to Jennifer for all of her hard work in getting this protocol up and running for both networks, for her continued collaboration, and for the many excellent species identification cards she has designed and shared. We would like to thank Charlene Donahue, Forest Entomologist for the state of Maine, for information regarding winter moth distribution in Maine. We would like to thank Ed Sharron (NETN Science Communication Specialist) for revising the format of this report, incorporating ISED training into his “Road Shows” and printing the ISED field guides. Finally, we would like to thank our park resource managers for helping to develop the target species lists, and their continued commitment to making this protocol successful.

Introduction

Invasive exotic species are those that have the potential to cause negative economic impacts and/or harm to the environment or human health (USPEO 1999). Invasive species are also one of the leading threats to biodiversity and ecological integrity of ecosystems worldwide (Mooney et al. 2005). Early detection of invasive species was identified as a priority vital sign by several Inventory and Monitoring (I&M) Networks in the Northeast Region of the National Park Service (NPS). In 2008 the Northeast Temperate Network (NETN) and Eastern Rivers and Mountains Network (ERMN) began developing a shared invasive species early detection (ISED) protocol.

NETN is currently implementing the ISED protocol in 12 network parks, including Acadia National Park (ACAD), Boston Harbor Islands National Recreational Area (BOHA), Marsh-Billings-Rockefeller National Historical Park (MABI), Minute Man National Historical Park (MIMA), Morristown National Historical Park (MORR), Roosevelt-Vanderbilt National Historic Sites (ROVA), Saint-Gaudens National Historic Site (SAGA), Saratoga National Historical Park (SARA), Saugus Iron Works National Historic Site (SAIR), and Weir Farm National Historic Site (WEFA). Roosevelt-Vanderbilt National Historic Sites includes Eleanor Roosevelt National Historic Site (ELRO), Home of Franklin D. Roosevelt National Historic Site (HOFR), and Vanderbilt Mansion National Historic Site (VAMA). NETN is also monitoring status and trends of invasive species in many of these parks as part of the Long-term Forest Monitoring Protocol (Tierney et al. 2011).

The overall goal of the ISED protocol is to utilize opportunistic sampling to detect invasive species in the early stages of establishment while the costs of eradication are still relatively low. This is accomplished by first developing a modest list of target insect pest and exotic plant species specific to each park that can easily be managed by non-experts. The target list includes species that are either 1) present in the park at low levels and of management concern if new populations are detected, or 2) not present in the park, but that have demonstrated impacts to ecosystem function in the region. Target lists are reviewed annually and updated as needed. To aid with identification, NETN provides laminated field guides to each park and NETN field crews, and annual ISED training for NETN field crews and interested parks. The field guides contain each park's target list, identification cards for each species on the target list, and laminated pest and plant detection forms. The detection forms list the information that should be collected for each detection and can be recorded on using dry erase markers or wax pencils. The detection forms are also available as datasheets on "Rite in the Rain" paper, and digitally as fillable Adobe .pdf forms upon request. Starting in 2013, NETN field crews will record ISED sightings into the smartphone application "What's Invasive," and we encourage parks to do the same. This app will include updated target lists for each NETN park. The app will automatically store important data associated with the detection including GPS location, photographs, and extent of population. This information can later be downloaded as an excel spreadsheet from the website. The "What's Invasive" smartphone app can be downloaded at:

<https://itunes.apple.com/us/app/whats-invasive/id529665562?mt=8> for the iPhone, and at <https://play.google.com/store/apps/details?id=edu.ucla.cens.whatsinvasive> for the Android.

A reporting plan is in place for each park so that park managers can be immediately notified of early detections. Data management tasks, such as gathering and storing early detection location

and species information from NETN field crews and park staff and volunteers, are handled by NETN staff. Finally, summaries of early detections for each park are included in annual reports. For more details on the ISED protocol, refer to Keefer et al. (2010).

The aim of this report is to centralize early detection and invasive species information for each park into a single annual report. Herein we provide updates on the ISED program and park target lists, report all early detections from 2012, and summarize invasive species management efforts in each park from 2012. There are two important caveats to keep in mind while reading this report. First, the invasive species management information is a brief summary of the information that was provided to NETN by each network park and/or the NEEPMT, and may not include all species that were inventoried or managed over the year. Secondly, while the locations of forest monitoring plots with target invasive species are provided, these plots must NOT be specifically targeted for invasive species removal. Invasive species removal on monitoring plots should only occur when removal is conducted in a larger management area that happens to include one or more plots. That is, forest monitoring plots need to be treated the same as the surrounding area to maintain the integrity of the forest monitoring sample design.

Methods

Sampling

The ISED protocol was designed to require minimal staff time and funding and to rely on opportunistic sampling by NETN field crews (e.g., forest health monitoring crew (FHMC), water monitoring staff), park staff (e.g., maintenance crews, biological technicians), cooperators and volunteers who may encounter invasive species while performing other tasks in the parks. In some cases, park staff and volunteers were actively searching for early detections. While this is highly encouraged, it is not a requirement of the ISED protocol.

Reporting and Data Management

New detections of invasive species on our target lists were documented with as much detail and supporting evidence as possible. ISED plant and pest reporting forms were filled out when available. Starting in 2013, detections will also be reported with smartphones using the app, “What’s Invasive”, or on-line at www.whatsinvasive.com. This app and website are managed by the Early Detection & Distribution Mapping System (EDDMapS), which is the University of Georgia’s web-based mapping system for documenting invasive species distributions. Data collection procedures are outlined in SOP 2 – Data Collection of the ISED protocol (Keefer et al. 2010). When target species were detected, the designated park contact (DPC) listed on the ISED field guides and/or the NETN Early Detection Lead (Jesse Wheeler) were notified immediately of the location and species detected. The DPC and NETN Early Detection Lead alerted each other of new detections. NETN staff managed the spatial and tabular data related to early detection in network parks and summarized these results in this annual report.

Rapid Response

Rapid response is a key component of the ISED program and is primarily the responsibility of park managers to plan and implement. Additional assistance may be provided by the Northeast Exotic Plant Management Team (NEEPMT), the NPS Regional Integrated Pest Management (IPM) Coordinator, the Animal and Plant Health Inspection Service (APHIS), local weed management organizations (e.g., the New Jersey Invasive Species Strike Team), and network and park personnel (Keefer et al. 2010).

Results and Discussion

ISED Species Review

As part of our annual protocol review, the 2013 ISED list has been developed for all NETN parks to reflect the current top priority species. Species that have had numerous detections in a park and appear to be well-established were considered by NETN and park staff for removal from the park ISED target list. In addition, we evaluated new candidates for park ISED target lists that are close to park boundaries and potentially present a high invasive threat to habitats represented within the park. Current species distribution data obtained from EDDMapS (2012) and Invasive Species Impact Rankings (I-Rank) were evaluated using NatureServe Explorer (2012). For further information on this review process, refer to SOP 1 – Updating Invasive Species Early Detection Lists of the ISED protocol (Keefer et al. 2010). Future reviews will only focus on half of the NETN parks each year to more closely reflect the sampling schedule of the NETN FHMC.

ISED Program Updates

Updated target species lists for each park are incorporated in Table 1 and listed by park in Appendices A & B. Discussion of candidate species for addition and removal for each park are summarized below. Identification cards have been developed for each species listed in Table 1, and are available digitally (as .pdf files) upon request. For the 2013 field season, new species cards will be developed for winter moth (*Operophtera brumata*), European spindletree (*Euonymus europaeus*) and Japanese snowbell (*Styrax japonicus*). Eastern Rivers and Mountains Network (ERMN) also continues to create new species cards to keep up with their ISED needs, and we will inform NETN parks of new cards as they are completed. Two new species cards for NETN, amur honeysuckle (*Lonicera maackii*) and common reed (*Phragmites australis*), were developed by the U.S. Forest Service and ERMN, respectively. Detections of target species in 2012 are discussed for each park in the sections that follow.

An invasive aquatic plant and algae component was added to ISED monitoring in MABI, SAGA and WEFA, and will be expanded to all parks except BOHA in 2013. These parks all contain water bodies at risk of invasion and previously did not have designated aquatic ISED lists. NETN staff created aquatic ISED target lists and corresponding species identification cards to be used in MABI, SAGA and WEFA. The 12 aquatic plants (lakes and ponds) and one alga species (streams) for these parks, including several that were already on ACAD and SAIR's list, can be found in Table 1. The lists were distributed as .pdf documents to park staff and to the NETN water monitoring staff, who routinely visits these locations collecting water quality samples throughout the growing season. There were no reports of invasive aquatic plants in any of the parks during 2012.

In 2012, all ISED locations from 2010-2011 were uploaded, along with GPS coordinates and notes associated with the detections, to the EDDMapS website, as described in the ISED protocol (Keefer et al. 2010).

This

Table 1. Invasive species early detection target lists for each park in the Northeast Temperate Network. “X” indicates a species remaining on the list, “--” indicates a species removed from the list, and “X” indicates a species added to the list for 2013. “~X” indicates an aquatic species added to the list in 2012.

Scientific Name	Common Name	Category	ACAD	BOHA ¹	MABI	MIMA	MORR	ROVA	SAGA	SAIR	SARA	WEFA
<i>Adelges tsugae</i>	hemlock woolly adelgid	PEST	X		X	--			X		X	
<i>Agrilus planipennis</i>	emerald ash borer	PEST	X	X	X	X	X	X	X	X	X	X
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	PEST	X	X	X	X	X	X	X	X	X	X
<i>Pyrrhalta viburni</i>	viburnum leaf beetle	PEST		X			X	X		X		X
<i>Operophtera brumata</i>	winter moth	PEST	X									
<i>Sirex noctilio</i>	sirex woodwasp	PEST			X			X	X		X	
<i>Acer platanoides</i>	Norway maple	PLANT	X ²		X							
<i>Ailanthus altissima</i>	tree of heaven	PLANT	X	X	X				X		X	X
<i>Akebia quinata</i>	chocolate vine	PLANT					X					
<i>Alliaria petiolata</i>	garlic mustard	PLANT	--	--					X			
<i>Ampelopsis brevipedunculata</i>	porcelainberry	PLANT		X		X	X	X	X	X	X	X
<i>Aralia elata</i>	Japanese aralia	PLANT					X	X				
<i>Berberis thunbergii</i>	Japanese barberry	PLANT	--	X								
<i>Berberis vulgaris</i>	common barberry	PLANT	--		X							
<i>Cabomba caroliniana</i>	fanwort	AQ PLANT	X									
<i>Cardamine impatiens</i>	narrowleaf bittercress	PLANT	X	X	X	X			X	X	X	
<i>Celastrus orbiculatus</i>	oriental bittersweet	PLANT	--		X							
<i>Centaurea stoebe ssp. micranthos</i>	spotted knapweed	PLANT	X			X						
<i>Cynanchum spp.</i>	swallow-worts	PLANT	X	X	X		X			X	X	
<i>Didymoshpenia geminate</i>	didymo	AQ ALGAE	X		~X	X	X	X	X	~X	X	
<i>Dioscorea oppositifolia</i>	Chinese yam	PLANT				X	X	X	X		X	X
<i>Egeria densa</i>	Brazilian waterweed	AQ PLANT	X		~X					~X		~X
<i>Eichhornia crassipes</i>	water hyacinth	AQ PLANT										~X
<i>Elaeagnus umbellata</i>	autumn olive	PLANT	X		X				X			

¹ The ISED target lists for BOHA were combined in this table to save space. To view the target lists for each BOHA subunit, refer to Appendix B.

² Species removed from ISED list for eastern portion of Mount Desert Island unit of ACAD.

Table 1. Invasive species early detection target lists for each park in the Northeast Temperate Network. “X” indicates a species remaining on the list, “--” indicates a species removed from the list, and “X” indicates a species added to the list for 2013. “~X” indicates an aquatic species added to the list in 2012 (continued).

Scientific Name	Common Name	Category	ACAD	BOHA ¹	MABI	MIMA	MORR	ROVA	SAGA	SAIR	SARA	WEFA
<i>Euonymus alatus</i>	winged burning bush	PLANT	X	X	X				X		X	
<i>Euonymus europaeus</i>	European spindle tree	PLANT		X								
<i>Frangula alnus</i>	glossy buckthorn	PLANT	X ²		X			X			X	X
<i>Heracleum mantegazzium</i>	giant hogweed	PLANT	X		X	X		X			X	X
<i>Hydrilla verticillata</i>	hydrilla	AQ PLANT	X						~X			~X
<i>Hydrocharis morsus-ranae</i>	common frogbit	AQ PLANT	X						~X			
<i>Lepidium latifolium</i>	perennial pepperweed	PLANT		--		X				X		
<i>Ligustrum</i> spp.	privet species	PLANT	X		X				X		--	
<i>Lonicera</i> spp.	bush honeysuckle species	PLANT	X							X		
<i>Lonicera japonica</i>	Japanese honeysuckle	PLANT	X	X						X	X	
<i>Lonicera maackii</i>	amur honeysuckle	PLANT					X					
<i>Lythrum salicaria</i>	purple loosestrife	PLANT	X									X
<i>Microstegium vimineum</i>	Japanese stiltgrass	PLANT	X	X	X	X			X	X	X	
<i>Myriophyllum aquaticum</i>	parrotfeather	AQ PLANT	X									~X
<i>Myriophyllum heterophyllum</i>	variable watermilfoil	AQ PLANT	X		~X				~X	X		~X
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	AQ PLANT	X		~X				~X	X		~X
<i>Najas minor</i>	brittle water nymph	AQ PLANT	X						~X	X		~X
<i>Nymphoides peltata</i>	yellow floating heart	AQ PLANT	X		~X							
<i>Oplismenus hirtellus</i> ssp. <i>undulatifolius</i>	wavyleaf basketgrass	PLANT		X			X	X	X	X	X	X
<i>Parthenocissus tricuspidata</i>	Boston ivy	PLANT					X					
<i>Paulownia tomentosa</i>	princess tree	PLANT				X		X	X			X
<i>Photinia villosa</i>	oriental photinia	PLANT					--					

¹ The ISED target lists for BOHA were combined in this table to save space. To view the target lists for each BOHA subunit, refer to Appendix B.

² Species removed from ISED list for eastern portion of Mount Desert Island unit of ACAD.

Table 1. Invasive species early detection target lists for each park in the Northeast Temperate Network. “X” indicates a species remaining on the list, “--” indicates a species removed from the list, and “X” indicates a species added to the list for 2013. “~X” indicates an aquatic species added to the list in 2012 (continued).

Scientific Name	Common Name	Category	ACAD	BOHA [†]	MABI	MIMA	MORR	ROVA	SAGA	SAIR	SARA	WEFA
<i>Phragmites australis</i>	common reed	PLANT	X						X			
<i>Polygonum cuspidatum/ P. sachalinense</i>	Japanese/ giant knotweed	PLANT	--	X	X	--			X			X
<i>Polygonum perfoliatum</i>	mile-a-minute	PLANT		X		X	X	X	X	X	X	X
<i>Populus alba</i>	white poplar	PLANT		X								
<i>Potamogeton crispus</i>	curly pondweed	AQ PLANT	X						~X	X		~X
<i>Pueraria montana var. lobata</i>	kudzu	PLANT		X		X	X	X		X		
<i>Ranunculus ficaria</i>	lesser celandine	PLANT				X	X	X	X		X	X
<i>Rhamnus cathartica</i>	common buckthorn	PLANT										X
<i>Rhodotypos scandens</i>	black jetbead	PLANT					X					
<i>Rosa multiflora</i>	multiflora rose	PLANT	X		X							
<i>Rubus phoenicolasius</i>	wine raspberry	PLANT		X	X	X		X	X		X	X
<i>Styrax japonicus</i>	Japanese snowbell	PLANT					X					
<i>Trapa natans</i>	water chestnut	AQ PLANT	X						~X	X		~X
<i>Viburnum dilataum</i>	linden arrowwood	PLANT					X					
<i>Viburnum sieboldii</i>	Siebold's arrowwood	PLANT					--					
<i>Wisteria floribunda/ W. sinensis</i>	Japanese/Chinese wisteria	PLANT					--	X				X

[†] The ISED target lists for BOHA were combined in this table to save space. To view the target lists for each BOHA subunit, refer to Appendix B.

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Finally, several network parks and the NEEPMT provided information on invasive species management and inventory efforts over the 2012 season. Associated data are being stored by NETN in spreadsheets and shapefiles, and can be provided to parks upon request. This information is also summarized in the park sections below. NETN would like to hear from park managers regarding whether including summaries of invasive species management in this report is useful, and if there are other ways park managers would like information conveyed.

Acadia National Park

Early Detections

Two new locations of glossy buckthorn (*Frangula alnus*) were detected by NETN staff in wetlands on the west side of Duck Brook Road. Bush honeysuckle (*Lonicera* spp.) and Japanese barberry (*Berberis thunbergii*) were located again in forest plot 082, which is also near Duck Brook Road. These species were detected in the same plot when it was first sampled in 2008, and the location was reported to ACAD staff in 2008 and in 2012. Although these species are still present in the plot, there is evidence of invasive species control efforts nearby. There were no reports of invasive aquatic plants detected during annual aquatic plant surveys in the ponds and lakes of ACAD in 2012.

In recent years, there have been increasing reports by property owners in surrounding towns of hemlock woolly adelgid (HWA; *Adelges tsugae*) in horticultural plantings of eastern hemlock (*Tsuga canadensis*) not far from park boundaries. ACAD has increased awareness to the possibility of HWA encroaching on forested settings within the park and has asked members of the community to be on the lookout while hiking in the park. State of Maine forest service crews conducted surveys through some areas of the park during the winter of 2012-2013.

ISED Target List Review

Many of the species already on the list are known to be present in small, isolated populations in the park, and are still appropriate for the target list. However, it is becoming apparent that several species are well established throughout the park, and have been for some time (Appendix A: Table A.1). NETN is removing two of these species, Japanese barberry (*Berberis thunbergii*) and Japanese knotweed (*Polygonum cuspidatum*), from the overall target list and removing two species, glossy buckthorn (*Frangula alnus*) and Norway maple (*Acer platanoides*), from the east side of Mount Desert Island, where they are more established than elsewhere in the park. Many of the other target species that are known to be present in the park occur in more disturbed areas (e.g., bush honeysuckle [*Lonicera* spp.], purple loosestrife [*Lythrum salicaria*] and oriental bittersweet [*Celastrus orbiculatus*]). These species will remain on the target list used by the NETN FHMC and others venturing into less disturbed, intact forest sections of the park where an outbreak of these species would warrant a rapid response.

On the other hand, a few highly invasive species are on the park's doorstep, either found in Hancock county or a nearby county, and are considered good candidates for the target list. Four new plant species were added to the list, including tree of heaven (*Ailanthus altissima*), Japanese honeysuckle (*Lonicera japonica*), common reed (*Phragmites australis*) and two swallow-wort species (*Cynanchum louiseae* and *C. rossicum*). Japanese honeysuckle is found already in ACAD at low levels in an isolated location at Compass Harbor and is being added to the target list because of its high invasive potential. All of these invasive plants have invasive rankings ranging from medium to high (NatureServe I-Rank). In addition, we added the forest pest winter moth

(*Operophtera brumata*) to the ISED target list. Winter moth has recently been confirmed on the coast of Maine near ACAD, including Bar Harbor and Tremont (Charlene Donahue, Maine State Forest Entomologist, e-mail communication, 01-29-2013). It is not yet known what the extent of infestation is or if there are breeding populations, but the Maine Forest Service (MFS) expects possible hardwood defoliation in the near future for these areas. Winter moth has the potential to defoliate a wide range of hardwoods, such as oak, maple, birch and blueberry. The MFS is looking into long-term control measures using biological control methods.

ACAD uses the top 11 pond/lake invasive aquatic plants list developed by the Maine Center for Invasive Aquatic Plants and these species are listed in Appendix A: Table A.1. The stream alga species, didymo (*Didymosphenia geminata*), was added to the aquatic invasive list for 2013.

Invasive Species Management

Of the 26 non-native species that were targeted and treated in ACAD during 2012 by the ACAD Exotic Plant Management Team, 10 species are on the NETN ISED target list. The ISED target species that were managed in 2012 include: common barberry (*Berberis vulgaris*), exotic bush honeysuckle (*Lonicera* spp.), garlic mustard (*Alliaria petiolata*), glossy buckthorn (*Frangula alnus*), Japanese barberry (*Berberis thunbergii*), Japanese knotweed (*Polygonum cuspidatum*), multiflora rose (*Rosa multiflora*), narrowleaf bittercress (*Cardamine impatiens*), oriental bittersweet (*Celastrus orbiculatus*), and purple loosestrife (*Lythrum salicaria*). A total of 48.6 hectares were surveyed and treated throughout the park during 2012.

Boston Harbor Islands National Recreational Area

Early Detection

During the 2012 season, three ISED species were newly documented on three of the park's units (Appendix B: Table B.1). At Webb Memorial State Park, a dense patch of garlic mustard (*Alliaria petiolata*) that was roughly 15 m x 15 m in area was located along the west side trail and on the west facing slope of the northern peninsula. A "sparse" patch of garlic mustard (as described in BOHA's 2012 early detection brief from park staff) was detected in a forested setting just above the east facing beach on the north end of Thompson Island. Peddocks Island surveys turned up a small patch (500-1,000 individuals over approximately 0.10 ha) of black swallow-wort (*Cynanchum louiseae*) at the Middle Head end of the Tombolo trail. Winged burning bush (*Euonymus alatus*) was also found in a mixed invasive shrub zone near West Head of Peddocks Island.

ISED Target List Review

Wine raspberry (*Rubus phoenicolasius*) will be added to the ISED target list on all units because it is found in nearby counties, invades disturbed open areas, and has a high invasive ranking (NatureServe, I-Rank). Expanding porcelainberry (*Ampelopsis brevipedunculata*) populations should be watched carefully in Webb Memorial State Park, and it may make sense to remove porcelainberry from this unit's ISED target list in the future. European spindletree (*Euonymus europaeus*) will be added to Spectacle Island. The invasibility of this species has not been ranked by NatureServe yet, but the shrub is found invading areas in nearby counties. Garlic mustard will be removed from the Webb Memorial State Park and Thompson Island lists because the populations that exist there are no longer effectively controlled by rapid response. Peddocks Island will have perennial pepperweed (*Lepidium latifolium*) stricken from its ISED list as two populations continue to persist there.

Invasive Species Management

Eight island and peninsula units received some degree of invasive species management at BOHA. With a diverse group of invasive plants being treated, glossy buckthorn (*Frangula alnus*) was a major focus throughout the park. Specific invasive species treated are found in Appendix C (Table C.1), while the ISED species treated this year are described here. Two porcelainberry patches (~25 individuals) first detected and treated in 2011 on Webb Memorial State Park were re-treated in 2012. These were located in the depression at the southeast corner of the park, as well as the hill-top on the northern lobe of the park. Bumpkin Island also had one porcelainberry individual, found in 2011, that was treated with herbicide this year. Hand-pulling retreatment of garlic mustard was conducted on a patch that was detected on Bumpkin Island in 2011.

Marsh-Billings-Rockefeller National Historical Park

Early Detection

Several species on the ISED target list were found and/or managed in MABI by park staff and cooperators in 2012 (Appendix D). Winged burning bush (*Euonymus alatus*), which was originally planted in the landscaping around the mansion, was found in fewer numbers (11 plants in three locations) outside the mansion grounds this year compared to previous years. Most of these locations were near the Elm lot, close to the overlook on the trail. The extent of oriental bittersweet (*Celastrus orbiculatus*) was unknown in previous years because it was thought to possibly be the native species, American bittersweet (*Celastrus scandens*). Now that a vine in Stand 5 (south-central boundary of the park) has matured and fruited, a positive ID of oriental bittersweet has been made and it will be managed in subsequent years. In late April, two common barberry (*Berberis vulgaris*) shrubs were flagged to be pulled at a later date. A large stand of Norway maple (*Acer platanoides*) was removed west of the Belvedere in 2005 and replanted with Norway spruce (*Picea abies*), a common plantation tree in MABI. This area around the new plantation has seen explosions of Norway maple seedlings, either deposited as seed before the mature trees were removed, or blown in from neighboring trees just south of the park boundary. To date, an estimated 2,000 seedlings were pulled from this area. Norway maple continues to crop up in other areas of the park, such as near the Bungalow on the hill west of the visitor center and west of the pasture near the horse shed on the Billings Park Link trail. An estimated 5,000 plants were removed from these areas in 2012. Autumn olive (*Elaeagnus umbellata*) was found in three isolated patches near large hemlocks in Stand 5. Over 50 individuals in Stand 5 (re-sprouts from cut stumps) were treated with herbicide in July and November. Black swallow-wort (*Cynanchum louiseae*) continues to persist near the gravel parking lot across from the Billings Farm & Museum on Old River Road as well as along roadsides surrounding the park. Redstart Forestry & Consulting has been treating these populations annually. There were no reports of invasive aquatic plants in the Pogue or elsewhere in MABI.

ISED Target List Review

Several of the species on the ISED target list occur in MABI at low levels or in manageable populations. These species include oriental bittersweet, Norway maple and winged burning bush. We decided to keep these and other species on the target list, as documenting their range and whereabouts in the interior forest sections of the park will encourage a rapid response (Appendix A: Table A.2). NETN will add two species to the target list, tree of heaven (*Ailanthus altissima*)

because of its high invasive ranking and garlic mustard (*Alliaria petiolata*) because it persists in isolated pockets of the park and has a high invasive ranking (NatureServe 2012, I-Rank).

Invasive Species Management

Through cooperation between park staff, Student Conservation Association (SCA) interns, Redstart Forestry & Consulting and the Ottawaquechee Cooperative Invasive Species Management Area team, twenty invasive species (includes target list species) were managed in 2012. The priority was to remove as many mature woody invasive plants and seedlings as possible, especially in areas slated for tree harvesting in the next year. Exotic bush honeysuckle (*Lonicera* spp.) plants were treated in one of the last known patches of large honeysuckle plants occurring in the park. Treatment involved a combination of hand pulling in the spring and treatment with herbicide on cut stumps in the fall. During the months of April and November, 185 honeysuckle plants were pulled in ten different locations throughout MABI. MABI has adopted a strategy of gathering GPS waypoints and marking native *Lonicera* species, so as not to confuse them with the invasive *Lonicera* during control efforts. Garlic mustard has been managed with some success for several years by hand pulling, and this has resulted in declining populations. More than 100 mature and many small garlic mustard plants were pulled in four sites, including modest populations in King Farm (72 plants) and a revisit in stand 5 (30 plants). The bulk of the removal was carried out by Redstart Forestry & Consulting. Redstart also treated a localized patch of common reed (*Phragmites australis*) at the Prosper road parking lot and removed the seed pods from black swallow-wort before they had a chance to release any seed. Another notable invasive that was managed and inventoried in 2012 was Japanese barberry (*Berberis thunbergii*), where 86 plants were either pulled or cut and treated with herbicide. Locations where Japanese barberry was treated include 30 large plants at the summit of the West Ridge trail and the Pogue, along the pasture edge surrounding the horse shed, and six plants in Stand 18 (large stand on the west end of the park). Mature individuals of this species are not known to occur inside the park boundary, which is a noteworthy achievement. However, mature plants are commonly found just outside the park. Continued vigilance will be required.

Minute Man National Historical Park

Early Detection

There was one ISED detection in MIMA during 2012 (Appendix D). For the second visit in a row (2010 was the first), the FHMC observed a few eastern hemlock (*Tsuga canadensis*) trees infested with hemlock woolly adelgid (*Adelges tsugae*, HWA). The 2012 observations were on the east side of the John Nelson house, west of the visitor center parking lot. Unfortunately, HWA appears to be well established in MIMA and may require substantial treatment efforts if managing this pest is desired within park boundaries.

ISED Target List Review

Two species were removed from the ISED target list: hemlock woolly adelgid and Japanese knotweed (*Polygonum cuspidatum*). Hemlock woolly adelgid appears to be established in the park, and significant populations of Japanese knotweed have been managed in recent years (Appendix A: Table A.3). One new candidate species added to the ISED target list, perennial pepperweed (*Lepidium latifolium*), is capable of invading natural ecosystems in riparian areas and other wetlands. It is known within Middlesex county and has a high invasive ranking (NatureServe, I-Rank). The stream alga species, didymo (*Didymosphenia geminata*), was added to the aquatic invasive list for 2013.

Invasive Species Management

The NEEPMT did not visit MIMA in 2012, and the park did not provide information related to invasive species management in 2012.

Morristown National Historical Park

Early Detection

Five new locations of species on the ISED target list were observed in 2012. One detection of porcelainberry (*Ampelopsis brevipedunculata*) and two each of black jetbead (*Rhodotypos scandens*) and linden arrowwood (*Viburnum dilatatum*) were detected by park staff (Appendix D).

ISED Target List Review

NETN staff removed three species from the target list in 2012 (Appendix A: Table A.4). Siebold's arrowwood (*Viburnum sieboldii*), oriental photinia (*Photinia villosa*) and wisteria species (*Wisteria floribunda*/*W. sinensis*) have been found in several forest health plots or are managed elsewhere in the park, and were therefore removed from the ISED target list. Two new shrubs, Japanese snowbell (*Styrax japonicus*) and amur honeysuckle (*Lonicera maackii*), were added to the ISED list. Amur honeysuckle is known to occur in Morris county and has a high invasive ranking (NatureServe, I-Rank). Japanese snowbell has been documented in isolated areas of the park near Cross Estates. Documenting the whereabouts of other locations of these two species will be helpful to resource managers. The stream alga species, didymo (*Didymosphenia geminata*), was added to the aquatic invasive list for 2013. The remaining fifteen species will stay on the list because of their continued invasive potential and/or unknown status within MORR.

Invasive Species Management

Several species were mechanically removed or treated with herbicide in 2012, including the following targeted ISED species: Siebold's arrowwood, oriental photinia and black swallow-wort (*Cynanchum louiseae*). In addition, an unknown species in the *Photinia* genus was also removed.

Roosevelt-Vanderbilt National Historic Sites

Early Detection

The invasive pest, emerald ash borer (*Agrilus planipennis*; EAB), was observed in the VAMA unit of ROVA in late 2012. The discovery was confirmed by the New York State Department of Environmental Conservation in January of 2013 in two sentinel ash trees. This new location of EAB adds to other recent detections on the east side of the Hudson River in Dutchess County and in western Massachusetts and Connecticut. NETN field crews and staff will be particularly vigilant with inspection of ash trees in all units of ROVA to document the eventual spread of EAB throughout the area. Park managers will treat significant specimen ash trees, but do not have plans to control infestations in the native forests as treatment is very costly. For more details on the spread of EAB, current quarantine areas through New York State, and strategies for slowing the spread of EAB, check the NY DEC's EAB website at: www.dec.ny.gov/animals/7253.html. No new target plant species were observed in ROVA in 2012.

ISED Target List Review

NETN staff decided that all species should remain on the watch list (Appendix A: Table A.5). Although several invasive species of concern are creeping closer to ROVA (e.g. perennial pepperweed [*Lepidium latifolium*] and Siebold's arrowwood [*Viburnum sieboldii*]), we don't think they need to be added to the list at this time. These species will be considered for inclusion in the future. One current ISED species, *Wisteria* ssp., may be present in the park (according to the ROVA vegetation map species list) but has not been confirmed. We propose to keep wisteria on the list until its status in ROVA is better known. Another target species, wine raspberry (*Rubus phoenicolasius*), was detected in 2009 and 2011 by the FHMC. However, the full extent of wine raspberry is unknown, which is the reason for keeping this species on the target ISED list. The stream alga species, didymo (*Didymoshpenia geminate*), was added to the aquatic invasive list for 2013.

Invasive Species Management

The Northeast Exotic Plant Management Team (NEEPMT) managed several invasive species in ROVA in 2012. Japanese stiltgrass (*Microstegium vimineum*) was targeted by treating 1.21 ha with a foliar application of herbicide in the HOFR unit. Other invasive treatments included two small patches of wine raspberry.

Saint-Gaudens National Historic Site

Early Detection

No new detections of target terrestrial or aquatic species were observed in SAGA during 2012. While sampling forest plots in 2012, the NETN forest crew visually inspected eastern hemlock (*Tsuga canadensis*) trees in forest plots for hemlock woolly adelgid (*Adelges tsugae*), and found no evidence of HWA.

ISED Target List Review

NETN staff decided that all species should remain on the target list (Appendix A: Table A.6). Although there are some invasive species of concern that are creeping closer to SAGA (e.g., glossy buckthorn [*Frangula alnus*], common barberry [*Berberis vulgaris*] and Japanese honeysuckle [*Lonicera japonica*]), we don't think they need to be added to the current list. One new species, common reed (*Phragmites australis*), was added to the ISED list because of its high invasive ranking (NatureServe, I-Rank), and close proximity to SAGA. In addition, SAGA has vulnerable wetland habitat that could be significantly impacted by an infestation of common reed. The stream alga species, didymo (*Didymoshpenia geminate*), was added to the aquatic invasive list for 2013.

Invasive Species Management

The NEEPMT did not visit SAGA in 2012, yet treatment efforts were conducted by park staff on several invasive species. Staff mechanically removed around 5,000 Japanese tree lilacs (*Syringa reticulata*) from an area close to its source in the historic landscape, across the road from Aspet, the home of Saint-Gaudens. The vast majority of individuals were seedlings, though some saplings and mature individuals were removed as well. Park staff also mechanically removed ten Japanese barberry (*Berberis thunbergii*) shrubs and 123 Morrow's bush honeysuckles (*Lonicera morrowii*) at Blow-Me-Down Pond.

Saugus Iron Works National Historic Site

Early Detection

Multiple search efforts by park staff and volunteers turned up no early detection species in SAIR during 2012.

ISED Target List Review

NETN staff decided that all species should remain on the target ISED list (Appendix A: Table A.7). Although there are some invasive species that are creeping closer to SAIR (e.g. autumn olive [*Eleagnus umbellata*] and privet species [*Ligustrum* spp.]), we don't think they need to be added on top of the current list. These species will be considered for inclusion in the future.

Invasive Species Management

During 2012, no new invasive species were detected at SAIR. However, there were at least six established invasive species that were managed and treated (Appendix C: Table C.2). Operating with a new management plan, a large focus in SAIR has been to manage purple loosestrife (*Lythrum salicaria*) by removing the flower heads and/or hand pulling the plants. With more intensive herbicide treatment plans set aside until 2013, common reed (*Phragmites australis*) was cut back in a couple of areas. Fortunately, populations of common reed have been significantly reduced along both sides of the river after mechanical removal 5 years ago, as part of the Turning Basin restoration project. In more terrestrial areas of the park, notable invasive plants that were controlled include multiflora rose (*Rosa multiflora*), oriental bittersweet (*Celastrus orbiculatus*), glossy buckthorn (*Frangula alnus*), Japanese knotweed (*Polygonum cuspidatum*), and tree of heaven (*Ailanthus altissima*).

Saratoga National Historical Park

Early Detection

The 2012 FHMC sampled forest plots in SARA, and had no new detections of invasive species. The range of the emerald ash borer (EAB; *Agrilus planipennis*) continues to expand in eastern New York State, but has not been observed any closer to SARA since the detection in Selkirk, NY in 2011. For more detail on the spread of EAB, current quarantine areas throughout New York State, and strategies for slowing the spread of EAB, check the NY Department of Environmental Conservation's EAB website (www.dec.ny.gov/animals/7253.html).

Although not on the ISED target list, viburnum leaf beetles (*Pyrrhalta viburni*) were seen on southern arrowwood (*Viburnum dentatum*) shrubs within forest plot 032 in early successional old field habitat. The impact of this pest in natural settings is not fully understood and native viburnums in forest habitats should be closely monitored.

ISED Target List Review

NETN staff removed one species and added one new species to the ISED target list (Appendix A: Table A.8). Privet was removed (*Ligustrum* spp.), since it appears to be more established than originally thought and it has been detected in three forest health monitoring plots since 2010. Japanese honeysuckle, an aggressive vine that is known to occur in Saratoga County and has a High/Medium invasive ranking (NatureServe, I-Rank), was added to the 2013 target list. The remaining seventeen species will stay on the list because of their continued invasive potential and/or unknown status within SARA. The stream alga species, didymo (*Didymosphenia geminata*), was added to the aquatic invasive list for 2013.

Invasive Species Management

The NEEPMT and park staff inventoried 122 ha for invasive plants and managed them in about 32 ha of fields throughout the park. Brown knapweed (*Centaurea jacea*), spotted knapweed (*Centaurea stoebe* ssp. *micranthos*), bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense*) and cow vetch (*Vicia cracca*) were treated in fields totaling 23 ha. In addition, several other invasive species were treated by park staff with herbicide in a total of 9.3 ha (Appendix C: Table C.3).

Weir Farm National Historic Site

Early Detection

No new locations of early detection species, including aquatic plants, were observed in WEFA in 2012. However, mile-a-minute (*Polygonum perfoliatum*) was observed near the park, signifying that awareness and vigilance for detecting this plant early should remain at the forefront of the ISED program at WEFA. Also, the range of the emerald ash borer (*Agilus planipennis*; EAB) continues to expand and is getting closer to WEFA, as it was found in prism traps in western Massachusetts and in neighboring New Haven County (National Agricultural Pest Information System, 2012).

ISED Target List Review

NETN staff determined that all species should remain on the target list (Appendix A: Table A.9). Several species have been detected in WEFA, but are, in our professional opinion, at low enough levels that we suggest keeping these species on the list until their full extent is known throughout the park. Although there are several invasive species of concern that are creeping closer to WEFA (e.g. chocolate vine [*Akebia quinata*], Japanese aralia [*Aralia elata*], and privet species [*Ligustrum* spp.]), we don't think they need to be added to the current list at this time. These species will be considered for inclusion in the future.

Invasive Species Management

With the assistance from youth groups, WEFA park staff and interns managed several invasive species in 2012. In a 1.2 ha old-field site, control efforts focused on barberry (*Berberis* spp.), oriental bittersweet (*Celastrus orbiculatus*), winged burning bush (*Euonymus alatus*), multiflora rose (*Rosa multiflora*), and privet species. Working from previous inventories, the rapidly expanding Japanese stiltgrass (*Microstegium vimineum*) was hand pulled throughout the park by staff and interns.

Conclusions

The ISED program, now in its 3rd year, has entered the stage of reviewing the original species target lists based on a number of detections and updated species ranges. Feedback from park managers indicates that the target lists and ISED field guides have increased awareness of priority invasive species, and have made identification of these species easier. Prompt reporting is expected to increase with the use of smartphones in the field, which are capable of documenting ISED species directly to a web-based system immediately following detections. For those without access to smartphones, we encourage the continued use of paper forms and/or reporting on-line to the park specific site on whatsinvasive.com. NETN is very interested in additional feedback about how this monitoring program and annual report can be more useful to park managers.

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Appendix A: Early detection species summary tables.

Table A.1. Updated species target list for Acadia National Park 2012/2013.

Scientific Name	Common Name	Status
REMOVED FROM LIST		
Shrub		
<i>Berberis thunbergii</i>	Japanese barberry	Established in park
Herb		
<i>Polygonum cuspidatum</i>	Japanese knotweed	Established in park
REMOVED FROM EAST MOUNT DESERT ISLAND (MDI)		
Tree		
<i>Acer platanoides</i>	Norway maple	Established on east side MDI
Shrub		
<i>Frangula alnus</i>	glossy buckthorn	Established on east side MDI
ADDED TO LIST		
Pest		
<i>Operophtera brumata</i>	winter moth	Near ACAD boundary
Herb		
<i>Phragmites australis</i>	common reed	Hancock county
Vine		
<i>Lonicera japonica</i>	Japanese honeysuckle	In ACAD at low levels
<i>Cynanchum louiseae/C. rossicum</i>	swallow-worts	Lincoln county
Tree		
<i>Ailanthus altissima</i>	tree of heaven	Penobscot county
Aquatic alga		
<i>Didymoshpenia geminata</i>	didymo	
KEPT ON LIST		
Pest		
<i>Adelges tsugae</i>	hemlock woolly adelgid	Near ACAD boundary
<i>Agrilus planipennis</i>	emerald ash borer	
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	
Herb		
<i>Alliaria petiolata</i>	garlic mustard	In disturbed areas of ACAD
<i>Cardamine impatiens</i>	narrowleaf bittercress	In ACAD at low levels
<i>Heracleum mantegazzianum</i>	giant hogweed	In ACAD at low levels
<i>Lythrum salicaria</i>	purple loosestrife	In ACAD at low levels
<i>Microstegium vimineum</i>	Japanese stiltgrass	
Vine		
<i>Celastrus orbiculatus</i>	oriental bittersweet	In disturbed areas of ACAD
Shrub		
<i>Berberis vulgaris</i>	common barberry	In ACAD at low levels
<i>Euonymus alatus</i>	winged burning bush	Hancock county
<i>Ligustrum</i> spp.	privet species	In ACAD at low levels
<i>Frangula alnus</i> (west MDI only)	glossy buckthorn	Established on east side MDI
<i>Lonicera</i> spp.	bush honeysuckle species	In disturbed areas of ACAD
<i>Rosa multiflora</i>	multiflora rose	In ACAD at low levels

Appendix A. Early detection species summary tables (continued).

Table A.1. Updated species target list for Acadia National Park 2012/2013 (continued).

Scientific Name	Common Name	Status
Tree		
<i>Acer platanoides</i> (west MDI only)	Norway maple	Established on east side MDI
Aquatic plant		
<i>Cabomba caroliniana</i>	fanwort	
<i>Egeria densa</i>	Brazilian waterweed	
<i>Hydrilla verticillata</i>	hydrilla	Lincoln county
<i>Hydrocharis morsus-ranae</i>	common frogbit	
<i>Myriophyllum aquaticum</i>	parrotfeather	
<i>Myriophyllum heterophyllum</i>	variable watermilfoil	
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	
<i>Najas minor</i>	brittle waternymph	
<i>Nymphoides peltata</i>	yellow floating heart	Knox county
<i>Potamogeton crispus</i>	curly pondweed	
<i>Trapa natans</i>	water chestnut	

Appendix A. Early detection species summary tables (continued).

Table A.2. Updated species target list for Marsh-Billings-Rockefeller National Historical Park 2012/2013.

Scientific Name	Common Name	Status
ADDED TO LIST		
Herb		
<i>Alliaria petiolata</i>	garlic mustard	In MABI at low levels
Tree		
<i>Ailanthus altissima</i>	tree of heaven	
KEPT ON LIST		
Pest		
<i>Adelges tsugae</i>	hemlock woolly adelgid	Nearby county
<i>Agrilus planipennis</i>	emerald ash borer	
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	
<i>Sirex noctilio</i>	sirex woodwasp	
Herb		
<i>Cardamine impatiens</i>	narrowleaf bittercress	Windsor county
<i>Heracleum mantegazzianum</i>	giant hogweed	Nearby county
<i>Microstegium vimineum</i>	Japanese stiltgrass	
<i>Polygonum cuspidatum/ P. sachalinense</i>	Japanese/giant knotweed	In MABI at low levels
Vine		
<i>Celastrus orbiculatus</i>	oriental bittersweet	In MABI at low levels
<i>Cynanchum louiseae/C. rossicum</i>	swallow-worts	In MABI at low levels
Shrub		
<i>Berberis vulgaris</i>	common barberry	In MABI at low levels
<i>Elaeagnus umbellata</i>	autumn olive	In MABI at low levels
<i>Euonymus alatus</i>	winged burning bush	In MABI at low levels
<i>Frangula alnus</i>	glossy buckthorn	Windsor county
<i>Ligustrum</i> spp.	privet species	Windsor county
<i>Rosa multiflora</i>	multiflora rose	Windsor county
<i>Rubus phoenicolasius</i>	wine raspberry	Windsor county
Tree		
<i>Acer platanoides</i>	Norway maple	In MABI at low levels
Aquatic plant/alga		
<i>Didymosphenia geminata</i>	didymo (alga)	
<i>Egeria densa</i>	Brazilian waterweed	Nearby county
<i>Myriophyllum heterophyllum</i>	variable watermilfoil	
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Windsor county
<i>Nymphoides peltata</i>	yellow floating heart	Nearby county

Appendix A. Early detection species summary tables (continued).

Table A.3. Updated species target list for Minute Man National Historical Park 2012/2013.

Scientific Name	Common Name	Status
REMOVED FROM LIST		
Pest		
<i>Adelges tsugae</i>	hemlock woolly adelgid	Established in MIMA
Herb		
<i>Polygonum cuspidatum/ P. sachalinense</i>	Japanese/giant knotweed	Established in MIMA
ADDED TO LIST		
Herb		
<i>Lepidium latifolium</i>	perennial pepperweed	Middlesex county
Aquatic alga		
<i>Didymoshpenia geminata</i>	didymo	
KEPT ON LIST		
Pest		
<i>Agrilus planipennis</i>	emerald ash borer	
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	Nearby county
Herb		
<i>Cardamine impatiens</i>	narrowleaf bittercress	In MIMA at low levels
<i>Centaurea stoebe ssp. micranthos</i>	spotted knapweed	In MIMA at low levels
<i>Heracleum mantegazzianum</i>	giant hogweed	
<i>Microstegium vimineum</i>	Japanese stiltgrass	Near MIMA boundary
<i>Ranunculus ficaria</i>	lesser celandine	Middlesex county
Vine		
<i>Ampelopsis brevipedunculata</i>	porcelainberry	In MIMA at low levels
<i>Dioscorea oppositifolia</i>	Chinese yam	
<i>Polygonum perfoliatum</i>	mile-a-minute	Middlesex county
<i>Pueraria montana var. lobata</i>	kudzu	Middlesex county
Shrub		
<i>Rubus phoenicolasius</i>	wine raspberry	Middlesex county
Tree		
<i>Paulownia tomentosa</i>	princess tree	

Appendix A. Early detection species summary tables (continued).

Table A.4. Updated species target list for Morristown National Historical Park 2012/2013.

Scientific Name	Common Name	Status
REMOVED FROM LIST		
Tree		
<i>Viburnum sieboldii</i>	Siebold's arrowwood	Established in MORR
<i>Photinia villosa</i>	oriental photinia	Established in MORR
Vine		
<i>Wisteria floribunda/W. sinensis</i>	wisteria species	Established in MORR
ADDED TO LIST		
Shrub		
<i>Lonicera maackii</i>	amur honeysuckle	Morris County
<i>Styrax japonicus</i>	Japanese snowbell	In MORR at low levels
Aquatic alga		
<i>Didymoshpenia geminata</i>	didymo	
KEPT ON LIST		
Pest		
<i>Agrilus planipennis</i>	emerald ash borer	
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	Nearby county
<i>Pyrrhalta viburni</i>	viburnum leaf beetle	
Herb		
<i>Oplismenus hirtellus ssp. undulatifolius</i>	wavyleaf basketgrass	
<i>Ranunculus ficaria</i>	lesser celandine	
Vine		
<i>Akebia quinata</i>	chocolate vine	In MORR at low levels
<i>Ampelopsis brevipedunculata</i>	porcelainberry	In MORR at low levels
<i>Cynanchum louiseae/C. rossicum</i>	swallow-worts	In MORR at low levels
<i>Dioscorea oppositifolia</i>	Chinese yam	Nearby county
<i>Parthenocissus tricuspidata</i>	Boston ivy	Morris county
<i>Polygonum perfoliatum</i>	mile-a-minute	Morris county
<i>Pueraria montana var. lobata</i>	kudzu	Morris county
Shrub		
<i>Rhodotypos scandens</i>	black jetbead	In MORR at low levels
<i>Viburnum dilataum</i>	linden arrowwood	In MORR at low levels
Tree		
<i>Aralia elata</i>	Japanese aralia	In MORR at low levels

Appendix A. Early detection species summary tables (continued).

Table A.5. Species target list for Roosevelt-Vanderbilt National Historic Sites 2012/2013.

Scientific Name	Common Name	Status
ADDED TO LIST		
Aquatic alga		
<i>Didymoshpenia geminata</i>	didymo	
KEPT ON LIST		
Pest		
<i>Agrilus planipennis</i>	emerald ash borer	Dutchess county (2012)
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	
<i>Pyrrhalta viburni</i>	viburnum leaf beetle	
<i>Sirex noctilio</i>	Sirex woodwasp	
Herb		
<i>Heracleum mantegazzianum</i>	giant hogweed	
<i>Oplismenus hirtellus</i> ssp. <i>undulatifolius</i>	wavyleaf basketgrass	
Vine		
<i>Ampelopsis brevipedunculata</i>	porcelainberry	Dutchess county
<i>Dioscorea oppositifolia</i>	Chinese yam	
<i>Polygonum perfoliatum</i>	mile-a-minute	Dutchess county
<i>Pueraria montana</i> var. <i>lobata</i>	kudzu	
<i>Ranunculus ficaria</i>	lesser celandine	
<i>Wisteria floribunda</i> / <i>W. sinensis</i>	Japanese/Chinese wisteria	In ROVA at low levels
Shrub		
<i>Aralia elata</i>	Japanese aralia	
<i>Frangula alnus</i>	glossy buckthorn	Nearby county
<i>Rubus phoenicolasius</i>	wine raspberry	In ROVA at low levels
<i>Paulownia tomentosa</i>	princess tree	Nearby county

Appendix A. Early detection species summary tables (continued).

Table A.6. Updated species target list for Saint-Gaudens National Historic Site 2012/2013.

Scientific Name	Common Name	Status
ADDED TO LIST		
Herb		
<i>Phragmites australis</i>	common reed	Sullivan county
Aquatic alga		
<i>Didymoshpenia geminata</i>	didymo	
KEPT ON LIST		
Pest		
<i>Adelges tsugae</i>	hemlock woolly adelgid	Nearby county
<i>Agrilus planipennis</i>	emerald ash borer	
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	
<i>Sirex noctilio</i>	sirex woodwasp	
Herb		
<i>Alliaria petiolata</i>	garlic mustard	Sullivan county
<i>Cardamine impatiens</i>	narrowleaf bittercress	Sullivan county
<i>Microstegium vimineum</i>	Japanese stiltgrass	
<i>Oplismenus hirtellus</i> ssp. <i>undulatifolius</i>	wavyleaf basketgrass	
<i>Polygonum cuspidatum</i> / <i>P. sachalinense</i>	Japanese/giant knotweed	Nearby county
<i>Ranunculus ficaria</i>	lesser celandine	
Vine		
<i>Ampelopsis brevipedunculata</i>	porcelainberry	
<i>Dioscorea oppositifolia</i>	Chinese yam	
<i>Polygonum perfoliatum</i>	mile-a-minute	Nearby county
Shrub		
<i>Elaeagnus umbellata</i>	autumn olive	Sullivan county
<i>Euonymus alatus</i>	winged burning bush	Nearby county
<i>Ligustrum</i> spp.	privet species	In SAGA at low levels
<i>Rubus phoenicolasius</i>	wine raspberry	Sullivan county
Tree		
<i>Ailanthus altissima</i>	tree of heaven	Nearby county
<i>Paulownia tomentosa</i>	princess tree	
Aquatic plant		
<i>Hydrilla verticillata</i>	hydrilla	
<i>Hydrocharis morsus-ranae</i>	common frogbit	
<i>Myriophyllum heterophyllum</i>	variable watermilfoil	
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Sullivan county
<i>Najas minor</i>	brittle waternymph	
<i>Potamogeton crispus</i>	curly pondweed	Sullivan county
<i>Trapa natans</i>	water chestnut	

Appendix A. Early detection species summary tables (continued).

Table A.7. Species target list for Saugus Iron Works National Historic Site 2012/2013.

Scientific Name	Common Name	Status
Pest		
<i>Agrilus planipennis</i>	emerald ash borer	
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	
<i>Pyrrhalta viburni</i>	viburnum leaf beetle	
Herb		
<i>Cardamine impatiens</i>	narrowleaf bittercress	
<i>Lepidium latifolium</i>	perennial pepperweed	Essex county
<i>Microstegium vimineum</i>	Japanese stiltgrass	Nearby county
<i>Oplismenus hirtellus</i> ssp. <i>undulatifolius</i>	wavyleaf basketgrass	
Vine		
<i>Ampelopsis brevipedunculata</i>	porcelainberry	Essex county
<i>Cynanchum louiseae</i> / <i>C. rossicum</i>	swallow-worts	In SAIR at low levels
<i>Lonicera japonica</i>	Japanese honeysuckle	Essex county
<i>Polygonum perfoliatum</i>	mile-a-minute	Nearby county
<i>Pueraria montana</i> var. <i>lobata</i>	kudzu	Essex county
Shrub		
<i>Lonicera</i> spp.	bush honeysuckles	Essex county
Aquatic plant/alga		
<i>Didymosphenia geminata</i>	didymo (alga)	
<i>Egeria densa</i>	Brazilian waterweed	
<i>Myriophyllum heterophyllum</i>	variable watermilfoil	
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Essex county
<i>Najas minor</i>	brittle waternymph	Nearby county
<i>Potamogeton crispus</i>	curly pondweed	In SAIR at low levels
<i>Trapa natans</i>	water chestnut	Essex county

Appendix A. Early detection species summary tables (continued).

Table A.8. Updated species target list for Saratoga National Historical Park 2012/2013.

Scientific Name	Common Name	Status
REMOVED FROM LIST		
Shrub		
<i>Ligustrum spp.</i>	privet species	Established in SARA (2010)
ADDED TO LIST		
Vine		
<i>Lonicera japonica</i>	Japanese honeysuckle	Saratoga county
Aquatic alga		
<i>Didymoshpenia geminata</i>	didymo	
KEPT ON LIST		
Pest		
<i>Adelges tsugae</i>	hemlock woolly adelgid	Nearby county
<i>Agrilus planipennis</i>	emerald ash borer	Nearby county
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	
<i>Sirex noctilio</i>	sirex woodwasp	
Herb		
<i>Cardamine impatiens</i>	narrowleaf bittercress	Nearby county
<i>Heracleum mantegazzianum</i>	giant hogweed	
<i>Microstegium vimineum</i>	Japanese stiltgrass	Nearby county
<i>Oplismenus hirtellus ssp. undulatifolius</i>	wavyleaf basketgrass	
<i>Ranunculus ficaria</i>	lesser celandine	
Vine		
<i>Ampelopsis brevipedunculata</i>	porcelainberry	
<i>Cynanchum louiseae/C. rossicum</i>	swallow-worts	Nearby county
<i>Dioscorea oppositifolia</i>	Chinese yam	
<i>Polygonum perfoliatum</i>	mile-a-minute	
Shrub		
<i>Euonymus alatus</i>	winged burning bush	In SARA at low levels
<i>Frangula alnus</i>	glossy buckthorn	Nearby county
<i>Rubus phoenicolasius</i>	wine raspberry	In SARA at low levels
Tree		
<i>Ailanthus altissima</i>	tree of heaven	In SARA at low levels

Appendix A. Early detection species summary tables (continued).

Table A.9. Species target list for Weir Farm National Historic Site 2012/2013.

Scientific Name	Common Name	Status
KEPT ON LIST		
Pest		
<i>Agrilus planipennis</i>	emerald ash borer	Nearby county
<i>Anoplophora glabripennis</i>	Asian longhorned beetle	
<i>Pyrrhalta viburni</i>	viburnum leaf beetle	
Herb		
<i>Heracleum mantegazzianum</i>	giant hogweed	In WEFA at low levels
<i>Lythrum salicaria</i>	purple loosestrife	In WEFA at low levels
<i>Oplismenus hirtellus</i> ssp. <i>undulatifolius</i>	wavyleaf basketgrass	
<i>Ranunculus ficaria</i>	lesser celandine	
Vine		
<i>Ampelopsis brevipedunculata</i>	porcelainberry	Fairfield county
<i>Dioscorea oppositifolia</i>	Chinese yam	Nearby county
<i>Polygonum perfoliatum</i>	mile-a-minute	Near WEFA boundary
<i>Pueraria montana</i> var. <i>lobata</i>	kudzu	In WEFA at low levels
<i>Wisteria floribunda</i> / <i>W. sinensis</i>	Japanese/Chinese wisteria	In WEFA at low levels
Shrub		
<i>Frangula alnus</i>	glossy buckthorn	In WEFA at low levels
<i>Rhamnus cathartica</i>	common buckthorn	Fairfield county
<i>Rubus phoenicolasius</i>	wine raspberry	In WEFA at low levels
Tree		
<i>Ailanthus altissima</i>	tree of heaven	In WEFA at low levels
<i>Paulownia tomentosa</i>	princess tree	Fairfield county
Aquatic plant/alga		
<i>Didymosphenia geminata</i>	didymo (alga)	
<i>Egeria densa</i>	Brazilian waterweed	Fairfield county
<i>Eichhornia crassipes</i>	water hyacinth	Fairfield county
<i>Hydrilla verticillata</i>	hydrilla	Fairfield county
<i>Myriophyllum aquaticum</i>	parrotfeather	
<i>Myriophyllum heterophyllum</i>	variable watermilfoil	Fairfield county
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Fairfield county
<i>Najas minor</i>	brittle waternymph	Fairfield county
<i>Potamogeton crispus</i>	curly pondweed	Fairfield county
<i>Trapa natans</i>	water chestnut	

Appendix B: Invasive species early detection target list for Boston Harbor Islands by park subunit.

Table B.1. BOHA early detection target list by island. An “X” indicates species was detected in 2012. “X^{TR}” represents removal treatments. “-” indicates a species removed from the target list and “X” indicates a species added to the list for 2013. Cells that are shaded are NOT on the ED list for that island.

Scientific Name	Common Name	Bumpkin Island	Grape Island	Webb Memorial St. Pk.	World's End	Spectacle Island	Thompson Island	Georges Island	Lovells Island	Calf Island	Little Brewster	Peddocks Island	Great Brewster
Pest													
<i>Agrilus planipennis</i>	emerald ash borer												
<i>Anoplophora glabripennis</i>	Asian longhorned beetle												
<i>Pyrrhalta viburni</i>	viburnum leaf beetle												
Herb													
<i>Alliaria petiolata</i>	garlic mustard	X ^{TR}		--			--						
<i>Cardamine impatiens</i>	narrowleaf bittercress												
<i>Lepidium latifolium</i>	perennial pepperweed											--	
<i>Microstegium vimineum</i>	Japanese stiltgrass												
<i>Oplismenus hirtellus</i> ssp. <i>undulatifolius</i>	wavyleaf basketgrass												
<i>Polygonum cuspidatum</i> / <i>P. sachalinense</i>	Japanese/giant knotweed												
Vine													
<i>Ampelopsis brevipedunculata</i>	porcelainberry	X ^{TR}		X ^{TR}									
<i>Cynanchum</i> spp.	swallow-worts												X
<i>Lonicera japonica</i>	Japanese honeysuckle												
<i>Polygonum perfoliatum</i>	mile-a-minute												
<i>Pueraria montana</i> var. <i>lobata</i>	kudzu												
Shrub													
<i>Berberis thunbergii</i>	Japanese barberry												
<i>Euonymus alatus</i>	winged burning bush												X
<i>Euonymus europaeus</i>	European spindle tree					X							
<i>Rubus phoenicolasius</i> *	wine raspberry*	X	X	X	X	X	X	X	X	X	X	X	X
Tree													
<i>Ailanthus altissima</i>	tree of heaven												
<i>Populus alba</i>	white poplar												

*Added to target list for 2013

Appendix C: Invasive plant inventory and treatment information.

Table C.1. 2012 Invasive plant species locations and management data for Boston Harbor Islands National Recreation Area. The visiting Northeast Exotic Plant Management Team aided in treatments conducted on Lovells and Thompson Islands.

Location	Scientific Name	Common Name	Treatment	Inventoried / Treated
Bumpkin Island	<i>Ampelopsis brevipedunculata</i>	porcelainberry	foliar, cut/paint	1 individual
	<i>Alliaria petiolata</i>	garlic mustard	manual pulling	
	<i>Celastrus orbiculatus</i>	oriental bittersweet	cut/paint	
	<i>Lonicera morrowii</i>	morrow's honeysuckle	cut/paint	
Grape Island	<i>Frangula alnus</i>	glossy buckthorn	cut/paint	
Lovells Island	<i>Ailanthus altissima</i>	tree of heaven	Basal barked	0.18 ha
	<i>Populus alba</i>	white poplar	Basal barked	0.05 ha
	<i>Lepidium latifolium</i>	perennial pepperweed	manual pulling	
	<i>Cynanchum louiseae/C. rossicum</i>	swallow-worts	manual pulling/foliar spray	
	<i>Celastrus orbiculatus</i>	oriental bittersweet	foliar, cut/paint	0.03 ha
	<i>Polygonum cuspidatum</i>	Japanese knotweed	foliar sprayed	Large re-sprout patch from previous year
Peddocks Island	<i>Ligustrum</i> spp.	privet species	manual	
	<i>Celastrus orbiculatus</i>	oriental bittersweet	manual	
	<i>Rosa multiflora</i>	multiflora rose	manual	
	<i>Frangula alnus</i>	glossy buckthorn	manual	
Thompson	<i>Rosa multiflora</i>	multiflora rose	foliar	0.10 ha
	<i>Cynanchum louiseae/C. rossicum</i>	swallow-worts	foliar	0.09 ha re-treatment
	<i>Frangula alnus</i>	glossy buckthorn	foliar	0.008 ha
	<i>Ailanthus altissima</i>	tree of heaven	Basal barked	0.035 ha
	<i>Celastrus orbiculatus</i>	oriental bittersweet	foliar	0.10 ha
Webb Memorial	<i>Rosa multiflora</i>	multiflora rose	cut/paint	
	<i>Polygonum cuspidatum</i>	Japanese knotweed	cut/paint	
	<i>Ampelopsis brevipedunculata</i>	porcelainberry	cut/paint	~50 individuals
World's End	<i>Alliaria petiolata</i>	garlic mustard	manual pulling	
	<i>Frangula alnus</i>	glossy buckthorn	manual cutting	

Appendix C: Invasive plant inventory and treatment information (continued).

Table C.2. Saugus Iron Works National Historic Site invasive plant management actions by park staff and volunteers in 2012.

Scientific Name	Common Name	Treatment	Location
<i>Ailanthus altissima</i>	tree-of-heaven	foliar herbicide (Garlon 3A) on 15 saplings	East riparian zone
<i>Alliaria petiolata</i>	garlic mustard	mechanical removal	East riparian zone
<i>Celastrus orbiculatus</i>	oriental bittersweet	cut and pulled	West and East riparian zone
<i>Frangula alnus</i>	glossy buckthorn	mechanical removal	East riparian zone
<i>Lythrum salicaria</i>	purple loosestrife	cut flower heads and pulled	steep slope in West riparian zone, about 80% of the Berm/riffle, along the high marsh and in small patches of the East riparian zone
<i>Phragmites australis</i>	common reed	cut and pulled	West riparian zone and the high marsh
<i>Polygonum cuspidatum</i>	Japanese knotweed	cut and paint with Accord herbicide	West riparian zone
<i>Rhamnus cathartica</i>	common buckthorn	mechanical removal	East riparian zone
<i>Rosa multiflora</i>	multiflora rose	cut and pulled	West riparian zone and along fence between the East riparian zone and a street

Appendix C: Invasive plant inventory and treatment information (continued).

Table C.3. Saratoga National Historical Park (SARA) invasive plant management actions conducted by park staff and the Northeast Exotic Plant Management Team (NEEPMT) in 2012. Total area inventoried by the NEEPMT was 121.5 ha. Total area treated by SARA staff was 9.3 ha.

Scientific Name	Common Name	Gross Infested (ha)	Infested (ha)	Treated (ha)	Monitored (ha)	Retreated (ha)
NEEPMT						
Treatments						
<i>Centaurea stoebe</i> ssp. <i>micranthos</i>	spotted knapweed	25.20	2.04	2.03	0.90	0.00
<i>Centaurea jacea</i>	brown knapweed	25.20	21.23	20.47	0.90	0.76
<i>Cirsium arvense</i>	Canada thistle	0.01	0.01	0.01	0.00	0.00
<i>Cirsium vulgare</i>	bull thistle	1.00	0.06	0.06	0.90	0.00
<i>Vicia cracca</i>	cow vetch	25.20	0.27	0.26	0.90	0.00
	Total	76.59	23.61	22.83	3.59	0.78
SARA Staff						
Treatments¹						
<i>Acer platinoides</i>	Norway maple					
<i>Alliaria petiolata</i>	garlic mustard					
<i>Berberis thunbergii</i>	Japanese barberry					
<i>Celastrus orbiculatus</i>	oriental bittersweet					
<i>Elaeagnus umbellata</i>	autumn olive					
<i>Phragmites australis</i>	common reed					
<i>Rhamnus cathartica</i>	common buckthorn					
<i>Robinia pseudoacacia</i>	black locust					
<i>Rosa multiflora</i>	multiflora rose					

¹ Treatment and infestation data for specific species were not provided.

Appendix D: Location descriptions of early detection species records for Marsh-Billings-Rockefeller National Historical Park (MABI), Minute Man National Historical Park (MIMA) and Morristown National Historical Park (MORR) 2012.

Park	Scientific Name	Common Name	Location Description	Notes
MABI	<i>Euonymus alatus</i>	winged burning bush	Near overlook on Elm lot trail	11 large, and a few small plants pulled or treated with herbicide
MABI	<i>Celastrus orbiculatus</i>	oriental bittersweet	Stand 5 (red pine plantation)	Suspected in previous years, the now mature vines were positively identified
MABI	<i>Acer platanoides</i>	Norway maple	Norway spruce (50 th anniversary) plantation, west of Belvedere	Many seedlings found, either from previously removed trees, or blown in from outside park. About 280 plants pulled near the bungalow and west of visitor center.
MABI	<i>Berberis vulgaris</i>	common barberry	South of The Pogue, inside loop path and between stands 4&5	A hand full of plants were flagged for future removal
MABI	<i>Elaeagnus umbellata</i>	autumn olive	Stand 5 and McKenzie orchard	Isolated patches. Cut stump 50 re-sprouts in Stand 5 treated with herbicide
MABI	<i>Cynanchum louiseae</i>	black swallow-wort	Roadsides surrounding park and the Billings Farm gravel parking lot	Near gravel parking lot on River road across from Billings farm
MIMA	<i>Adelges tsugae</i>	hemlock woolly adelgid	Next to the John Nelson house, west of visitor center parking lot	Visible on one tree close to the house, but likely present on nearby trees
MORR	<i>Rhodotypos scandens</i>	black jetbead	E 538374, N 4513118 18N (UTM zone)	
MORR	<i>Rhodotypos scandens</i>	black jetbead	E 538884, N 4514008 18N (UTM zone)	
MORR	<i>Viburnum dilatatum</i>	Linden arrowwood	E 538877, N 4513879 18N (UTM zone)	
MORR	<i>Viburnum dilatatum</i>	Linden arrowwood	E 539663, N 4513559 18N (UTM zone)	
MORR	<i>Ampelopsis brevipedunculata</i>	porcelainberry	E 540588, N 4512701 18N (UTM zone)	

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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