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Natural Resource Program Center

Early Detection of Invasive Species: Surveillance Monitoring and Rapid Response

Eastern Rivers and Mountains Network Summary Report 2010

Natural Resource Data Series NPS/ERMN/NRDS—2011/150

ON THE COVER
Chinese weevil *(Rhinoncomimus latipes*) feeding on mile-a-minute (*Polygonum perfoliatum*) at Delaware Water Gap National Recreation Area (DEWA).
Photograph by: Jeff Shreiner.

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Executive Summary

Early detection monitoring of incipient invasive plants, animals, and diseases was ranked among the top priorities in the Eastern Rivers and Mountains Network (ERMN) in the vital signs selection process due to the clear identification of and concern about the effects these organisms can have on park ecosystems. The known ecological impacts of invasive species include loss of threatened and endangered species, altered structure and composition of terrestrial and aquatic communities, and reduction in overall species diversity.

While long-term changes associated with invasive species are being monitored through other protocols, it is also critical to catch new populations of invasive species early in their invasion of new and sensitive habitats. Only when invasions are caught early will the chance of eradication remain high.

During invasive species early detection surveillance monitoring in 2010, four new invasive plant and pest occurrences were documented at two parks in the ERMN by the vegetation monitoring crew and Jeff Shreiner, park biologist. Two new occurrences of mile-a-minute (*Polygonum perfoliatum*) and one of linden arrowwood (*Viburnum dilatatum*) were detected at Delaware Water Gap National Recreation Area and one occurrence of viburnum leaf beetle (*Pyrrhalta viburni*) was detected at Johnstown Flood National Memorial. In response to the two mile-a-minute detections, 5,000 Chinese weevils (*Rhinoncomimus latipes*) were released as biological control agents. The viburnum leaf beetle discovery in Cambria County, Pennsylvania, provided the opportunity to focus on site management implications at the new Flight 93 National Memorial in adjacent Somerset County, Pennsylvania.

Introduction

During 2008, the Eastern Rivers and Mountains Network (ERMN) of the National Park Service (NPS) began early detection of invasive species surveillance monitoring throughout its nine parks. This monitoring effort is a component of the ERMN Vital Signs monitoring program (Marshall and Piekielek 2007), which is part of the nationwide NPS Inventory and Monitoring Program (Fancy et al. 2009).

One of the primary objectives of the ecological monitoring program in the ERMN is to detect incipient populations of invasive plants, animals, and diseases before they have a chance to become widely established. To achieve this objective, target "watch" species lists were developed; target species identification information was maintained and distributed to all ERMN field crews and other interested cooperators, resource managers, and volunteers; and an early detection reporting and tracking system that disseminates information on potential infestations in a timely and efficient manner was developed. The primary goal of this protocol is to assist park managers to identify high priority invasive species, quickly disseminate new occurrence information to all interested parties (NPS, public, private, etc.), assess the risk presented by incipient populations, and assist with management of newly detected species.

An "invasive species" is an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (USPEO 1999). Early detection followed by rapid response can detect and eradicate incipient populations of invasive species before they have a chance to become widely established; thus, eliminating the need for costly and resource-intensive control programs (Ashton and Mitchell 1989, OTA 1993, Atkinson 1997, Myers et al. 2000, Timmins and Braithwaite 2001, Harris et al. 2001, Rejmánek and Pitcairn 2002). Only when invasions are caught early will the chance of eradication remain high (Rozenfelds et al. 1999, NISC 2008). Eradication of established invasive species is difficult, if not impossible, in many cases, but early detection and associated management responses have proven effective in reducing, if not eliminating, the associated costs and consequences (MacDonald et al. 1989, Braithwaite 2000).

This report is intended to provide ongoing results to natural resource managers at Allegheny Portage Railroad National Historic Site (ALPO), Bluestone National Scenic River (BLUE), Delaware Water Gap National Recreation Area (DEWA), Fort Necessity National Battlefield (FONE), Friendship Hill National Historic Site (FRHI), Gauley River National Recreation Area (GARI), Johnstown Flood National Memorial (JOFL), New River Gorge National River (NERI), and Upper Delaware Scenic and Recreational River (UPDE).

Methods

Although a brief overview of the Invasive Species Early Detection (ISED) methods is provided here, a detailed explanation of the background, rationale, and methods, in addition to Standard Operating Procedures, are provided in the protocol (Keefer et al. 2010).

Selecting Early Detection Species

The process for selecting a short list of invasive species for inclusion in the ISED program for each park in the ERMN consisted of four main components: 1) review existing park datasets and literature and compile a list of all invasive plant and pest species known or thought to occur in the parks; 2) eliminate all common and well-established species as candidates for "early detection;" 3) consult relevant existing invasive species data sources from nearby parks, towns, counties, and states for incipient invasive species not yet present in the parks and add them to the candidate ISED list; and 4) conduct more extensive research on each candidate species and consult with park natural resource managers to narrow down and finalize each park ISED list (Keefer et al. 2010). At the conclusion of this process, each park's final ISED list (Table 1) generally consists of between 10 and 20 species.

Opportunistic Sampling

"Every person working or recreating in a national park has the potential to serve as an early detector" (Williams et al. 2007). Knowledgeable crew members provided an additional "set of eyes and ears" to detect invasive species occurrences while they were collecting data at monitoring sites, walking to and from monitoring sites, and driving along park roads. Invasive plants and pests present on each park's ISED list (Table 1) were sought during routine vegetation monitoring activities (Perles et al. 2010). Park natural resource managers, Exotic Plant Management Teams (EPMT), volunteers, and other NPS individuals with scientific backgrounds also served as early detectors during their daily park activities.

Invasive Species Early Detection Field Guide

To assist with the identification of early detection species, ISED cards will be provided to monitoring crews and interested parties. Two separate field guides will be used to distribute target species identification information. The first is a hand-held, weather-proof pocket guide provided cost-free by the USDA Forest Service, "Invasive Plants Field and Reference Guide: An Ecological Perspective of Plant Invaders of Forests and Woodlands" (USFS field guide) (Huebner et al. 2005). The second is a supplemental identification field guide developed by the ERMN. Production of the "Early Detection of Invasive Species Surveillance Monitoring Field Guide" and nine species cards was completed in summer 2009. In addition, the ERMN began development of Supplement 1 to the Early Detection of Invasive Species Surveillance Monitoring Field Guide in spring 2010. Supplement 1 will contain 10 new species cards. To date, six cards have been designed and printed. Each completed species card, as well as the entire field guide, were posted on the ERMN Web site and are available for download at http://science.nature.nps.gov/im/units/ermn/monitoring/earlydetection.cfm.

Table 1. 2010 list of plant and pest species included in the Invasive Species Early Detection (ISED) program for the Eastern Rivers and Mountains Network (ERMN) by park and taxa category.

Scientific Name	Common Name	Taxa Category	ALPO	BLUE	DEWA	FONE	FRHI	GARI	JOFL	NERI	UPDE
Adelges tsugae	hemlock woolly adelgid	PEST	P/ED			ED	ED				
Agrilus planipennis	emerald ash borer	PEST	ED	ED	ED	ED	ED	ED	ED		ED
Anoplophora glabripennis	Asian long-horned beetle	PEST	ED		ED	ED	ED		ED		ED
Pyrrhalta viburni	viburnum leaf beetle	PEST	ED		ED	ED	ED		ED		ED
Sirex noctilio	Sirex woodwasp	PEST	ED		ED	ED	ED		ED		ED
Didymosphenia geminata	didymo	AQPLANT	ED	ED	ED	ED	ED	ED	ED	ED	ED
Trapa natans	water chestnut	AQPLANT			ED						ED
Acer platanoides	Norway maple	PLANT		ED				ED		ED	
Ailanthus altissima	tree of heaven	PLANT							ED		ED
Akebia quinata	chocolate vine	PLANT		ED				ED		ED	
Alliaria petiolata	garlic mustard	PLANT						ED			
Ampelopsis brevipedunculata	Amur peppervine	PLANT		ED	ED			ED		ED	
Aralia elata	Japanese aralia	PLANT			ED						ED
Berberis thunbergii	Japanese barberry	PLANT		ED				ED		P/ED	
Cardamine impatiens	narrowleaf bittercress	PLANT	ED		P/ED	ED	ED		ED		ED
Celastrus orbiculatus	oriental bittersweet	PLANT		ED		ED		ED	ED		
Cynanchum louiseae/C. rossicum	Louise's & European swallow-worts	PLANT	ED		ED						ED
Dioscorea oppositifolia	Chinese yam	PLANT		P/ED				ED			
Euonymus alatus	winged burning bush	PLANT					ED			ED	
Frangula alnus	glossy buckthorn	PLANT	ED	ED	ED	ED		ED	ED	ED	
Heracleum mantegazzium	giant hogweed	PLANT	ED	ED	ED	ED	ED	ED	ED	ED	ED
Humulus japonicus	Japanese hop	PLANT				ED	ED	ED	ED	ED	
Lespedeza cuneata	Chinese lespedeza	PLANT						P/ED			
Ligustrum obtusifolium/L. vulgare	border/European privets	PLANT									ED
Lonicera japonica	Japanese honeysuckle	PLANT							ED		ED
Lythrum salicaria	purple loosestrife	PLANT						ED			
Microstegium vimineum	Japanese stiltgrass	PLANT							ED		
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass	PLANT	ED	ED	ED	ED	ED	ED	ED	ED	ED
Phellodendron amurense	Amur corktree	PLANT			P/ED						ED
Phragmites australis	phragmites	PLANT		ED	P/ED		ED				
Polygonum cuspidatum/sachalinense	Japanese/giant knotweed	PLANT		P/ED				P/ED			
Polygonum perfoliatum [*Persicaria perfoliata*]	mile-a-minute	PLANT	P/ED	ED	P/ED	ED	ED	ED	ED	ED	
Pueraria montana var. *lobata*	kudzu	PLANT	ED	ED	ED	ED	ED	ED	ED		ED

Scientific Name	Common Name	Taxa Category	ALPO	BLUE	DEWA	FONE	FRHI	GARI	JOFL	NERI	UPDE
Ranunculus ficaria	lesser celandine	PLANT	ED	ED	ED	ED	ED	ED	ED	ED	ED
Rhamnus cathartica	common buckthorn	PLANT		ED		ED	ED	ED	ED	P/ED	ED
Rhodotypos scandens	jetbead	PLANT	ED		ED	ED	ED		ED		ED
Viburnum dilatatum	linden arrowwood	PLANT	ED		P/ED	ED	ED		ED		ED

Parks include:
Allegheny Portage Railroad National Historic Site (ALPO), Bluestone National Scenic River (BLUE), Delaware Water Gap National Recreation Area (DEWA), Fort Necessity National Battlefield (FONE), Friendship Hill National Historic Site (FRHI), Gauley River National Recreation Area (GARI), Johnstown Flood National Memorial (JOFL), New River Gorge National River (NERI), and Upper Delaware Scenic and Recreational River (UPDE).

ED = Early detection species not yet known to occur in the park.
P/ED = Present within the park in small numbers, but early detection is still warranted to prevent the spread to other areas of the park.
[ ] = Species in brackets denote botanical synonyms or scientific names that have recently changed.

Alert System

Data acquired from ISED are time-sensitive and all new detection occurrences are immediately reported through the appropriate chain of command. Each observer or monitoring crew leader is responsible for alerting the designated park contact (DPC) and Invasive Species Early Detection Coordinator (ISEDC) to all new species detections. In cases where noxious weeds or high priority pests are detected, the ISEDC will follow up with each DPC and may assist with alerting relevant outside agencies.

Rapid Response

Rapid responses to invasions are effective and can prevent the spread and permanent establishment of invasive species. Coordinating and/or executing a rapid response is primarily the responsibility of the respective park resource manager(s) in which the infestation was detected. Rapid response should include positive species identification and management/eradication activities, and may involve coordination with an EPMT, the NPS Regional Integrated Pest Management (IPM) Coordinator, agencies such as the Bureau of Plant Industry and the Animal and Plant Health Inspection Service (APHIS) within the U.S. Department of Agriculture, local weed management organizations, and network and park personnel, as well as park interns. Each response was based on the individual needs of the park and the resources available (Figure 1) (Keefer et al. 2010).

Data Management and Reporting

Currently, the ERMN is using a Microsoft Excel spreadsheet to keep track of all new invasive species occurrences; however, we are in the process of developing an ISED database, which is a Microsoft Access based and Natural Resource Database Template (NRDT)-compliant relational database. This database will keep track of new species occurrences (documents presence), assessments, and all management or rapid responses at the documented location.

The Early Detection and Distribution Mapping System (EDDMapS), in conjunction with the ERMN Web site, will provide a data entry port, alert system, and a one-stop resource for invasive species information, including links to other invasive species Web sites, photos, important contacts, and other pertinent information. To view the current ERMN Web site, visit: http://science.nature.nps.gov/im/units/ermn/monitoring/EarlyDetection.cfm.

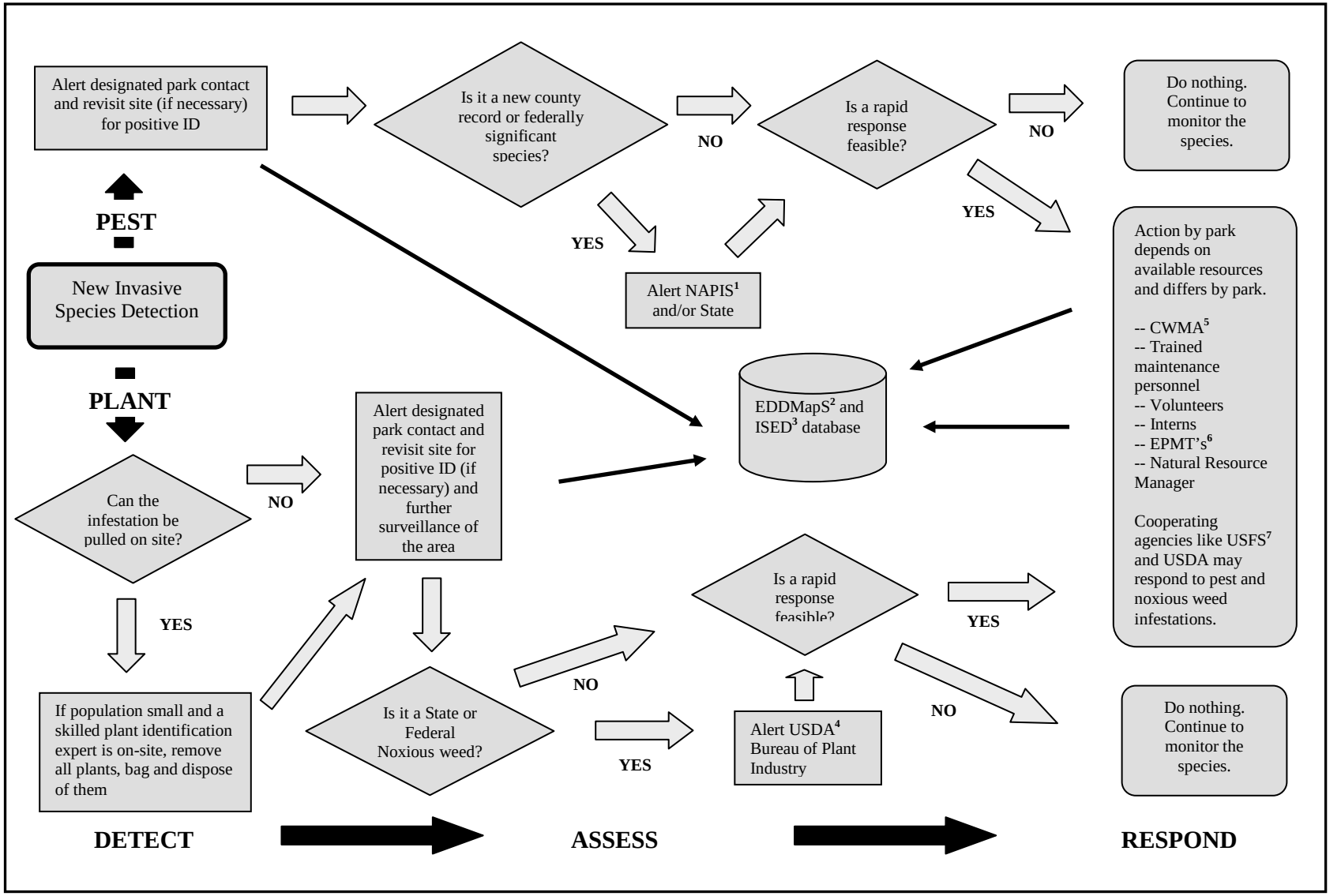

Figure 1. Early Detection of Invasive Species Rapid Response system for the Eastern Rivers and Mountains Network (ERMN)**.**

1. National Agricultural Pest Information System (NAPIS); 2. Early Detection & Distribution Mapping System (EDDMapS); 3. Invasive Species Early Detection (ISED); 4. United States Department of Agriculture (USDA); 5. Cooperative Weed Management Area (CWMA); 6. Exotic Plant Management Team (EPMT); 7. United States Forest Service (USFS).

Results and Discussion

New for 2010

Development of Supplement 1 to the Early Detection of Invasive Species Surveillance Monitoring Field Guide began in spring 2010. Six of ten new species cards were designed and printed. Didymo (*Didymosphenia geminata*) was the first aquatic species to be added to the field guide. Other new species cards included viburnum leaf beetle (*Pyrrhalta viburni*), Amur peppervine (*Ampelopsis brevipedunculata*), linden arrowwood (*Viburnum dilatatum*), Amur corktree (*Phellodendron amurense*), and Japanese aralia (*Aralia elata*).

Allegheny Portage Railroad National Historic Site (ALPO)

The ALPO invasive species early detection list was reviewed and updated during winter/spring 2010. Three new species were added to the list: Didymo (*Didymosphenia geminata*), linden arrowwood (*Viburnum dilatatum*), and jetbead (*Rhodotypos scandens*). One species was removed from the list: hemlock woolly adelgid (*Adelges tsugae*). Known to occur in smaller numbers prior to the commencement of this protocol, hemlock woolly adelgid has spread and is now considered established at ALPO. The National Park Service, in collaboration with the United States Forest Service, began treatment in late summer 2010 (Kathy Penrod, pers. comm., February 10, 2011).

No new invasive species early detection occurrences were recorded at ALPO by the vegetation monitoring crew or park personnel in 2010. The ALPO invasive species early detection list will be re-evaluated and updated as necessary during winter 2010–11.

See the Appendix to view a summary score card of early detection plant and pest species for ALPO.

Bluestone National Scenic River (BLUE)

The BLUE invasive species early detection list was reviewed and updated during winter/spring 2010. Three new species were added to the list: Amur peppervine (*Ampelopsis brevipedunculata*), chocolate vine (*Akebia quinata*), and Didymo (*Didymosphenia geminata*).

No new invasive species early detection occurrences were recorded at BLUE by the vegetation monitoring crew or park personnel in 2010. The BLUE invasive species early detection list will be re-evaluated and updated as necessary during winter 2010–11.

See the Appendix to view a summary score card of early detection plant and pest species for BLUE.

Delaware Water Gap National Recreation Area (DEWA)

The DEWA invasive species early detection list was reviewed and updated during winter/spring 2010. Six new species were added to the list: Amur peppervine (*Ampelopsis brevipedunculata*), linden arrowwood (*Viburnum dilatatum*), Amur corktree (*Phellodendron amurense*), jetbead (*Rhodotypos scandens*), Didymo (*Didymosphenia geminata*), and water chestnut (*Trapa natans*).

Three new occurrences of two early detection species, linden arrowwood (*Viburnum dilatatum*) and mile-a-minute (*Polygonum perfoliatum*), were detected at DEWA in 2010 (Figure 2). Linden

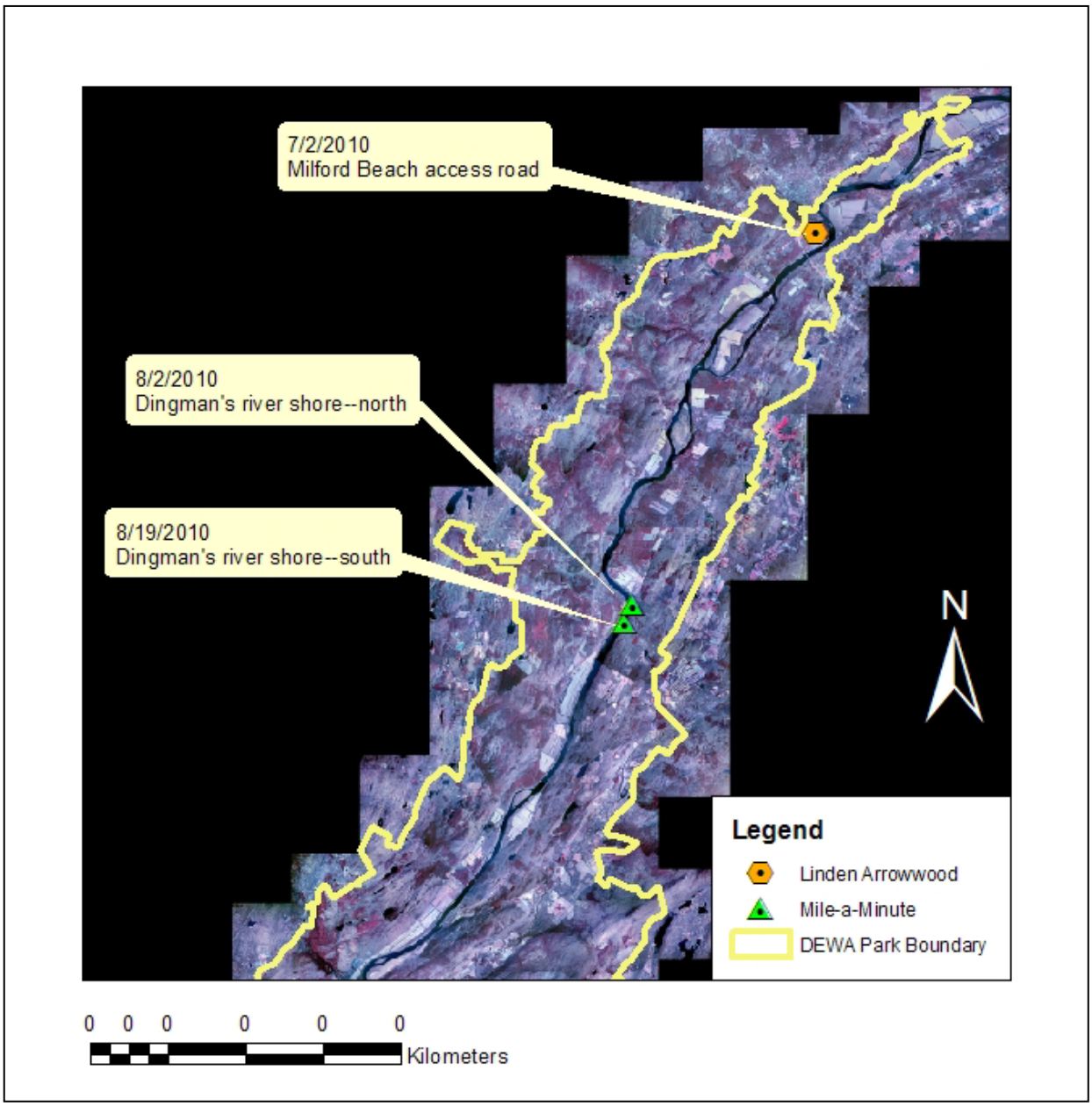

Figure 2. Locations of linden arrowwood (*Viburnum dilatatum*) and mile-a-minute (*Polygonum perfoliatum*) early detection occurrences in Delaware Water Gap National Recreation Area (DEWA).

arrowwood was observed at one new location in Pike County, Pennsylvania, along Milford Beach access road near the storage sheds and near the toll booth, by Doug Manning, ERMN vegetation monitoring crew member. At least 12 stems were observed, three of which were flagged, but many more are believed to exist in the general area. Additional stems were also observed across the road on private property. Treatment on NPS property is planned for 2011 (Jeff Shreiner, pers. comm., January 27, 2011).

Mile-a-minute was observed at two new locations in Sussex County, New Jersey, by Jeff Shreiner, park biologist, and the ERMN vegetation monitoring crew. Both sites are approximately a quarter mile apart along the Dingmans Ferry Rivershore Natural Heritage Site (NJ). The northern site extends approximately 25 m on the riverbank and the southern site occupies a few square meters on the riverbank. Evidence of larval feeding damage confirmed the presence of the Chinese weevil (*Rhinoncomimus latipes*), a biological control agent and mile-a-minute specialist, which was present in low numbers from a previous release upstream at Minisink Island. On August 12 and September 17, 2010, Mark Mayer, Supervising Entomologist with the New Jersey Department of Agriculture, in collaboration with DEWA resource managers, released 2,500 additional Chinese weevils at the northern and southern site, respectively. The park is hopeful that the supplemental releases will result in control of this invasive vine and the weevils will spread to other unknown mile-a-minute sites in the area (Jeff Shreiner, pers. comm., January 27, 2011.).

The DEWA invasive species early detection list will be re-evaluated and updated as necessary during winter 2010–11.

See the Appendix to view a summary score card of early detection plant and pest species for DEWA.

Fort Necessity National Battlefield (FONE)

The FONE invasive species early detection list was reviewed and updated during winter/spring 2010. Five new species were added to the list: Oriental bittersweet (*Celastrus orbiculatus*), linden arrowwood (*Viburnum dilatatum*), Japanese hop (*Humulus japonicus*), jetbead (*Rhodotypos scandens*), and Didymo (*Didymosphenia geminata*).

No new invasive species early detection occurrences were recorded at FONE by the vegetation monitoring crew or park personnel in 2010. The FONE invasive species early detection list will be re-evaluated and updated as necessary during winter 2010–11.

See the Appendix to view a summary score card of early detection plant and pest species for FONE.

Friendship Hill National Historic Site (FRHI)

The FRHI invasive species early detection list was reviewed and updated during winter/spring 2010. Four new species were added to the list: linden arrowwood (*Viburnum dilatatum*), Japanese hop (*Humulus japonicus*), jetbead (*Rhodotypos scandens*), and Didymo (*Didymosphenia geminata*). One species was removed from the list: privet (*Ligustrum* spp.).

Privet is now considered established at FRHI and no treatment has been conducted on known populations.

No new invasive species early detection occurrences were recorded at FRHI by the vegetation monitoring crew or park personnel in 2010. The FRHI invasive species early detection list will be re-evaluated and updated as necessary during winter 2010–11.

See the Appendix to view a summary score card of early detection plant and pest species for FRHI.

Gauley River National Recreation Area (GARI)

The GARI invasive species early detection list was reviewed and updated during winter/spring 2010. Four new species were added to the list: Amur peppervine (*Ampelopsis brevipedunculata*), chocolate vine (*Akebia quinata*), Japanese hops (*Humulus japonicus*), and Didymo (*Didymosphenia geminata*).

No new invasive species early detection occurrences were recorded at GARI by the vegetation monitoring crew or park personnel in 2010. The GARI invasive species early detection list will be re-evaluated and updated as necessary during winter 2010–11.

See the Appendix to view a summary score card of early detection plant and pest species for GARI.

Johnstown Flood National Memorial (JOFL)

The JOFL invasive species early detection list was reviewed and updated during winter/spring 2010. Seven new species were added to the list: Oriental bittersweet (*Celastrus orbiculatus*), Japanese hop (*Humulus japonicus*), linden arrowwood (*Viburnum dilatatum*), jetbead (*Rhodotypos scandens*), common buckthorn (*Rhamnus cathartica*), tree of heaven (*Ailanthus altissima*), and Didymo (*Didymosphenia geminata*).

One new early detection species, viburnum leaf beetle (*Pyrrhalta viburni*), was detected at JOFL in 2010 (Figure 3). It was observed in a section of the park south of Rt. 869 in Cambria County, Pennsylvania, by the ERMN vegetation monitoring crew. The host species was northern arrowwood (*Viburnum recognitum*), and many plants exhibited feeding damage or irregular foliar holes (Figure 4), as well as live beetles. Insect specimens were sent to the United States Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS) for confirmation and it was determined that this was the first confirmed sighting of this species in Cambria County, Pennsylvania. Word quickly spread through the local parks, including the new Flight 93 National Memorial (FLNI) in adjacent Somerset County, Pennsylvania, which is currently in the process of designing and constructing the permanent memorial. Jodie Petersen, Registered Landscape Architect and Project Manager for FLNI, consulted with Deputy Superintendent Keith Newlin and agreed that guidance regarding landscaping plant species needed to be given to the Architect/Engineering firm. On July 21, 2010, the landscape planting list was revised to replace the native southern arrowwood (*Viburnum dentatum*) with another native plant species not affected by the viburnum leaf beetle. In addition, it was decided that all viburnum species would be excluded from the FLNI landscape needs. A revised planting schedule was then sent to the contractor, who forwarded it to their subcontractor. The quick

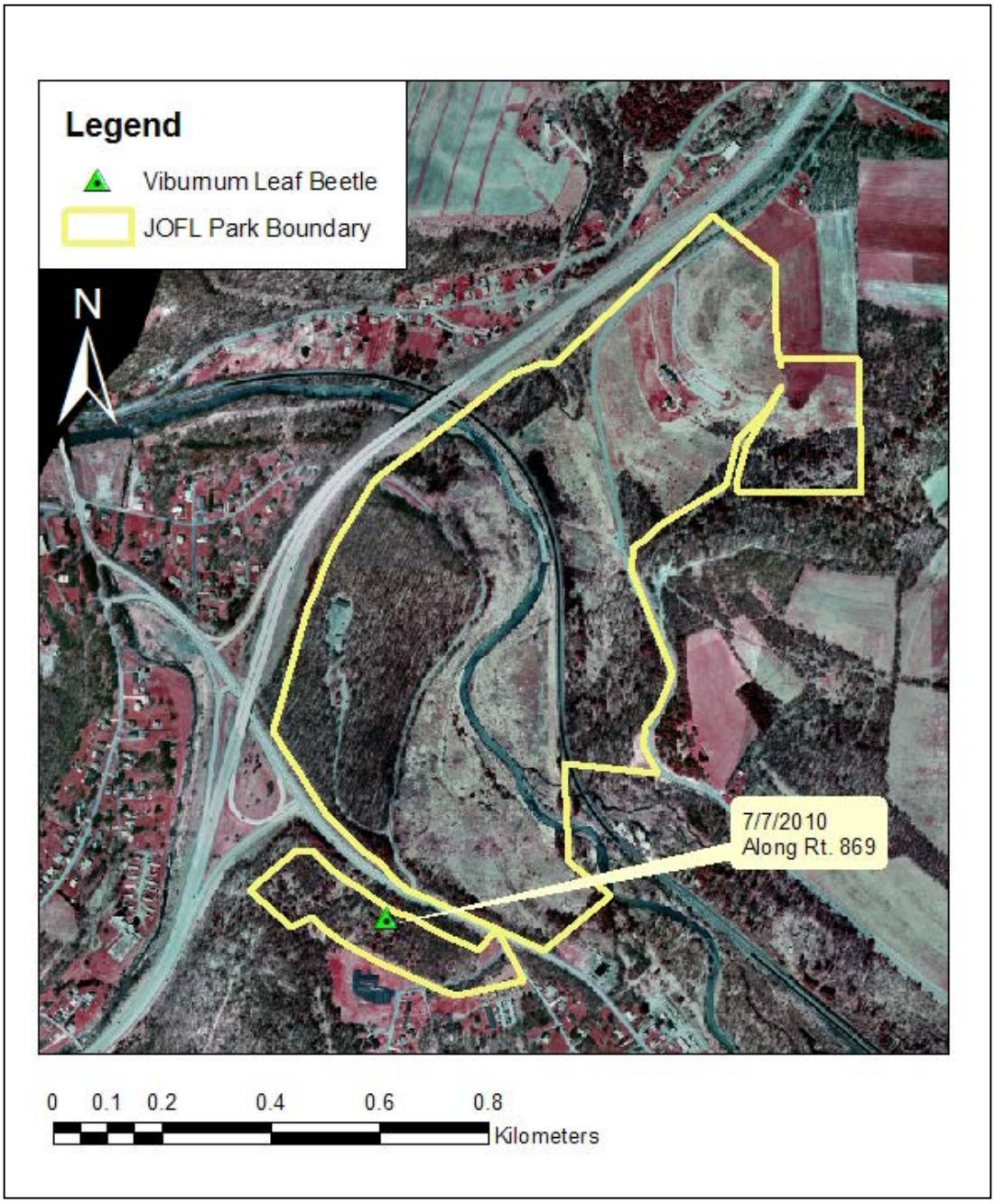

Figure 3. Location of viburnum leaf beetle (*Pyrrhalta viburni*) early detection occurrence in Johnstown Flood National Memorial (JOFL).

Figure 4. Viburnum leaf beetle *(Pyrrhalta viburni*) foliar damage at Johnstown Flood National Memorial (JOFL). Photo taken by Doug Manning.

response of all National Park Service personnel to the early detection of viburnum leaf beetle will potentially save a lot of time and money in replanting costs. Kathy Penrod, Natural Resource Specialist, is considering horticultural oil treatment and pruning of larger shrubs in 2011 (Kathy Penrod, pers. comm. February 10, 2011).

The JOFL invasive species early detection list will be re-evaluated and updated as necessary during winter 2010–11.

See the Appendix to view a summary score card of early detection plant and pest species for JOFL.

New River Gorge National River (NERI)

The NERI invasive species early detection list was reviewed and updated during winter/spring 2010. Five new species were added to the list: Amur peppervine (*Ampelopsis brevipedunculata*), chocolate vine (*Akebia quinata*), Japanese hops (*Humulus japonicus*), winged burning bush (*Euonymus alatus*), and Didymo (*Didymosphenia geminata*). Two species were removed from the list: gypsy moth (*Lymantria dispar*) and emerald ash borer (*Agrilus planipennis*). There is no current treatment for emerald ash borer and spread is inevitable. Gypsy moth is widespread and established breeding populations were confirmed in 2009 (Keefer 2010).

No new invasive species early detection occurrences were recorded at NERI by the vegetation monitoring crew or park personnel in 2010. The NERI invasive species early detection list will be re-evaluated and updated as necessary during winter 2010–11.

See the Appendix to view a summary score card of early detection plant and pest species for NERI.

Upper Delaware National Scenic and Recreational River (UPDE)

The UPDE invasive species early detection list was reviewed and updated during winter/spring 2010. Five new species were added to the list: linden arrowwood (*Viburnum dilatatum*), Amur corktree (*Phellodendron amurense*), jetbead (*Rhodotypos scandens*), Didymo (*Didymosphenia geminata*), and water chestnut (*Trapa natans*).

No new invasive species early detection occurrences were recorded at UPDE by park personnel in 2010. The UPDE invasive species early detection list will be re-evaluated and updated as necessary during winter 2010–11.

See the Appendix to view a summary score card of early detection plant and pest species for UPDE.

Invasive Species Occurrence Mapping

All new invasive plant species occurrences were mapped and are available for viewing in the Early Detection and Distribution Mapping System (EDDMapS). To view these data in EDDMapS, visit: http://www.eddmaps.org/ and click on "Distribution Maps." Choose a species, and then click on a state and then a county to see information about the species.

Looking Ahead to 2011

New for the spring 2011 field season will be the completion of the final four species cards in Supplement 1 to the Early Detection of Invasive Species Surveillance Monitoring Field Guide. Japanese hop (*Humulus japonicus*), Jetbead (Rhodotypos scandens), Chinese lespedeza (*Lespedeza cuneata*), and water chestnut (*Trapa natans*) will be designed and printed.

Additional cards will be needed as new invasive plants, animals, and diseases threaten ERMN park resources. A new species card is being considered for Thousand Cankers Disease, a progressive disease that kills walnut trees within two to three years after initial infection (Tisserat et al. 2009). The recent and unexpected detection of this disease in eastern Tennessee in July 2010 marks the first detection of this pest east of the Mississippi River.

In addition, during winter/spring 2011 each park ISED list will be reviewed by network staff, park natural resource managers, and other pertinent contacts to ensure that the list is current and contains the top priority species (See Updating Invasive Species Early Detection Lists SOP 1; Keefer et al. 2010). New invasive species threats will be evaluated for possible inclusion in a park's ISED list, while the prior year's list of species should be evaluated to determine if any should be removed from the list.

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Appendix. Summary score cards of early detection plant and pest species for parks in the Eastern Rivers and Mountains Network (ERMN).

Table A1. Summary score card of early detection plant and pest species for Allegheny Portage Railroad National Historic Site (ALPO).

Scientific Name	Common Name	Year Detected[^]			Action[+]			
		2008	2009	2010	Treated or Removed	No Action	Treatment Planned	Reported to EDDMapS[*]
PEST								
Adelges tsugae[†]	hemlock woolly adelgid				'10			
Agrilus planipennis	emerald ash borer							
Anoplophora glabripennis	Asian longhorned beetle							
Pyrrhalta viburni	viburnum leaf beetle							
Sirex noctillio	sirex woodwasp							
AQUATIC								
Didymosphenia geminata[‡]	didymo							
HERB								
Cardamine impatiens	narrowleaf bittercress							
Heracleum mantegazzium	giant hogweed							
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass							
Ranunculus ficaria	lesser celandine							
VINE								
Cynanchum spp.[‡]	swallowworts							
Polygonum perfoliatum	mile-a-minute							
Pueraria montana var. *lobata*	kudzu							
SHRUB								
Frangula alnus	glossy buckthorn							
Rhodotypos scandens[‡]	jetbead							
Viburnum dilatatum[‡]	linden arrowwood							

[^] Only species detected after the commencement of this protocol in 2008 are noted here.
[+] Numbers listed in each field represent the year action was taken; for example, '10 = 2010.
[*] As of December 2010, only plant observations can be entered into EDDMapS. As the Mid-Atlantic Mapping System is developed as part of EDDMapS, the ability to enter and view maps of pest detections may be added in the future.
[†] These species were removed from the park's Invasive Species Early Detection list in 2010.
[‡] These species were added to the park's Invasive Species Early Detection list in 2010.

Table A2. Summary score card of early detection plant and pest species for Bluestone National Scenic River (BLUE).

Scientific Name	Common Name	Year Detected[^]			Action[+]			
		2008	2009	2010	Treated or Removed	No Action	Treatment Planned	Reported to EDDMapS[*]
PEST								
Agrilus planipennis	emerald ash borer							
AQUATIC								
Didymosphenia geminata[‡]	didymo							
HERB								
Dioscorea oppositifolia	Chinese yam							
Heracleum mantegazzium	giant hogweed							
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass							
Phragmites australis	phragmites							
Polygonum cuspidatum/P. sachalinense	Japanese/giant knotweed	X[#]			'09			'09
Ranunculus ficaria	lesser celandine							
VINE								
Akebia quinata[‡]	chocolate vine							
Ampelopsis brevipedunculata[‡]	Amur peppervine							
Celastrus orbiculata	Oriental bittersweet							
Polygonum perfoliatum	mile-a-minute							
Pueraria montana var. *lobata*	kudzu							
SHRUB								
Berberis thunbergii	Japanese barberry							
Frangula alnus	glossy buckthorn							
Rhamnus cathartica	common buckthorn							
TREE								
Acer platanoides	Norway maple							

[^] Only species detected after the commencement of this protocol in 2008 are noted here.
[+] Numbers listed in each field represent the year action was taken; for example, '10 = 2010.
[*] As of December 2010, only plant observations can be entered into EDDMapS. As the Mid-Atlantic Mapping System is developed as part of EDDMapS, the ability to enter and view maps of pest detections may be added in the future.
[#] Species originally discovered in 11/28/2003 by contractor, but was re-visited and treated in 2009 as a result of the development and initiation of the ISED protocol.
[‡] These species were added to the park's Invasive Species Early Detection list in 2010.

Table A3. Summary score card of early detection plant and pest species for Delaware Water Gap National Recreation Area (DEWA).

Scientific Name	Common Name	Year Detected[^]			Action[+]			
		2008	2009	2010	Treated or Removed	No Action	Treatment Planned	Reported to EDDMapS[*]
PEST								
Agrilus planipennis	emerald ash borer							
Anoplophora glabripennis	Asian longhorned beetle							
Pyrrhalta viburni	viburnum leaf beetle		X[#]			'09		
Sirex noctillio	sirex woodwasp							
AQUATIC								
Didymosphenia geminata[‡]	didymo							
Trapa natans[‡]	water chestnut							
HERB								
Cardamine impatiens	narrowleaf bittercress	X	X		'09		'09	'09
Heracleum mantegazzium	giant hogweed							
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass							
Phragmites australis	phragmites							
Ranunculus ficaria	lesser celandine							
VINE								
Ampelopsis brevipedunculata[‡]	Amur peppervine							
Cynanchum spp.	swallowworts							
Polygonum perfoliatum	mile-a-minute			X	'10			'10
Pueraria montana var. *lobata*	kudzu							
SHRUB								
Frangula alnus	glossy buckthorn							
Rhodotypos scandens[‡]	jetbead							
Viburnum dilatatum	linden arrowwood		X	X	'09		'10	'09/'10
TREE								
Aralia elata	Japanese aralia							
Phellodendron amurense	Amur corktree		X		'09			'09

[^] Only species detected after the commencement of this protocol in 2008 are noted here.
[+] Numbers listed in each field represent the year action was taken; for example, '10 = 2010.
[*] As of December 2010, only plant observations can be entered into EDDMapS. As the Mid-Atlantic Mapping System is developed as part of EDDMapS, the ability to enter and view maps of pest detections may be added in the future.
[#] Evidence was reported to the Department of Agriculture and species confirmation is needed before the detection can be listed in the National Agricultural Pest Information System (NAPIS).
[‡] These species were added to the park's Invasive Species Early Detection list in 2010.

Table A4. Summary score card of early detection plant and pest species for Fort Necessity National Battlefield (FONE).

Scientific Name	Common Name	Year Detected[^]			Action[+]			
		2008	2009	2010	Treated or Removed	No Action	Treatment Planned	Reported to EDDMapS[*]
PEST								
Adelges tsugae	hemlock woolly adelgid							
Agrilus planipennis	emerald ash borer							
Anoplophora glabripennis	Asian longhorned beetle							
Pyrrhalta viburni	viburnum leaf beetle							
Sirex noctillio	sirex woodwasp							
AQUATIC								
Didymosphenia geminata[‡]	didymo							
HERB								
Cardamine impatiens	narrowleaf bittercress							
Heracleum mantegazzium	giant hogweed							
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass							
Ranunculus ficaria	lesser celandine							
VINE								
Celastrus orbiculatus[‡]	Oriental bittersweet							
Humulus japonicus[‡]	Japanese hop							
Polygonum perfoliatum	mile-a-minute							
Pueraria montana var. *lobata*	kudzu							
SHRUB								
Frangula alnus	glossy buckthorn							
Rhamnus cathartica	common buckthorn							
Rhodotypos scandens[‡]	jetbead							
Viburnum dilatatum[‡]	linden arrowwood							

[^] Only species detected after the commencement of this protocol in 2008 are noted here.
[+] Numbers listed in each field represent the year action was taken; for example, '10 = 2010.
[*] As of December 2010, only plant observations can be entered into EDDMapS. As the Mid-Atlantic Mapping System is developed as part of EDDMapS, the ability to enter and view maps of pest detections may be added in the future.
[‡] These species were added to the park's Invasive Species Early Detection list in 2010.

Table A5. Summary score card of early detection plant and pest species for Friendship Hill National Historic Site (FRHI).

Scientific Name	Common Name	Year Detected^			Action+			
		2008	2009	2010	Treated or Removed	No Action	Treatment Planned	Reported to EDDMapS*
PEST								
Adelges tsugae	hemlock woolly adelgid							
Agrilus planipennis	emerald ash borer							
Anoplophora glabripennis	Asian longhorned beetle							
Pyrrhalta viburni	viburnum leaf beetle							
Sirex noctillio	sirex woodwasp							
AQUATIC								
Didymosphenia geminata‡	didymo							
HERB								
Cardamine impatiens	narrowleaf bittercress							
Heracleum mantegazzium	giant hogweed							
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass							
Phragmites australis	phragmites							
Ranunculus ficaria	lesser celandine							
VINE								
Humulus japonicus‡	Japanese hop							
Polygonum perfoliatum	mile-a-minute							
Pueraria montana var. *lobata*	kudzu							
SHRUB								
Euonymus alatus	winged burning bush							
Ligustrum spp.†	privet	X				‘09		‘09
Rhamnus cathartica	common buckthorn							
Rhodotypos scandens‡	jetbead							
Viburnum dilatatum‡	linden arrowwood							

^ Only species detected after the commencement of this protocol in 2008 are noted here.
+ Numbers listed in each field represent the year action was taken; for example, ’10 = 2010.
* As of December 2010, only plant observations can be entered into EDDMapS. As the Mid-Atlantic Mapping System is developed as part of EDDMapS, the ability to enter and view maps of pest detections may be added in the future.
† These species were removed from the park’s Invasive Species Early Detection list in 2010.
‡ These species were added to the park’s Invasive Species Early Detection list in 2010.

Table A6. Summary score card of early detection plant and pest species for Gauley River National Recreation Area (GARI).

Scientific Name	Common Name	Year Detected[^]			Action[+]			
		2008	2009	2010	Treated or Removed	No Action	Treatment Planned	Reported to EDDMapS[*]
PEST								
Agrilus planipennis	emerald ash borer							
AQUATIC								
Didymosphenia geminata[‡]	didymo							
HERB								
Alliaria petiolata	garlic mustard							
Dioscorea oppositifolia	Chinese yam							
Heracleum mantegazzium	giant hogweed							
Lespedeza cuneata	Chinese lespedeza							
Lythrum salicaria	purple loosestrife							
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass							
Polygonum cuspidatum/P. sachalinense	Japanese/giant knotweed		X				'09	'09
Ranunculus ficaria	lesser celandine							
VINE								
Akebia quinata[‡]	chocolate vine							
Ampelopsis brevipedunculata[‡]	Amur peppervine							
Celastrus orbiculata	Oriental bittersweet							
Humulus japonicus[‡]	Japanese hop							
Polygonum perfoliatum	mile-a-minute							
Pueraria montana var. *lobata*	kudzu							
SHRUB								
Berberis thunbergii	Japanese barberry							
Frangula alnus	glossy buckthorn							
Rhamnus cathartica	common buckthorn							
TREE								
Acer platanoides	Norway maple							

[^] Only species detected after the commencement of this protocol in 2008 are noted here.
[+] Numbers listed in each field represent the year action was taken; for example, '10 = 2010.
[*] As of December 2010, only plant observations can be entered into EDDMapS. As the Mid-Atlantic Mapping System is developed as part of EDDMapS, the ability to enter and view maps of pest detections may be added in the future.
[‡] These species were added to the park's Invasive Species Early Detection list in 2010.

Table A7. Summary score card of early detection plant and pest species for Johnstown Flood National Memorial (JOFL).

Scientific Name	Common Name	Year Detected[^]			Action[+]			
		2008	2009	2010	Treated or Removed	No Action	Treatment Planned	Reported to EDDMapS[*]
PEST								
Agrilus planipennis	emerald ash borer							
Anoplophora glabripennis	Asian longhorned beetle							
Pyrrhalta viburni	viburnum leaf beetle			X[#]			'10	
Sirex noctillio	sirex woodwasp							
AQUATIC								
Didymosphenia geminata[‡]	didymo							
HERB								
Cardamine impatiens	narrowleaf bittercress							
Heracleum mantegazzium	giant hogweed							
Microstegium vimineum	Japanese stiltgrass							
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass							
Ranunculus ficaria	lesser celandine							
VINE								
Celastrus orbiculata[‡]	Oriental bittersweet							
Humulus japonicus[‡]	Japanese hop							
Lonicera japonica	Japanese honeysuckle							
Polygonum perfoliatum	mile-a-minute							
Pueraria montana var. *lobata*	kudzu							
SHRUB								
Frangula alnus	glossy buckthorn							
Rhamnus cathartica[‡]	common buckthorn							
Rhodotypos scandens[‡]	jetbead							
Viburnum dilatatum[‡]	linden arrowwood							
TREE								
Ailanthus altissima[‡]	tree of heaven							

[^] Only species detected after the commencement of this protocol in 2008 are noted here.
[+] Numbers listed in each field represent the year action was taken; for example, '10 = 2010.
[*] As of December 2010, only plant observations can be entered into EDDMapS. As the Mid-Atlantic Mapping System is developed as part of EDDMapS, the ability to enter and view maps of pest detections may be added in the future.
[#] Evidence was sent to the Department of Agriculture and the species was confirmed. The detection was added to the National Agricultural Pest Information System (NAPIS).
[‡] These species were added to the park's Invasive Species Early Detection list in 2010.

Table A8. Summary score card of early detection plant and pest species for New River Gorge National River (NERI).

Scientific Name	Common Name	Year Detected[^]			Action[+]			
		2008	2009	2010	Treated or Removed	No Action	Treatment Planned	Reported to EDDMapS[*]
PEST								
Agrilus planipennis[†]	emerald ash borer		X[#]				'09	
Lymantria dispar[†]	gypsy moth		X			'09		
AQUATIC								
Didymosphenia geminata[‡]	didymo							
HERB								
Heracleum mantegazzium	giant hogweed							
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass							
Ranunculus ficaria	lesser celandine							
VINE								
Akebia quinata[‡]	Chocolate vine							
Ampelopsis brevipedunculata[‡]	Amur peppervine							
Humulus japonicus[‡]	Japanese hop							
Polygonum perfoliatum	mile-a-minute							
SHRUB								
Berberis thunbergii	Japanese barberry		X		'09			'09
Euonymus alatus[‡]	winged burning bush							
Frangula alnus	glossy buckthorn							
Rhamnus cathartica	common buckthorn							
TREE								
Acer platanoides	Norway maple							

[^] Only species detected after the commencement of this protocol in 2008 are noted here.
[+] Numbers listed in each field represent the year action was taken; for example, '10 = 2010.
[*] As of December 2010, only plant observations can be entered into EDDMapS. As the Mid-Atlantic Mapping System is developed as part of EDDMapS, the ability to enter and view maps of pest detections may be added in the future.
[#] Emerald ash borer presence discovered and confirmed by the Animal and Plant Health Inspection Service (APHIS).
[†] These species were removed from the park's Invasive Species Early Detection list in 2010.
[‡] These species were added to the park's Invasive Species Early Detection list in 2010.

Table A9 Summary score card of early detection plant and pest species for Upper Delaware National Scenic and Recreational River (UPDE).

Scientific Name	Common Name	Year Detected[^]			Action[+]			
		2008	2009	2010	Treated or Removed	No Action	Treatment Planned	Reported to EDDMapS[*]
PEST								
Agrilus planipennis	emerald ash borer							
Anoplophora glabripennis	Asian longhorned beetle							
Pyrrhalta viburni	viburnum leaf beetle							
Sirex noctillio	sirex woodwasp							
AQUATIC								
Didymosphenia geminata[‡]	didymo							
Trapa natans[‡]	water chestnut							
HERB								
Cardamine impatiens	narrowleaf bittercress							
Heracleum mantegazzium	giant hogweed							
Oplismenus hirtellus ssp. *undulatifolius*	wavyleaf basketgrass							
Ranunculus ficaria	lesser celandine							
VINE								
Cynanchum spp.	swallowworts							
Lonicera japonica	Japanese honeysuckle							
Pueraria montana var. *lobata*	kudzu							
SHRUB								
Ligustrum obtusifolium/L. vulgare	border/European privets							
Rhamnus cathartica	common buckthorn							
Rhodotypos scandens[‡]	jetbead							
Viburnum dilatatum[‡]	linden arrowwood							
TREE								
Ailanthus altissima	tree of heaven							
Aralia elata	Japanese aralia							
Phellodendron amurense[‡]	Amur corktree							

[^] Only species detected after the commencement of this protocol in 2008 are noted here.
[+] Numbers listed in each field represent the year action was taken; for example, '10 = 2010.
[*] As of December 2010, only plant observations can be entered into EDDMapS. As the Mid-Atlantic Mapping System is developed as part of EDDMapS, the ability to enter and view maps of pest detections may be added in the future.
[‡] These species were added to the park's Invasive Species Early Detection list in 2010.

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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