



# Exotic Plant Management Team Program

## *2011 Annual Report*

Natural Resource Report NPS/NRSS/BRMD/NRR—2012/546



#### **ON THE COVER**

**Top:** Devils Tower National Monument (Northern Great Plains EPMT). **Second row (from left):** Wind Cave National Park (Northern Great Plains EPMT), data collection in the rain (Pacific Islands EPMT). **Third row (from left):** Summer interns in training (Pacific Islands EPMT), EPMT crew members (Alaska EPMT), Yosemite National Park (California EPMT).

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The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate high-priority, current natural resource management information with managerial application. The series targets a general, diverse audience, and may contain NPS policy considerations or address sensitive issues of management applicability.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

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# Contents

	Page
Contents .....	ii
Figures.....	v
Tables.....	ix
Jacob Rigby.....	xi
Introduction.....	1
Accomplishments .....	1
Map of the Exotic Plant Management Teams.....	3
Management Strategies.....	4
Safety .....	7
Exotic Plant Management Team Program Future and Review.....	9
Future of the Program.....	9
EPMT Ten-Year Review .....	9
Exotic Plant Management Team Reports .....	11
<b>Alaska Region</b>	
Alaska EPMT.....	12
<b>Intermountain Region</b>	
Chihuahuan Desert / Shortgrass Prairie EPMT .....	14
Colorado Plateau EPMT .....	16
Gulf Coast EPMT .....	18
Northern Rocky Mountain EPMT .....	20
<b>Midwest Region</b>	
Great Lakes EPMT .....	22
Heartland Network EPMT .....	24

## Contents (continued)

	Page
Northern Great Plains EPMT.....	26
<b>National Capital Region</b>	
National Capital Region EPMT.....	28
<b>Northeast Region</b>	
Mid-Atlantic EPMT.....	30
Northeast EPMT .....	32
<b>Pacific West Region</b>	
California EPMT .....	34
Lake Mead EPMT.....	36
North Coast / Cascades Network EPMT .....	38
Pacific Islands EPMT .....	40
<b>Southeast Region</b>	
Florida / Caribbean EPMT.....	42
Southeast EPMT .....	44
Southeast Coast EPMT .....	46
Appendix A: Program Participants .....	49
Appendix B: Glossary.....	61
Appendix C: Common Acronyms .....	63
Appendix D: Plant Species Index (by scientific name) .....	65

# Figures

	Page
Figure 1: Control work at Grand Canyon National Park (Lake Mead EPMT).....	1
Figure 2: EPMTs provided invasive plant management expertise to parks in all seven NPS regions. ....	3
Figure 3: Treatment of bamboo at Cowpens National Battlefield (Southeast EPMT). ....	4
Figure 4: Monitoring and data collection on the island of Maui (Pacific Islands EPMT).....	5
Figure 5: Volunteers at Kenai Fjords National Park (Alaska EPMT). ....	6
Figure 6: Collecting senna seeds at Kalaupapa National Historical Park (Pacific Islands EPMT). ....	9
Figure 7: Crew members hike to a remote infestation at Kenai Fjords National Park. ....	12
Figure 8: Park biologist Christina Kriedeman and crewmember Travis Fulton prepare for a backcountry survey trip. ....	13
Figure 9: Removal of an infestation of common timothy ( <i>Phleum pratense</i> ). ....	13
Figure 10: Amistad second saltcedar treatment – before.....	15
Figure 11: Amistad second saltcedar treatment – after.....	15
Figure 12: The late Jacoby Rigby with chainsaw and crew clearing tamarisk around willows to prepare for community gardens at Deadman Wash, Wupatki NM, Arizona. ....	16
Figure 13: Lake Mead EPMT with local park staff hiking out to control Russian knapweed at Yucca House NM, Colorado.....	17
Figure 14: Post treatment kudzu on a bluff along the west bank of the Neches River in the Big Thicket National Preserve. Photograph taken in June 2010 by Eric Worsham, Team Liaison. ....	18
Figure 15: Photograph of the west bank of the Neches River in the Big Thicket National Preserve taken one year post treatment, June 2011, demonstrating the success of the prior year’s effort. Photograph by Eric Worsham, Team Liaison. ....	19
Figure 16: Climbing the Wapi Lava Flows to search out Dyer’s woad in the kapukas, Craters of the Moon NM&P. ....	20

Figure 17: Picking through debris and native plants to spray thistles in the Three Rivers Area, Grand Teton NP. ....	21
Figure 18: Volunteers from Mississippi National River and Recreation Area hauling brush for the EPMT during buckthorn removal. ....	22
Figure 19: EPMT conducting hybrid cattail management in Brady Cove at Isle Royal National Park. ....	23
Figure 20: Filming of Great Lakes Restoration Initiative videos on invasive species in the Apostle Islands National Lakeshore. ....	23
Figure 21: Conservation Corps Iowa treating Garlic Mustard at Effigy Mounds National Monument. ....	24
Figure 22: Student volunteers clearing Autumn Olive at Cuyahoga Valley National Park. ....	25
Figure 23: Wind Cave Resource Management staff assisted EPMT ATV riders with filling water and herbicide to keep things rolling over an intense three days of application. ....	26
Figure 24: Conservation Corps of Minnesota crews help EPMT and KNRI staff cut and treat over 3 acres of densely packed buckthorn along the Knife River. ....	26
Figure 25: Looking for Canada thistle at Scotts Bluff National Monument. ....	27
Figure 26: A crew member treats <i>Phragmites australis</i> in the Roaches Run Waterfowl Sanctuary along the George Washington Memorial Parkway. ....	28
Figure 27: Team Leader Frank Archuleta measures out a study plot that will be used to test the efficacy of Sethoxydim E Pro on Japanese Stiltgrass ( <i>Microstegium vimineum</i> ) in Catoctin Mountain Park. ....	28
Figure 28: Data Manager Geoff Clark treats a large infestation of <i>Wisteria sinensis</i> in Prince William Forest Park in Virginia. ....	29
Figure 29: Beginning phase 2, there is a wall in there somewhere, Hopewell Furnace National Historic Site. ....	30
Figure 30: Wall restoration nearing completion, Hopewell Furnace National Historic Site. ....	31
Figure 31: Herbicide treatment adjacent to Sensitive Vetch habitat, Colonial National Historical Park. ....	31
Figure 32: Cape Cod NS, June 2011. Crew Member / SCA Intern Jereme Didier iterating at Pamet Bog. ....	32



Figure 33: Gateway NRA, Sandy Hook Unit, September 2011. Crew member Jason Zarnowski (left) and Team Leader Brian McDonnell discuss options for setting up new herbicide trial plots.....	33
Figure 34: Heather Smith treating yellow starthistle on steep incline above the Merced River at Yosemite NP. ....	34
Figure 35: Applying a pre-emergent herbicide reduced cheatgrass cover by 58% at a reclaimed hydrothermal well site.....	35
Figure 36: Heather Ferguson treating post fire plots at Joshua Tree NP. ....	36
Figure 37: Hannah Wigginton and Curt Deuser treating Ravenna Grass at Cottonwood Gulch in Glen Canyon NRA. ....	37
Figure 38: Left to right, team members Joe Castello, Sam Smyrk, Brad Jones, Dwayne Coleman and Lauren Alnwick-Pfund protecting the Kelso Dunes from Sahara mustard invasion in Mojave NP.....	37
Figure 39: A crew member treats yellow-flag iris ( <i>Iris pseudacorus</i> ) in a parcel managed jointly by Lewis and Clark National Park and Washington State Parks. ....	38
Figure 40: A member of the LARO crew clears black locust ( <i>Robinia pseudoacacia</i> ) near the Kettle Falls campground in Lake Roosevelt National Recreation Area. ....	39
Figure 41: Highly invasive miconia ( <i>Miconia calvescens</i> ), fruiting specimen (Maui, HI). ....	40
Figure 42: Collaborative NPS, EPMT, and Molokai Invasive Species Committee Crew; Coastal Lowlands Ironwood ( <i>Casaurina</i> ) control.....	41
Figure 43: EPMT crew performing a basal bark application on a camphor tree ( <i>Cinnamomum camphora</i> ) in Timucuan Ecological and Historic National Preserve.....	42
Figure 44: Treating exotic species atop the large powder magazine in the parade grounds of Fort Jefferson, Dry Tortugas National Park. ....	43
Figure 45: Private contractor crew unloading supplies at Henley Cay, Virgin Islands NP. ....	43
Figure 46: Collecting seed from Cade’s Cove at Great Smoky Mountain National Park, Tennessee.....	44
Figure 47: Uprooting Asiatic Dayflower at Carl Sandburg National Historic Site in Flat Rock, North Carolina. ....	45
Figure 48: Team members foliar treat Wisteria ( <i>Wisteria sinensis</i> ) at Congaree National Park. ....	47



## Tables

	Page
Table 1: EPMT Program Accomplishments in 2011 .....	2
Table 2: Alaska EPMT Accomplishments.....	13
Table 3: Chihuahuan Desert / Shortgrass Prairie EPMT Accomplishments .....	15
Table 4: Colorado Plateau EPMT Accomplishments .....	17
Table 5: Gulf Coast EPMT Accomplishments .....	19
Table 6: Northern Rocky Mountain EPMT Accomplishments .....	21
Table 7: Great Lakes EPMT Accomplishments .....	23
Table 8: Northern Great Plains EPMT Accomplishments.....	27
Table 9: National Capital Region EPMT Accomplishments.....	29
Table 10: Mid-Atlantic EPMT Accomplishments.....	31
Table 11: Northeast EPMT Accomplishments .....	33
Table 12: California EPMT Accomplishments.....	35
Table 13: Lake Mead EPMT Accomplishments.....	37
Table 14: North Coast / Cascades EPMT Accomplishments .....	39
Table 15: Pacific Islands EPMT Accomplishments .....	41
Table 16: Florida/Caribbean EPMT Accomplishments.....	43
Table 17: Southeast EPMT Accomplishments .....	45
Table 18: Southeast Coast EPMT Accomplishments .....	47





In Memory of  
**Jacob Rigby**  
1984 - 2011

In 2011 the National Park Service and the EPMT program lost one of its own. Jake died while doing what he loved best, hiking in the back country of our National Parks. His memory will be cherished by those who knew and worked with him. He worked tirelessly across the country with this program managing invasive species, restoring native species and preserving our lands for future generations. His friendship and contributions will be fondly remembered and we will all miss him, every day.



# Introduction

Invasive species are recognized as one of the major factors contributing to ecosystem change and instability throughout the world. The National Park Service (NPS) protects some of the most iconic and ecologically important areas in the United States. Invasive species are altering the native and cultural landscapes in virtually every unit of the National Park Service. The Exotic Plant Management Team (EPMT) Program was created and serves as a critical resource to strategically manage invasive plant populations that are threatening these treasured landscapes.

The teams are recognized as technical experts and leaders in invasive plant management, both within National Park Service and by partners. The success of the program can be attributed to several factors: an expert and highly trained workforce, teams designed to meet park needs, and a highly mobile workforce able to respond to changing problems and conditions. The EPMT Program provides a wide range of services to parks including inventory, monitoring, treatment, restoration of disturbed landscapes, training, facilitation and support of partnership development. Teams work with steering committees and individual parks to identify management needs and priorities.

Invasive species are introduced and spread in parks through visitors, roads, trails, waterways, maintenance activities, construction, wildlife, and from adjacent lands. Management of invasive species requires coordination across a variety of NPS programs and with land owners that surround parks. The teams facilitate partnerships with adjacent landowners, state and federal agencies, and local organizations to promote education, awareness and coordinated management of invasive species at a landscape scale.

The program was first established in 2000 with four teams serving 99 parks. The program reached its current size in 2003 with 16 teams that now serve more than 230 parks. The program continues to evolve in response to

increasing threats from invasive plants and the ability of parks to respond to these threats.

Two new Exotic Plant Management Teams, the Southeast Coast EPMT based out of Congaree National Park and Heartland Network EPMT headquartered at Wilson's Creek National Battlefield, have been established. These teams are not formally part of the National EPMT network, but function in much the same way as the national teams. Accomplishments for all teams are included in this report.



Figure 1: Control work at Grand Canyon National Park (Lake Mead EPMT).

This report contains a summary of the 2011 accomplishments for each team. Any questions regarding the EPMT Program can be directed to Rita Beard (Program Coordinator; [rita\\_beard@nps.gov](mailto:rita_beard@nps.gov)).

## Accomplishments

The EPMT Program provides critical assistance to parks in invasive plant management efforts. In the relatively short period since the

implementation of the EPMT Program, the teams have made significant strides in reducing the introduction and spread of invasive plants in and around parks. The teams participate in all aspects of invasive plant management: inventory, monitoring, treatment, prevention, restoration and research. Since the creation of the EPMT Program in 2000, the teams have inventoried 88,817,032 acres<sup>1</sup> and treated more than 115,450 acres.

Table 1: EPMT Program Accomplishments in 2011<sup>2</sup>

<b>Measure</b>	<b>Acres</b>
Treated/Retreated	8,453
Inventoried	2,164,232
Monitored	86,081
Gross Infested Area (GIA)	98,237
Infested Area (IA)	9,589

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<sup>1</sup> Inventoried acres include land outside of National Parks in cooperation with local and regional organizations and government agencies.

<sup>2</sup> Program accomplishments reflect the efforts of all EPMTs except Heartland Network and Southeast Coast, which are regionally-funded teams.



## Map of the Exotic Plant Management Teams

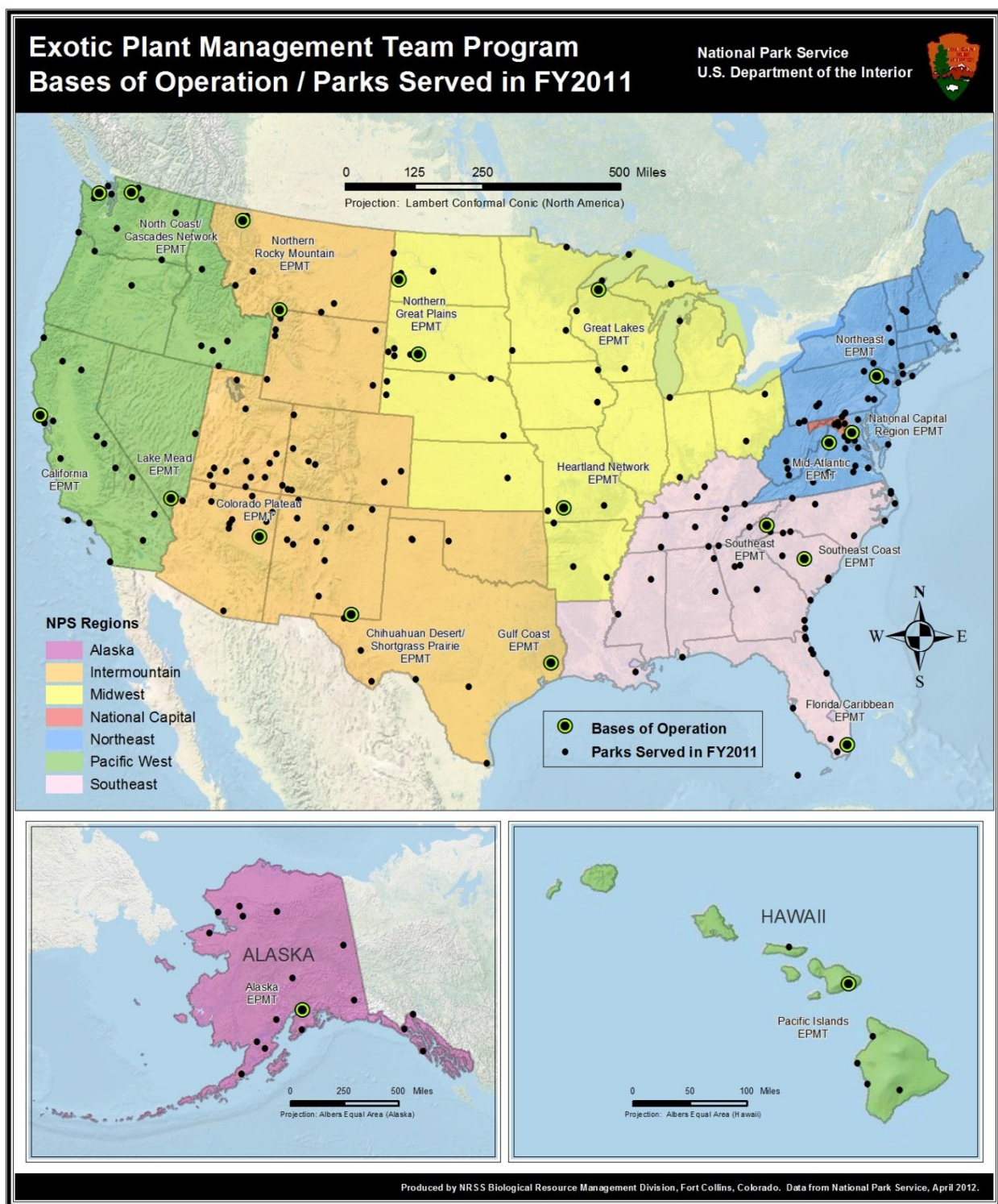


Figure 2: EPMTs provided invasive plant management expertise to parks in all seven NPS regions.

## Management Strategies

In concert with NPS policy the teams use an integrated pest management (IPM) approach to controlling invasive plants; choosing methods that are the most effective and have the least environmental impact. Throughout the year teams spend more time on treatments than any other single aspect of invasive plant management.

### Treatment

The teams employ a variety of treatment methods including manual, mechanical, biological and chemical. Treatment methods can range from prescribed burning, requiring extensive planning and cooperation from local fire managers, hand pulling individual stems with volunteer groups to aerial applications to treat large infestations.



Figure 3: Treatment of bamboo at Cowpens National Battlefield (Southeast EPMT).

In 2010 Alaska completed a management plan and an environmental assessment for all national park units in the state. Remote locations have historically limited invasive plant invasions in Alaska parks. Increased populations, tourism, trade and expansion of invasive plant populations from the U.S. and Canada have accelerated the introduction and spread of nonnative vegetation. The completion of the management plan allowed Alaska parks to institute an integrated pest management approach including herbicides in 2011. These efforts will help prevent the establishment and spread into backcountry areas of Alaska parks.

The Northern Rockies Team has been controlling widespread thistle infestation at Big Hole Battlefield since 2005. Continued monitoring and retreatment have reduced populations by 99%, allowing recovery of native plant communities.

Horehound (*Marrubium vulgare*) has been an increasing problem at Wind Cave National Park. Current surveys indicate more than 1,000 acres are currently infested. In cooperation with the park the Northern Great Plains EPMT treated over 1,100 acres. An integrated approach to the growing problem included; extensive inventories of the area, herbicide treatments and pretreatment mowing to increase the efficacy of the herbicides. The project was initiated to control horehound, restore native plant communities and in turn improve habitat for the black-tailed prairie dog, the principal food source for the endangered black footed ferret, which has been recently reintroduced into the park.

### Inventory

Inventories describe the location and abundance of invasive species allowing parks to understand the extent of invasive plant infestations and better set priorities for management. Several NPS programs contribute to inventories including the EPMTs, Inventory and Monitoring Program, and park resource managers. Invasive plant inventories are critical to understanding the threats facing park resources and provide a basis for developing and refining resource management plans. Approximately 5 – 10% of park lands have been inventoried for invasive species.

Completing park-wide inventories of invasive plants was a major focus for the Northeast EPMT in 2011. Parks needed updated inventories in preparation for completion of new invasive plant management plans. The Team completed inventories for all three Roosevelt-Vanderbilt National Historic Sites. Saratoga National Historical Park capitalized on Youth Conservation Corps funding to form a three person Invasive Plant Inventory Team. The EPMT provided training on GPS equipment and inventory techniques and project oversight. The



inventory team was able to inventory all high priority areas for potential invasion such as: roads, trails, and, rights of way. At all parks where inventories were completed, management plans will be developed during the coming winter.

During the 2011 season, the EPMT program inventoried nearly 2.26 million acres. The inventories completed by all teams during the 2011 field season revealed that there were 98,237 gross infested acres which resulted in 9,589 infested acres. Gross infested acres represent the general perimeter of an area containing invasive plants, while the infested acres represent the actual canopy or leaf cover for identified infestations. For more information please see Appendix B.

### **Monitoring**

Monitoring is used to determine changes in invasive populations, treatment effectiveness, response of native plant communities to treatment, and the success of restoration activities. In 2011, the teams monitored more than 86,081 acres. Monitoring allows teams to adjust management in response to success of past treatments, observations, new information, changing conditions, using adaptive management principals.



Figure 4: Monitoring and data collection on the island of Maui (Pacific Islands EPMT).

Many park activities such as road and trail construction and maintenance, grazing, driving and hiking can introduce invasive species. Monitoring these activities can identify new invasive plants and allow prompt treatment before populations are allowed to establish and spread. The teams work closely with the fire program to ensure that fire activities minimize

the introduction and proliferation of invasive plants. At Olympic National Park the North Cascades EPMT is monitoring and treating invasive plant populations that expanded after the Heatwave Fire. This is a joint effort between the team and fire program.

### **Restoration**

The ultimate goal of the EPMT program is to facilitate the restoration of park ecosystems to communities dominated by native vegetation that will support a full array of native fauna. Treatment of infestations may reduce invasive populations to the point where native species can regain dominance and native plant communities can recover. Ecosystems that have been highly altered by invasive plants and or disturbance may require restoration actions to restore native dominance, such as planting of native species. The teams assist in planting native vegetation including the Lake Mead EPMT planting over 2,200 native shrub stems. In the 2011 season, teams' actions fully restored more than 20 acres.

Brazilian pepper (*Schinus terebinthifolius*) readily replaces native vegetation in Florida. The EPMT in cooperation with other agencies and organizations treated more than 700 acres in 2011. Monitoring plots established on similarly treated sites in 2007 indicate that Brazilian pepper was reduced from 92% cover to 0% cover in 2011 and native species increased from 8% to 98%.

### **Prevention**

Prevention refers to actions that prevent or retard the introduction, establishment, and distribution of invasive plant species. Prevention is the most efficient management strategy for invasive species. Teams work with park staff to institute prevention practices into all aspects of park operations and with the public. Working with parks to incorporate invasive plant management into planned construction and maintenance activities is one of the ways the EPMTs build prevention activities into park operations. Prevention can include a wide variety of techniques include cleaning field equipment such as boots, tools, and vehicles, selecting routes in and out of an infestation to minimize potential dispersal, using certified weed seed

free construction and restoration materials. Teams also work with weed management groups and adjacent communities to adopt prevention strategies on a landscape scale. Following are some examples of these efforts.

For many years Whiskeytown National Recreation Area has used a waste rock disposal site as a source of gravel for road improvement projects. The site was heavily infested with cheatgrass and yellow starthistle, allowing the spread of these species to sites throughout the park. The California EPMT assisted the park in developing and then instituting practices to minimize the spread of invasive species during construction and maintenance projects. Invasive plants at the site will be controlled and new weed free sources of gravel will be found for park projects.

### ***Cooperation and Collaboration***

In addition to working within NPS, the teams facilitate collaborative efforts across park boundaries, fostering partnerships and cooperation with adjacent landowners, cooperative weed management areas (CWMAs), state offices, tribal governments, and federal agencies to more effectively manage invasive plants on a landscape scale. These partnerships provide more efficient invasive plant control over broader landscapes and can protect parks from invasive populations outside park boundaries. These partnerships also allow the teams to leverage funding with partners and cooperating entities.

Kudzu (*Pueraria montana*) was first observed at Big Thicket National Preserve in fall of 2009 along the banks of the Neches River. The newly identified infestation spanned National Park and U.S. Army Corps of Engineers (USACOE) managed lands. A cooperative agreement allowed for use of USACOE equipment to access the site and EPMT to treat the expanding infestation. The site continues to be monitored and treated under this cooperative arrangement and has prevented the spread of kudzu in the area.

Management of invasive species on the Blue Ridge Parkway near Ashville, South Carolina is

a cooperative effort between local citizen groups, private landowners and the EPMT. The program focuses on removal of exotic vine species and preservation of the native hardwood forests. The cooperative arrangement allows visitors along the parkway to see native forests and prevents invasive vines from spreading both from private land and the Parkway.

The EPMT program has an impressive track record with youth employment programs providing training and career tracks into seasonal and then permanent employment in natural resources. Former interns are now in supervisory positions in invasive plant programs throughout the service. More than half of our current Exotic Plant Management Teams (EPMT) term, permanent and leadership positions are former youth program interns. The Chihuahuan Desert Team has fostered a long standing partnership with AmeriCorps using these youth crews for a number of projects in the New Mexico parks. The Southeast Team has placed 65 interns from the Student Conservation Association since 2004.



Figure 5: Volunteers at Kenai Fjords National Park (Alaska EPMT).

### ***Outreach and Education***

Outreach and education are critical to successful management of invasive plants. Audiences range from visitors to park staff and park partners. Teams work with parks, cooperative weed management areas, friends groups, and many other groups to educate citizens, land managers, and resource users about the issues invasive species can introduce or exacerbate.

The Great Lakes EPMT has been able to leverage funding through the Great Lakes Initiative to increase education and awareness programs throughout the region. A large media campaign developed posters, interpretive kiosks, billboards, short educational films, and boot brush stations that extend the message of preventing the spread of invasive species beyond the borders of the parks.

## **Safety**

The Exotic Plant Management Teams often work in demanding and hazardous conditions. Treatments may require the use of potentially hazardous equipment such as chainsaws, weed wrenches, ATVs, and helicopters. Crews must often hike for long distances, carrying heavy loads and navigate remote, steep, and uneven terrain. Pack stock and technical climbing equipment are used to reach remote invasive plant infestations.

To manage these hazardous working conditions the EPMT program emphasizes safety and caution in all operations. Each team prepares a job hazard analysis for every type of operation. These analyses are updated frequently to reflect current conditions. On the job safety meetings are held frequently, reinforcing good safety practices. The teams work with each park to ensure that the safety plans and hazardous analyses meet park standards and local environmental conditions. The teams have recorded over a million field hours over the last 10 years with very few lost time injuries, representing less than .02% percent of the field hours. The admirable safety record of EPMT program is a testament to the dedication to safety and the expertise of the teams.



# Exotic Plant Management Team Program Future and Review

## Future of the Program

Effective management of invasive species requires continued vigilance. Seeds can remain viable in the soil for more than 20 years. To maintain the accomplishments of the teams, parks and teams must be able to monitor and continue treatment. Teams have reduced the cover of invasive plants to less than 1% over thousands of acres, but if not monitored or treated the areas can quickly be re-infested by invasive plants. Invasive species have the ability to affect all aspects of park management and require a cohesive management approach that considers input from a multidisciplinary perspective.

The EPMT program, like many others, is facing the challenge of maintaining services. Only a small portion of parklands have been inventoried for invasive species. Of the 395 national park units, the EPMT program currently assists only 230 parks with invasive plant management. Despite the success of the EPMT's collaborations with partner parks, there are extensive areas infested with invasive plants that remain untreated. It is estimated that NPS treats less than 5% of known infestations each year. Climate change, introduction of new invasive species, changing fire regimes, and habitat fragmentation are all processes that will increase invasive species pressure on native ecosystems.

## EPMT Ten-Year Review

A review of the Exotic Plant Management Team program was initiated in 2010, with the final report completed in April 2011. The purpose of the program review was to:

- Assess the effectiveness and efficiencies of the current EPMT organization and program.
- Assess the degree to which EPMT efforts are reducing and can continue to reduce impacts from invasive plants locally, regionally, and nationally.

- To identify the need for changes or modifications to the current program to address evolving park, regional, and national invasive plant management needs.

The review found that the EPMT program has been a success; it is highly regarded by the parks and NPS partners, it has been very effective in assisting parks with managing invasive plants and a small core investment in the program has resulted in large gains in invasive plant management.



Figure 6: Collecting senna seeds at Kalaupapa National Historical Park (Pacific Islands EPMT).

The review resulted in several recommendations including:

- Forming a national advisory group for the program;
- Creating a strategic plan for the coming years, including resources need to support the program into the coming years and provide services to current unserved park units;
- Create a service-wide database for invasive plants, and;
- Establish or review charters and steering committees for all EPMT units.

The Review findings and recommendations will be used to guide the EPMT Program over the next decade. We hope to use the program's past successes to guide management of invasive species and the EPMT program into the future.





# **Exotic Plant Management Team Reports**



The Alaska Exotic Plant Management Team (EPMT) provides invasive plant management assistance to each of the 16 national parks in Alaska. These parks cover over 52 million acres of pristine natural areas and wilderness, including coastal fjords, glacial valleys, tundra, and boreal forests. The majority of national parks in Alaska contain healthy, intact native ecosystems with very low levels of infestation by invasive plants.

The geography of Alaska makes invasive plant management strategies more difficult than in the lower 48 states. Most parks have little or no road access, multiple dispersed backcountry uses such as concessionaires, subsistence, airstrips, or public use cabins. Travel and access costs are high even in some cases to simply arrive at a park boundary. This is the main reason why the program dedicates individual staff members and resources to select parks for an entire season. This structure improves the local knowledge base, reduces the amount of resources being directed towards travelling between parks, and more efficiently manages front country infestations.

### **2011 IPM Program**

With the signing of the Invasive Plant Management Plan in 2010, the 2011 season marked the first time the EPMT incorporated herbicide treatments into invasive plant management at the 16 Alaska parks. The entire 2011 herbicide program was funded by an Alaska Regional Block Grant with the exception of the EPMT Liaison's time, which came from EPMT base funding. Being the first time for herbicide use there were several hurdles in

getting parks prepared, such as getting parks to submit Pesticide Use Proposals, something that most Alaska parks have never done before. The process began early in the year with the EPMT staff working with parks to determine priority treatment areas and ideal treatment times, something that was made easier by consulting the multiple years of phenology logs which EPMT crews have collected. Infestations in four parks were chosen and parks began the process of getting compliance in place with input from EPMT staff on treatment details.

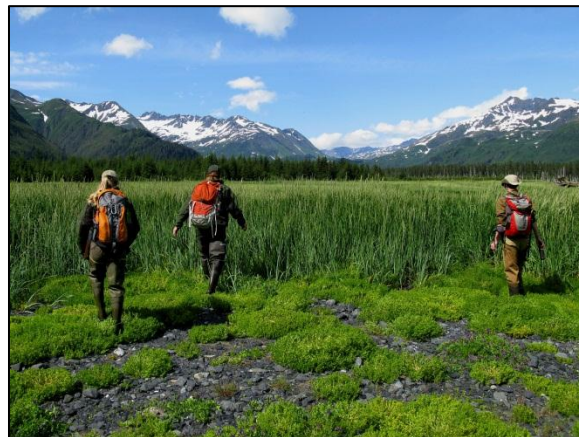


Figure 7: Crew members hike to a remote infestation at Kenai Fjords National Park.

Due to some hesitation by parks, all 2011 herbicide applications were handled entirely by EPMT regional staff. This led to significant investment in time and money for travel to and from Anchorage, and challenges anticipating weather and plant phenology. Learning from this experience, it is planned that park-based EPMT staff will be trained and certified as pesticide applicators during the 2012 season and they will lead the herbicide treatments, with

some assistance from regional staff if a project warrants. It is anticipated that all 2011 herbicide treatment areas will be revisited and retreated in 2012.

Another difficulty faced during this season was the relatively cool spring, which greatly delayed the development of the target species in some areas and inhibited access in others, with lakes not fully thawing and therefore blocking float plane access. This greatly compressed the spring treatment window for three parks: Katmai National Park & Preserve, Kenai Fjords National Park, and Wrangell-St. Elias National Park & Preserve. The treatment schedule that had started as a full week of treatments at each park had to be condensed into a couple of days. Luckily, EPMT staff was still able to fully treat the target infestations of bird vetch (*Vicia cracca*) and common dandelion (*Taraxacum officinale ssp. officinale*) at Katmai and narrowleaf hawksbeard (*Crepis tectorum*) at Wrangell-St. Elias, however, only a containment treatment around the infestation of common dandelion at Kenai Fjords was possible.



Figure 8: Park biologist Christina Kriedeman and crewmember Travis Fulton prepare for a backcountry survey trip.

Only Glacier Bay National Park & Preserve had a fall treatment scheduled, targeting perennial sowthistle (*Sonchus arvensis*). This infestation occurs at an old fox farm site in an area that is within designated Wilderness. This was yet another site where weather was an issue with treatment plans, as fall rains began early. Within the week that had been scheduled only one day of treatment was possible. Only a containment treatment was possible. Due to the

difficulty of fall weather in southeast Alaska, it is planned to move the timing of this treatment to the spring.



Figure 9: Removal of an infestation of common timothy (*Phleum pratense*).

Overall, monitored treatment sites have so far shown a good reaction to the herbicide treatments with minimal off target impacts. Areas will continue to be monitored by park staff next spring in preparation for the second round of treatments. After this initial year of herbicide application there are two new parks looking to participate during the 2012 season – Denali National Park & Preserve treating bird vetch and Sitka National Historical Park treating European mountain ash (*Sorbus aucuparia*).

Table 2: Alaska EPMT Accomplishments

Measure	Acres
Treated/Retreated	52
Inventoried	108
Monitored	596
Gross Infested Area (GIA)	766
Infested Area (IA)	175



## Chihuahuan Desert / Shortgrass Prairie EPMT

The Chihuahuan Desert / Shortgrass Prairie Exotic Plant Management Team (EPMT) serves 14 National Parks ranging across 600 miles of southwestern arid lands in the states of New Mexico, Texas, Colorado and Oklahoma.

This network of parks preserves and protects a wide range of unique natural and cultural settings, from the gypsum dune fields of White Sands National Monument, north to some of the last remaining Shortgrass Prairie communities in the southern Great Plains, and south to Big Bend National Park, a United Nations designated Biosphere Preserve. Collectively, these parks manage more than one million acres. While diverse, common threads among these parks are native biological systems adapted to an arid climate, and increasingly heavy pressure from exotic species.

2011 was an exceptionally challenging year, as the network area is experiencing the worst drought since the Dust Bowl of the 1930's. Abnormal plant emergence and major wildfires on two of the parks led to constant reformulation of operational plans and timing. A series of backup plans enabled us to redirect crews to alternative projects and cope with emerging issues.

Washita Battlefield National Historic Site in Cheyenne, Oklahoma is a prime example of the challenges and opportunities faced by the network's grassland parks. Originally, the EPMT was tasked with extirpation of saltcedar (*Tamarix ramosissima*) and Siberian elm (*Ulmus pumila*) which were degrading riparian habitat and water supplies associated with the Washita

River. Through intensive effort by the EPMT in collaboration with Black Kettle National Grassland, and a Memorandum of Understanding with neighboring property owners, these populations were reduced significantly to a small annual maintenance level. This accomplishment was exceptionally timely as the prairie communities at Washita and the other grassland parks are now threatened by an alarming increase in a different class of exotic invasives, rangeland and agricultural weeds.

This change in focus has necessitated a change in operational tempo, strategies, and materials and methods. Building on a well-established partnership with AmeriCorps and strong lines of communication with park staff and Inventory & Monitoring crews, EPMT staff was able to arrive at the park with solid information on exotic species presence, abundance and distribution, and prepare a plan of attack prior to the arrival of the crew. This approach enabled us to simultaneously treat multiple species in high priority areas, and develop a plan to return the entire park to maintenance level in three years. This year's efforts focused on cheatgrass (*Bromus tectorum*), Johnsongrass (*Sorghum halepense*), field bindweed (*Convolvulus arvensis*), and yellow sweetclover (*Melilotus officinalis*). Target areas were vector routes and dense floodplain infestations, next year the priority will be boundary lines and rights-of-way, with a third year objective of treating disjunct infestations in the interior. This approach was also applied to Capulin Volcano National Monument, and will be utilized next

year at Fort Union National Monument and Pecos National Historic Site.



Figure 10: Amistad second saltcedar treatment – before.



Figure 11: Amistad second saltcedar treatment – after.

None of these operations could have had the same degree of success without the impressive increase in support and follow-up work undertaken by partner park staff. Also illustrative of partners' growing interest in adaptive management, Washita played host to the program's first workshop on prescribed grazing sponsored by the EPMT and Texas A&M University.

At the geographically opposite end of the network is another example of change in EPMT focus; providing training, support, and technical guidance to park staff. Amistad National Recreation Area on the Texas-Mexico border is a park with severe exotic plant problems. As is the case with more than half of the networks' parks it had no natural resource staff. When a resources staff was hired this year, the EPMT

immediately programmed in time to provide training in Vegetation Management, Chainsaw Operators certification, and herbicide training. With a trained staff newly created, Amistad is now able to supplement EPMT control operations, and provide critical inventory and mapping support. This support enabled the EPMT to efficiently utilize one contract and one AmeriCorps crew to remove more than one half of the saltcedar population in a high visitor use area, this project is scheduled for completion in 2012.

Table 3: Chihuahuan Desert / Shortgrass Prairie EPMT Accomplishments

Measure	Acres
Treated/Retreated	210
Inventoried	1,291
Monitored	0
Gross Infested Area (GIA)	1,173
Infested Area (IA)	110





There are 23 parks within the Colorado Plateau (COPL) region partnering with the Exotic Plant Management Team (EPMT) Program. In 2011, the Colorado Plateau Exotic Plant Management Team partner parks were served by the Lake Mead and Northern Rockies EPMTs, while the team is undergoing consideration for re-organization. The Lake Mead EPMT conducted priority exotic plant control projects in nine of the COPL NPS Units during 2011 and the Northern Rockies in two parks.

During October 2010 the Team treated the last remaining Russian olive (*Elaeagnus angustifolia*) trees along the Green River within Dinosaur National Monument. This was a significant and nostalgic accomplishment since Dinosaur NM was an original partner of the Lake Mead EPMT during its developmental era in the late 1990's. The Team continued controlling Russian olive during October 2010 in the Wahweap area of Glen Canyon National Recreation Area.

In early November 2010 the Team assisted Wupatki National Monument with preparing a site at Deadman Wash for development of a community garden for native riparian trees. The team cleared large areas of tamarisk (*Tamarix spp.*) and controlled camelthorn (*Alhagi pseudalhagi*). These areas will be planted with cottonwood (*Populus spp.*) and willow (*Salix spp.*) trees, and once established this site can be a propagule source for other restoration sites. The concept for the restoration project in cooperation with Northern Arizona University is to utilize trees adapted to these harsh site

conditions and adapted to the anticipated climate change conditions.

Later in November the crew returned to Russian olive control this time in Black Rock Canyon within Canyon De Chelly National Monument. It is important to focus on Russian olive control throughout the region due to the further establishment of the tamarisk leaf beetle biological control agent. Once tamarisk cover is reduced by the leaf beetle it is likely that Russian olive populations will expand if left unmanaged. The good thing is that the Lake Mead EPMT is well equipped and capable of accomplishing Russian olive control which requires expertise, skills and labor intensity beyond the capacity of some partner parks.



Figure 12: The late Jacoby Rigby with chainsaw and crew clearing tamarisk around willows to prepare for community gardens at Deadman Wash, Wupatki NM, Arizona.

The team also put away the chainsaws and conducted a small cheatgrass (*Bromus tectorum*) control project at Keet Seel cultural site within Navajo National Monument and consulted with

local park staff to continue control efforts since it is not widespread within the Monument yet. If cheatgrass is not managed within this site, it will increase hazardous fire fuels and threaten the cultural sites.

In the spring of 2011 the Team assisted Grand Canyon National Park controlling tamarisk at Crystal Creek, a tributary of the Colorado River. These river based projects are logistically challenging and require extensive planning and hiking by the crews. Grand Canyon NP staff provided excellent support to the EPMT crews working effectively together to accomplish the project and overcome these difficult challenges.



Figure 13: Lake Mead EPMT with local park staff hiking out to control Russian knapweed at Yucca House NM, Colorado.

In June the EPMT Liaison spent a few days with Glen Canyon National Recreation Area staff to inventory and map multiple exotic plant species along the San Juan River. The result was a map for the park which will be used for controlling isolated populations of Ravenna grass (*Saccharum ravennae*) inside and outside the NPS lands. The Park is coordinating with the Bureau of Land Management and the Navajo Nation along the river corridor to utilize the EPMT to eradicate Ravenna grass.

In September 2011 the Team split up to serve multiple parks at the same time controlling several herbaceous species and thistles at Mesa Verde National Park and Yucca House National Monument. At Chaco Culture National Historical Park the team worked with the Southwest Colorado Conservation Youth Corp crew to control tamarisk that was impeding

access to the cultural site. A combination of EPMT funds and park funds will be used in the future to continue with this long term project to protect park resources and provide employment to youth.

The Team also conducted multiple interagency exotic plant control projects on the Colorado Plateau. Cooperative agreements were developed with the U.S. Forest Service on the Kaibab, Coconino and Prescott National Forests. Additional partnership projects were conducted with the Navajo Nation Bureau of Indian Affairs and a new agreement was established with the Arizona Fish and Game Department to conduct exotic plant control on the Upper Verde River Wildlife Habitat Area. These partnerships provide supplemental funding for the team, increase government efficiency and ensure weeds are being managed on a cooperative basis across agency boundaries.

In October, 2010, the NRM-EPMT continued very successful projects at Dinosaur NM (DINO). Each October since 2008, the Team has travelled across network boundaries to assist that remote park in fall projects controlling Russian knapweed (*Acroptilon repens*), Russian olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix ramosissima*). In 2008, the first year of these trips, the Team treated 31.4 acres of Russian knapweed that heavily covered 126 acres. By 2010, there was only a trace of knapweed and olive remaining, so the Team has turned its attention to other species and areas, treating about 10 acres of numerous species of non-natives around the park. These projects fit well at the end of the field season, when the network's partner parks are winding down operations.

Table 4: Colorado Plateau EPMT Accomplishments

Measure	Acres
Treated/Retreated	55
Inventoried	4,664
Monitored	250
Gross Infested Area (GIA)	3,687
Infested Area (IA)	137





The Gulf Coast Exotic Plant Management Team (EPMT) spans the Gulf Coast region from Texas to Florida and includes six partner parks and two non-partner parks. This is a region of warm year round temperatures, high precipitation, and high plant diversity, including a high diversity of exotic vegetation.



Figure 14: Post treatment kudzu on a bluff along the west bank of the Neches River in the Big Thicket National Preserve. Photograph taken in June 2010 by Eric Worsham, Team Liaison.

New species of exotic vegetation are discovered annually in our parks and the EPMT makes every effort to control those new exotic populations before they have a chance to spread to a larger area. The western riparian corridors are infested with Chinaberry tree (*Melia azedarach*), Japanese privet (*Ligustrum japonicum*), Japanese honeysuckle (*Lonicera japonica*), giant cane (*Arundinaria gigantea*), and golden bamboo. In the western upland parks, common invasives include musk thistle (*Carduus nutans*), old world bluestems, and Johnsongrass (*Sorghum halepense*). Coastal

parks are primarily concerned with invasive grasses such as cogon grass (*Imperata cylindrical*), phragmites (*Phragmites australis*) and old world bluestems which are adapted to low lying wet areas. The lowland forest sites face threats from Chinese tallow (*Triadica sebifera*), royal paulownia (*Paulownia tormentosa*), mimosa tree (*Albizia mimosa*), and kudzu among many others.

The recent hurricane history in the region has provided ample opportunity for these species to gain a foothold in stressed native ecosystems. Most of the forested ecosystems within the parks have the potential to naturally revegetate after invasive species are removed. Disturbed grasslands within the parks require more active restoration efforts. These sites often need decades to naturally revegetate with native species unless reseeding and weed control are practiced. The focus of our team in the coming years will be to replace these exotic species with suitable, adapted native species, both in an effort to restore native habitats and to prevent re-infestation of exotic species from surrounding exotic plant populations and the remaining seed bank.

Kudzu (*Pueraria montana*) was observed by park staff of the Big Thicket National Preserve in the fall of 2009 growing on a high bluff along the banks of the Neches River. This species had not been previously reported at the park, and given its ominous reputation, assumed a high priority by the park for eradication. Control efforts were partnered with the US Army Corps of Engineers (USACOE) by a Memorandum of Agreement to provide access, coordination and



planning assistance. USACOE assistance included operation of army owned heavy equipment to facilitate access for control efforts by the National Park Service on both USACOE and NPS managed lands. Kudzu treatments were initiated in 2010 with a second treatment in 2011. An additional treatment for 2012 has been scheduled and it is expected to take five years to bring the population under complete control. This project demonstrates three essential fundamentals of the Exotic Plant Management Teams; early detection and rapid response, coordination with adjacent land owners to allow treatment of the entire population, and partnering to increase both the magnitude and efficiency of the control effort.



Figure 15: Photograph of the west bank of the Neches River in the Big Thicket National Preserve taken one year post treatment, June 2011, demonstrating the success of the prior year's effort. Photograph by Eric Worsham, Team Liaison.

Management efforts in future years will shift from a focus on control to an emphasis on restoration. Initial restoration efforts will focus on grassland habitats. Prairie restoration plans will be in place at several network or proposed network parks including San Antonio Mission National Historic Park, Lyndon Johnson National Historic Park, and Palo Alto Battlefield National Historic Park. Infrastructure required to facilitate the shift to restoration was purchased this year and will be followed by procurement of plant materials, seed and supplies in the spring. This is an exciting new horizon for the EPMT. The ultimate goal of the EPMT program is to restore native ecosystems. Given the extensive infestations and persistence of many invasive

plants, site restoration is a great achievement; one that did not always seem feasible.

Table 5: Gulf Coast EPMT Accomplishments

Measure	Acres
Treated/Retreated	283
Inventoried	19,797
Monitored	183
Gross Infested Area (GIA)	3,440
Infested Area (IA)	284



The 15 partner parks served by the Northern Rocky Mountain Exotic Plant Management Team (EPMT) consist of more than four million acres spread across four states (Idaho, Montana, Utah, and Wyoming) and two NPS regions (Intermountain and Pacific West). Encompassing high desert, forests, sub-alpine meadows, sagebrush-steppe, wetland and riparian areas, as well as unique thermal features, the area is immense and diverse. Because of the vastness of this region, the EPMT is divided into three, 3-person crews strategically based at parks throughout the network, so that all partner parks receive annual work. Since its inception in 2003, the EPMT has assisted partner parks with protecting and improving the health of native habitats in these diverse areas. The EPMT's goals emphasize the systematic, long-term management and control of invasive plant species. Much of the effort is focused on controlling state listed noxious weeds, as well as providing rapid response to new invaders. The EPMT employs scientifically-based Integrated Pest Management, so that its actions on the ground are effective, efficient and safe for the public and the environment.

### ***Dyer's Woad in Idaho***

Jointly managed by the Bureau of Land Management and National Park Service, Craters of the Moon National Monument and Preserve is a 750,000 acre preserve that protects three large lava flows that emanate from the Great Rift. In 2007, park staff discovered Dyer's woad (*Isatis tinctoria*) invading the southern end of the Preserve and threatening to invade the unique habitats within the kapukas – isolated, small

pockets of grass/shrublands encircled by lava flows.

To address this population effectively, the EPMT brought together all nine team members to augment the park weed crew for the first trips of the spring in 2009 and 2010. In addition, Park staff sought and received special project funding starting in 2011 to allow two 8-day visits in May and early June. These intense visits supplemented the work of the park crew, who surveyed and treated before the EPMT's arrival and continued the work between their visits.

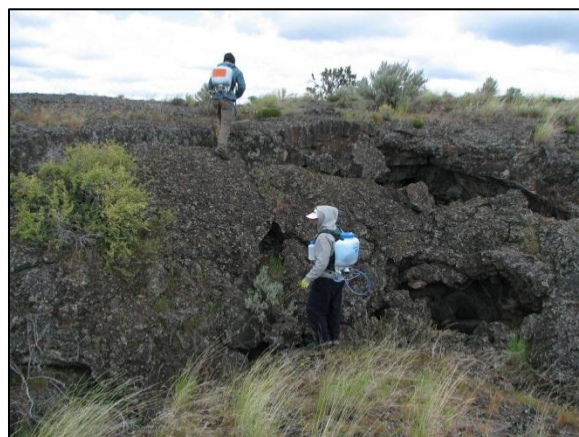


Figure 16: Climbing the Wapi Lava Flows to search out Dyer's woad in the kapukas, Craters of the Moon NM&P.

Spring and fall surveys in 2011 indicated that the population was significantly reduced from the previous year. A cool, wet spring may have contributed to a smaller spring population. However, the smaller fall population suggested that at least some of this reduction can be attributed to successful treatments.

The EPMT anticipates continuing spring trips at least another year. With continued success, it should be possible to reduce the number of days and/or EPMT members needed to continue controlling the Dyer's woad.

### **Grand Teton Three Rivers Area**

The Three Rivers Area is about 300 acres of riparian habitat within the Moran District of Grand Teton National Park. It is a complex region consisting of open fields, river banks, large and small forest tracts with many hidden pockets and fingers containing invasive species. These pockets contain mostly thistles but the EPMT treated six species – musk thistle (*Carduus nutans*), Canada and a few bull thistles (*Cirsium arvense* and *Cirsium vulgare*), common tansy (*Tanacetum vulgare*), houndstongue (*Cynoglossum officinale*) and oxeye daisy (*Chrysanthemum leucanthemum*).

Three members of the EPMT sprayed the open meadow areas in 2010. 2011 treatments concentrated on the small pockets and fringe areas full of fallen logs and other obstacles, and re-treating the open areas.

It will take several years to reduce the exotic plant populations. Then park re-vegetation crews can begin planting native species to complete the restoration of this gorgeous area. A perfect project for the EPMT that highlights the cooperation between the team and park staffs, the crew looks forward to continuing work in this truly wild and remote area.

### **Nez Perce National Historic Park Montana Sites**

Nez Perce National Historic Park is a complex of 38 small sites throughout Idaho, Montana, Oregon and Washington that commemorate the history of the Nez Perce people and their interactions with European explorers and settlers who moved through or into their traditional territory. There are two such sites in Montana which are part of the EPMT network – Bear Paw Battlefield and Big Hole National Battlefield. The two small parks (197 and 673 acres, respectively) are comprised of dry, open sagebrush prairie with willow and grass riparian corridors. These parks are relatively weed-free,

although the weeds they do have can be challenging to control – Canada thistle (*Cirsium arvense*), spotted knapweed (*Centaurea maculosa*), field bindweed (*Convolvulus arvensis*), and common tansy (*Tanacetum vulgare*), among others.



Figure 17: Picking through debris and native plants to spray thistles in the Three Rivers Area, Grand Teton NP.

One of the primary missions of the EPMT program is to assist small parks with exotic plant control when they do not have staff to conduct such management activities. The EPMT started treating at Bear Paw Battlefield in 2010, after the park completed a floral survey. In just two days, the EPMT covered the entire park, spraying Canada thistle and small patches of bindweed. The thistle treatments have already shown success, with the population reduced by 64% after only one year. Thistle treatments at Big Hole National Battlefield have been equally successful, with a reduction of 99% since 2005. This has allowed the three-person crew to concentrate more on spotted knapweed, the most tenacious weed in that park. Eventually the EPMT hopes to maintain control of these invasive plants during visits only every two or three years.

Table 6: Northern Rocky Mountain EPMT Accomplishments

Measure	Acres
Treated/Retreated	225
Inventoried	5,276
Monitored	10,376
Gross Infested Area (GIA)	12,574
Infested Area (IA)	265





The Great Lakes Exotic Plant Management Team (EPMT) provides support to ten national parks across four states in the western Great Lakes Region. From the boreal forests of northern Minnesota, to the dunes along the eastern and southern shores of Lake Michigan, and west to the scenic river ways of Wisconsin and Minnesota, this region claims diverse aquatic and terrestrial ecosystems. Harsh winters and long distances from coastal ports have mostly limited the impact of invasive species to those of cultural origin such as buckthorn (*Rhamnus sp.*), black locust (*Robinia pseudoacacia*), and purple loosestrife (*Lythrum salicaria*). However, visitor use and maintenance activities have introduced new invasive species. The EPMT balances its activity to meet two vastly different needs: (1) long-term, large-scale control and restoration, and (2) early detection and eradication of nascent populations.

### ***Restoration in Mississippi National River and Recreation Area***

In 2010, the Mississippi National River and Recreation Area based in metropolitan St. Paul, Minnesota acquired a 27 acre parcel of land that was previously owned by the Bureau of Mines. The land had been managed as lawn with a small wooded area and later abandoned. During the 15 years of abandonment, invasive species such as common buckthorn (*Rhamnus cathartica*) and garlic mustard (*Alliaria petiolata*) have overtaken the once open savanna. The park intends to restore the site to its historic habitat: prairie/oak savanna. Several 150 to 200 year old open-grown oak trees that helped document the area's historic vegetation remain. In the

spring of 2010, the EPMT began cutting invasive brush. During several trips to the site in 2010 and 2011, nearly all buckthorn was cut, and garlic mustard control was initiated. Following each of the EPMT's visits, massive amounts of brush were removed by park staff, volunteers and community crews. Brush piles were used as biofuel by District Energy in St. Paul, Minnesota to produce energy.



Figure 18: Volunteers from Mississippi National River and Recreation Area hauling brush for the EPMT during buckthorn removal.

After years of being overshadowed by invasives, native vegetation has begun to repopulate the site. However, several years of work will be needed by the EPMT, the park, and dedicated volunteers to prevent the reestablishment of invasive plants. During the winter of 2012, contractors will remove 11 buildings and re-grade several areas. Reseeding and careful monitoring for new invasives will be necessary following demolition. Follow-up treatment of garlic mustard and buckthorn will be required for several years given the established seed

bank. Maintaining the restored site in an urban setting will be an ongoing effort even after the project has been completed.



Figure 19: EPMT conducting hybrid cattail management in Brady Cove at Isle Royale National Park.

### **Early Detection Efforts at Isle Royale National Park**

Remote locations also require invasive species management, as populations of invasives can go unnoticed due to their isolation. Isle Royale National Park, an island located in Lake Superior, contains over 132,000 acres of wilderness with shoreline habitats that are important for wildlife such as moose and state-threatened common loons. The park's isolated geographical location helps limit the number of invasives that impact the island. However, management efforts can be very challenging due to limited accessibility and an inability to effectively monitor the island. In 2010 the EPMT began control of hybrid cattails (*Typha spp.*) located on McCargo Cove and Brady Cove, and on an inland lake, Sargent Lake. Invasive species in these areas can easily spread to several of the park's high quality wetlands. Following treatments, a flush of native wetland species emerged in one of the formerly densest stands of hybrid cattails in Brady Cove. A high degree of success in these areas will allow the EPMT to expand efforts to other more remote inland lakes that may have established populations of hybrid cattails or other invasives.



Figure 20: Filming of Great Lakes Restoration Initiative videos on invasive species in the Apostle Islands National Lakeshore.

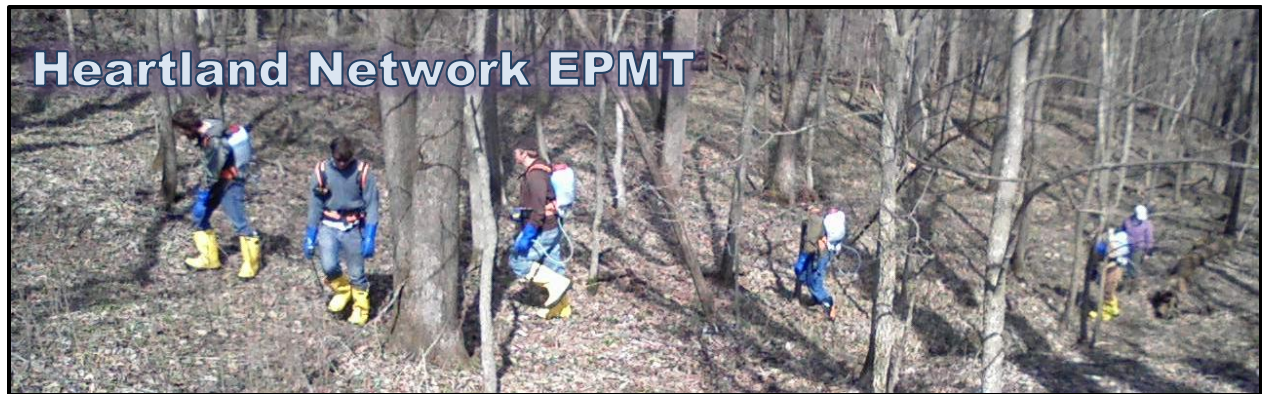
### **Program Leverage through the Great Lakes Restoration Initiative.**

Funding from the Environmental Protection Agency in 2010 and 2011 through the Great Lakes Restoration Initiative allowed the EPMT to increase on-the-ground control and education efforts in Great Lakes national park units. Specifically, funding provided seasonal support to parks that lacked resources to adequately manage invasive species and augmented existing programs in parks. As control efforts are only part of a cohesive invasive species management program, additional funding supported programmatic compliance, inter-agency data sharing, and provided interpretive activity in the parks and surrounding communities. A large media campaign developed posters, interpretive kiosks, billboards, short educational films, and boot brush stations that extend the message of preventing the spread of invasive species beyond the borders of the parks.

Table 7: Great Lakes EPMT Accomplishments

Measure	Acres
Treated/Retreated	53
Inventoried	651
Monitored	177
Gross Infested Area (GIA)	651
Infested Area (IA)	54





The Heartland Network Exotic Plant Management Team (EPMT) is a collaborative partnership between 15 parks in the National Park Service's Midwest Region. The parks, located in eight states, support a range of plant communities. These plant communities include tallgrass prairie, consisting of unplowed prairie in the Flint Hills of Kansas and Sioux quartzite outcrops in Minnesota and numerous prairie restorations; Eastern deciduous forests, ranging from Northeastern Iowa to Northwestern Ohio; Midwestern riparian woodlands, such as cottonwood- and bur oak-dominated forests; mixed shortleaf pine-oak-hickory forests in the Ozark and Ouachita Mountains; and a variety of wetlands from southeastern cypress-tupelo swamps to emergent wetlands along tributaries to Lake Erie. The majority of these parks commemorate important historical events, locations, people, and, cultural practices, which requires integrating invasive plant management into cultural, as well as natural, landscapes. The diversity, complexity, and geographical extent of these park resources requires the commitment and shared expertise of all cooperating parks to sustain an invasive plant management program.

The EPMT has committed to the control of garlic mustard (*Alliaria petiolata*) at Effigy Mounds National Monument. Park staff began herbicide treatment in 2004 to kill seedlings and rosettes and to use torches to incinerate seeds while still within fruits in 2008. In 2011, the EPMT was able to provide additional staff during the early spring and late fall, when garlic mustard can be treated with little to no collateral damage to adjacent native plants. The EPMT staff provided 11 staff days and funded 100 days

of effort from Conservation Corps of Iowa (CCI) staff during April and October 2010 and April 2011. Park staff supervised and coordinated the activities of the CCI to ensure safe work practices within areas of highest priority, including exotic-plant control within the forests of the northern and Heritage units on the park. The model for these efforts is the southern unit of the park, in which to date, control efforts only require eradicating few newly establishing populations. In 2012, the EPMT will re-treat the majority of the areas treated in 2011. In this way, treatment data will serve as monitoring data, and we expect to see significant reductions in cover. The outcome will be carefully evaluated to assess whether garlic mustard control at a scale of 2,000 acres is viable.



Figure 21: Conservation Corps Iowa treating Garlic Mustard at Effigy Mounds National Monument.

In 2011, the EPMT partnered with parks to prepare or maintain restored prairies within several parks. At Herbert Hoover National Historic Site, the EPMT supported a veteran seasonal biotechnician and CCI staff to control

reed canarygrass (*Phalaris arundinacea*) prior to planting the sites with a mixture of native warm season grasses, such as big bluestem (*Andropogon gerardii*) and forbs. The EPMT will support follow up treatments in 2012 to control re-establishing reed canarygrass.

In Tallgrass Prairie National Preserve, the EPMT staff, park staff, and CCI, spent over 70 staff days maintaining a newly established bottomland prairie. The crew treated Johnsongrass (*Sorghum halepense*) that may spread at the expense of the native grasses. The crew also removed numerous black locust trees (*Robinia pseudoacacia*) to reduce seed sources that lead to woody plant encroachment in the prairie. Given that invasive plant control is especially critical during the first years following planting, the EPMT expects to continue with this project over the next two to four years. At George Washington Carver National Monument, Homestead National Monument of America, and Wilson's Creek National Battlefield, EPMT staff spent over 40 days controlling Chinese lespedeza (*Lespedeza cuneata*), smooth sumac (*Rhus glabra*), and winged sumac (*Rhus copallinum*). Following treatment in 2009 and 2010, the 2011 treatment required much less effort and chemical use in these long-established restorations.

The EPMT support allowed to Cuyahoga Valley National Park (CUVA), Hopewell Culture National Historical Park and Lincoln Boyhood National Memorial to leverage additional funds and expand partnerships. Using matching funds provided through the Great Lakes Restoration Initiative and other sources, CUVA hired an exotic-plant-crew leader and crew, as well as a coordinator to create a cooperative weed management area within the Cuyahoga River Watershed. Support provided by the EPMT also enabled CUVA to obtain funds to control exotic plants and reforest two disturbed sites totaling 64 acres, and to partner with Cleveland Metroparks to win a \$380,000 grant to provide equipment and multi-year work crews to combat exotic plants on NPS and park-partner lands.



Figure 22: Student volunteers clearing Autumn Olive at Cuyahoga Valley National Park.

Working with nearly 1,500 volunteers who contributed more than 11,000 volunteer hours, the EPMT treated exotic plants on over 200 acres at CUVA, specifically targeting upland and bottomland habitats that support rare plants. Exotic plants of primary concern included Japanese knotweed (*Polygonum cuspidatum*), bush honeysuckle (*Lonicera* spp.), common privet (*Ligustrum vulgare*), autumn olive (*Eleaagnus umbellata*), multiflora rose (*Rosa multiflora*), common reed (*Phragmites australis*) and garlic mustard. The EPMT focused particular efforts on controlling autumn olive and bush honeysuckle at the Terra Vista Natural Study Area at CUVA. Treatment of this 150-acre site began in 2010 with an EPMT crew funded partially by the Heartland Network EPMT program. Native plants have recolonized much of the site and natural colonization will be supplemented with additional seeding in 2012, 2013, and 2014. In the fall of 2012, park staff plans to introduce prescribed fire to promote restoration of native plant communities at the site.





## Northern Great Plains EPMT

The Northern Great Plains Exotic Plant Management Team (EPMT) works with fourteen partner parks in four states and two regions, consisting of more than 452,000 acres. These parks share the characteristics of prairie grasslands but vary in rugged badlands, steep tree covered hills and river valleys. EPMT goals focus on controlling the spread of invasive species and restoring areas to native plant communities. Emphasis is placed on Integrated Pest Management techniques including chemical control and restoration using manual control, prescribed burning and reseeding. Providing training to park staff and partners on identification, early detection and rapid response, and control techniques is a team priority.



Figure 23: Wind Cave Resource Management staff assisted EPMT ATV riders with filling water and herbicide to keep things rolling over an intense three days of application.

### **Horehound Control at Wind Cave National Park**

The EPMT undertook a brand new project this year, chemically treating horehound (*Marribium vulgare*) at Wind Cave National Park (WICA). Horehound has become a huge problem in the park, taking over a thousand acres of prairie dog

towns, thus losing valuable habitat for black-tailed prairie dogs. Prairie dogs are the main food source for the threatened and endangered black footed ferret which were reintroduced into the park recently. Little is known about the effectiveness of herbicide treatment on horehound in the United States so the park conducted several small scale herbicide trials last summer, helping to determine the correct herbicide and rate at which to apply.

Two separate projects for horehound treatment were conducted. The first involved the application of herbicide using ATV mounted boom-less sprayers by the EPMT. The second application was completed via contract truck and UTV mounted sprayers. This contract was paid for by the EPMT and the acting liaison served as COTR on the project.



Figure 24: Conservation Corps of Minnesota crews help EPMT and KNRI staff cut and treat over 3 acres of densely packed buckthorn along the Knife River.

These projects required the cooperation of the EPMT, park resource management staff, and maintenance and fire staff. Park staff extensively surveyed the prairie dog towns for horehound and mapped highly dense areas.



They also mowed several hundred acres, removing the previous year's growth to ensure good herbicide coverage. Three miles of hose-lay was set up in order to get water out to treatment sites and thousands of gallons of water were pumped in using park fire trucks and water tenders. This greatly increased time efficiency and reduced the impacts to the land from ATV travel. WICA resource management staff also served as water fillers and herbicide mixers, allowing the EPMT crew members on ATVs to quickly refill and return to the treatment areas. In all, over 300 ATV loads of herbicide were used to treat over 1,100 acres of horehound. Over 800 person hours were worked during this three day project. The park will monitor the sites and determine if treatment will be required again next year.



Figure 25: Looking for Canada thistle at Scotts Bluff National Monument.

### **Exotic Plant Control Efforts at Knife River Indian Villages National Historic Site**

A new project submitted by EPMT staff was funded this year at Knife River Indian Villages National Historic Site. This project provided the resources needed to allow the EPMT to bring on four Conservation Corps of Minnesota (CCM) crews for a two week period. Several areas of the park are heavily forested with a thick understory of densely packed fallen trees and sinkholes, making it a haven for exotic vegetation. All work in these areas is done on foot and is very labor intensive. To add to the challenge, record setting snowfall and spring rains caused major flooding along the Knife and Missouri rivers. Water was so high that a UTV was used to haul water and supplies into the crews when roads were washed out or under water. With this assistance from the CCM,

EPMT staff treated over 250 acres of Canada thistle (*Cirsium arvense*) and absinth wormwood (*Artemisia absinthium*) in heavily forested areas along the Knife River via backpack sprayers. The crews also assisted EPMT and park staff with three acres of buckthorn (*Rhamnus cathartica*) removal that completed a project began last year. Knife River biotechnicians assisted during the buckthorn project by applying the herbicide to the freshly cut stumps. Park staff will monitor the treated the buckthorn areas and treat any new sprouts that may arise.

Table 8: Northern Great Plains EPMT Accomplishments

Measure	Acres
Treated/Retreated	4,876
Inventoried	54,739
Monitored	0
Gross Infested Area (GIA)	7,126
Infested Area (IA)	4,882



The National Capital Region (NCR) Exotic Plant Management Team (EPMT) continues to perform its mission assisting parks in the management of exotic invasive plants species. From Rock Creek Park located in the center of Washington, DC, to Catoctin Mountain Park in the foothills of the Appalachian Mountains, the National Capital Region parks protect valuable species and communities and encompass a wide variety of ecosystems. The EPMT also assists Assateague Island National Seashore and the Appalachian National Scenic Trail.



Figure 26: A crew member treats *Phragmites australis* in the Roaches Run Waterfowl Sanctuary along the George Washington Memorial Parkway.

The EPMT works closely with our 13 NCR partner parks, nearby sections of the Appalachian Trail, and cooperative partners to develop annual work plans, inventory and monitor exotic plant infestations, train park employees and partners in best treatment practices, coordinate treatment and restoration efforts, and share resources and information. Our goals are to: preserve healthy habitats using early detection and rapid response to prevent exotic plant populations from establishing; control invasive plants currently infesting

ecologically sensitive areas such as riparian areas, rare habitats and forest interiors; and restore native habitats by removing exotic pest plants, and re-establishing native plants and natural processes.



Figure 27: Team Leader Frank Archuleta measures out a study plot that will be used to test the efficacy of Sethoxydim E Pro on Japanese Stiltgrass (*Microstegium vimineum*) in Catoctin Mountain Park.

As a member of the Wavyleaf Basketgrass Task Force, the EPMT has done Early Detection and Rapid Response on small populations of wavyleaf basketgrass (WLBG; *Oplismenus hirtellus ssp. undulatifolius*) that have been found in the Greenbelt Park, National Capital Parks–East, for the past three years. WLBG is an extremely aggressive invasive perennial grass that can invade a wide variety of plant communities and can form dense monocultures that displace native plant species. The EPMT has received help in both locating populations of WLBG within the park and determining the Best Management Practices for treating WLBG. That help has come from our partners in the task force

including the Anacostia Watershed Society and Marc Imlay, a Park Ranger with Maryland State Parks. Our monitoring efforts of past treatments of WLBG in Greenbelt Park have shown that our treatments have been successful; however, follow-up efforts have been necessary on some populations.

A key component of the efforts to stop the spread of WLBG and other invasive species is accurate mapping distribution. The EPMT has entered spatial information for all of our past treatments from 2005 through 2010 into EDDMaps (Early Detection and Distribution Mapping System) so that our partners in the WLBG Task Force and other land managers can be aware of the presence of invasive plant populations that might affect their lands.



Figure 28: Data Manager Geoff Clark treats a large infestation of *Wisteria sinensis* in Prince William Forest Park in Virginia.

Efforts to remove non-native populations of Common Reed (*Phragmites australis*) from the riparian areas along the Anacostia and Potomac River waterways continue in both the George Washington Memorial Parkway (GWMP) and the Kenilworth Aquatic Gardens, National Capital Parks–East. Common Reed reproduces from seed and spreads vegetatively from rhizomes. Both seeds and root fragments can be transported by water and establish new populations. Treatment efforts are important not only to restore currently infested park land, but also to prevent the downstream spread of Common Reed. The work at GWMP was done cooperatively with the Arlington County, VA exotic plant management crew. The crew was

made up of county staff and Student Conservation Association volunteers. By sharing expertise and equipment, we were able to effectively treat the entire Common Reed population in Roaches Run Waterfowl Sanctuary and adjacent county lands in only two days. Both parks have seen a significant decline in the amount of infested acreage; we hope to turn the projects back over to the parks for monitoring within the next two or three years.

The EPMT worked on native meadow restoration projects in three parks in the greater Washington D.C. area: Rock Creek Park, Wolf Trap National Park for the Performing Arts, and Fort DuPont, National Capital Parks–East. Native meadows and grasslands are among the most threatened habitats in the Washington, D.C. area due to habitat loss and invasion by exotic species. These projects were collaborations that included: park staff, local habitat restoration groups, The Anacostia Watershed Society, Virginia Master Gardeners Association, and botanists and ecologists from the National Capital Region Inventory & Monitoring Program. Working with such a diverse group of partners and sharing information and ideas was a learning experience for all parties involved and is a key to developing restoration plans that will be successful in the long term. Part of this project will include outreach through interpretive signs to inform the public about the need for native meadow restoration including exotic plant management and presenting at informal pre-concert events to visitors at Wolf Trap to explain our restoration projects and answer questions.

Table 9: National Capital Region EPMT Accomplishments

Measure	Acres
Treated/Retreated	107
Inventoried	73
Monitored	798
Gross Infested Area (GIA)	73
Infested Area (IA)	111





The Mid-Atlantic Exotic Plant Management Team (EPMT) is part of an 18-park cooperative in Virginia, West Virginia, Maryland, and Pennsylvania, consisting of approximately 305,000 acres. The parks are within three physiographic types that pose differing management challenges, including the eastern coastal plateau, piedmont, and the hill-and-valley environment. The goals of the EPMT are to effectively control targeted invasive plants and develop volunteer and education programs. Cooperation between parks, use of volunteers in parks (VIPs), and collaboration with outside agencies and neighbors are hallmarks of the EPMT's efforts. Exotic vegetation threatens to destroy native diversity and ecosystem health, replacing thousands of species with a relative few. Protecting the natural legacy of the region is essential to ensure that future generations enjoy its expanse and native beauty. The EPMT uses an integrated pest management approach where prevention and a variety of control methods are employed.

The EPMT provided support to a variety of ongoing projects for our partner parks in 2011. Reaching long-term project goals, maintaining project continuity and training and education are just a few of the reasons for these collaborative operations. One such project is the restoration of a culturally significant dry-laid stone fence, headwall and corresponding irrigation canal at Hopewell Furnace National Historic Site (HOFU). Part of the original furnace operations, and once restored in 1939, it had fallen into disrepair throughout the years from 1939 - 2008. Initial stages of wall restoration, was complicated by the overwhelming presence of

invasive species: Multiflora rose (*Rosa multiflora*), woolly mullein (*Verbascum thapsus*), Himalayan blackberry (*Rubus discolor*), and mile-a-minute vine (*Persicaria perfoliata*).

Follow up treatments, coupled with mechanical control (mowing) efforts in 2009, 2010 and 2011 have significantly reduced invasive populations, allowing crews to near completion of the rock wall restoration ahead of schedule. To date, nine week-long group sessions (two dedicated to NPS personnel) and seven weekend sessions have been made available for training opportunities in rock wall restoration. This has allowed the EPMT to promote our exotic management message in a forum backed by the positive results of this collaborative effort.



Figure 29: Beginning phase 2, there is a wall in there somewhere, Hopewell Furnace National Historic Site.

The EPMT has begun phase two of this project by treating the next segment of rock wall that is impacted by previous listed invasives as well as oriental bittersweet (*Celastrus orbiculatus*). This culturally significant section of wall is currently intact; however, structural integrity is

being threatened by root systems of invasive species, particularly oriental bittersweet.

Other projects of interest from 2011 are continued treatment of Common Reed (*Phragmites australis*) at Colonial National Historic Park (COLO) and Garlic Mustard (*Alliaria petiolata*) at Appomattox Courthouse National Historic Site (APCO).



Figure 30: Wall restoration nearing completion, Hopewell Furnace National Historic Site.

At COLO, a combination of heli-spraying coupled with aggressive on-the-ground efforts in 2009, 2010 and 2011 has resulted in significant reductions in common reed at the Jamestown Island location and adjacent sensitive tidal habitats. The EPMT completed treatment in locations the helicopter contractor could not manage to access as well as areas previously treated by helicopter operators.

The EPMT also treated sensitive areas with populations of the threatened species joint-vetch (*Aeschynomene virginica*). Approximately 50 acres of 100% common reed covered area has been treated through the cooperation of the EPMT, helicopter contractors, and COLO staff,

resulting in an 80% reduction in common reed at project locations.



Figure 31: Herbicide treatment adjacent to Sensitive Vetch habitat, Colonial National Historical Park.

At APCO, collaboration between park staff, volunteers, and the EPMT has occurred along the Appomattox River, for the control of garlic mustard. The river treatment area is typed as a Basic Seepage Swamp Community and defined by the park as a high priority for conservation. Some state-rare species such as the Kentucky lady-slipper (*Cypripedium kentuckiense*) and bog twayblade (*Liparis loeselii*) occur here. Previous years have primarily concentrated on hand control using staff and volunteers as remote access has deterred herbicide treatment efforts. After an assessment in 2009 it was determined that herbicide treatment by the EPMT may significantly increase coverage of the treatment areas and planning was begun to accomplish this. Current treatment of the area, utilizing herbicide treatments by the EPMT, manual efforts by park staff and volunteers have reduced infestation from 40% to 4% over a 28 acre area. Maintenance and further control of invasive species will be performed by park staff, volunteers, and the EPMT as they have time.

Table 10: Mid-Atlantic EPMT Accomplishments

Measure	Acres
Treated/Retreated	388
Inventoried	5,910
Monitored	204
Gross Infested Area (GIA)	6,382
Infested Area (IA)	557





The Northeast Exotic Plant Management Team (EPMT), stationed at Delaware Water Gap NRA, has been serving 23 parks in the upper Northeast Region of the National Park Service since August 2003. The parks, located in eight states from Pennsylvania and New Jersey to Maine, encompass over 335,000 acres. The number of parks visited by the EPMT each year depends on regional priorities and on-going projects. EPMT services include on-site control work, inventory and monitoring, revegetation, technical advice, planning, prevention, facilitating collaborations, outreach, funding, contract assistance, and research.



Figure 32: Cape Cod NS, June 2011. Crew Member / SCA Intern Jerome Didier iterating at Pamet Bog.

Completing park-wide inventories of invasive plants was a major focus this year. Many parks need to update inventories for new invasive plant management plans. Inventories were completed for all three Roosevelt-Vanderbilt National Historic Sites. The EPMT also finished an inventory of Sagamore Hill National Historic Site, including redoing sections which had been under contract for invasive plant removal and

revegetation since 2009. Inventory results were given to the park to help assess the contractor's work.

A team of two teens and a SCA intern were hired for Saratoga National Historical Park (SARA) with Youth Conservation Corps (YCC) funding, forming a 3-person Invasive Plant Inventory Team. The EPMT provided a week of training on GPS equipment and inventory techniques while park staff taught the inventory team how to identify fifteen of the park's problem species. The inventory team was able to cover all high priority areas for potential invasion and spread of invasive plants such as: roads, trails, and, rights of way. Both SARA and EPMT staffs were satisfied with the results, and the EPMT hopes to replicate this project at other parks. At all parks where inventories were completed, management plans will be developed during the coming winter.

Treatment of invasive plants is another major task of the EPMT. In order to cover many parks and acres, the EPMT must use the most cost and time effective control methods which are also environmentally and human health friendly. The areas the EPMT focuses on are those considered high priority by the park. Ten partner parks were visited this year and the areas visited were generally those where the EPMT has been before, retreating old sites and expanding into new ones. It takes at least two years, to ensure that an infestation is under control so the park can take over management of the site, including monitoring for reinvasion.

On-the-ground work included spraying of dense thickets of Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*) along sections of the Appalachian Trail, hitting common reed (*Phragmites australis*) invading a rare freshwater wetland at Boston Harbor Island, and broadcast spraying old farm fields in several parks to maintain open areas for wildlife and historical resources. The ultimate goal is to restore all these areas to self-sustaining native plant communities.

Pamet Bog in Cape Cod National Seashore (CACO) is an example of a site which is recovering once the team removed the invasive Phragmites. This remnant cranberry bog has exploded with native shrubs and herbaceous plants since the Phragmites was reduced to almost zero coverage a few years ago. The EPMT retreated Phragmites in 2011 via the “clip and drip” method. Though time-consuming, this method does little damage to surrounding vegetation, and will keep the bog open for years to come (see Figure 32).



Figure 33: Gateway NRA, Sandy Hook Unit, September 2011. Crew member Jason Zarnowski (left) and Team Leader Brian McDonnell discuss options for setting up new herbicide trial plots.

The EPMT has been initiating herbicide trials for a few species which have been difficult to control. One of these species is Asiatic sand sedge (*Carex kobomugi*) which is found on the dunes of the Sandy Hook Unit (SHU) of Gateway National Recreation Area (GATE). Starting in 2009, Team Leader Brian McDonnell set up a series of herbicide plots on infested dunes at SHU to identify the most efficacious chemical, rate and timing. For these trials, the EPMT has collaborated with a professor from a

local university, an expert on sand sedge biology, along with her own students and students from the Marine Academy of Science and Technology. They have been instrumental in identifying infestations, marking trial plots, and monitoring control results. Brian presented results from the initial trials at the 2011 Northeast Weed Science Society meeting. New plots were set up this year when older plots were destroyed by Hurricane Irene. A similar but smaller trial was set up this year in Morristown National Historic Park focusing on black swallow-wort (*Cynanchum louiseae*).

Increasingly, EPMT has been setting up monitoring plots at sites where it is working, especially if control of target species is unsatisfactory. Plots were set up in SARA farm fields infested with brown and spotted knapweeds (*Centaurea jacea* and *Centaurea stoebe*). Knapweed infestations, in fields regularly burned by SARA and then monitored by the regional fire effects team, are not being controlled, so the regional fire program asked the EPMT to team up with them. Next year will yield initial results of the three pronged strategy of burning, herbicide application, and mowing. Meanwhile, fields where the EPMT applied a herbicide, noted for controlling knapweed, are showing positive results after a year.

Table 11: Northeast EPMT Accomplishments

Measure	Acres
Treated/Retreated	269
Inventoried	15,084
Monitored	1,246
Gross Infested Area (GIA)	3,216
Infested Area (IA)	669





The California Exotic Plant Management Team (EPMT) serves 14 parks that reside within the California Floristic Province. This region is one of 25 world biodiversity hotspots, and is known for its unusually high concentration of endemic plants. Of the 3,500 vascular plants found in California's floristic hotspot, 2,124 species are found nowhere else in the world. Projects sites were extremely varied, ranging from the remote Channel Islands to the high elevation Sierra Nevada sites in Sequoia and Kings Canyon National Parks. With almost 14 percent (or 290,436 acres) of the California partner parks' 2.1 million acres infested, we dedicate significant energy to developing efficiencies that will help the parks streamline restoration efforts.

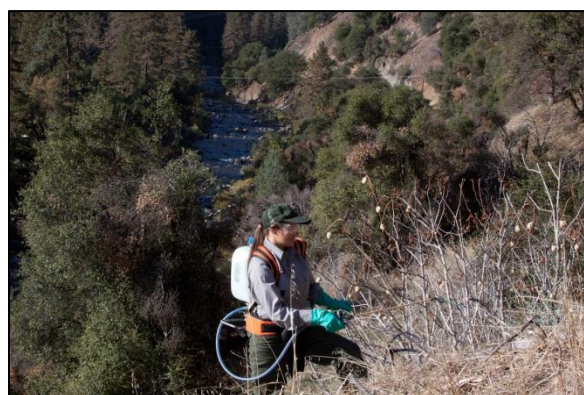


Figure 34: Heather Smith treating yellow starthistle on steep incline above the Merced River at Yosemite NP.

The final year of our first decade of operation has been the most productive year in the history of the EPMT. We focused on projects that could leverage EPMT dollars. The result has been an increased ability for parks to compete for matching funding – both internal and external to the Service. The EPMT sponsored treatment of

46 species on 277 sites covering 294 net infested acres. These treatments represent a 42% increase in infested acres treated from the previous year. Our projects ranged from landscape-scale projects to early detection treatments and mapping.

**Landscape Scale Projects:** Five EPMT network parks focused on yellow starthistle (*Centaurea solstitialis*), one of California's most invasive plants. These treatments constituted 55 % of the overall net acres treated and target our larger sites. This annual plant was introduced from Eurasia and has remarkable invasion features. One plant can produce 150,000 seeds per plant every year, and its root system out-competes native plants ability to tap water.

Yellow starthistle has grown into Yosemite National Park's "most wanted" weed as it has rapidly invaded the rich native plant habitat. Since its introduction about over a decade ago, yellow starthistle expanded explosively to about 350 gross infested acres in Yosemite and has been equally as invasive in neighboring National Forest lands. With the help of EPMT funding over the last few years, the park has been able to serve as the lead agency among seven agencies and non-profit groups in cooperative management across 18-river miles of the Merced Wild and Scenic River. This collaboration reduces Yosemite's chance of otherwise certain reinvasion in the future and it has strengthened interagency relationships.

The EPMT lead is currently serving as a coordinating member of the newly formed California-based prevention team. The group is

focusing on the development of statewide best management practices, promoting the use of weed free forage and straw mulch, and the establishment of a program that certifies weed-free sand and gravel materials. Yosemite NP is leading the way by instituting standard gravel pit inspection procedures prior to allowing materials to enter the park. These programs have the capacity to greatly reduce the overall, rather daunting, invasive treatment needs of the parks over time.

Early detection and rapid response: The San Francisco Bay Area Inventory and Monitoring Network (I&M Network) and Lassen Volcanic National Park were two programs that received EPMT assistance for early detection and control activities. Both programs focused on getting information to better plan future treatment strategies and stop new invaders before they get established.

The network surveyed road and trail corridors in Golden Gate National Recreation Area for two highly invasive plants, oxeye daisy (*Leucanthemum vulgare*) and licorice plant (*Helichrysum petiolare*). Surveys covered 239 acres of prioritized sites and managed to treat over 50% of what was mapped. The non-treated sites were too large for this volunteer cadre to treat, however mapping details about populations (location, size, density, and characteristics) are added to a list of follow-up treatments planned.

Lassen Volcanic National Park implemented an early detection survey protocol developed by Utah State University (Dewey and Anderson). The survey methodology and data management approach were refined in 2010. With EPMT support the program went “live” in 2011 and surveyed 5,000 acres in places judged to be the most likely to contain undetected weed populations. The 2011 surveys showed that while most of the backcountry of Lassen remains uninfested, small colonies of cheatgrass (*Bromus tectorum*), woolly mullein (*Verbascum thapsus*), and bull thistle (*Cirsium vulgare*) do exist. This early detection approach is one way of working more intelligently in the weed science world. Now park staff can focus on

treating these small patches and prevent them from becoming too large and economically infeasible to control.



Figure 35: Applying a pre-emergent herbicide reduced cheatgrass cover by 58% at a reclaimed hydrothermal well site.

After a decade of operation with flat budgets and shrinking value of the dollar, the EPMT considers an annual critique of our program fundamental to our success. The positive side of the financial stressor is that it has inspired creative partnerships and sharing of resources; thereby expanding what we can do with limited resources. With the networking established in 2011, we are looking forward to a creative and productive 2012.

Table 12: California EPMT Accomplishments

Measure	Acres
Treated/Retreated	306
Inventoried	5,895
Monitored	3,245
Gross Infested Area (GIA)	2,650
Infested Area (IA)	352





The Lake Mead Exotic Plant Management Team (EPMT) was established in 1996 serving as the prototype model for what eventually developed into the National Park Service (NPS) EPMT program. The EPMT has conducted projects at 31 NPS Units, five US Fish and Wildlife Service (USFWS) Refuges, five Bureau of Land Management (BLM) Districts, four National Forests, BIA Navajo Region, Bureau of Reclamation and other state and local entities throughout the southwest effecting millions of acres. The EPMT has three primary goals: 1) Provide expertise in the control of weeds from priority areas to preserve, restore and maintain native plant communities. 2) Professionalize invasive plant management within the NPS and its partners by developing staff expertise. 3) Improve government efficiencies through interagency cooperation by developing partnerships to effectively manage weeds on a landscape level.

Partnerships are integral to the EPMT's success, leveraging each NPS base dollar with 2-3 additional dollars on an annual basis. These partnerships facilitate weed management across agency boundaries and increase our capacity to serve NPS Units. For example BLM funds are provided to the EPMT through an agreement to control weeds adjacent to Mojave National Park, Death Valley National Park and Lake Mead National Recreation Area. All of these additional funds combine to allow for up to a 20-person crew in the field on a daily basis forming the largest EPMT in the nation.

The EPMT conducts weed control projects continuously throughout the year during all

seasons due to the EPMT's locality and partnerships in the regional area. A year-round operation maximizes the EPMT's ability to serve its various partners, control a diversity of weeds, and adds flexibility in scheduling projects.



Figure 36: Heather Ferguson treating post fire plots at Joshua Tree NP.

### **2011 Accomplishment Summary**

The EPMT conducted projects at 19 NPS Units, and 12 interagency partners.

One highlight of the year includes completing initial treatment of high density infestations of Ravenna grass (*Saccharum ravennae*) at five isolated drainages within Glen Canyon National Recreation Area during the last three years. An extremely dense patch of Ravenna grass had taken over a remote area of Cottonwood Gulch in difficult terrain outcompeting valuable riparian and wetland plant species. Aerial support with helicopters was being considered in order to control this dense patch, however, an opportunistic flood occurred in the drainage that

wiped out some of the vegetation and allowed for ground crew treatment within a few days, which otherwise would have taken weeks to accomplish. Control methods are effective and follow up treatments are mainly only necessary to control new seedlings emerged from the seed bank and native plants have expanded at treatment sites. The EPMT inventoried, detected, and treated much smaller populations of Ravenna grass in three other drainages a few miles away. This early detection rapid response kept this plant from further spread in the region thereby saving the NPS and others in the watershed hundreds of thousands of dollars that would have had to be spent for future treatment. Future control efforts include partnering with the BLM and Navajo Nation to control small populations of Ravenna grass along the San Juan River.



Figure 37: Hannah Wigginton and Curt Deuser treating Ravenna Grass at Cottonwood Gulch in Glen Canyon NRA.

Athel tree (*Tamarix aphylla*) control at Lake Mead NRA is another Early Detection / Rapid Response project being funded by Southern Nevada Public Lands Management Act. The goal is to eradicate the only reproducing athel tree infestations from seed in North America. This seven year project has been conducted by the Nevada Conservation Corps youth employment program and the EPMT. This project is also very important since this population had the potential to spread throughout the Lower Colorado River Basin and into parts of the Grand Canyon. The project serves as another example of preventing future weed problems and saving millions of dollars for

control if allowed to spread beyond this source population.



Figure 38: Left to right, team members Joe Castello, Sam Smyrk, Brad Jones, Dwayne Coleman and Lauren Alnwick-Pfund protecting the Kelso Dunes from Sahara mustard invasion in Mojave NP.

Success is being achieved by the EPMT at keeping Sahara mustard (*Brassica tournefortii*) out of the majestic Kelso Dunes in Mojave National Preserve. Populations have decreased within treatment buffer zones surrounding the dunes during the last four years. Significant reduction in Sahara mustard was observed last year and annual treatments will be necessary to keep this plant out of this park's popular visitor attraction.

The EPMT continues to obtain Burned Area Rehabilitation project funds to control post fire weeds at multiple parks. Post fire weed control projects at Joshua Tree National Park included implementing research plots evaluating three different herbicide treatments to control annual brome grasses and forbs while promoting native plant recovery.

Table 13: Lake Mead EPMT Accomplishments

Measure	Acres
Treated/Retreated	329
Inventoried	21,322
Monitored	3,798
Gross Infested Area (GIA)	17,693
Infested Area (IA)	435



## North Coast / Cascades Network EPMT

From the open range of the Palouse prairie in Idaho and Washington to the high desert of eastern Oregon, along the creeks and rivers fed by the glacial North Cascades and Olympic mountains, and in the rainforests and remnant prairies of the northwest coast, the North Coast / Cascades Network Exotic Plant Management Team (EPMT) provides professional invasive plant management services to its partner parks. The Team focuses on fostering projects that assist with the restoration of degraded park resources, preventing the spread of non-native species into fragile wilderness areas, and expanding ecosystem-level partnerships to combat invasive plant species with other stakeholders. The Team provides coverage for between 12 and 14 parks across Idaho, Oregon, and Washington during any given field season, representing approximately 2.1 million acres of federal lands in the Pacific Northwest.

In fiscal year 2011, the Team provided support for partner parks on a number of ongoing projects, maintaining project continuity, and helping partners reach long-term goals. In riparian areas and wetlands west of the Cascades, familiar species such as knotweed (*Polygonum sp.*), yellow-flag iris (*Iris pseudacorus*), and reed canary grass (*Phalaris arundinacea*) remained a priority. At Olympic National Park (OLYM), along the shores of Lake Quinault and the Quinault River, the team entered its third and potentially final year of a cooperative project with the Olympic National Forest and the Quinault Nation. The effort, funded through grants from the NPS's "Service First" program and the U.S. Forest Service, was designed to bring populations of Bohemian

knotweed (*Polygonum x bohemicum*) to levels of maintenance control. In conjunction with this project the team eradicated an incipient population of purple loosestrife (*Lythrum salicaria L.*), preventing this species from becoming established in the park. Knotweed control also continued at Mount Rainier National Park along the Nisqually River drainage in cooperation with crews from Pierce and Thurston counties, and in the floodplain of the Skagit River at North Cascades National Park, in partnership with Skagit Fisheries Enhancement, and Seattle City Light.



Figure 39: A crew member treats yellow-flag iris (*Iris pseudacorus*) in a parcel managed jointly by Lewis and Clark National Park and Washington State Parks.

The Team also expanded control efforts on several other riparian and wetland species. The team entered its third year of treatment of yellow-flag iris populations at various parcels located within Lewis and Clark National Park, and adjacent units of Cape Disappointment State Park while simultaneously initiating control of this species on the recently acquired property.

In the Ross Lake National Recreation area, crews expanded reed canary grass control efforts pioneered along the shoreline of Ross Lake in 2004. The team also initiated a survey to determine the extent of reed canary grass in the Big Beaver drainage to protect a fragile wetland ecosystem.

Terrestrial weed control also represents an important facet of the program. At John Day Fossil Beds National Monument (JODA), the team continued to follow-up on the control of Russian knapweed (*Acroptilon repens*), in conjunction with the park's efforts to restore threatened steelhead trout spawning habitat and re-establish native vegetation. After three years, this population, once over 100 infested acres, has been reduced to a level of control that can be readily maintained by park staff. Also at JODA, the team completed a fourth season of treating widespread populations of Dalmatian toadflax (*Linaria dalmatica*) in the Sheep Rock unit.



Figure 40: A member of the LARO crew clears black locust (*Robinia pseudoacacia*) near the Kettle Falls campground in Lake Roosevelt National Recreation Area.

Dalmatian toadflax was also a priority at Lake Roosevelt National Recreation Area (LARO), where after three years of treatment, the team has achieved maintenance control in many locations where this species was once dominant, restoring native grasslands in the process. Also at LARO, the team eradicated the park's only known population of myrtle spurge (*Euphorbia myrsinites*) over a three-year period. In cooperation with LARO maintenance and resource management staff and with the support of the park's fee demo program, the team

controlled almost 20 acres of black locust (*Robinia pseudoacacia*) invading native forests near the Kettle Falls campground.

Controlling invasive plants in disturbed areas remained a high priority in 2011. At OLYM, crews began a second year managing Canada thistle (*Cirsium arvense*) and herb Robert (*Geranium robertanum*) populations that began expanding after the Heatwave Complex Fire with support from the Burned Area Rehabilitation (BAR) program. Also at OLYM, the Team continued to control a variety of invasive species along the upper reaches of the Elwha River, in preparation for the removal of the Glines Canyon dam. These populations would otherwise serve as seed sources threatening not only the disturbed lands that result from the removal of the dam, but also the park's wilderness areas. The Team also began the first year of a three-year BAR funded early detection and rapid response program in the Lake Chelan National Recreation Area to control cheat grass (*Bromus tectorum*) following the Rainbow Fire of 2010.

Cooperative Weed Management Areas are an important focus for the Team. In 2011, the program entered the second of five years of a project implemented with cooperation from Washington State Parks, The Nature Conservancy of Washington, Island County, and local farmers to manage poison hemlock (*Conium maculatum*), while restoring the iconic hedgerows, and remnant prairies. This spirit of cooperation typifies the actions of the Team over the last 10 field seasons. Flexible and resourceful, the program continues to succeed as it begins its second decade in the Pacific Northwest.

Table 14: North Coast / Cascades EPMT Accomplishments

Measure	Acres
Treated/Retreated	305
Inventoried	3,836
Monitored	204
Gross Infested Area (GIA)	3,444
Infested Area (IA)	312





In 2011, the Pacific Islands Exotic Plant Management Team (EPMT) continued its commitment to proactively controlling invasive plants that threaten the biological integrity of six parks in the Hawaiian Islands. On the island of Maui alone, partnership efforts increased the capacity of the EPMT to protect Hawaiian ecosystems by a factor of five. On the Big Island, EPMT efforts supported Hawai'i Volcanoes National Park Resources Management (HAVO RM) crews controlling 34 invasive plant species in a wide range of Hawaiian ecosystems including coastal lowlands, rainforest, dry woodlands and valuable koa forest.



Figure 41: Highly invasive miconia (*Miconia calvescens*), fruiting specimen (Maui, HI).

The specialized experience of the EPMT at HAVO complements the park's strategic control of invasive weeds in highly valued management sites known as Special Ecological Areas (SEAs). The SEA model, developed in HAVO, prioritizes sites for intensive weed management based on characteristics including biological

diversity, accessibility, and value to research and interpretation. In 2011, the EPMT and park crews controlled 13 invasive species in 27 SEA blocks totaling 6,343 acres, removing 93,126 plants. This included control of species such as faya tree (*Morella faya*), kahili ginger (*Hedychium gardnerianum*), and Himalayan raspberry (*Rubus ellipticus*). These species are widespread in the park and are well documented for their disruptive effects on Hawaiian ecosystems, and are cited by the International Union for Conservation of Nature (IUCN) as among the world's worst 100 invasive species.

The importance of the EPMT to the strategic management of invasive plants can be illustrated by highlighting accomplishments in two very contrasting SEA units. In Koa SEA, a spectacular and dense Hawaiian rainforest home to a rich flora including at least three federally listed endangered plant species, the EPMT along with HAVO RM crews systematically controlled eight species totaling 21,962 plants over 105 acres to limit impacts to this endemic community. In the Mauna Ulu SEA, a windswept woodland on a young volcanic lava field, the EPMT assisted with the expansion of the SEA system, supporting HAVO crews in the initial removal of 22,431 faya tree over 671 acres. This work complements control work begun in 2010 and completes initial management of the unit totaling 827 acres. Faya tree is among the most disruptive plant species in Hawai'i, and these efforts significantly expand areas where natural succession can now occur unimpeded by faya tree.



A second and equally important component of the EPMT weed management strategy is the aggressive control of incipient infestations. The EPMT continues to afford specialized botanical and technical experience to identify and control species with localized distributions at early stages of invasion. This includes continuation of Padang cassia (*Cinnamomum burmanni*) control where individuals were first detected and controlled in 2010 at HAVO. This tree is highly disruptive and previously unknown to occur in the park. EPMT crews also continued to lead the control of the shrub Koster's curse (*Clidemia hirta*) a State of Hawai'i noxious weed first detected in 2003, also ranked among the IUCN's top 100 worst invasive species. Control of Koster's curse is complicated by the species' aggressive growth and high fecundity, and because plants occur on steep slopes. EPMT and HAVO crews have jointly developed techniques to safely access and control these plants. Other notable incipient invaders controlled by PI-EPMT include the treatment of 89 Caribbean pine (*Pinus caribaea*) and 99 Formosa koa (*Acacia confusa*) over 318 acres at the Ainahou site, control of knotweed (*Polygonum capitatum*) along 79 miles of roadsides, and treatment of English ivy (*Hedera helix*) and white shrimp plant (*Justicia betonica*) parkwide.



Figure 42: Collaborative NPS, EPMT, and Molokai Invasive Species Committee Crew; Coastal Lowlands Ironwood (*Casaurina*) control.

The top tier of invasive species often profoundly alters ecosystem fire regimes. EPMT crews lead or assist projects to control these species in key areas on three different islands. With added support from the NPS Regional Fire Program and the Three Mountain Alliance, the State's largest watershed conservation partnership, The EPMT led the initial removal of 1,265 silk oak

(*Grevillea robusta*) over 214 acres in the dry ohia woodlands of the southwest boundary at HAVO. This large Australian tree species spreads rapidly, and is notoriously flammable and deleterious to Hawaiian ecosystems. This work complements 2010 control work in an adjacent site; over the past two years 3,633 trees have been controlled over 367 acres.

Also notable was continued EPMT leadership with the fountain grass (*Pennisetum setaceum*) removal program in Ocean View, Hawai'i. This program, also with support from the NPS Regional Fire Program, aims to remove the fire promoting fountain grass from 156 miles of roadsides in the island's largest residential community. Citizens are better informed about park natural resource management programs, the threats posed by invasive species, and safe control methods. Since 2005, 10 outings have led to the removal of 11,938 fountain grass plants along invasion corridors to the park. Alien fire promoting grasses have also been controlled along 1.2 miles of a fuel break at Puuhonua O Honaunau NHP, on the west coast of Hawai'i's Big Island.

Long term successful invasive plant management in the NPS requires commitment to proactive detection and treatment of incipient species and aggressive initial knockdown of more established pests in high value areas. Following its eleventh operational year, the EPMT has established itself as an effective collaborator with parks, watershed restoration and invasive species partnerships, and private entities to leverage our collective efforts.

Table 15: Pacific Islands EPMT Accomplishments

Measure	Acres
Treated/Retreated	41
Inventoried	4,035
Monitored	64,392
Gross Infested Area (GIA)	30,682
Infested Area (IA)	267

## Florida / Caribbean EPMT



The Florida / Caribbean Exotic Plant Management Team (EPMT) supports fifteen National Park Service units in Florida and the Caribbean by augmenting existing exotic plant control efforts including inventory and monitoring, control, education, and research. Control is accomplished through regional contractors. Smaller projects are carried out by seasonal NPS crews. Florida and the Caribbean have the distinction of having one of the worst invasive species problems in the country with over 1.5 million acres of conservation areas infested with invasive plants. These invasive plants are having detrimental effects on native plant communities by reducing native plant diversity, altering ecological processes such as fire behavior and impacts to surface water conveyance. In Florida and the Caribbean over 400,000 acres of the approximately 2 million acres of National Park Service lands are infested with invasive plants.

In 2011, the EPMT steering committee with representatives from Florida and Caribbean NPS units, the U.S. Army Corp of Engineers, U.S. Fish and Wildlife Service and the state of Florida selected five major invasive plant control projects to be accomplished through cost efficient private contractors at: Canaveral National Seashore, Everglades National Park, Big Cypress National Preserve, and Biscayne National Park. In addition the steering committee developed a treatment schedule for the treatment crew. In this year's annual report we will be highlighting the Brazilian pepper (*Schinus terebinthifolius*) control project at Canaveral National Seashore and a joint early detection/rapid response project with the South

Florida and Caribbean Inventory & Monitoring Network entitled "Corridors of Invasiveness".

Canaveral National Seashore is managed by the National Park Service in partnership with the National Aeronautics and Space Administration (NASA), which owns approximately two-thirds of the National Seashore. Over 30,000 acres of the seashore are co-managed with the adjacent Merritt Island National Wildlife Refuge, administered by the U.S. Fish and Wildlife Service.



Figure 43: EPMT crew performing a basal bark application on a camphor tree (*Cinnamomum camphora*) in Timucuan Ecological and Historic National Preserve.

The habitats of the seashore consist of upland oak scrub, subtropical hammocks, wet marshes and seasonally flooded swamps. The rare upland oak scrub community provides critical habitat essential for the survival of the federally-protected Florida Scrub Jay (*Aphelocoma coerulescens*).

The invasive plant Brazilian pepper was introduced into Florida from Brazil in the late

1800's. It is one of Florida's worst invasive plant species readily displacing native vegetation on hundreds, of thousands of acres in Florida. In Canaveral National Seashore, Brazilian pepper forms dense mono-cultures displacing the oak scrub communities essential for the survival of the Florida Scrub Jay. Since 2000 the EPMT has been working on controlling Brazilian pepper as well as other invasive plants from all areas of the seashore including critical scrub habitat. Our efforts have been augmented by a partnership with the Florida Wildlife Conservation Commission (FWC). Through this partnership we have received considerable assistance in the form of contract labor and herbicides. For example in 2011, the EPMT provided \$142,000 and FWC provided \$122,000 to treat almost 700 acres of Brazilian pepper.

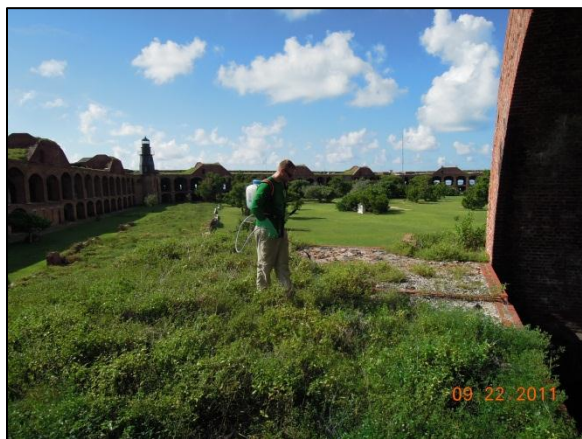


Figure 44: Treating exotic species atop the large powder magazine in the parade grounds of Fort Jefferson, Dry Tortugas National Park.

These treatment efforts have been extremely effective in restoring native habitats. In 2007 three circular plots (6 m) were established in dense Brazilian pepper to quantify restoration success. Following herbicide treatments and prescribed fire the plots were re-sampled. Brazilian pepper cover decreased from 92% to 0% and native species cover went from 8% to 98%.

A joint project called the "Corridors of Invasiveness" was initiated this year between the EPMT and the South Florida Caribbean Inventory & Monitoring Network (SFCN).

The goal of the project is to detect newly emerging invasive plant species in or adjacent to parks of South Florida. In the next five years Biscayne National Park, Everglades National Park, and Big Cypress National Preserve will systematically survey roads, trails and campgrounds for new exotic plant species.



Figure 45: Private contractor crew unloading supplies at Henley Cay, Virgin Islands NP.

Detecting these new species while they are still in small manageable populations can make the difference between a newly established population and a successful eradication. The sampling effort is optimized with the use of a two person crew consisting of a botanist and a certified pesticide applicator. When an exotic plant species is found, a GPS point is taken and treated immediately or recorded for later eradication.

This year, the group surveyed six sites at Biscayne National Park for a total length of 36 miles and 215 acres. A total of 32 exotic species were encountered with three of them new to the park. A large 108-acre portion of the areas that were recorded but not treated are scheduled to be treated with in-house crew.

Table 16: Florida/Caribbean EPMT Accomplishments

Measure	Acres
Treated/Retreated	879
Inventoried	2,021,076
Monitored	1
Gross Infested Area (GIA)	4,267
Infested Area (IA)	878





In the ninth year of operation the Southeast Exotic Plant Management Team (EPMT) continues to provide support to 18 national parks located across seven states in the Southeast Region. During 2011 the EPMT provided on the ground control, monitoring and survey activities for invasive plants to 16 partner parks. Technical assistance, training and/or materials were provided to 17 partner parks and one non partner park. Natural and cultural resources found in the EPMT work area lie within the broad physiographic provinces of the Cumberland Plateau, the Appalachian Highlands and the Piedmont. Many unique habitats such as archeological sites, historic battlefields, cave features, remnant cedar glades, earthworks, sandstone and scenic byways are preserved in these biogeographic regions.



Figure 46: Collecting seed from Cade's Cove at Great Smoky Mountain National Park, Tennessee.

Early Detection and Rapid Response (EDRR) has become a priority providing the opportunity to significantly reduce the impacts from such infestations and the cost associated with

controlling an invasive after it has become established. In 2011 the EPMT, in partnership with the South Carolina Department of Agriculture, and the South Carolina (SC) Cogongrass Task Force completed road and right-of-way surveys for the highly invasive plant Cogongrass (*Imperata cylindrical*) in four SC counties including the counties containing Ninety Six National Historic Site, Cowpens National Battlefield and Kings Mountain National Military Park. Each of these parks contains extensive open woodlands and fields suitable for colonization by this highly aggressive grass. No occurrences were found within these counties. This survey work will take place annually. Three additional surveys resulted in the first documented occurrences of the invasive herb beefsteak (*Perilla frutescens*) at Fort Donelson National Battlefield in Tennessee, Mammoth Cave National Park in Kentucky, Carl Sandburg Home National Historic Site in North Carolina and Russell Cave National Monument in Alabama. The EPMT will continue to include surveys of roads and right-of-ways within and adjacent to partner parks as part of the integrated pest management protocols.

In 2011, the EPMT provided training to our partner parks. Seven training events were held for six of our partner parks. These included Safe and Effective Herbicide Use, Exotic Plant Control Techniques, Wildland Sawyer Certification, Defensive Driving, Safe Trailering, and Safe ORV Operators Certification. Also, in 2011 the EPMT provided comprehensive training for a six person seasonal team based at Cowpens National Battlefield (COWP).



The EPMT continued to work in close partnership with the Student Conservation Association providing seven internships to young adults. This year marks placement of 65 interns since the EPMT's inception in 2004.



Figure 47: Uprooting Asiatic Dayflower at Carl Sandburg National Historic Site in Flat Rock, North Carolina.

This fiscal year marks the ninth year of safe operations with no hours lost to injury. To accomplish this, the EPMT is provided extensive safety training and supervision. At least one team member maintains certification as a Wilderness First Responder ensuring safe operations and quick response to injury if working in remote, rugged locations. In 2011 a team member also received Red Cross Safety and First Aid Instructor Certification enabling interns, park staff and volunteers to receive Red Cross Safety and First Aid.

Managing invasive, woody plants on the river scour prairie found in Big South Fork National River and Recreation Area (BISO) in Tennessee and Kentucky continues to be a priority for the EPMT. This unique riparian vegetation type is home to numerous rare plants endemic to the Cumberland Plateau of Tennessee and Kentucky. With fewer than 500 acres (200 ha) of this habitat remaining in the world today stewardship and careful management are a priority for NPS. One of the primary threats to these areas continues to be the fast growing and prolific seed producing tree Mimosa (*Albizia mimos*). A native to Asia and well adapted to the environmental conditions of BISO this plant grows rapidly, produces summer shade and may dominate water and nutrient resources. The EPMT and park staff were able to remove

mimosa from over 17 miles of river bank at BISO and Obed Wild and Scenic River in 2011. This work greatly contributes to protecting two federally listed species, Cumberland rosemary (*Conradina verticillata*) and Virginia spirea (*Spiraea virginiana*), and several dozen globally or regionally rare plants. Partners in this effort include the EPMT, the U.S. Fish and Wildlife Service, BISO Natural Resources staff, and the Student Conservation Association.

Work along the Blue Ridge Parkway (BLRI) remained focused on the removal of the exotic vine Oriental bittersweet (*Celastrus orbiculatus*). The goal is to preserve native hardwood by removing the vine and eliminating shading and accumulation of biomass capable of toppling mature trees. This section of the BLRI is heavily used for recreation and is an important urban wilderness area for the residents of metropolitan Asheville, NC. In 2009 the received funding through the American Recovery and Reinvestment Act focused on the removal of Oriental bittersweet. In 2011 work continued using EPMT resources in partnership with community volunteers and adjacent property owners both public and private.

The EPMT is working with partner parks to control large areas infested with aggressive exotics such as privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*). These two species gain a foot hold when damage to the tree canopy occurs from natural tree fall or storm events. The EPMT, working with park staff, addressed the effects of a tornado that tore through Stones River National Battlefield in 2009. Extensive areas of mature forest were laid on the ground by this storm and in the year following, an explosion of the seed bank resulted in 1000s of privet seedlings.

Table 17: Southeast EPMT Accomplishments

Measure	Acres
Treated/Retreated	78
Inventoried	415
Monitored	0
Gross Infested Area (GIA)	415
Infested Area (IA)	99

## Southeast Coast EPMT



The Southeast Coast Exotic Plant Management Team (EPMT) is based at Congaree National Park. Initiated as a pilot project in 2005, the team acquired permanent funding in 2009 and 2010 through park based initiatives. Although this team is funded separately from the national EPMT program, the goal is for both programs to work in partnership. This new partnership will increase cooperation, reduce duplication, and improve invasive plant management efforts at the local and national levels.

This team serves 15 units of the National Park Service in the Southeast Coastal Network. The current list of partner parks includes Cape Hatteras National Seashore/Fort Raleigh National Historic Site/Wright Brothers National Monument, Cape Lookout National Seashore, and Moores Creek National Battlefield in North Carolina; Congaree National Park and Fort Sumter National Monument/Charles Pinckney National Monument in South Carolina; Chattahoochee River National Recreation Area, Cumberland Island National Seashore, Fort Frederica National Monument, Fort Pulaski National Monument Kennesaw Mountain National Battlefield Park, and Ocmulgee National Monument in Georgia; and Horseshoe Bend National Military Park in Alabama.

The Team is developing and refining short term and long term goals with its partner parks. Current goals identified for this team include:

- 1) On the ground control of invasive plants that threaten both natural and cultural resources,
- 2) Post-disturbance restoration, including restoration after treatment of invasive plants,

- 3) Education of park staff and visitors on issues associated with invasive plants, including the threat that invasive plants pose to native plant and animal communities. Education efforts will be conducted in cooperation with the Old-Growth Bottomland Forest Research and Education Center that is based at Congaree National Park., and
- 4) Partner park staff training on prevention, early detection-rapid response, and management of invasive plants.

Organization of the Southeast Coast EPMT will continue through 2012. Although 2011 began with a new Liaison, the position was vacated in February 2011 and a Liaison will be hired in 2012. The team has been composed primarily of volunteers from the Student Conservation Association Native Plant Corps Teams, including two teams this year (a three month team, followed by a six month team). In July, a permanent Field Crew Leader was hired with the goal of improving the quality and consistency of work. In addition, the Team will work with partner parks to develop an advisory committee composed of superintendents and resource managers to determine management needs, develop a list of invasive plant species to target, and assist with prioritizing the team's efforts. Other objectives include gathering, editing, and finalizing safety documents; determining equipment and supply needs; and developing a method to prioritize parks and species for future treatment.

From October 2010 to September 2011 the Team had a total of eleven SCA Interns based at Congaree National Park. Without the housing

and office space provided by Congaree, in addition to the administrative and maintenance support they provide, the team would have difficulty serving its many partner parks. The team does not have a data manager; therefore, the last day of every hitch is devoted to data and reporting.



Figure 48: Team members foliar treat Wisteria (*Wisteria sinensis*) at Congaree National Park.

During the course of the program, the team treated many species including Chinese privet (*Ligustrum sinense*), Japanese privet (*Ligustrum japonicum*), kudzu (*Pueraria montana*), mimosa (*Albizia julibrissin*), Japanese wisteria (*Wisteria floribunda*), English ivy (*Hedera helix*), Chinese tallow (*Triadica sebifera*), silver bamboo (*Bamboosa multiplex*), golden bamboo (*Phyllostachys aurea*), arrow bamboo (*Pseudosasa japonica*), tamarisk (*Tamarix gallica*), Japanese stilt grass (*Microstegium vimineum*), tree-of-heaven (*Ailanthus altissima*), Japanese honeysuckle (*Lonicera japonica*), tungoil tree (*Aleurites fordii*), Japanese climbing fern (*Lygodium japonicum*), Chinaberry (*Melia azedarach*), lantana (*Lantana camara*), shrubby

lespedeza (*Lespedeza bicolor*), and beefsteak (*Perilla frutescens*).

The Team assists Resource Management staff at Congaree National Park with public outreach and educational activities. During Swamp Fest, the Team interacted with the local community to inform the public about invasive plants, including a pamphlet that highlighted native plant alternatives for gardens. The crew also created a flora activities table for CONG's Nature Fest, in order to raise awareness about the park's invasive plants. Team members participated in Congaree Campfire Chronicles, a living history event that brings the history of Congaree to life. Each team member prepared and presented PowerPoint presentations about the work that they conducted while serving on the Team. Lastly, each SCA Native Plant Corps Team conducted a Volunteer Service Day, where the team led volunteers in the removal of exotic plants from Congaree National Park's floodplain forest.

Table 18: Southeast Coast EPMT Accomplishments

Measure	Acres
Treated/Retreated	20
Inventoried	124
Monitored	44
Gross Infested Area (GIA)	117
Infested Area (IA)	20





## Appendix A: Program Participants

The Exotic Plant Management Teams (EPMTs) do not function in isolation. The achievements of the teams are due in large part to the time, resources and contributions of many. The EPMT initiative is a coordinated effort made up of park leadership, park staff, seasonal and permanent Team members, the Student Conservation Association, AmeriCorps and hundreds of volunteers. Following is a partial list of people who contributed to the 2011 achievements described in the report.

### Alaska EPMT

#### Administration

Bonnie Million (Liaison), Tim Federal (Seasonal Data Manager)

#### Crew

Travis Fulton, Zachary Gooding (SCA Intern), AnnMarie Lain, Timothy Leuthke (SCA Intern), Matthew Schultheis (SCA Intern), Rebecca Thompson (SCA Intern), Eric Walker (SCA Intern), Amanda Wolfe (SCA Intern)

#### Region/Network Support

Alaska Region Office – Guy Adema, Joel Cusick, Bud Rice

#### Park Support

Denali National Park – Pat Owen, Carl Roland, Wendy Mahovlic

Gates of the Arctic National Park and Preserve – Jobe Chakuchin, Tom Liebscher

Glacier Bay National Park and Preserve – Lewis Sharman, J. Rob Fisk, Shelby Timm (SCA Intern)

Katmai National Park and Preserve – Whitney Rapp, Troy Hamon, Peter Frank (SCA Intern), Arielle Woods (SCA Intern)

Kenai Fjords National Park – Fritz Klasner, Christina Kriedeman

Klondike Gold Rush National Historic Park – Dave Schirokauer

Lake Clark National Park and Preserve - Jeff Shearer

Sitka National Historic Park – Craig Smith

Western Arctic National Parklands – Peter Neitlich

Wrangell-St. Elias National Park and Preserve – Miranda Terwilliger, Eric Veach

Yukon-Charley Rivers National Preserve – Jobe Chakuchin, Tom Liebscher

#### Volunteers

Alaska Association of Conservation Districts, Alaska Sea Life Center, Need for Seed, Resurrection Bay Conservation Alliance, Skagway Public Library, Southeast Alaska Guidance Association, Taiya Inlet Watershed Council

#### Steering Committee

Alaska Region Office – Jennifer Allen (Fire Ecologist), Sara Wesser (I&M Coordinator), Tim Hudson (Associate Regional Director)

Alaska Department of Transportation – Larry Johnson

Bureau of Land Management – Jeanne Standley

Denali National Park – Carl Roland

Klondike Gold Rush National Historic Park – Susan Boudreau

Southwest Alaska Network Inventory and Monitoring Coordinator – Michael Shephard

Wrangell-St. Elias National Park and Preserve – Eric Veach

## **California EPMT**

### Administration

Bobbi Simpson (Liaison), Patrick Kelly (Data manager)

### Partners

American Conservation Experience  
AmeriCorps  
California Department of Parks and Recreation  
Cameron Colson  
Courage for Change  
Great Tree Tenders  
Native Range (John Knapp)

### Region/Network Support

Pacific West Region Office – Jay Goldsmith (Natural Resources Specialist)

### Steering Committee

Klamath Inventory and Monitoring Network – Stassia Samuels  
Mediterranean Inventory and Monitoring Network – Christy Brigham  
Pacific West Region Office – Jay Goldsmith  
San Francisco Bay Area Inventory and Monitoring Network – Sue Fritzke  
Sierra Inventory and Monitoring Network – Athena Demetry

## **Chihuahuan Desert / Shortgrass Prairie EPMT**

### Administration

Patrick Wharton (Team Leader)

### Region/Network Support

Chihuahuan Desert Inventory and Monitoring Network – Kirsten Gallo  
Intermountain Region Office – Myron Chase (IPM Coordinator), Linda Kerr (Fire Ecologist), Pam Benjamin (Vegetation Ecologist), Sarah Wynn (Restoration Ecologist)  
Southern Colorado Plateau Inventory and Monitoring Network – Rob Bennetts, Tomye Folts

### Partners

San Angelo National Wildlife Refuge  
Texas A&M University  
Texas Environmental Corps  
World Wildlife Fund

### Steering Committee

Amistad National Recreation Area – Greg Garetz  
Bents Old Fort National Historic Site – Fran Pannebaker  
Big Bend National Park – Joe Sirotnak  
Capulin Volcano National Monument – Kim Struthers  
Carlsbad Caverns National Park – Renee West  
Fort Davis National Historic Site – John Heiner  
Fort Union National Monument – Marie Frias  
Guadalupe Mountain National Park – Fred Armstrong  
Lake Meredith National Recreation Area – Arlene Wimer  
Pecos National Historic Site – Cheri Dorshak  
Sand Creek Massacre National Historic Site – Karl Zimmermann  
Washita Battlefield National Historic Site – Dick Zahm

White Sands National Monument – David Bustos

## **Florida / Caribbean Partnership EPMT**

### Administration

Tony Pernas (Liaison), Alan Shane McKinley (Crew Leader), Aaron Parns (Data Manager)

### Crew

Eric Walker, Dan Lucero, Alex Heeren

### Region/Network Support

North Coast / Cascades Network EPMT – Todd Neel (Liaison)

South Florida and Caribbean Network – Brooke Shamblin, Brian Wicher, Judd Patterson

### Park Support

Big Cypress National Preserve – William Snyder, Jim Burch

Biscayne National Park – Shelby Moneysmith, Vanessa McDonough

Buck Island Reef National Monument – Ian Lundgren, Zandy Hillis-Starr

Canaveral National Seashore – John Stiner

DeSoto National Memorial – Jorge Acevedo

Dry Tortugas National Park – Tracy Ziegler, Kayla Nimmo

Everglades National Park – Hillary Cooley, Jonathan Taylor, Sergio Martinez, Elise Morrison, Louie and

Alice Toth, Wayne Strebe, Ashley Schnitker

Fort Matanzas National Monument – Kurt Foote

Gulf Islands National Seashore – Mark Nicholas

Timucuan Ecological and Historic Preserve – Shauna Allen, Ryan Williams

Virgin Islands National Park – Rafe Boulon, Thomas Kelly, Kelly Altenhofen

### Partners

Florida Wildlife Conservation – Dennis Giardina

Miami-Dade County – Jane Dozier, Dallas Hazelton, Jeff Fobb

US Department of Agriculture – Jonathan Lewis

### Steering Committee

Big Cypress National Preserve – Jim Burch

Biscayne National Park – Vanessa McDonough

Buck Island Reef National Monument – Ian Lundgren

Canaveral National Seashore – John Stiner

Everglades National Park – Hillary Cooley

Florida Wildlife Conservation – Jackie Smith

Fort Matanzas National Monument – Kurt Foote

Gulf Islands National Seashore – Mark Nicholas

US Army Corps of Engineers – John Lane

US Fish & Wildlife Service – William Thomas

South Florida Water Management District – Leroy Rogers

Southeast Region – Chris Furqueron (IPM Coordinator)

Timucuan Ecological and Historic Preserve – Shauna Allen

Virgin Islands National Park – Kelly Altenhofen

## **Great Lakes EPMT**

### Administration

Carmen Chapin (Liaison), Isaiah Messerly (Crew Leader), Rebecca Key (Data Manager)

### Crew

Ryan Colley, Carly Belliveau (SCA Intern), Emily Heeszal (SCA Intern), Joe Helseth (SCA Intern), Tina Helseth (SCA Intern), Nick Schiltz (SCA Intern), Emily St. Aubin (SCA Intern)

### Region/Network Support

Midwest Region Office – Chris Holbeck

### Steering Committee

Apostle Islands National Lakeshore – Peggy Burkman  
Grand Portage National Monument – Brandon Seitz  
Ice Age National Scenic Trail – Mark Holden  
Indiana Dunes National Lakeshore – John Kwilosz  
Isle Royal National Park – Paul Brown  
Midwest Regional Office – Julie Stumpf  
Mississippi National River and Recreation Area – Nancy Duncan  
Pictured Rocks National Lakeshore – Bruce Leutscher  
Saint Croix National Scenic River – Robin Maercklein  
Sleeping Bear Dunes National Lakeshore – Steve Yancho  
Voyagers National Park – John Snyder

## **Gulf Coast EPMT**

### Administration

Eric Worsham (Liaison)

### Region/Network Support

Southeast Region Office – Chris Furqueron (IPM Coordinator)

### Park Support

Big Thicket National Preserve – Dave Roemer, Brian Lockwood  
Gulf Islands National Seashore – Riley Hoggard, Gary Hopkins  
Intermountain Region Office – Myron Chase (IPM Coordinator)  
Jean Lafitte National Historic Park and Preserve – Dusty Pate, David Muth  
Natchez Trace Parkway – Lisa McInnis  
Palo Alto Battlefield National Historic Park – Rolando Garza  
San Antonio Missions National Historic Park – Greg Mitchell, Greg Smith  
Vicksburg National Military Park – Virginia Duboway

### Partners

Arrowhead Star Company  
Colorado State University  
Ladybird Johnson Wildflower Center  
Rice University  
Union Forestry  
University of Texas  
US Army Corps of Engineers

### Volunteers

AmeriCorps, Student Conservation Association



## **Lake Mead EPMT**

### **Administration**

Curt Deuser (Liaison), Tarl Norman (Crew Leader), Sue Knowles (Administrative Assistant; position shared with Lake Mead Resource Management), Scott Briggs (Budget Assistant; position shared with Lake Mead Resource Management), Ryan Tietjen (Data Manager), Vanessa Truitt (Data Manager), Dwayne Coleman (Squad Leader), Beth Points (Squad Leader), Joseph Castello (Squad Leader), Samuel Smyrk (Squad Leader)

### **Crew**

Jacob Rigby, Anna O'Brien, Amorita Brackett, Lauren-Alnwick Pfund, Heather Ferguson, Dawn Hulton, Tamberlain Jacobs, William Lide, Timothy Marsh, Christopher Penny, Kevin Reichling, Casey Sandusky, Valerie Seeton, Adam Throckmorton, Rebecca Welytok, Hannah Wigginton

### **Park Support**

Arches National Park – Clay Kark, Clay Allred, Mark Miller  
Bryce Canyon National Park – Laura Schrage  
Canyon de Chelly National Monument / Navajo National Monument – Mick Castillo  
Chaco Culture National Historic Site – Jim Von Haden  
Death Valley National Park – Kelly Fuhrmann, Jane Cipra, Kirtsen Lund  
Dinosaur National Monument – Tamara Naumann  
Glen Canyon National Recreation Area – Lonnie Pilkington, John Spence, Chris Hughes  
Grand Canyon National Park – Talise Dow, Melissa McMaster, Lori Makarick  
Joshua Tree National Park – Josh Hoines  
Lake Mead National Recreation Area – Kent Turner, Gordon Olson, Alice Newton, Carrie Norman  
Mesa Verde National Park / Yucca House National Monument – Bryan Wender, George San Miguel  
Mojave National Park – Anne Kearns  
Parashant National Monument – Jeff Bradybaugh, Rosie Pepito, Kathleen Harcksen  
Tumacacori National Historic Site – Jeremy Moss  
Wupatki National Monument – Charles Schelz  
Zion National Park / Cedar Breaks National Monument – Eric Lassance, Brian Black, Cheryl Decker

### **Partners**

Bureau of Land Management – Nora Caplette, Lauren Brown, Sean McEldery, Nancy Williams, Mindy  
Bureau Of Reclamation – Marc Maynard, Jason Kirby.  
California Fish and Game Department – Troy Kelly, Bruce Kenyon  
PWR – Jay Goldsmith  
Seal, Kathleen Harcksen, Whit Bunting, Alex Neiberger, Glenn Harris, Martha Dicks  
US Fish and Wildlife Service – Mark Kaib (BAER/BAR Coordinator), Jack Allen, Allison Manwaring,  
Amy Lavoie, Kathleen Blair, Stan Cummings  
US Forest Service – Marissa Anderson, Laura Moser  
Western Navajo Agency – Rene Benally, Lawrence Yazzie

### **Volunteers**

Pat Riley (Shop Master)

## **Mid-Atlantic EPMT**

### **Administration**

James Åkerson (Liaison), Craig Bentley (Crew Leader)

### **Crew**

Nathan Wender, Coleman Minney, Jonathan Boutwell (SCA Intern), Michael Contrivo (SCA Intern),  
Quintin Quigley (SCA Intern)

### Region/Network Support

Northeast Region Office – David W. Reynolds (Chief Natural Resources and Science Division), Wayne Millington (IPM Specialist)

Appalachian Trail Inventory and Monitoring Network – Fred Dieffenbach

Eastern Rivers and Mountains and Mojave Desert Inventory and Monitoring Network – Jennifer Stingelin Keefer

### Park Support

Appomattox Court House National Historic Site – B. Eick, R. Tillotson, J. Spangler

Appalachian National Scenic Trail – C. Reese, M. Miller, L. Parriott, M. Gray, T. Sowers, M. Elfner, D.

Bryon, T. Pryor, R. Williams, W. Ebersberger, S. Mayes, S. Schaffer, P. Dennison

Booker T Washington National Monument – T. Sims, C. Mays

Colonial National Historic Park – D. Geyer

Fredericksburg and Spotsylvania National Military Park – G. Kneipp, W. Albridge, K. Mullholland

Gettysburg National Military Park / Eisenhower National Historic Site – J. Johnson, S. Koenig, R.

Krichten, C. Brown, G. Thomas, A. Roach, B. Robinson

George Washington Birthplace / Thomas Stone National Historic Site – R. Moräwe

Hampton National Historic Site – P. Bitzel, M. Lynch, A. Klopka, J. Hicks

Hopewell Furnace National Historic Site – E. Shean-Hammond, S. Ambrose, G. Martin, F. Delmar;

New River Gorge National River / Blue Ridge Parkway / Gauley River National recreation Area – J. Perez

Petersburg National Battlefield – D. Shockley, T. Blumenschine

Richmond National Battlefield Park – K. Allen, M. Prowatzke

Shenandoah National Park – G. Olson, W. Cass, J. Hughes, A. Webb, T. Pryor

Valley Forge National Historic Park – K. Heister, K. Jensen

### Volunteers

Alvernia University, Classical Cottage School, Mountain Laurel Montessori, Oberle School, Sherando High School, Virginia Governor's School, Defenders of Wildlife, Friends of the National Zoo, National Audubon Society

### Sponsors

National Audubon Society of Virginia, Defenders of Wildlife, National Environmental Education Foundation, Shenandoah National Park Association, Student Conservation Association, Appalachian Trail Conservancy, Potomac Appalachian Trail Club, Leave No Trace

### Steering Committee

Appomattox Court House National Historic Park – Brian Eick

Appalachian National Scenic Trail – C. Casey Reese

Booker T Washington National Monument – Timothy Sims

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Fredericksburg and Spotsylvania National Military Park – Gregg Kneipp

Gettysburg National Military Park – Sara Koenig, Randy Krichten

George Washington Birthplace National Monument – Rijk Moräwe

Hampton National Historic Site – Paul Bitzel

Hopewell Furnace National Historic Site – Steven Ambrose

New River Gorge/Blue Ridge Parkway / Gauley River National Recreation Area – Scott Stonum, John Perez

Petersburg National Battlefield – Dave Shockley, Tim Blumenschine

Richmond National Battlefield Park – Kristen Allen

Shenandoah National Park – Jim Schaberl

Valley Forge National Historic Park – Kristina Heister

## **National Capital Region EPMT**

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Leinwohl, Josh Lowman, Dan Malooly,

### Region/Network Support

National Capital Region Office – Dan Sealy (Deputy Chief of Natural Resources and Sciences)

### Park Support

Antietam National Battlefield – Joe Calzarette  
Appalachian National Scenic Trail – Kent Schwarzkopf  
Assateague Island National Seashore – Jonathan Chase  
Catocin Mountain Park – Matt Gilford, Becky Loncosky  
Chesapeake and Ohio Canal National Historic Park – P. Scott Bell, Michele Carter  
George Washington Memorial Parkway – Erik Oberg  
Harpers Ferry National Historical Park – Dale Nisbet  
Monocacy National Battlefield – Eric Kelley  
National Capital Parks East – Mikaila Milton  
Rock Creek Park – Joe Kish  
Wolf Trap National Park for the Performing Arts – Betsy Chittenden, Phil Goetkin

### Partners

Animal and Plant Health Inspection Service – Alan Tasker  
The Nature Conservancy – Mary Travaligni (Volunteer Coordinator), Jamie Weaver (Volunteer Coordinator)  
United States Fish and Wildlife Service – Phil Pannill (NCTC Grounds Manager), Karin Christensen

### Volunteers

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### Steering Committee

National Capital Region – Jim Sherald (Chief of Natural Resources and Sciences), Diane Pavsek (Botanist and Research Coordinator), Jil Swearingen (IPM Specialist)  
Antietam National Battlefield – Ed Wenschof  
Catocin Mountain Park – Sean Denniston  
Chesapeake and Ohio Canal National Historic Park – Scott Bell  
George Washington Memorial Parkway – Brent Steury  
Harpers Ferry National Historic Park – Bill Hebb  
Manassas National Battlefield Park – Bryan Gorsira  
Monocacy National Battlefield – Andrew Banasik  
National Capital Parks East – Steve Syphax  
National Mall – Mary Willeford Bair  
Prince William Forest Park – Paul Petersen  
Rock Creek Park – Ken Ferebee  
Wolf Trap National Park for the Performing Arts – Duane Erwin

## **North Coast / Cascades Network EPMT**

### Administration

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### Crew

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### Region/Network Support

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Regina Rochefort (Network Science Advisor)

### Park Support

Ebey's Landing National Historical Reserve – Craig Holmquist  
Fort Vancouver National Historic Site – Tracy Fortmann  
John Day Fossil Beds National Monument – Shirley Hoh  
Lake Chelan National Recreation Area – Vicki Gempko  
Lake Roosevelt National Recreation Area – Ken Hyde, Nate Krohn  
Lewis and Clark National Park – Carla Cole, Chris Clatterbuck  
Mount Rainier National Park – Lou Whiteaker, Will Arnesen  
Nez Perce National Historical Park – Jason Lyon, Jannis Jocious  
North Cascades National Park / Ross Lake National Recreation Area – Jack Oelfke, Mignonne Bivin  
Olympic National Park – Steve Acker  
San Juan Island National Historic Park – Jerald Weaver  
Whitman Mission National Historic Site – Roger Trick

## **Northeast EPMT**

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### Crew

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### Region/Network Support

Northeast Region Office – Wayne Millington (IPM Coordinator), David W. Reynolds (Division Chief, Natural Resources & Science)

### Park Support

Acadia National Park – Aleta McKeage, 2 biological science technicians (seasonal)  
Appalachian National Scenic Trail – Casey Reese, Adam Brown (Appalachian Trail Conservancy; partner)  
Boston Harbor Islands National Recreation Area – Marc Albert, Valerie Wilcox (seasonal), 1 biological science technician (seasonal)  
Cape Cod National Seashore – Stephen M. Smith  
Delaware Water Gap National Recreation Area – Larry Hilaire, Jeff Shreiner, Tom Witter (VIP), Doug Millard (VIP)  
Fire Island National Seashore – Jordan Raphael, 2 SCA Interns  
Gateway National Recreation Area – Four students from the Marine Academy of Science & Technology  
Morristown National Historic Park – Robert Masson  
Roosevelt-Vanderbilt Headquarters – Dave Hayes, Anna DeCordova  
Sagamore Hill National Historic Site – Sherry Justus  
Saratoga National Historical Park – Chris Martin, Linda White, Cindy VanDerwerker, Joe Vuchak (SCA Intern), Patrick Coppens (YCC youth), Colin Wells (YCC youth)

## **Northern Great Plains EPMT**

### Administration

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### Crew

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### Park Support

Agate Fossil Beds National Monument – James Hill

Badlands National Park – Brian Kenner, Milt Haar, Mark Slovek, Lee Vaughn, Casey Sawvell, Laniece Sawvell

Devils Tower National Monument – Angela Wetz, Ed Eberhardy

Fort Laramie National Historic Site – Mitzi Frank, Gayle Jones

Fort Union Trading Post National Historic Site – Andy Banta

Jewel Cave National Monument – Rene Ohms

Knife River Indian Villages National Historic Site – John Moeykens

Minuteman Missile National Historic Site – John Black

Missouri National Recreational River – Gia Wagner

Mount Rushmore National Memorial – Bruce Weisman, Al Sage

Niobrara National Scenic River – Pam Sprenkle

Scottsbluff National Monument – Bob Manasek

Theodore Roosevelt National Park – Bill Whitworth, Laurie Richardson, Chad Sexton, Meg Schwartz

Wind Cave National Park – Greg Schroeder, Beth Burkhardt, Kevin Kovacs

### Steering Committee

Midwest Regional Office - Chris Holbeck

Agate Fossil Beds National Monument – James Hill

Badlands National Park – Brian Kenner

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Theodore Roosevelt National Park – Bill Whitworth

Wind Cave National Park – Greg Schroeder

## **Northern Rocky Mountain EPMT**

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### Park Support

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City of Rocks National Reserve – Trenton Durfee, Steven Murray

Craters of the Moon National Monument & Preserve (host park) – Steven Bekedam, seasonal staff

Dinosaur National Monument – Tamara Naumann

Fossil Butte National Monument – Arvid Aase, Clay Kyte, Phil Knecht

Glacier National Park (host park) – Dawn LaFleur, Matt Kennedy, seasonal staff  
Golden Spike National Historic Site – Tammy Benson  
Grand Teton National Park & John D. Rockefeller Memorial Parkway – Jason Brengle  
Grant-Kohrs Ranch National Historic Site – Jason Smith  
Hagerman Fossil Beds National Monument & Minidoka Internment National Monument – Ray Vader  
Little Bighorn Battlefield National Monument – Melana Stichman  
Nez Perce National Historic Park – Jannis Jocius, Jimmer Stevenson  
Rocky Mountain National Park – Jim Cheatham, Jim Bromberg, seasonal staff  
Yellowstone National Park (host park) – Christopher Overbaugh, Troy Nedved, Eric Reinertson, seasonal staff

### Steering Committee

Yellowstone National Park (host park) – Dan Reinhart  
Glacier National Park (host park) – Dawn LaFleur  
Craters of the Moon National Monument & Preserve (host park) – John Apel, Steve Bekedem  
Bighorn Canyon National Recreation Area – Cassity Bromley  
City of Rocks National Reserve – Kristen Bastis  
Fossil Butte National Monument – Arvid Aase  
Golden Spike National Historic Site – Tammy Benson  
Grand Teton National Park / John D. Rockefeller Memorial Parkway – Kelly McCloskey, Jason Brengle  
Grant-Kohrs Ranch National Historic Site – Chris Ford, Jason Smith  
Hagerman Fossil Beds National Monument / Minidoka Internment National Monument – JoAnn Blalack  
Little Bighorn Battlefield National Monument – Melana Stichman  
Nez Perce National Historic Park – Jannis Jocius, Jason Lyon

## **Pacific Islands EPMT**

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### Park Support

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### Partners

Maui Invasive Species Council – Adam Radford (Operations Manager), Brooke Mahnken (Field Technician / Data Manager), Michael Ade (Crew Leader)  
Interagency Miconia Management Program – Sean Birney (Data Manager), Imi Nelson (Crew Leader)

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Haleakala National Park – Steve Anderson  
Hawaii Division of Forestry and Wildlife – Fern Duvall  
Hawaii Volcanoes National Park – Dr. Rhonda Loh  
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The Nature Conservancy Hawaii, Maui Program – Pat Bily  
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## **Southeast EPMT**

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### Volunteers

Jane Hargreaves, Arthur Miller, Diane Riggs, Western NC Alliance, Green Asheville, Warren Wilson College, Friend of the Blue Ridge Parkway, NC Native Plant Society.

### Steering Committee

Abraham Lincoln Birthplace National Historic Park – Jenny Jones  
Andrew Johnson National Historic Site – Jim Small  
Big South Fork National River and Recreation Area – Marie Kerr  
Blue Ridge Parkway – Chris Ulrey  
Carl Sandburg Home National Historic Site – Irene Van Horn  
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Cowpens National Battlefield – Kathy McKay  
Cumberland Gap National Historic Park – Jenny Beeler  
Fort Donelson National Battlefield – Michael Manning  
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Kings Mountain National Military Park – Chris Revels  
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Mammoth Cave National Park – Bob Ward  
Ninety Six National Historic Site – Gray Wood  
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Shiloh National Military Park – Marcus Johnson  
Stones River National Battlefield – Terri Hogan

## **Southeast Coast EPMT**

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Chattahoochee River National Recreation Area – Allyson Read  
Congaree National Park – Theresa Yednock  
Cumberland Island National Seashore – Doug Hoffman  
Fort Frederica National Monument – Chad Thomas  
Fort Pulaski National Monument – Laura Rich-Acosta  
Fort Sumter National Monument / Charles Pinckney National Monument – Rick Dorrance  
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Kennesaw Mountain National Military Park – Tom Sparks  
Moores Creek National Battlefield – James Sutton  
Ocmulgee National Monument – Guy LaChine



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## **Appendix B: Glossary**

### **Exotic, Invasive, Noxious, and Weed**

The terms exotic, invasive, noxious weed, and weed are used in this report and the literature. These are related terms with variations in meaning. Exotic refers to organisms including plants that are not native to an ecosystem. Not all exotic organisms are invasive. For this report, invasive species are exotic organisms that can reproduce, persist, and even dominate ecosystems. The National Park Service, along with others use the term Invasive species as defined by Executive Order 13112; Plants that are: 1) non-native (or alien) to the ecosystem under consideration, and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health ( Executive Order 13112). Weeds are the most general term with the broad definition of any plant out of place. Finally, noxious weed is a legal term referring to any plant that has been designated as noxious by a federal, state, or county entity. There is often a legal obligation to control, contain, or not distribute plant species designated as noxious.

### **Gross Infested Area**

Like Infested Area, it is the area of land occupied by a single weed species. Unlike Infested Area, the area is defined by drawing a line around the general perimeter of the invasive plant population not the canopy cover of the plants. The gross area may contain significant parcels of land that are not occupied by weeds.

Gross area is used in describing large infestations. Some infestations are very large or discontinuous and it is difficult or not useful to map these larger infestations based on the canopy cover of the plants (Infested Area). The increase in accuracy gained by plotting individual plants may not compensate for the increase in cost or manpower. The general location on the landscape and an estimate of land area may be sufficient to meet inventory, monitoring, and treatment requirements. For these larger infestations a line is drawn around the outer perimeter of general weeded area or the plant population, this is the Gross Area. When a value is entered for gross area, the assumption is that the area within the perimeter of the weed population (area perimeter) is an estimate or the product of calculating the area within a described perimeter. It is not a measured value. If an infestation is mapped using Gross Area, a value for Infested Area must still be recorded. The value for Infested Area is derived from estimating the actual or percentage of land occupied by weed plants.

### **Infested Area**

This is the area of land containing a single weed species. An infested area of land is defined by drawing a line around the actual perimeter of the infestation as defined by the canopy cover of the plants, excluding areas not infested. Areas containing only occasional weed plants per acre do not equal one acre infested. There is no lower or upper limit to the size of an infestation. An infestation can be 1/10,000 of an acre to several thousand acres. 1/10,000 or .0001 acres is approximately a 3' x 4' area and is equivalent to approximately one plant.

### **Inventoried Area**

An extensive point-in-time survey to determine the presence/absence, location, or condition of an invasive plant species. An area can be considered inventoried regardless of whether an invasive plant is found or not. Inventoried Area is reported in acres.

### **Maintained Area**

Maintaining an area in an invasive plant free state so that annual or periodic maintenance treatments represent 1% or less of the original infestation.

**Monitored Area**

Monitoring is the collection of information or repeated observations by measuring changes in an indicator or variable. Monitoring may include ecological factors such as soils and plant composition. Monitoring for the EPMT program often refers to measuring the changes in density, distribution abundance or location of an invasive species. Monitoring is reported in acres.

**Retreated Area**

This term refers to areas that have previously been treated. The retreated area may be a portion or a subset of the original treatment area, or the entire original treatment area.

**Treated Area**

Treated area is either the infested area or subset of an infested area that has received some form of treatment or control for invasive plants. Treatment area is calculated using the same standards as infested area and is reported in acres.

**Restored Area**

Acres restored to the condition specified in management plans. Returning an area, watershed, or landscape to some previous condition, often some desirable baseline through efforts that include controlling invasive plants and animals.

## **Appendix C: Common Acronyms**

CWMA – Cooperative Weed Management Area

EDRR – Early Detection and Rapid Response

EPMT – Exotic Plant Management Team

GIS – Geographic Information System

GPS – Global Positioning System

IPM – Integrated Pest Management

NHS – National Historic Site

NM – National Monument

NPS – National Park Service

NRA – National Recreation Area

USGS – United States Geological Survey





## Appendix D: Plant Species Index (by scientific name)

Acacia confusa	
Formosa koa .....	41
Acroptilon repens	
Russian knapweed .....	17, 39
Aeschynomene virginica	
joint vetch .....	31
Ailanthus altissima	
tree-of-heaven .....	47
Albizia julibrissin	
mimosa .....	47
Albizia mimosa	
mimosa tree .....	18, 45
Aleurites fordii	
tungoil tree .....	47
Alhagi pseudalhagi	
camelthorn .....	16
Alliaria petiolata	
garlic mustard .....	22, 24, 31
Andropogon gerardii	
big bluestem .....	25
Artemisia absinthium	
absinth wormwood .....	27
Arundinaria gigantea	
giant cane .....	18
Bamboosa multiplex	
silver bamboo .....	47
Berberis thunbergii	
Japanese barberry .....	33
Brassica tournefortii	
Sahara mustard .....	37
Bromus tectorum	
cheatgrass .....	14, 16, 35, 39
Carduus nutans	
musk thistle .....	18, 21
Carex kobomugi	
Asiatic sand sedge .....	33
Celastrus orbiculatus	
oriental bittersweet .....	30, 45
Centaurea jacea	
spotted knapweed .....	33
Centaurea maculosa	
spotted knapweed .....	21
Centaurea solstitialis	
yellow starthistle .....	34
Centaurea stoebe	
spotted knapweed .....	33
Chrysanthemum leucanthemum	
oxeye daisy .....	21

Cinnamomum burmanni	
Padang cassia.....	41
Cirsium arvense	
bull thistle .....	21, 27, 39
Cirsium vulgare	
bull thistle .....	21, 35
Clidemia hirta	
Koster's curse.....	41
Conium maculatum	
poison hemlock.....	39
Conradina verticillata	
Cumberland rosemary.....	45
Convolvulus arvensis	
field bindweed .....	14, 21
Crepis tectorum	
narrowleaf hawksbeard.....	13
Cynanchum louiseae	
black swallow-wort.....	33
Cynoglossum officinale	
houndstongue.....	21
Cypripedium kentuckiense	
Kentucky lady-slipper.....	31
Elaeagnus angustifolia	
Russian olive .....	16, 17
Elaeagnus umbellata	
autumn olive .....	25
Euphorbia myrsinites	
myrtle spurge .....	39
Geranium robertianum	
herb Robert .....	39
Grevillea robusta	
silk oak.....	41
Hedera helix	
English ivy.....	41, 47
Hedychium gardnerianum	
kahili ginger.....	40
Helichrysum petiolare	
licorice plant .....	35
Imperata cylindrical	
cogon grass .....	18, 44
Iris pseudacorus	
yellow flag iris .....	38
Isatis tinctoria	
Dyer's woad .....	20
Justicia betonica	
white shrimp plant .....	41
Lantana camara	
lantana.....	47
Lespedeza bicolor	
shrubby lespedeza.....	47
Lespedeza cuneata	

Chinese lespedeza.....	25
Leucanthemum vulgare	
oxeye daisy .....	35
Ligustrum japonicum	
Japanese privet.....	18, 47
Ligustrum sinense	
privet.....	45, 47
Ligustrum vulgare	
common privet.....	25
Linaria dalmatica	
Dalmatian toadflax .....	39
Liparis loeselii	
bog twayblade.....	31
Lonicera japonica	
Japanese honeysuckle .....	18, 47
Lonicera spp.	
bush honeysuckle.....	25
Lygodium japonicum	
Japanese climbing fern .....	47
Lythrum salicaria	
purple loosestrife .....	22, 38
Maribium vulgare	
horehound .....	4, 26
Melia azedarach	
Chinaberry tree .....	18, 47
Melilotus officinalis	
yellow sweetclover .....	14
Microstegium vimineum	
Japanese stilt grass.....	47
Morella faya	
faya tree .....	40
Oplismenus hirtellus ssp. undulatifolius	
wavyleaf basketgrass .....	28
Paulownia tomentosa	
royal paulownia .....	18
Pennisetum setaceum	
fountain grass.....	41
Perilla frutescens	
beefsteak .....	44
Perilla frutescens	
beefsteak .....	47
Persicaria perfoliata	
mile-a-minute vine.....	30
Phalaris arundinacea	
reed canarygrass .....	25, 38
Phragmites australis	
phragmites .....	18, 25, 29, 31, 33
Phyllostachys aurea	
golden bamboo .....	47
Pinus caribaea	
Caribbean pine.....	41



Polygonum capitatum	
knotweed.....	41
Polygonum cuspidatum	
Japanese knotweed .....	25
Polygonum sp.	
knotweed.....	38
Polygonum x bohemicum	
Bohemian knotweed .....	38
Populus spp.	
cottonwood .....	16
Pseudosasa japonica	
arrow bamboo .....	47
Pueraria montana	
kudzu .....	6, 18, 47
Rhamnus cathartica	
common buckthorn .....	22, 27
Rhamnus sp.	
buckthorn.....	22
Rhus coppalinum	
winged sumac .....	25
Rhus glabra	
smooth sumac .....	25
Robinia pseudoacacia	
black locust .....	22, 25, 39
Rosa multiflora	
multiflora rose.....	25, 30, 33, 45
Rubus discolor	
Himalayan blackberry.....	30
Rubus ellipticus	
Himalayan raspberry.....	40
Saccharum ravennae	
Ravenna grass .....	17, 36
Salix spp.	
willow .....	16
Schinus terebinthifolius	
Brazilian pepper.....	5, 42
Sonchus arvensis	
perennial sowthistle .....	13
Sorbus aucuparia	
European mountain ash .....	13
Sorghum halepense	
Johnsongrass .....	14, 18, 25
Spiraea virginiana	
Virginia spirea .....	45
Tamarix aphylla	
athel tree .....	37
Tamarix gallica	
tamarisk .....	47
Tamarix ramosissima	
saltcedar, tamarisk .....	14, 17
Tamarix spp.	

tamarisk .....	16
Tanacetum vulgare	
common tansy .....	21
Taraxacum officinale ssp. officinale	
common dandelion .....	13
Triadica sebifera	
Chinese tallow .....	18, 47
Typha spp.	
hybrid cattail .....	23
Ulmus pumila	
Siberian elm .....	14
Verbascum thapsus	
common mullein, wooly mullein .....	30, 35
Vicia cracca	
bird vetch .....	13
Wisteria floribunda	
Japanese wisteria .....	47



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