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Natural Resource Stewardship and Science

Invasive Species Early Detection Report in the Northeast Temperate Network

2010-2011 Summary Report

Natural Resource Data Series NPS/NETN/NRDS—2012/267

ON THE COVER
Oriental photinia (*Photinia villosa*) in Morristown National Historical Park
Photograph by: Jesse S. Wheeler, National Park Service

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Jesse S. Wheeler
Northeast Temperate Network
Acadia National Park
Bar Harbor, ME 04609

Kate M. Miller
Northeast Temperate Network
Acadia National Park
Bar Harbor, ME 04609

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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

In 2010 the Northeast Temperate Network (NETN) began 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 2 years, NETN provided parks with laminated ISED field guides, offered training to NETN field staff and interested parks, and reported over a dozen detections to park managers. In 2011, six new invasive plant occurrences were detected by the NETN forest crew including oriental photinia (*Photinia villosa*) and Siebold's arrowwood (*Viburnum sieboldii)* in Morristown National Historical Park, wine raspberry (*Rubus phoenicolasius*) in Vanderbilt Mansion National Historic Site, and several invasive shrub species in Acadia National Park.

In addition to ISED monitoring, routine inventory and management of established invasive plant populations were conducted by park staff, cooperators and the Northeast Exotic Plant Management Team (NEEPMT) at Acadia National Park, Boston Harbor Islands National Recreational Area, Marsh-Billings-Rockefeller National Historical Park, Minute Man National Historical Park, Morristown National Historical Park, and Saratoga National Historical Park during 2010 and 2011. Species of swallow-wort (*Cynanchum* spp.), oriental bittersweet (*Celastrus orbiculatus*), and Japanese barberry (*Berberis thunbergii*) were the most commonly treated invasive species in NETN parks.

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 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 help with developing 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 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). Not surprisingly, 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), and 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 list of a dozen or so target insect pest and exotic plant species specific to each park that can easily be learned 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 the 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 Rain paper, and digitally as fillable Adobe .pdf forms upon request.

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 2010 and 2011, and summarize invasive species management efforts in each park from 2010 and 2011. 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 us by each park and/or the Northeast Exotic Plant Management Team, and may not include all species that were inventoried or managed over the last 2 years. Secondly, while the locations of forest plots with target invasive species are provided, forest plots must NOT be specifically targeted for invasive species removal. That is, forest plots need to be treated the same as any location in the park 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, park staff, cooperators and volunteers who may encounter invasive species while performing other tasks in the parks. In some cases, park staff and volunteers are actively searching for early detections. While this is highly encouraged, it is not a requirement of the ISED protocol.

Reporting and Data Management

When target species are detected, the designated park contact (DPC) listed on the ISED field guides and/or the NETN Plant Ecologist are notified immediately of the location and species detected. The DPC and NETN Plant Ecologist will alert each other of new detections. With the exception of ACAD, NETN staff manage the spatial and tabular data related to early detection in network parks, and summarize these results in annual reports.

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 Program Updates

In 2010 target lists were finalized and laminated field guides were provided to ACAD, MABI, SAGA, and SARA. In 2011 target lists were finalized and field guides were provided to BOHA, MIMA, MORR, ROVA, SAIR and WEFA. Target species lists for each park are included in Table 1. Identification cards have been developed for each species listed in Table 1, and are available digitally (as .pdf files) upon request. NETN staff are currently working on additional target lists and species cards for aquatic invasive species to be used in MABI, SAGA and WEFA. These parks contain at least one water body with sufficient habitat for submerged vegetation, and are at risk of invasion by exotic aquatic species from nearby waterways. Jennifer Keefer (Early Detection Coordinator for Eastern Rivers and Mountains Network) also continues

to create new species cards to keep up with ERMN ISED needs, and we will inform NETN parks of new cards as they are completed. Detections of target species are discussed for each park in the sections that follow, and detection summary tables are included in Appendix A and D.

The only update on park target lists relates to the viburnum leaf beetle. The viburnum leaf beetle (*Pyrrhalta viburni*) was originally placed on target lists in most NETN parks because the distribution and impacts of this exotic beetle were largely unknown for the northeastern US. Once we started looking, we realized that the beetle was widespread in plantings of arrowwood viburnum (*Viburnum dentatum*) and highbush cranberry (*Viburnum opulus*) throughout NETN. We have yet to observe viburnum leaf beetles feeding on naturally occurring viburnums (i.e., in forest or wetland habitats), and we would like to know if any parks have observed viburnum leaf beetles feeding on native viburnums in forest habitats.

Finally, several network parks and the NEEPMT provided information on invasive species management and inventory efforts over the last 2 years. 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, and more details are provided in Appendix C. We would like to hear from park managers if including summaries of invasive species management in the annual ISED report is useful, and if there are other ways park managers would like us to convey this information.

Acadia National Park

Early Detection

New locations of four species were detected by NETN field crews over the last 2 years (Appendix A: Table A-1) in ACAD. Glossy buckthorn (*Frangula alnus*) was detected in multiple new locations in ACAD by the NETN forest crew, including a stand of mature glossy buckthorn in a small perched wetland in the saddle between Enoch Mountain and the Beehive, several locations along the park loop road, and several seedlings in a forest monitoring plot uphill from Great Meadow. Patches of exotic bush honeysuckle (*Lonicera* spp.) were detected in the saddle between Enoch Mountain and the Beehive, and in forest plot 084. Japanese barberry (*Berberis thunbergii*) was detected north of forest plot 029, in forest plot 084 and near the eastern end of Man-of-War Fire Road. All locations and GPS coordinates were reported to the ACAD Exotic Plant Management Crew Leader and are listed in Appendix B.

Invasive Species Management

Of the 25 species that have been identified in ACAD as invasive, 20 are actively being managed by the ACAD Exotic Plant Management Team. A few of the species that were managed in 2011 include garlic mustard (*Alliaria petiolata*), glossy buckthorn (*Frangula alnus*), Japanese barberry (*Berberis thunbergii*), Japanese knotweed (*Polygonum cuspidatum*), and oriental bittersweet (*Celastrus orbiculatus*). For more information on ACAD invasive management plans and additional species that were controlled and inventoried in 2011, refer to Duggan et al. (2011).

Table 1. 2011 Early Detection target lists for each park in the Northeast Temperate Network.

Scientific Name	Common Name	Category	ACAD	BOHA[1]	MABI	MIMA	MORR	ROVA	SAGA	SAIR	SARA	WEFA
Adelges tsugae	hemlock woolly adelgid	PEST	X		X	X			X		X	
Agrilus planipennis	emerald ash borer	PEST	X	X	X	X	X	X	X	X	X	X
Anoplophora glabripennis	Asian longhorned beetle	PEST	X	X	X	X	X	X	X	X	X	X
Pyrrhalta viburni	viburnum leaf beetle	PEST		X			X	X		X		X
Sirex noctilio	sirex woodwasp	PEST			X			X	X		X	
Acer platanoides	Norway maple	PLANT	X		X							
Ailanthus altissima	tree of heaven	PLANT		X					X		X	X
Akebia quinata	chocolate vine	PLANT					X					
Alliaria petiolata	garlic mustard	PLANT	X	X					X			
Ampelopsis brevipedunculata	Amur peppervine	PLANT		X		X	X	X	X	X	X	X
Aralia elata	Japanese aralia	PLANT					X	X				
Berberis thunbergii	Japanese barberry	PLANT	X	X								
Berberis vulgaris	common barberry	PLANT	X		X							
Cardamine impatiens	narrowleaf bittercress	PLANT	X	X	X	X			X	X	X	
Celastrus orbiculatus	oriental bittersweet	PLANT	X		X							
Centaurea stoebe ssp. micranthos	spotted knapweed	PLANT				X						
Cynanchum spp.	swallow-worts	PLANT		X	X		X			X	X	
Dioscorea oppositifolia	Chinese yam	PLANT				X	X	X	X		X	X
Elaeagnus umbellata	autumn olive	PLANT			X				X			
Euonymus alatus	winged burning bush	PLANT	X	X	X				X		X	
Frangula alnus	glossy buckthorn	PLANT	X		X			X			X	X
Heracleum mantegazzium	giant hogweed	PLANT	X		X	X		X			X	X
Lepidium latifolium	perennial pepperweed	PLANT		X						X		
Ligustrum spp.	privet species	PLANT	X		X				X		X	
Lonicera spp.	bush honeysuckle species	PLANT	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 C.

Table 1. 2011 Early Detection target lists for each park in the Northeast Temperate Network (continued).

Scientific Name	Common Name	Category	ACAD	BOHA[1]	MABI	MIMA	MORR	ROVA	SAGA	SAIR	SARA	WEFA
Lonicera japonica	Japanese honeysuckle	PLANT		X						X		
Lythrum salicaria	purple loosestrife	PLANT	X									X
Microstegium vimineum	Japanese stiltgrass	PLANT	X	X	X	X			X	X	X	
Myriophyllum heterophyllum	variable watermilfoil	AQ PLANT								X		
Myriophyllum spicatum	Eurasian watermilfoil	AQ PLANT								X		
Najas minor	brittle waternymph	AQ PLANT								X		
Oplismenus hirtellus ssp. undulatifolius	wavyleaf basketgrass	PLANT		X			X	X	X	X	X	X
Parthenocissus tricuspidata	Boston ivy	PLANT					X					
Paulownia tomentosa	princess tree	PLANT				X		X	X			X
Photinia villosa	Oriental photinia	PLANT					X					
Polygonum cuspidatum/ P. sachalinense	Japanese/giant knotweed	PLANT	X	X	X	X			X			X
Polygonum perfoliatum (Persicaria perfoliata)	mile-a-minute	PLANT		X		X	X	X	X	X	X	X
Populus alba	white poplar	PLANT		X								
Potamogeton crispus	curly pondweed	AQ PLANT								X		
Pueraria montana var. lobata	kudzu	PLANT		X		X	X	X		X		
Ranunculus ficaria	lesser celandine	PLANT				X	X	X	X		X	X
Rhamnus cathartica	common buckthorn	PLANT										X
Rhodotypos scandens	black jetbead	PLANT					X					
Rosa multiflora	multiflora rose	PLANT	X		X							
Rubus phoenicolasius	wine raspberry	PLANT			X	X		X	X		X	X
Trapa natans	water chestnut	AQ PLANT								X		
Viburnum dilataum	linden arrowwood	PLANT					X					
Viburnum sieboldii	Siebold's arrowwood	PLANT					X					
Wisteria floribunda/ W. sinensis	Japanese/Chinese wisteria	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 C.

Boston Harbor Islands National Recreational Area

Early Detection

With help from volunteers, numerous ISED species were documented in BOHA in 2010 and 2011 (Appendix D). Amur peppervine (*Ampelopsis brevipedunculata*; porcelainberry) was detected on Bumpkin Island, and in several locations in Webb Memorial State Park. Perennial pepperweed (*Lepidium latifolium*) was newly detected at Worlds End and Webb Memorial State Park (See Appendix B for Webb Memorial detections). Finally, garlic mustard (*Alliaria petiolata*) was detected on Bumpkin Island.

Invasive Species Management

Numerous invasive species were inventoried and treated in BOHA in 2010 and 2011, many of which were ISED target species (Appendix C: Table C-1). A few examples of species that were treated in BOHA include amur peppervine on Bumpkin Island and in Webb Memorial State Park, garlic mustard on Bumpkin Island, and perennial pepperweed and Japanese knotweed at Worlds End.

Marsh-Billings-Rockefeller National Historical Park

Early Detection

New detections of common barberry (*Berberis vulgaris*) and black swallow-wort (*Cynanchum nigrum*) were located in 2010 and 2011 (Appendix A: Table A-2) (detection locations in Appendix B). In 2010 the NETN forest crew detected common barberry in the following NETN forest plots: 03, 04, 06, 07 and 08. Park staff and interns conducted additional inventories of common barberry plants during the fall of 2011. Park staff and cooperators also detected several new locations of black swallow-wort.

Invasive Species Management

With the help of SCA Interns and Redstart Forestry & Consulting, several invasive species were inventoried and controlled in 2011, including black swallow-wort, European alder (*Alnus glutinosa*), garlic mustard (*Alliaria petiolata*) and wild chervil (*Anthriscus sylvestris*) (Appendix C: Table C-1).

Minute Man National Historical Park

Early Detection

In 2010, hemlock woolly adelgid (*Adelges tsugae*) was detected by the NETN forest crew on an isolated eastern hemlock (*Tsuga canadensis*) on the west side of the walking path between the restrooms and Hartwell Tavern. The GPS coordinates for this location were included in the 2010 annual forest report (Miller et al. 2011) and can be found here in Appendix B. A new population of Japanese knotweed (*Polygonum cuspidatum*) was detected by park staff and volunteers in the meadows surrounding North Bridge in 2011 (Appendix A: Table A-3).

Invasive Species Management

Black swallow-wort (*Cynanchum nigrum*) was managed by the park for the fifth consecutive year in the North Bridge unit (Appendix C: Table C-1). Using a combination of hand pulling, mowing and treating individuals with herbicide, MIMA hopes to have this population of black swallow-wort 80-90% controlled by next year. Japanese knotweed was also managed in the North Bridge unit. Additional species that were controlled over the last 2 years include common

buckthorn (*Rhamnus cathartica*), Japanese knotweed, oriental bittersweet (*Celastrus orbiculatus*), and multiflora rose (*Rosa multiflora*).

Morristown National Historical Park

Early Detection

In 2011 the NETN forest crew detected new locations of chocolate vine (*Akebia quinata*), black jetbead (*Rhodotypos scandens*), Siebold's arrowwood (*Viburnum sieboldii*), oriental photinia (*Photinia villosa*), and possibly Japanese aralia (*Aralia elata*) (Appendix A: Table A-4), with detection locations found in Appendix B. Both oriental photinia and Siebold's arrowwood were detected in multiple locations and are more widespread than were previously thought (Figure 1). The possible locations of Japanese aralia were all comprised of immature plants, and we were not able to distinguish this species from the native Devil's walking stick (*Aralia spinosa*) without flowering structures. The potential Japanese aralia plants were along the driveway leading to Cross Estates and in the Cross Estates gardens. We recommend park staff and/or cooperators visit these locations in late summer to verify the species when flowering structures will likely be present.

Invasive Species Management

The Northeast Exotic Plant Management Team (NEEPMT) managed populations of multiple invasive species at the Warren Estate in 2010 and 2011 including oriental photinia (and possibly another species of exotic photinia), kiwi vine (*Actinidia chinensis*), amur peppervine (*Ampelopsis brevipedunculata*), wisteria (*Wistera* spp.), snowbell (*Styrax japonicus*), Japanese barberry (*Berberis thunbergii*) and black swallow-wort (*Cynanchum nigrum*) (Appendix C: Table C-1). Approximately 8 ha (20 acres) of Japanese barberry and multiflora rose (*Rosa multiflora*) were treated by a contractor in the Jockey Hollow unit of MORR. Japanese knotweed (*Polygonum cuspidatum*) and Japanese aralia also received some management in 2011.

Roosevelt-Vanderbilt National Historic Sites

Early Detection

A small patch of wine raspberry (*Rubus phoenicolasius*) was the only early detection in ROVA in 2011 (Appendix A: Table A-5), and it was detected by the NETN forest crew along the east bank of the pond, between the bridge and dam, in VAMA (Appendix B). With the recent discovery of emerald ash borer (*Agrilus planipennis*; EAB) that is just across the Hudson River from ROVA, NETN field crews and staff were particularly concerned about the health of ash trees in ROVA this year. Ash trees that were encountered in plots or on the way to/from plots were examined closely for signs of EAB. No trees were suspected of EAB. However EAB is very difficult to detect in forests during early stages of infestation. Continued vigilance by park staff, cooperators and volunteers is important to slow the spread of EAB.

Invasive Species Management

The Northeast Exotic Plant Management Team (NEEPMT) conducted invasive species inventories across all three ROVA park units in 2011 (Appendix C: Table C-2). These data will be used to develop an Invasive Species Management Plan for ROVA. Several species were also intensively managed in ROVA, including Norway maple (*Acer platanoides*), exotic bush honeysuckle (*Lonicera* spp.), oriental bittersweet (*Celastrus orbiculatus*), and multiflora rose (*Rosa multiflora*).

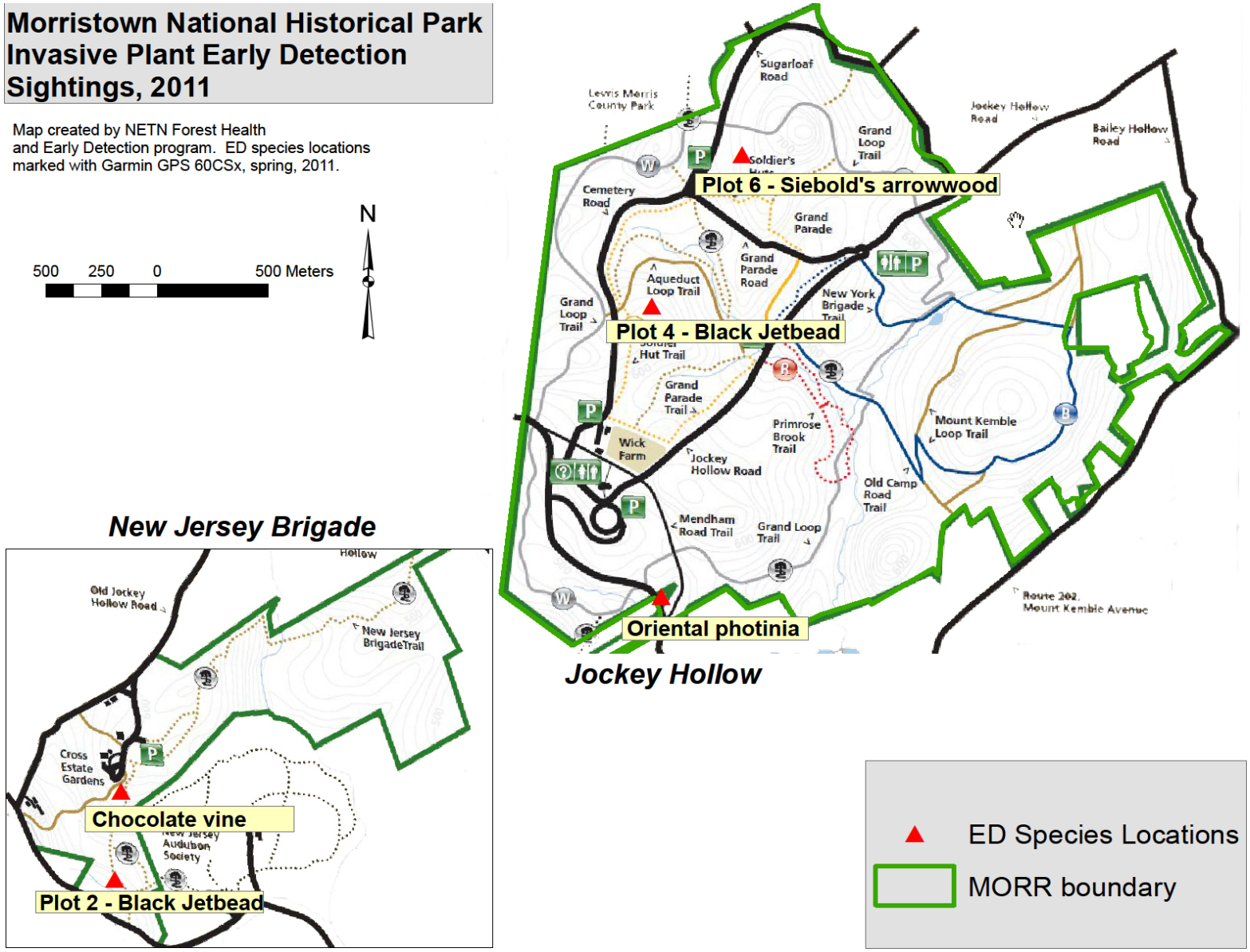

Figure 1. Locations of five invasive species early detection sightings at Morristown National Historical Park in May 2011.

Saint-Gaudens National Historic Site

Early Detection

No new detections of target species were observed in SAGA during 2010 or 2011 (Appendix A: Table A-6). While sampling forest plots in 2010, the NETN forest crew visually inspected eastern hemlock (*Tsuga canadensis*) trees in forest plots for hemlock woolly adelgid (*Adelges tsugae*), and no trees were suspected of being infested.

Invasive Species Management

Over the past 2 years park staff and New Hampshire Conservation Corps crews managed multiple infestations in the newly acquired Blow-Me-Down Farm area. Species managed include Norway maple (*Acer platanoides*), Japanese barberry (*Berberis thunbergii*), Morrow's honeysuckle (*Lonicera morrowii*), and black swallow-wort (*Cynanchum nigrum*).

Saugus Iron Works National Historic Site

Early Detection

Despite multiple search efforts by park staff and volunteers, no early detection species were observed in SAIR during 2010 or 2011 (Appendix A: Table A-7).

Invasive Species Management

Invasive plant management did not occur in SAIR in 2010 or 2011.

Saratoga National Historical Park

Early Detection

The 2010 NETN forest crew observed seedlings of privet (*Ligustrum* spp.) in forest plots 04, 05 and 11 (Appendix A: Table A-8), with detection locations found in Appendix B. These locations should have been immediately reported to park managers, but unfortunately the crew failed to notice that privet was on the early detection list for SARA. Park staff found tree of heaven (*Ailanthus altissima*) along the floodplain in the southeast section of the park.

The NETN forest crew and NETN staff visually inspected several eastern hemlock (*Tsuga canadensis*) trees on the north end of the park with binoculars and no trees were suspected of being infested with hemlock woolly adelgid (*Adelges tsugae*). The range of the emerald ash borer (EAB; *Agrilus planipennis*) continues to expand and is getting closer to SARA. Along with the recent detections in Ulster, Greene and Orange Counties, EAB was detected in a prism trap in Selkirk, NY, which is approximately 40 miles from SARA's border. Because EAB was only detected in a trap (i.e., not found infested in trees), the infestation may be at an early phase and may be containable. For more detail on the spread of EAB through New York State, and strategies for slowing the spread of EAB, check the NY Department of Environmental Conservation's EAB website (http://www.dec.ny.gov/animals/7253.html).

Invasive Species Management

The NEEPMT and park staff inventoried and mapped populations of 17 invasive species throughout the park, with efforts primarily focused in open fields and meadows (Appendix C: Table C-3). Brown knapweed (*Centaurea jacea*), spotted knapweed (*Centaurea stoebe* ssp. *micranthos*), bull thistle (*Cirsium vulgare*), and reed canarygrass (*Phalaris arundinacea*) were also managed in two fields totaling 7 ha. During 2010 two winged burning bush (*Euonymus alatus*) plants were removed near the visitor center foundation.

Weir Farm National Historic Site

Early Detection

No new locations of early detection species were observed in WEFA during 2010 or 2011 (Appendix A: Table A-9).

Invasive Species Management

Over the past 2 years, park staff and volunteers inventoried and managed multiple invasive species in WEFA (Appendix C: Table C-1). Park managers pulled several stems of purple loosestrife (*Lythrum salicaria*) from the Truants meadow, removed over a dozen stems of wine raspberry (*Rubus phoenicolasius*) throughout the park, cut and treated multiflora rose (*Rosa multiflora*) in park fields, removed oriental bittersweet (*Celastrus orbiculatus*) along the roadside, and cut back wisteria (*Wisteria* spp.) seedlings in the Weir domestic landscape. Additionally, park managers inventoried and mapped Japanese stiltgrass (*Microstegium vimineum*), and report that this species has been rapidly expanding across the park.

Conclusions

Even though the ISED program is still in the early stages of implementation, more than two dozen early detections have been reported across the network since 2010. Feedback from park managers has suggested that the target lists and ISED field guides have increased awareness of priority invasive species, and made identification of these species easier. Prompt reporting of early detections needs the most improvement, and NETN staff will continue to work on this aspect of the program. NETN is very interested in additional feedback from park managers about how this monitoring program and annual report can be more useful to park managers.

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Appendix A. Early Detection summary tables

Table A-1. Early detection species list and detections (X) of target species in Acadia National Park during 2010 and 2011.

Scientific Name	Common Name	Year Detected	
		2010	2011
Pest			
Adelges tsugae	hemlock woolly adelgid		
Agrilus planipennis	emerald ash borer		
Anoplophora glabripennis	Asian longhorned beetle		
Herb			
Alliaria petiolata	garlic mustard		
Cardamine impatiens	narrowleaf bittercress		
Heracleum mantegazzianum	giant hogweed		
Lythrum salicaria	purple loosestrife		
Microstegium vimineum	Japanese stiltgrass		
Polygonum cuspidatum/ P. sachalinense	Japanese/giant knotweed		
Vine			
Celastrus orbiculatus	oriental bittersweet		X
Shrub			
Berberis thunbergii	Japanese barberry	X	X
Berberis vulgaris	common barberry		
Euonymus alatus	winged burning bush		
Frangula alnus	glossy buckthorn	X	X
Ligustrum spp.	privet species		
Lonicera spp.	bush honeysuckle species	X	
Rosa multiflora	multiflora rose		
Tree			
Acer platanoides	Norway maple		

Appendix A. Early Detection summary tables (continued).

Table A-2. Detections (X) of target species in Marsh-Billings-Rockefeller National Historical Park during 2010 and 2011.

Scientific Name	Common Name	Year Detected	
		2010	2011
Pest			
Adelges tsugae	hemlock woolly adelgid		
Agrilus planipennis	emerald ash borer		
Anoplophora glabripennis	Asian longhorned beetle		
Sirex noctilio	sirex woodwasp		
Herb			
Cardamine impatiens	narrowleaf bittercress		
Heracleum mantegazzianum	giant hogweed		
Microstegium vimineum	Japanese stiltgrass		
Polygonum cuspidatum/ P. sachalinense	Japanese/giant knotweed		
Vine			
Celastrus orbiculatus	oriental bittersweet		
Cynanchum spp.	swallow-worts	X	X
Shrub			
Berberis vulgaris	common barberry	X	X
Elaeagnus umbellata	autumn olive		
Euonymus alatus	winged burning bush		
Frangula alnus	glossy buckthorn		
Ligustrum spp.	privet species		
Rosa multiflora	multiflora rose		
Rubus phoenicolasius	wine raspberry		
Tree			
Acer platanoides	Norway maple		

Appendix A. Early Detection summary tables (continued).

Table A-3. Detections (X) of target species in Minute Man National Historical Park during 2010 and 2011.

Scientific Name	Common Name	Year Detected	
		2010	2011
Pest			
Adelges tsugae	hemlock woolly adelgid	X	
Agrilus planipennis	emerald ash borer		
Anoplophora glabripennis	Asian longhorned beetle		
Herb			
Cardamine impatiens	narrowleaf bittercress		
Centaurea stoebe ssp. micranthos	spotted knapweed		
Heracleum mantegazzianum	giant hogweed		
Microstegium vimineum	Japanese stiltgrass		
Polygonum cuspidatum/ P. sachalinense	Japanese/giant knotweed		X[1]
Ranunculus ficaria	lesser celandine		
Vine			
Ampelopsis brevipedunculata	amur peppervine/ porcelainberry		
Dioscorea oppositifolia	Chinese yam		
Polygonum perfoliatum	mile-a-minute		
Pueraria montana var. *lobata*	kudzu		
Shrub			
Rubus phoenicolasius	wine raspberry		
Tree			
Paulownia tomentosa	princess tree		

[1] Species may have been spotted before this year

Appendix A. Early Detection summary tables (continued).

Table A-4. Detections (X) of target species in Morristown National Historical Park during 2010 and 2011.

Scientific Name	Common Name	Year Detected	
		2010	2011
Pest			
Agrilus planipennis	emerald ash borer		
Anoplophora glabripennis	Asian longhorned beetle		
Pyrrhalta viburni	viburnum leaf beetle		
Herb			
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass		
Ranunculus ficaria	lesser celandine		
Vine			
Akebia quinata	chocolate vine		X
Ampelopsis brevipedunculata	amur peppervine/ porcelainberry		
Cynanchum spp.	swallow-worts	X	X
Dioscorea oppositifolia	Chinese yam		
Parthenocissus tricuspidata	Boston ivy		
Polygonum perfoliatum	mile-a-minute		
Pueraria montana var. *lobata*	kudzu		
Wisteria floribunda/ W. sinensis	Japanese/Chinese wisteria		
Shrub			
Rhodotypos scandens	black jetbead		X
Viburnum dilataum	linden arrowwood		
Tree			
Aralia elata	Japanese aralia	X	X
Photinia villosa	oriental photinia		X
Viburnum sieboldii	Siebold's arrowwood		X

Appendix A. Early Detection summary tables (continued).

Table A-5. Detections (X) of target species in Roosevelt-Vanderbilt National Historic Sites during 2010 and 2011.

Scientific Name	Common Name	Year Detected	
		2010	2011
Pest			
Agrilus planipennis	emerald ash borer		
Anoplophora glabripennis	Asian longhorned beetle		
Pyrrhalta viburni	viburnum leaf beetle		
Sirex noctilio	sirex woodwasp		
Herb			
Heracleum mantegazzianum	giant hogweed		
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass		
Ranunculus ficaria	lesser celandine		
Vine			
Ampelopsis brevipedunculata	amur peppervine/ porcelainberry		
Dioscorea oppositifolia	Chinese yam		
Polygonum perfoliatum	mile-a-minute		
Pueraria montana var. *lobata*	kudzu		
Wisteria floribunda/ W. sinensis	Japanese/ Chinese wisteria		
Shrub			
Frangula alnus	glossy buckthorn		
Rubus phoenicolasius	wine raspberry		X
Tree			
Aralia elata	Japanese aralia		
Paulownia tomentosa	princess tree		

Appendix A. Early Detection summary tables (continued).

Table A-6. Detections (X) of target species in Saint-Gaudens National Historic Site during 2010 and 2011.

Scientific Name	Common Name	Year Detected	
		2010	2011
Pest			
Adelges tsugae	hemlock woolly adelgid		
Agrilus planipennis	emerald ash borer		
Anoplophora glabripennis	Asian longhorned beetle		
Sirex noctilio	sirex woodwasp		
Herb			
Alliaria petiolata	garlic mustard		
Cardamine impatiens	narrowleaf bittercress		
Microstegium vimineum	Japanese stiltgrass		
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass		
Polygonum cuspidatum/ P. sachalinense	Japanese/giant knotweed		
Ranunculus ficaria	lesser celandine		
Vine			
Ampelopsis brevipedunculata	amur peppervine/ porcelainberry		
Dioscorea oppositifolia	Chinese yam		
Polygonum perfoliatum	mile-a-minute		
Shrub			
Elaeagnus umbellata	autumn olive		
Euonymus alatus	winged burning bush		
Ligustrum spp.	privet species		
Rubus phoenicolasius	wine raspberry		
Tree			
Ailanthus altissima	tree of heaven		
Paulownia tomentosa	princess tree		

Appendix A. Early Detection summary tables (continued).

Table A-7. Detections (X) of target species in Saugus Iron Works National Historic Site during 2010 and 2011.

Scientific Name	Common Name	Year Detected	
		2010	2011
Pest			
Agrilus planipennis	emerald ash borer		
Anoplophora glabripennis	Asian longhorned beetle		
Pyrrhalta viburni	viburnum leaf beetle		
Herb			
Cardamine impatiens	narrowleaf bittercress		
Lepidium latifolium	perennial pepperweed		
Microstegium vimineum	Japanese stiltgrass		
Myriophyllum heterophyllum	variable watermilfoil		
Myriophyllum spicatum	Eurasian watermilfoil		
Najas minor	brittle waternymph		
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass		
Potamogeton crispus	curly pondweed		
Trapa natans	water chestnut		
Vine			
Ampelopsis brevipedunculata	amur peppervine/ porcelainberry		
Cynanchum spp.	swallow-worts		
Lonicera japonica	Japanese honeysuckle		
Polygonum perfoliatum	mile-a-minute		
Pueraria montana var. *lobata*	kudzu		
Shrub			
Lonicera spp.	bush honeysuckle species		

Appendix A. Early Detection summary tables (continued).

Table A-8. Detections (X) of target species in Saratoga National Historical Park during 2010 and 2011.

Scientific Name	Common Name	Year Detected	
		2010	2011
Pest			
Adelges tsugae	hemlock woolly adelgid		
Agrilus planipennis	emerald ash borer		
Anoplophora glabripennis	Asian longhorned beetle		
Sirex noctilio	sirex woodwasp		
Herb			
Cardamine impatiens	narrowleaf bittercress		
Heracleum mantegazzianum	giant hogweed		
Microstegium vimineum	Japanese stiltgrass		
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass		
Ranunculus ficaria	lesser celandine		
Vine			
Ampelopsis brevipedunculata	amur peppervine/ porcelainberry		
Cynanchum spp.	swallow-worts		
Dioscorea oppositifolia	Chinese yam		
Polygonum perfoliatum	mile-a-minute		
Shrub			
Euonymus alatus	winged burning bush	X	
Frangula alnus	glossy buckthorn		
Ligustrum spp.	privet species	X	
Rubus phoenicolasius	wine raspberry		
Tree			
Ailanthus altissima	tree of heaven	X	X

Appendix A. Early Detection summary tables (continued).

Table A-9. Detections (X) of target species in Weir Farm National Historic Site during 2010 and 2011.

Scientific Name	Common Name	Year Detected	
		2010	2011
Pest			
Agrilus planipennis	emerald ash borer		
Anoplophora glabripennis	Asian longhorned beetle		
Pyrrhalta viburni	viburnum leaf beetle		
Herb			
Heracleum mantegazzianum	giant hogweed		
Lythrum salicaria	purple loosestrife		
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass		
Ranunculus ficaria	lesser celandine		
Vine			
Ampelopsis brevipedunculata	amur peppervine/ porcelainberry		
Dioscorea oppositifolia	Chinese yam		
Polygonum perfoliatum	mile-a-minute		
Wisteria floribunda/W. sinensis	Japanese/Chinese wisteria	X[1]	
Shrub			
Frangula alnus	glossy buckthorn		
Rhamnus cathartica	common buckthorn		
Rubus phoenicolasius	wine raspberry	X[1]	
Tree			
Ailanthus altissima	tree of heaven		
Paulownia tomentosa	princess tree		

[1] Species may have been spotted before this year

Appendix B: Locations and descriptions of early detection species records by park. ED reports lacking GPS coordinates are not included here.

Park	Scientific Name	Common Name	Easting (X)	Northing (Y)	UTM Zone	Notes
ACAD	*Berberis thunbergii*	Japanese barberry	554367	4907319	19N	Small patches at the end of Man-of-War fire road
ACAD	*Berberis thunbergii*	Japanese barberry	550369	4903785	19N	Found just north of forest plot 029
ACAD	*Berberis thunbergii*	Japanese barberry	558472	4917127	19N	Found in Forest plot 084
ACAD	*Frangula alnus*	glossy buckthorn	564758	4909586	19N	Growing on east bank of wetland, between Enoch Mtn. and the Beehive
ACAD	*Frangula alnus*	glossy buckthorn	563895	4912449	19N	Large patch, south side of loop road, on north edge of Bear Brook pond
ACAD	*Frangula alnus*	glossy buckthorn	564038	4912220	19N	1 small shrub growing on southwest bank of Bear brook pond
ACAD	*Lonicera ssp.*	honeysuckle-exotic shrub	564893	4909574	19N	Halfway up east side of the saddle between Enoch Mt. and the Beehive
ACAD	*Lonicera ssp.*	honeysuckle-exotic shrub	558472	4917127	19N	Found in Forest plot 084
BOHA	*Ampelopsis brevipedunculata*	amur peppervine	341141	4680421	19N	Webb Memorial State Park
BOHA	*Ampelopsis brevipedunculata*	amur peppervine	341377	4680283	19N	Webb Memorial State Park
BOHA	*Lepidium latifolium*	perrenial pepperweed	341308	4680500	19N	Webb Memorial State Park
MABI	*Berberis vulgaris*	common barberry	698310	4834423	18N	Found in Forest plot 003
MABI	*Berberis vulgaris*	common barberry	698344	4834661	18N	Found in Forest plot 004
MABI	*Berberis vulgaris*	common barberry	698369	4833675	18N	Found in Forest plot 006
MABI	*Berberis vulgaris*	common barberry	698085	4833712	18N	Found in Forest plot 007
MABI	*Berberis vulgaris*	common barberry	698085	4833712	18N	Found in Forest plot 008
MABI	*Cynanchum nigrum*	black swallow-wort	697905	4833622	18N	Small population in Stand 8
MABI	*Cynanchum nigrum*	black swallow-wort	700132	4834082	18N	Near Forest Center
MABI	*Cynanchum nigrum*	black swallow-wort	700035	4833936	18N	One plant; north side of carriage rd. at north edge of Pony pasture
MABI	*Cynanchum nigrum*	black swallow-wort	700051	4833718	18N	One plant; upslope of River St. stonewall, midway toward Belvidere

Appendix B: Locations and descriptions of early detection species records by park (continued).

Park	Scientific Name	Common Name	Easting (X)	Northing (Y)	UTM Zone	Notes
MABI	*Cynanchum nigrum*	black swallow-wort	700148	4833702	18N	Population along ledge outcrop of River St.
MIMA	*Adelges tsugae*	hemlock woolly adelgid	311420	4702561	19N	Approx. location on Bedford Ln, between North Great rd. and Virginia Rd.
MORR	*Rhodotypos scandens*	black jetbead	537133	4510237	18N	Occurs in Forest plot 2
MORR	*Rhodotypos scandens*	black jetbead	538823	4513344	18N	Occurs in Forest plot 4
SARA	*Ligustrum spp.*	privet	611374	4760509	18N	Seedlings found in Forest plot 004
SARA	*Ligustrum spp.*	privet	611575	4760160	18N	Seedlings found in Forest plot 005
SARA	*Ligustrum spp.*	privet	612019	4762494	18N	Seedlings found in Forest plot 011

Appendix C: Invasive plant inventory and treatment information.

Table C-1. 2011 Invasive plant species locations and management data for parks in the Northeast Temperate Network. Morristown treatments and inventories were conducted by the Northeast Exotic Plant Management Team (NEEPMT). MABI invasive treatment was administered by Redstart Forestry and Consulting in summer 2011. Remaining treatments and inventories were implemented by park staff and volunteers.

Park	Scientific Name	Common Name	Location	Treatment	Inventoried / Treated
BOHA	*Ampelopsis brevipedunculata*	amur peppervine	Webb Memorial	foliar, cut/paint	3 patches
BOHA	*Lepidium latifolium*	perennial pepperweed	Webb/Grape Island	inventory	whole island
BOHA	*Ampelopsis brevipedunculata*	amur peppervine	Bumpkin Island	cut/paint	1 small patch
BOHA	*Alliaria petiolata*	garlic mustard	Bumpkin Island	manual pulling	1 long patch
BOHA	*Ailanthus altissima*	tree of heaven	Grape Is.	Inventory	whole island
BOHA	*Lepidium latifolium*	perennial pepperweed	Worlds End	manual pulling	Part of large, dense patch
BOHA	*Polygonum cuspidatum*	Japanese knotweed	Worlds End	cut/paint	
MABI	*Cynanchum louiseae/C. rossicum*	swallow-worts	Stand 8	foliar - glyphosate	5-6 vines, 10-15 seedlings
MABI	*Cynanchum louiseae/C. rossicum*	swallow-worts	River St. stone wall	foliar - glyphosate	1 plant
MABI	*Cynanchum louiseae/C. rossicum*	swallow-worts	Carriage rd. C-24 north of Pony pasture	foliar - glyphosate	1 plant
MABI	*Cynanchum louiseae/C. rossicum*	swallow-worts	Forest Center	foliar - glyphosate	6-8 vines, 12-15 seedlings
MIMA	*Cynanchum nigrum*	black swallow-wort	Meadows either side of North Bridge.	manual/mow/herbicide	
MIMA	*Polygonum cuspidatum*	Japanese knotweed	Meadows either side of North Bridge.	manual cutting/pulling	0.1 ha
MORR	*Berberis thunbergii*	Japanese barberry	Warren Estate, mostly house site	foliar	0.02 ha
MORR	*Cynanchum nigrum*	black swallow-wort	Warren Estate, Old house site	foliar retreatment	0.26 ha
MORR	*Microstegium vimineum*	Japanese stiltgrass	Warren Estate, mostly old house site	inventory	1.97 ha
MORR	*Wisteria* spp.	wisteria	Warren Estate, wisteria infestation site	foliar	0.74 ha

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

Table C-1. 2011 Invasive plant species locations and management data for parks in the Northeast Temperate Network (continued).

Park	Scientific Name	Common Name	Location	Treatment	Inventoried / Treated
SAGA	*Lonicera morrowii*	morrow's honeysuckle		removal	100 plants
SAGA	*Celastrus orbiculatus*	oriental bittersweet		removal	25 plants
SAGA	*Syringa reticulata*	Japanese tree lilac		removal	18345 seedlings
WEFA	*Celastrus orbiculatus*	oriental bittersweet	road edges	inventory	
WEFA	*Lythrum salicaria*	purple loosestrife	Truants Meadow, east of Nod Hill rd.	removal	3 plants
WEFA	*Microstegium vimineum*	Japanese stiltgrass	park wide	inventory	
WEFA	*Rosa multiflora*	multiflora rose	fields	garlon	12 acres
WEFA	*Rubus phoenicolasius*	wine raspberry		removal	20 plants
WEFA	*Wisteria floribunda*	Japanese wisteria		cut back	seedlings

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

Table C-2. Roosevelt Vanderbilt National Historic Sites (ROVA) invasive plant inventory by park subunit for 2011, conducted by the Northeast Exotic Plant Management Team (NEEPMT).

Scientific Name	Common Name	ELRO (ha)	HOFR (ha)	VAMA (ha)	Total (ha)
Acer platanoides	Norway maple	0.02		1.66	1.68
Ailanthus altissima	tree of heaven	0.16	0.01	0.77	0.95
Alliaria petiolata	garlic mustard	0.07	0.01	<0.01	0.08
Artemisia vulgaris	common wormwood	0.03	0.21		0.24
Berberis thunbergii	Japanese barberry	0.04	0.01	0.20	0.25
Cardamine impatiens	narrowleaf bittercress	<0.01	0.22	0.02	0.24
Celastrus orbiculatus	oriental bittersweet	0.23		1.24	1.46
Centaurea stoebe ssp. *micranthos*	spotted knapweed	0.05			0.05
Centaurea jacea	brown knapweed	0.01			0.01
Cirsium arvense	Canada thistle	0.02		<0.01	0.02
Cynanchum nigrum	black swallow-wort			<0.01	<0.01
Euonymus alatus	winged burning bush	0.02	<0.01	0.23	0.25
Euphorbia cyparissias	cypress spurge	0.15		0.01	0.16
Lonicera spp.	bush honeysuckle species	1.45	<0.01	0.04	1.49
Lonicera japonica	Japanese honeysuckle	<0.01	0.03	0.10	0.13
Lythrum salicaria	purple loosestrife			0.02	0.02
Microstegium vimineum	Japanese stiltgrass	0.03	0.63	0.06	0.72
Phragmites australis	common reed	<0.01	<0.01	0.11	0.12
Polygonum cuspidatum	Japanese knotweed	0.01		0.01	0.02
Robinia pseudoacacia	black locust	0.01	0.03		0.05
Rosa multiflora	multiflora rose	0.74	0.07	0.45	1.26
Grand Total		3.05	1.22	4.91	9.20

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 2011.

Scientific Name	Common Name	Treatment	Inventoried/Treated (ac)	Inventoried/Treated (ha)
Acer platanoides	Norway maple	Inventory	0.99	0.40
Alliaria petiolata	garlic mustard	Inventory	0.06	0.03
Berberis thunbergii	Japanese barberry	Inventory	1.07	0.43
Celastrus orbiculatus	oriental bittersweet	Inventory	0.01	<0.01
Centaurea stoebe ssp. *micranthos*	spotted knapweed	Inventory	13.49	5.46
Centaurea stoebe ssp. *micranthos*	spotted knapweed	Foliar-Ground Broadcast	0.08	0.03
Centaurea jacea	brown knapweed	Inventory	233.99	94.70
Centaurea jacea	brown knapweed	Foliar-Ground Broadcast	13.82	5.59
Cirsium arvense	Canada thistle	Inventory	3.34	1.35
Cirsium vulgare	bull thistle	Inventory	12.64	5.12
Cirsium vulgare	bull thistle	Foliar-Ground Broadcast	0.08	0.03
Elaeagnus umbellata	autumn olive	Inventory	0.78	0.32
Euonymus alatus	winged burning bush	Cut	2 plants	
Polygonum cuspidatum	Japanese knotweed	Inventory	0.16	0.07
Lonicera spp.	bush honeysuckle species	Inventory	52.43	21.22
Lythrum salicaria	purple loosestrife	Inventory	5.92	2.40
Phalaris arundinacea	reed canary grass	Inventory	91.13	36.88
Phalaris arundinacea	reed canary grass	Foliar-Ground Broadcast	4.67	1.89
Phragmites australis	common reed	Inventory	0.49	0.20
Rhamnus cathartica	common buckthorn	Inventory	37.92	15.35
Robinia pseudoacacia	black locust	Inventory	2.29	0.93
Rosa multiflora	multiflora rose	Inventory	10.86	4.40
		Total	486.21	196.77

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

Table D. BOHA early detection target list for BOHA by island. An "X" indicates species was detected in 2010 or 2011. X^{TR} represents removal treatments. 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													
Agrilus planipennis	emerald ash borer												
Anoplophora glabripennis	Asian longhorned beetle												
Pyrrhalta viburni	viburnum leaf beetle												
Herb													
Alliaria petiolata	garlic mustard	X^{TR}											
Cardamine impatiens	narrowleaf bittercress												
Lepidium latifolium	perennial pepperweed			X	X^{TR}								
Microstegium vimineum	Japanese stiltgrass												
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass												
Polygonum cuspidatum/ P.sachalinense	Japanese/giant knotweed				X^{TR}								
Vine													
Ampelopsis brevipedunculata	Amur peppervine/ porcelainberry			X^{TR}									
Cynanchum spp.	swallow-worts												
Lonicera japonica	Japanese honeysuckle												
Polygonum perfoliatum	mile-a-minute												
Pueraria montana var. *lobata*	kudzu												
Shrub													
Berberis thunbergii	Japanese barberry												
Euonymus alatus	winged burning bush												
Tree													
Ailanthus altissima	tree of heaven				X								
Populus alba	white poplar												

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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National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov