National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Exotic Plant Management Team Program

2009 Annual Report

Natural Resource Report NPS/NRSS/NRR—2011/458

ON THE COVER

Top center - Lake Mead EPMT, Curt Deuser; Center left - Gulf Coast EPMT working with a volunteer group from the National Wildlife Federation, Eric Worsham; Center center - Pacific Island EPMT using fire to treat invasive plants, Jeremy Gooding; Center right - Northern Rocky Mountains EPMT working in Bighorn Canyon NRA, Sue Salmons; Bottom left - Alaska EPMT using GPS to map occurrences of invasive plants, Bonnie Million; Bottom center - Alaska EPMT teaching children to identify invasive plants in Denali National Park, Bonnie Million ; Bottom right - Northern Great Plains EPMT treating leafy spurge at Devils Tower National Monument, Chad Prosser.

Exotic Plant Management Team Program

2009 Annual Report

Natural Resource Report NPS/NRSS/NRR—2011/458

Rita Beard

National Park Service
Invasive Plant Program Coordinator
1201 Oakridge Dr., Suite 200
Fort Collins, CO 80525

Louisa Gibson

National Park Service
Program Assistant
1201 Oakridge Dr., Suite 200
Fort Collins, CO 80525

October 2011

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/nrpm/).

Please cite this publication as:

Beard, R., and L. Gibbons. 2011. Exotic Plant Management Team Program: 2009 annual report. Natural Resource Report NPS/NRSS/NRR—2011/458. National Park Service, Fort Collins, Colorado.

NPS 909/111437, October 2011

Table of Contents

Introduction

The spread of invasive species is recognized as one of the major factors contributing to ecosystem change and instability throughout the world. The proliferation of invasive species is changing native landscapes across North America, including our national parks. The potential for climate change indicates that invasive species will impact a broader spectrum of ecosystems at an accelerating pace. It is the policy of the National Park Service (NPS) to manage invasive species that are interfering with natural processes, native species, or native habitats. NPS has responded to this challenge by increasing resources dedicated to improving prevention, inventory and monitoring, and treatment programs. One of the many successful programs established to address the growing invasive species issue is the Exotic Plant Management Team Program.

Figure 1: Treating invasive plants at Isle Royale National Park, Great Lakes EPMT, 2009.

Exotic Plant Management Teams

The Exotic Plant Management Team Program provides a framework and a first response to invasive plant management within NPS. Originally developed in 1996, the program started with just four teams. Today, the program consists of 16 regionally located exotic plant management teams (EPMTs) comprised of highly trained individuals with expertise in plant identification, plant ecology, weed management, and pesticide use (figure 3).

Invasive plant species are able to transform ecosystems through a variety of mechanisms including: changing the composition of plant communities, contributing to soil erosion, changing soil chemistry, changing the physical structure of ecosystems, and modifying water availability. These changes result in a loss of biodiversity, threatened rare species, altered visual landscapes, and the loss of habitat for wildlife and other native organisms. Invasive species also reduce the resiliency of ecosystems, decreasing the ability to respond to both natural and human induced disturbances, such as fire and climate change. The teams mitigate the impacts of invasive plants through the use of science and proven strategies. The EPMTs work with parks and NPS partners to manage invasive plants through a combination of cooperation, collaboration, inventory, monitoring, prevention, treatment, and restoration.

Figure 2: Inventorying invasive plants along glacial moraines, Alaska EPMT, 2009.

The EPMTs, along with parks and resource managers, are gearing up to face an uncertain future resulting from a changing climate. Areas previously excluded from active management, such as alpine or glacial systems, are becoming sites of new invasions. Treatment in these emerging invaded ecosystems will likely require adaptations in treatment and restoration strategies. A critical component in preparing for these uncertain changes is completing natural resource inventories within the parks. These inventories will establish baseline data and facilitate the ability to identify, monitor, and respond to changes in ecosystems. Invasive plants are often indicators of ecosystem change. Monitoring trends in invasive plant distribution will become an increasingly important indicator for climate induced ecosystem change.

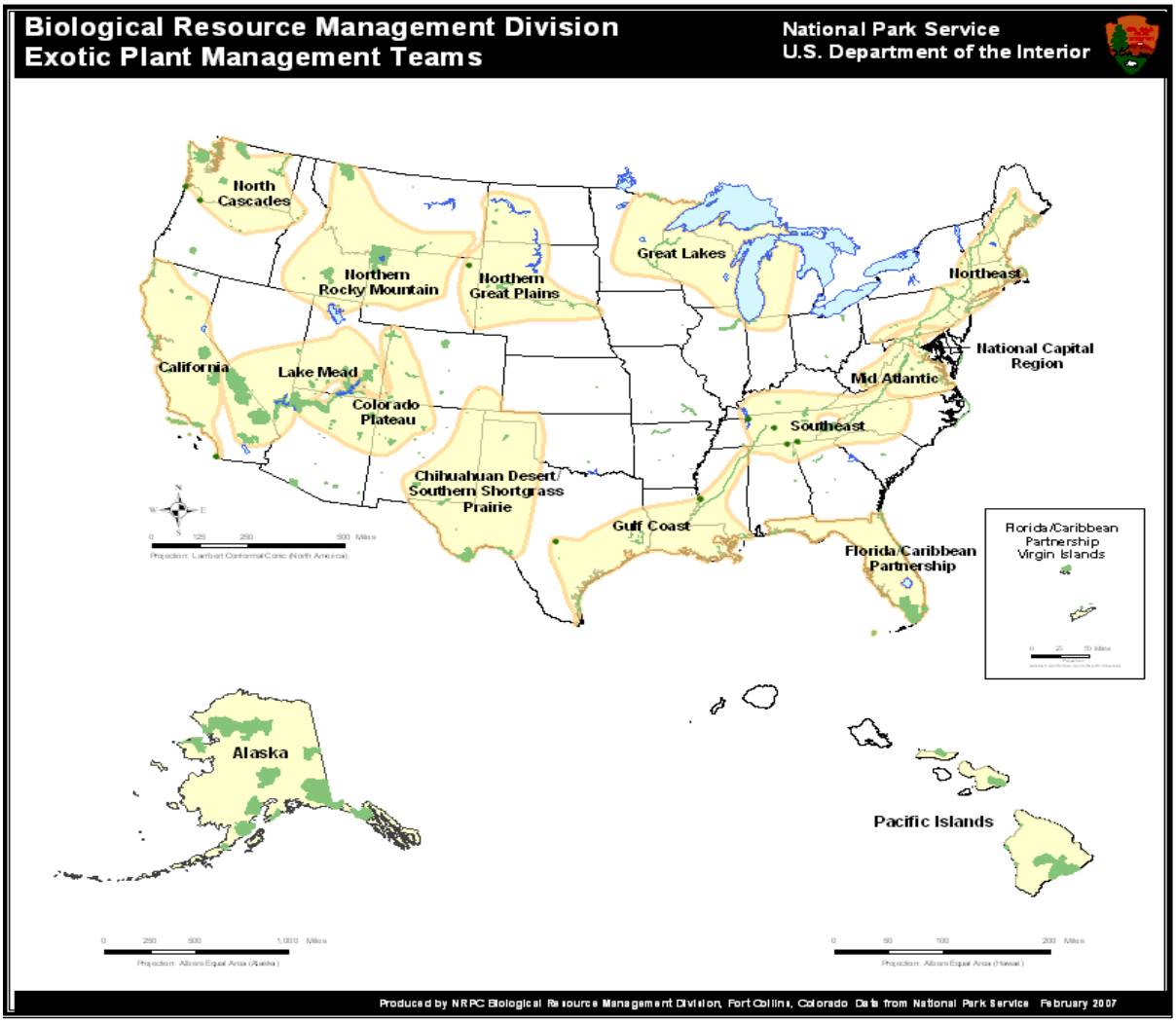


Figure 3. The Exotic Plant Management Teams.

Alaska Region

Alaska EPMT based in the Alaska Regional Office serving parks throughout Alaska.

Pacific Region

California EPMT based at Point Reyes National Seashore.

Lake Mead EPMT based at Lake Mead National Recreation Area.

North Cascades EPMT based at North Cascades National Park.

Pacific Islands EPMT based at Haleakala National Park.

Intermountain Region

Chihuahua Desert/Southern Shortgrass Prairie EPMT based at Carlsbad Caverns National Park.

Colorado Plateau EPMT based at Petrified Forest National Park.

Gulf Coast EPMT based at Big Thicket National Park.

Northern Rocky Mountain EPMT based at Yellowstone National Park.

Midwest Region

Great Lakes EPMT based at the Great Lakes Inventory and Monitoring Network Office.

Northern Great Plains EPMT based at Theodore Roosevelt National Park.

Northeast Region

Mid Atlantic Cooperative EPMT based at Shenandoah National Park.

Northeast EPMT based at Delaware Water Gap National Recreation Area.

National Capital Region

National Capitol Region EPMT based at Rock Creek Park.

Southeast Region

Southeast EPMT based at Blue Ridge Parkway.

Florida Caribbean Partnership EPMT based in Palmetto Bay, Florida.

2009 Accomplishments

The EPMT program is a leader in the management of invasive plants within NPS. The program supports NPS goals of invasive plant management through a multifaceted approach incorporating strategies of inventory, monitoring, collaboration, prevention, treatment, early detection and rapid response, and restoration. Each team tailors these strategies to reflect the needs of their partner parks, funding opportunities, and unique conditions on the ground. This structure results in unique goals, accomplishments, and success stories for each team. The teams provide assistance to parks, regions, inventory and monitoring networks, and partners through on the ground management, training to staff and volunteers, input and review of planning documents, and meeting Government Performance and Results Act (GPRA) goals.

In FY2009, the teams inventoried, treated, and monitored more acres than any previous year. Working with partners, the teams inventoried over 8 million acres of NPS and partner lands. In addition the team treated nearly 2,000 more acres and almost doubled the areas monitored. These accomplishments represent the efficiency and expertise of the teams.

2009 Accomplishments	
Inventoried Acres	8,160,458
Monitored Acres	43,524
Treated Acres	16,389
Restored Acres	11
Gross Infested Acres	105,114
Infested Acres	41,727

Table 1: 2009 Program accomplishments.

Inventory

Inventory efforts are critical to establishing baseline data on the presence of invasive species. This is the first step in efficient management of invasive plants. The teams assist parks, networks, and partners with inventorying acreage and documenting the presence invasive plants. This information facilitates identifying treatment locations, setting priorities, identifying pathways of invasion, and developing management plans.

In 2009, the teams inventoried approximately 8,160,458 acres. To complete this enormous inventory the teams used helicopters to complete fly over inventories, accessing larger areas and remote terrain. The teams are increasingly using innovative approaches and partnerships to complete inventory needs.

- **The California EPMT has incorporated the use of helicopters to access and inventory rugged and inaccessible terrain** on the Channel Islands. Over the course of five days and at a fraction of the cost, 57 acres were surveyed for seven priority weeds; 59 incipient populations were identified and treated. The helicopter approach also provided a vantage point that located nine infestations that would otherwise have gone undetected.
- **The Lake Mead EPMT inventoried over 2,000 acres of infested lands at Lake Roosevel**t in 2009 with the assistance of park planners and maintenance staff
- **The Alaska EPMT completes invasive plant inventories in high-risk areas** such as campgrounds, trailheads, and parking lots multiple times a season. Any infestations detected during these inventories are precisely mapped, immediately controlled using manual techniques, and closely monitored until they have been eliminated.

Figure 4: Using global positioning systems (GPS) to complete an inventory in Alaska

Monitoring

Following inventory and/or treatment efforts, it is crucial to monitor changes in invasive plant populations. Infested areas that were identified but

not treated are monitored to ensure that infestations are not growing or spreading. Treated acres are monitored to assess efficacy of treatment methods, to plan follow up strategies such as restoration activities, and to adapt management strategies. Once an invasive plant population occupies less than 1% of its original inventoried size, the population can be classified as controlled. These controlled sites must be monitored to ensure native systems are recovering and that any remaining invasive plant seed banks are not reestablishing reproducing invasive populations. Monitoring efforts often require multiple visits, ranging from seasonal to annual visits to detect changes.

The teams monitored a total of 43,524 acres in 2009, an increase from 23,792 acres in 2008. Monitoring efforts are increasing as more acres are treated and treated infested acreage begins to return to native species. Continued monitoring is needed to ensure invasive plants are not reestablishing through existing seed banks.

Figure 5: Phragmites growing along crack in sandstone wall, Lake Mead EPMT, 2009.

- **Early monitoring results and observations show the tamarisk leaf beetle has potential to reduce tamarisk populations on a watershed landscape level scale**. The Lake Mead EPMT is collaborating with researchers from the US Geological Service and University of California Santa Barbara to prepare for restoration following decline in tamarisk infestations.
- **The Northeast EPMT is collaborating with a local university who has established long term studies on Asian sand sedge**. The team will monitor the effects of various herbicide treatments on Asian sand sedge, which significantly affects the quality of nesting habitat for federally threatened piping plovers.
- **The North Coast Cascades EPMT has set up a number of long-term projects** to help managers make more informed decisions about controlling invasive species in the Northwest region, including:
    - a study conducted from 2004 – 2009 to examine the rate at which Japanese knotweed (*Polygonum sp*.) has spread along the Stehekin River in response to changing flood regimes
    - herbicide trials conducted in 2008 – 2009 to test the selectivity of different products against herb Robert (*Geranium robertanium*), while limiting damage to native vegetation;
    - an assessment of on-going efforts to control reed canary grass in wetland areas, while restoring native species.

Figure 6: Mile-a-minute vine

Collaboration

The ability to work with adjacent landowners, agencies, community groups and others is critical to the successful management of invasive species. Invasive species require managers to work across physical, jurisdictional, cultural, and financial boundaries. The teams collaborate with a variety of entities to address invasive plants maximizing available resources.

- **The Pacific Islands EPMT works with watershed groups, communities, governments, and parks, to collaborate on aggressive invasive plants such as miconia**

- **The Gulf Coast EPMT has increased its use of volunteers in the wake of hurricanes Katrina, Ike, and Rita.** The loss of commercial services required the team to use local volunteers on an "as available" basis.
- **In a collaborative effort the Northeast EPMT, Morristown National Historic Park, and the Central Jersey Strike Team are planning a joint control operation** in the coming year at the park with a focus on infestations of kiwi vine (*Actinidia arguta*)
- **The National Capital Region EPMT worked with staff from the George Washington Memorial Parkway, the city of Arlington, and Fairfax County in an effort to control common reed (*Phragmites australis*)** growing along the Potomac River in a large stand that spread across park, city and county lands. Due to previous successful efforts by the team in reducing the amount of common reed in this area, this was the only infestation requiring treatment this year.

Figure 7: Volunteer workday, Mid-Atlantic EPMT, 2009

- **California EPMT supported Redwood National and State Parks in a second-year of a Harding grass (*Phalaris aquatica*) treatment** in the Bald Hills region of Redwoods National and State Parks. This project is an example of a large-scale project that has leveraged project capacity through effective internal and external partnering. The project was funded jointly by California Department of Food and Agriculture, through the Humboldt Weed Management Area, and three NPS funding sources.

Prevention

Prevention is the most efficient strategy for invasive species management. Once a damaging invasive species is present within an ecosystem, immense resources must be devoted to controlling or eradicating the species. Prevention is a broad strategy encompassing numerous actions that can be completed by anyone ranging from park visitors to resource managers, to policy makers. Prevention is based upon education, communication, and implementation of decisive actions. Each team contributes to prevention efforts through a variety of means.

- **The Mid-Atlantic EPMT works extensively through public outreach** including working with volunteers in the field, giving presentations on the impacts of invasive plants on native ecosystems, and teaching about how invasive plants impact citizens.
- **Over the previous eight field seasons, the North Coast Cascades EPMT has focused on preventing the expansion of invasive plants** into high quality wilderness areas of Pacific Northwest parks by managing corridors of invasion such as roads, trails, and riparian zones, while simultaneously working to eradicate more remote infestations before they can gain a foothold.
- **In Alaska, heavy emphasis is placed on prevention measures** such as washing equipment prior to entering a park

Treatment

The majority of effort put forth by the EPMTs comes through treatment activities. Between 40-70% of each teams time is devoted to treatment activities. Treatment efforts involve extensive planning, balancing of needs, and the ability to respond and adapt methods. This year the teams treated a total of 16,389 acres, an increase of nearly 2,000 acres from 2008. The EPMT program uses a variety of treatment methods including mechanical, chemical, and biological means. The teams work closely with the Integrated Pest Management programs to ensure that all treatment methods are implemented in a manner which protects the health and safety of the team members, park staff, volunteers, visitors and ecosystem health. The methods employed by each team vary with park and regional parameters.

- **The Northern Great Plains EPMT is working closely with the fire program and maintenance staffs to incorporate prescribed burns and/or mowing as a pretreatment for fall herbicide application of Canada thistle (*Cirsium arvense*)**. This IPM approach is seeing maximum control in situations where terrain permits. At Agate Fossil Beds National Monument, this approach achieved 90% control in Canada thistle 12 months after treatment

Figure 8: Russian olive removal at Big Horn Canyon NRA

- **The Pacific Islands EPMT worked to control common nasturtium vines across 140 acres of native forest and knotweed control along 65 miles of roadside in the park.** Control of these two species with restricted distribution is essential to preventing the buildup of larger populations and stopping spread into more pristine areas.
- **New equipment has allowed the Chihuahuan Desert Shortgrass Prairie EPMT to increase acres treated.** The addition of a 4x4 mounted 200 gallon skid sprayer enabled the team to reduce Buffelgrass (*Pennisetum ciliare*) populations at Big Bend National Park by approximately 50% in two years and, in combination with a change of herbicide, helped reduce the infested acres of Scotch thistle (*Onopordium acanthium*) at Pecos National Historic Park by approximately 93% in three years of single visit treatments.
- **The Northern Rocky Mountain EPMT was able to reduce a 200-acre infestation** of musk and Canada thistles to 2.5 acres after two years of treatment at Grand Teton National Park.
- **The North Coast Cascades Network EPMT continued to support Lake Roosevelt's aquatic plant management program**, treating Eurasian watermilfoil (*Myriophyllum spicatum*) and various non-native pondweeds (*Potomogeton* sp.) at visitor use facilities along the lake.

Figure 9: Treatment at Golden Spike NHS

Early Detection and Rapid Response

Early detection and rapid response (EDRR) is at the core of the EPMT program. This approach recognizes that treating invasive species in the early stages of invasion provides the highest rate of success in control or elimination. Some invasive species may never be eradicated if left untreated in the early stages of invasion. The team structure allows for high mobility and quick response times.

- **The Alaska EPMT uses EDRR to maintain the relatively pristine wilderness of Alaska's parks and natural areas**. Oxeye daisy infestations are immediately treated when identified, preventing the spread of the aggressive invader of roadsides and campgrounds.
- **The National Capital Region EPMT is working with regional partners to prevent wavy-leaf basket grass (*Oplismenus hirtellus ssp. Undulatifolius*) and black swallowwort (*Cynanchum louiseae*) overtaking parks and natural areas**. Using the EDRR approach, identified infestations of these priority species are immediately treated and monitored for regeneration.

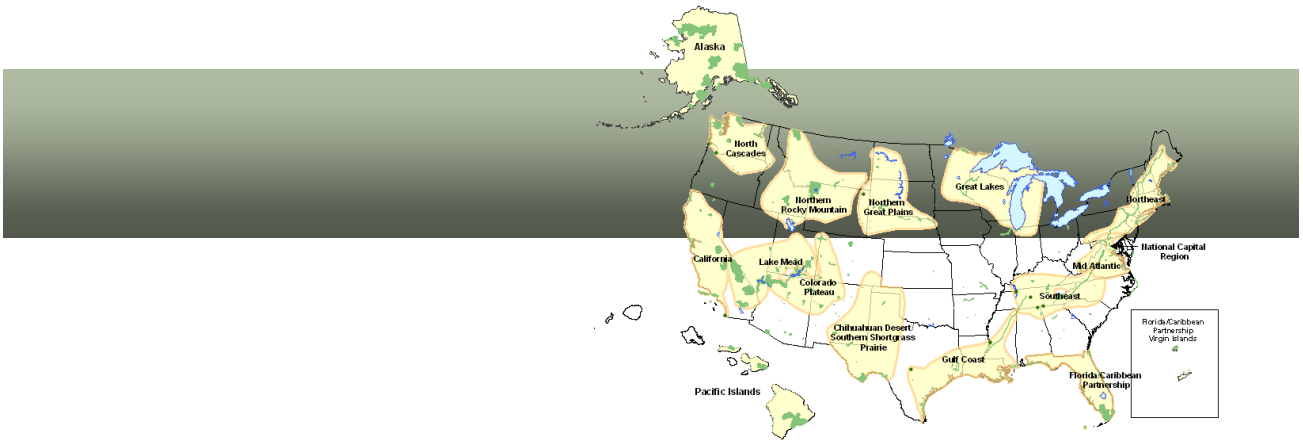
- **The Florida Caribbean EPMT uses the EDRR approach to stem the tide of invading species**. The team worked with Everglades Cooperative Invasive Species Management Area (ECISMA) to remove a horticultural mangrove tree, Kripa (*Lumnitzera racemosa*), which had begun invading native mangroves.

Restoration

Restoration of native communities is the ultimate goal of the EPMT program. All actions taken by the teams are focused on either passively or actively restoring native vegetative communities in parks and natural areas. Restoration activities completed by the team include removal of invasive species with natural regeneration of native communities and direct plantings and seeding. The restoration methods applied to a managed area depend upon the nature of the treated invasive plants, status of the native seed bank and native vegetation base, and available funding.

- **The Great Lakes EPMT worked with Sleeping Bear Dunes National Lakeshore to remove Black locust (*Robinia pseudoacacia*) trees to restore the native ecological landscape**. Despite being invasive they have been part of the cultural landscape at the park. The team and park worked with the community on changing the cultural landscape to restore native plant communities.
- **The North Coast Cascades EPMT assisted in acquiring grants to propagate native species** to plant in treated areas at North Cascades National Park and Ebey's Landing National Historic Reserve.
- **In the southwest, parks are increasing seed collection operations** to initiate restoration activities in coming years, and improve long-term treatment success. Selecting for native drought and fire tolerant species will give parks an important competitive advantage as they face the challenges of climate change.
- **The Lake Mead EPMT has responded to the successful control of tamarisk** by shifting control efforts to other high priority species and to implement restoration actions where necessary
- **The Northeast EPMT has been working with the Town of Lincoln Conservation Department (LCD) on a streamside restoration site** on the border of Minute Man NHP & the Town of Lincoln.

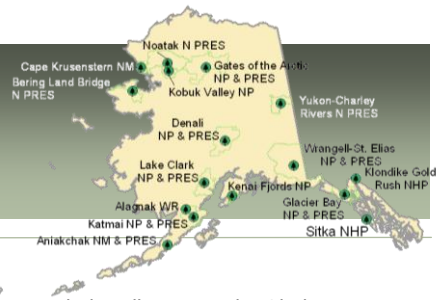
Figure 10 : Before and after shots of honeysuckle removal in a meadow in the Northeast.



Team Reports

Alaska

Exotic Plant Management Team



Partner Parks: *Alagnak WR, Aniakchak NM & PRES, Bering Land Bridge N PRES, Cape Krusenstern NM, Denali NP & PRES, Gates of the Arctic NP & PRES, Glacier Bay NP & PRES, Katmai NP & PRES, Kenai Fjords NP, Klondike Gold Rush NHP, Kobuk Valley NP, Lake Clark NP & PRES, Noatak N PRES, Sitka NHP, Wrangell-St. Elias NP & PRES, Yukon-Charley Rivers N PRES*

Alaska has historically experienced lower exposure to invasive species. Extreme temperatures and low population density have helped maintain low levels of successful invasion. The past decade has demonstrated that Alaska is increasingly vulnerable, especially as climate change potentially expands the range of invasive species. Aggressive invaders such as spotted knapweed (*Centaurea maculosa*), Canada thistle (*Cirsium arvense*), yellow toadflax (*Linaria vulgaris*), and purple loosestrife (*Lythrum salicaria*) have already taken hold of areas in Alaska's wildlands. Operating under the Early Detection Rapid Response (EDRR) strategy, the Alaska Exotic Plant Management Team (EPMT) is able to manage these aggressive invaders early in the invasion process on the 54 million acres of National Park Service land in Alaska. This greatly improves the potential success of managing invasive plants in Alaska.

2009 Accomplishments	
Inventoried Acres	481
Gross Infested Acres	504
Infested Acres	310
Treated Acres	86
Monitored Acres	343

In its seventh year, the Alaska EPMT continued to work on small widely distributed invasive plant infestations. The Alaska team has creatively addressed the invasive plant management workload in the region working cooperatively with partner parks to train existing park staff, help fund seasonal park staff, support internship positions, and Southeast Alaska Guidance Association (SAGA) AmeriCorps crews. In 2009, the Alaska EPMT program worked with 17 park staff, nine interns, and two months of SAGA crew work.

These personnel, combined with volunteer assistance from community groups and partnerships with neighboring land managers, worked towards containing existing infestations and eradicating new or smaller infestations using manual control methods in eight partner parks. The team was able to eradicate 194 infestations in 2009. To date the team has eradicated nearly 300 infestations, including bird vetch (*Vicia cracca*), reed canarygrass (*Phalaris arundinacea*), and many others.

This year emphasis was placed on backcountry areas. Kenai Fjords National Park crew members were able to visit several remote beaches along the outer coast of the park, including backcountry campgrounds and public use cabins. At Kenai Fjords, twelve of the parks' 400 coastal miles have been inventoried for invasive plants. Fortunately, no new infestations were discovered at any of the newly inventoried areas.

Figure 1. EPMT members collecting data by the Northeastern Glacier in Kenai Fjords National Park.

The Alaska EPMT education and outreach program engaged local residents and park visitors, teaching about the unique situation that faces Alaska parks when it comes to invasive plants. The team hosted 14 separate education events to engage the public, including volunteer weed pull days, summer camp presentations, Fourth of July activities, and informational

booths. A few of the more creative outreach activities included developing invasive weed recipes, an invasive plant identification table with fresh samples, and a non-native flower arranging contest. These activities encouraged volunteers and community members to have an active learning experience with invasive plants.

An Integrated Approach

The Alaska EPMT has a history of taking an integrated approach to weed management in the region. Heavy emphasis is placed on prevention stipulations, such as washing equipment prior to entering a park. Invasive plant inventories in high risk areas, such as campgrounds, trailheads, and parking lots, occur multiple times a season. Any invasive species detected during these inventories are mapped, immediately controlled using manual techniques, and closely monitored until they have been eliminated.

In Glacier Bay National Park and Preserve (NP), invasive species, such as Oxeye daisy (*Leucanthemum vulgare*), are thought to be attributed to escaped ornamentals which have proven very successful at growing throughout the area. Most often, a single plant is located indicating that it is likely the first year of establishment. In other areas, multiple plants suggest that the species has been present and reproducing for many years. Infestations are visited multiple times a season to pull any new plants. One of the major invasion pathways, the park entrance road, is monitored inside and outside the park boundary to ensure that encroaching plants are controlled.

Figure 2. EPMT members conducting inventories along trails in Wrangell-St. Elias National Park & Preserve.

Dry Bay has the most severe oxeye daisy problems of any area in Glacier Bay NP or the National Park Service Alaska Region. This location has been manually treated, through mowing or hand pulling, each year since 2005, with varying results. Although the large Dry Bay oxeye daisy infestations persist after five years of manual treatment, the effort required to control the plants is steadily decreasing each year – from 150 person hours in 2007 to 40 person hours in 2009. While this is a relative success story for manual control, there are numerous areas across the region where multiple years of hand pulling have had negligible impacts on infestation size or density. The Alaska EPMT has spent significant time and effort on controlling dandelions along the park road in Denali National Park and Preserve; 2,168 person hours hand pulling five acres in 2009. While these efforts have been worthwhile in keeping this species from spreading into the backcountry, they have done little to reduce the population size growing near the park entrance.

Figure 3. A mutant oxeye daisy found growing in Glacier Bay National Park & Preserve this summer.

Currently, only manual control techniques are approved for use in Alaska parks. The proposed Alaska Region Invasive Plant Management Plan was released for a final comment period, ending in November 2010. The management plan includes new options for invasive plant control. If the plan is approved, the Alaska EPMT may be able to incorporate additional treatment methods, such as herbicides. A full Environmental Assessment to analyze potential impacts from herbicide use within the parks was completed and presented for review. The proposed management plan would allow for up to 150 acres of herbicide treatment each year in Alaska parks. The proposed management plan incorporates a decision tree to determine whether herbicide use would be necessary, safe, and effective for a given infestation based on the weed species, size of the infestation, and potential sensitive resources found in the area.

California

Exotic Plant Management Team

Partner Parks: *Cabrillo NM, Channel Islands NP, Devils Postpile NM, Golden Gate NRA, John Muir NHS, Lassen Volcanic NP, Pinnacles NM, Point Reyes NS, Redwood NP, Santa Monica Mountains NRA, Sequoia and Kings Canyon NP, Whiskeytown NRA, Yosemite NP*

The California Exotic Plant Management Program (EPMT) serves 14 parks that reside within the California Floristic Province – a region designated as a world terrestrial hotspot by Conservation International. Sixty-one percent of the 3,488 vascular plants found in California are found nowhere else in the world. Twelve of the 14 parks reside in habitats identified as most vulnerable to global climate change – coastal and high-elevation mountainous regions. Now, more than ever, ambitious management of invasive plants is critical to building ecosystem resilience.

2009 Accomplishments	
Inventoried Acres	3,116
Gross Infested Acres	2,137
Infested Acres	192
Treated Acres	184
Monitored Acres	656

The California EPMT parks encompass 2.1 million acres; 290,436 acres are infested with invasive non-native plants. In 2009, the parks targeted 12,139 acres for treatment. The California EPMT was able to support these parks in treating a little over one-quarter of the targeted acres. Each year, using adaptive management and more efficient strategies we have been able to expand capacity to support park programs. Since 2002, improved efficiency has allowed the team to expand treated acreage by 278 percent. A new partnership with the San Francisco Bay Area Inventory and Monitoring Network helped increase our surveyed acres by 65 percent from 2008. The team co-sponsored two Early Detection Rapid Response (EDRR) interns that served Golden Gate National Recreation Area and Point Reyes National Seashore. Park staff trained and mentored these interns to lead groups of volunteers in surveying roads and trails for 74 key invasive species. Through this effort, 88 acres were surveyed, 239 new infestations were mapped, and 38 infestations were treated immediately. This strategy allowed the team to take advantage of the strong volunteer presence in the San Francisco Bay area.

Over the past four years, the California EPMT has been working with park resource and fire programs to treat yellow star-thistle (*Centaurea solstitialis*) in Santa Monica Mountains National Recreation Area (NRA). Yellow star-thistle is one of the worst invaders of wildland areas in California. This extremely spiny, yellow-flowered annual is able to completely dominate grassland areas throughout California. Yellow star-thistle forms dense monocultures, reducing native biodiversity, impeding the movement of people and wildlife, and posing a hazard to visitors.

Figure 1: Partnership with the NPS Inventory and Monitoring early detection crew. Volunteer team lead Richard Wong (center), with Jim Dougherty and Mary Swenson map capeweed along Coastal Trail above Muir Beach in Golden Gate NRA (April 8, 2009).

Yellow star-thistle spines can pierce skin, clothing, and light soled shoes. Although yellow star-thistle is common in parts of northern California, it is still uncommon in southern California. Over the initial three years of treatment in Santa Monica Mountains NRA, yellow star-thistle infestations have declined from an average of 95 percent canopy cover at the beginning of the project to an average of 18 percent canopy cover in 2009. Following

treatment in 2009, the team expects the percent cover in most sites to have declined to less than 10 percent. Native species are recovering and ecosystem functions such as soil retention, water use, and nutrient cycling are improving. The team expects to reach a maintenance control level (< 1% cover) with a final two years of treatment.

The California EPMT supported Redwood National and State Parks in a second year of a Harding grass treatment in the Bald Hills region of Redwoods National and Scenic Park. This project is an example of a large-scale project that has leveraged funding through effective partnerships. The California Department of Food and Agriculture, the Humboldt Weed Management Area, and three National Park Service sources jointly funded this project. The team worked with park staff and volunteers to inventory and treat more than 500 outlying infestations of Harding grass, distributed across 71 acres. This year, the California EPMT retreated all previously treated infestations and initial treatments were completed in the core infestation. 2009 inventory efforts identified a previously undiscovered large infestation that will be added to planned treatments in 2010.

Figure 2: Redwoods NP works with their Weed Management Area partners to host an invasive plant control workshop in September 2009. Bruce Bryan with Humboldt County Dept of Agriculture (right) shows how to weed-wrench a cotoneaster out of the ground.

Survey efforts to detect new species and track the effectiveness of treatments are key to successful monitoring in the long term. The park featured this project in a poster session at the California Invasive Plant Council's annual symposium sharing results. The information was shared with over 300 weed managers around the state. Additional outreach was conducted with adjacent landowners and partner agencies with an interagency Weed Management Area workshop held in September.

A California EPMT program highlight for 2009 is a project on Santa Cruz Island, part of Channel Islands National Seashore (NS). Using a non-traditional tool significantly expanded treatment capacity and strengthened a developing partnership. To overcome the logistical challenges related to managing projects in Channel Islands NS (remote, steep, difficult-to-traverse chaparral), the park contracted with a helicopter team that specializes in invasive plant mapping and removal. The helicopter transported water to strategic positions providing the ground team proximal access to water for spot herbicide treatments. Over the course of five days, and at a fraction of the cost, the team surveyed 57 acres for seven priority weeds and treated 59 incipient invasive plant populations. In addition, the helicopter approach allowed the team to identify nine infestations that would otherwise have gone undetected. This project complements the adjacent land manager's (The Nature Conservancy) established invasive plant program that focuses on larger infestations along roadways.

Figure 3: Efficient approach to treating incipient populations in rugged, difficult-to-access terrain. Contract crew treating Cortederia jubata (pampas grass) on Santa Cruz Island, Channel Islands National Park (February, 2009).

The California EPMT is helping parks forge effective treatment strategies and strengthen strategic partnerships. The ability to develop land management strategies that effectively support cross-boundary treatment of invasive plants is critical. With continued development of partnerships, the team will be better able to maintain follow-up treatments and monitoring.

Lake Mead

Exotic Plant Management Team

Partner Parks: *Arches NP, Bryce Canyon NP, Canyonlands NP, Capitol Reef NP, Cedar Breaks NM, Death Valley NP, Great Basin NP, Hovenweep NM, Joshua Tree NP, Lake Mead NRA, Manzanar NHS, Mojave NP, Natural Bridges NM, Parashant NM, Pipe Spring NM, Timpanogos Cave NM, Zion NP*

The Lake Mead Exotic Plant Management Team (EPMT) has provided invasive plant management services to numerous parks in two National Park Service (NPS) regions since 1996. Partnerships remain integral to the team's success, doubling the teams operating funds. The team has matched each NPS base dollar with two and three additional dollars on an annual basis. These partnerships facilitate invasive plant management across agency boundaries, promote information exchange by sharing best management practices, and help standardize species prioritization and control methods. In addition to working with Lake Mead EPMT partner parks, the team completed invasive plant management in six additional park units, three National Forests, four BLM Districts and one local government entity in 2009.

2009 Accomplishments	
Inventoried Acres	9,394
Gross Infested Acres	9,546
Infested Acres	268
Treated Acres	235
Monitored Acres	681

Thirty-eight different invasive plant species were treated during 2009. Treatment highlights include: smooth brome grass (*Bromus inermis*) control to protect endemic plants in high elevation meadows at Bryce Canyon National Park and Cedar Breaks National Monument; Saharan mustard (*Brassica tournefortii*) control at Mojave National Park to prevent establishment in the Kelso Dunes and along highly infested road corridors in Joshua Tree National Park; and control of incipient bull thistle (*Cirsium vulgare*) populations in seasonal marshes at Great Basin national Park and Capitol Reef National Park. Substantial progress was made towards achieving elimination of Russian olive (*Eleagnus angustifolia*) at Dinosaur National Monument, Capitol Reef National Park, and Bryce Canyon National Park. Fountain grass (*Pennisetum setaceum*) control efforts continued at Lake Mead National Recreation Area and Joshua Tree National Park to prevent its spread throughout the region. Another major accomplishment included completing initial treatment of a three mile streambed heavily infested by ravenna grass (*Erianthus ravennae*) within Glen Canyon National Recreation Area. External partnership highlights included two projects with the Prescott and Kaibab National Forests (NF) in Arizona. A three-year project agreement to control tamarisk along 12 miles of the Verde River in the Prescott NF was completed. This logistically challenging project included setting up a 30 person remote camp requiring more than a dozen helicopter sling loads. A new agreement was established with the Kaibab NF to treat several hundred acres of Dalmatian toadflax and bull thistle that established after a wildfire in the Kendrick Mountain area. The team anticipates that both of these partnership agreements will be extended into future years.

In 2009, the Lake Mead EPMT reorganized from seasonal crew positions to term subject-to-furlough appointments. This transition should enhance the team by providing greater capacity to conduct year round weed control for numerous species, retention of field-trained employees, and reduced time loss for annual training. Professionalization of invasive plant management within the NPS remains a goal of the EPMT program. Invasive plant management is a highly technical and scientific field where proficient knowledge is best acquired from experience and training. Prior to the establishment of the EPMT program, the majority of invasive plant management within the NPS was conducted primarily by collateral duty seasonal and volunteer labor. The EPMT program has greatly increased the capacity of its partner parks to control challenging invasive plant populations. Many crew members have worked on multiple teams, increasing the experience level of applicants and career building in the field of invasive species management within the NPS. The EPMT program has specialized in the control of exotic

invasive plant species in remote natural areas for the purpose of site restoration. This was an important void to fill since most of the historic weed expertise is centered around an agricultural environment.

Due to the expansion of the tamarisk eating leaf beetle, the focus of the Lake Mead EPMT is shifting from tamarisk to control of "secondary" weed invaders such as Russian olive, knapweed (*Centaurea maculosa*), and perennial pepperweed (*Lepidium latifolium*). The Lake Mead EPMT is collaborating with researchers from the US Geological Service (USGS) and University of California Santa Barbara to prepare for revegetation and weed treatments following beetle-killed tamarisk.

Figure 2: Tamarisk beetle strikes! Defoliated tamarisk along the Green River in Canyonlands NP, Utah. June 2009.

The tamarisk leaf beetle (*Diorhabda elongata)* is a biological control agent that has been introduced during the last several years in some western states. The beetle only feeds on tamarisk and has been intensively studied in North America. Although only one NPS Unit has released the beetle it has established in several park units throughout the Colorado Plateau from outside releases and is expanding throughout the region. Early monitoring results and observations show potential to reduce tamarisk populations on a watershed landscape level scale. There is concern that the rapid defoliation of tamarisk could adversely affect the endangered willow flycatcher, which occasionally nest in tamarisk. Although the long term effectiveness of the beetle is yet to be determined it holds promise as another integrated pest management tool. NPS, along with other federal agencies to monitor these potential effects.

The Lake Mead EPMT will continue to apply adaptive management strategies related to the effects of the beetle on tamarisk and the subsequent vegetation response. Restoration objectives will continue to focus on managing invasive plants to facilitate natural reestablishment of native plants.

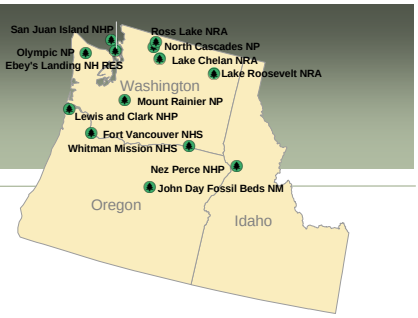
Figure 3: Dwayne Coleman, treats Ravenna grass in remote Lewellyn Gulch at Glen Canyon NRA, Utah. September 2009.

The team continued to conduct exotic plant control research on Saharan mustard (*Brassica tournefortii*) and annual bromus grass species in a partnership with the USGS. Results from these studies will be available and published in 2010 and published in literature. The team will also share this information with its partners and immediately incorporate results into treatment methodology and future strategies for these two challenging weed species.

Lake Mead NRA, the team's host park, continues to support the team in all aspects of management and operation including administrative, office space, storage facilities, agreements and contracting, budget and accounting and substantial funding supplementation. The Lake Mead EPMT also remains an integral cooperator in the interagency Southern Nevada Restoration Team (SNRT) partnership.

North Coast Cascades

Exotic Plant Management Team



Partner Parks: *Ebey's Landing NH RES, Fort Vancouver NHS, John Day Fossil Beds NM, Lake Roosevelt NRA, Lewis and Clark NHP, Mount Rainier NP, North Cascades National Park Complex (Lake Chelan NRA, North Cascades NP, Ross Lake NRA), Nez Perce NHP, Olympic NP, San Juan Island NHP, Whitman Mission NHS*

The North Coast Cascades Exotic Plant Management Team (EPMT) approach to managing invasive plants focuses on preventing the expansion of invasive plants into high quality wilderness areas by managing corridors of invasion, such as roads, trails, and riparian zones, and eradicating remote infestations before they can gain a foothold. In 2009, the North Coast Cascades Network EPMT provided invasive plant management on over 4,000 acres of NPS lands, initiating new projects with partner parks in Washington, Oregon, and Idaho.

2009 Accomplishments	
Inventoried Acres	1,184
Gross Infested Acres	4,262
Infested Acres	119
Treated Acres	93
Monitored Acres	844

Since its inception in April 2002, the North Coast Cascades EPMT has expanded its range from nine park units in Western Washington and Oregon to thirteen park units in Washington, Oregon, and Idaho. The North Coast Cascades Network EPMT program has increased park participation in Cooperative Weed Management Areas (CWMA) from one CWMA to five in 2009. Along with an emphasis on cooperative partnerships and early detection and rapid response (EDRR), the North Coast Cascades Network EPMT has worked to develop projects that look at the site as a whole, incorporating restoration and long-term research. In 2009, the North Coast Cascades EPMT established a new field team based at Lake Roosevelt National Recreation Area (NRA) to improve the efficiency of the team's work with park units in Eastern Washington, Eastern Oregon, and Idaho. The team also began a number of new projects with partner parks on both sides of the Cascades, focusing on early detection and rapid response (EDRR), as well as the restoration of badly degraded park resources.

Restoration activities completed by the team include both active and passive restoration. Active restoration can often reduce the need for maintenance control of regularly or historically disturbed areas. To help achieve restoration goals, the North Coast Cascades Network EPMT assisted partner parks in acquiring grants to propagate native species for restoration plantings in treated areas at North Cascades National Park and Ebey's Landing National Historic Reserve.

The North Coast Cascades Network EPMT worked in conjunction with John Day Fossil Beds National Monument in restoring riparian habitat. The team controlled over 80 acres of Russian knapweed directly adjacent to plantings of cottonwood and willow saplings in the park's Painted Hills unit. The project goal is to restore declining habitat for threatened and endangered steelhead trout populations. In the park's Foree unit, the team assisted with the restoration of native grasslands, selectively treating perennial pepperweed (*Lepidium latifolium*) in newly planted fields.

Complementing these restoration efforts the North Coast Cascades EPMT has also set up a number of long-term research projects to help managers make informed decisions about controlling invasive species in the Northwest. Long-term research projects include: a study conducted from 2004-2009 to examine the rate at which Japanese knotweed (*Polygonum* sp.) has spread along the Stehekin River in response to changing flood regimes; herbicide trials conducted in 2008 – 2009 to test the selectivity of different products against herb Robert (*Geranium robertanium*), while limiting damage to native vegetation; and an assessment of on-going efforts to control reed canary grass (*Phalaris arundinacea*) in wetland areas, while restoring native species.

With the assistance of park planners and maintenance staff, the new EPMT eastern field team inventoried over 2,000 acres of infested

lands at Lake Roosevelt NRA alone, resulting in almost 400 acres treated in the park; primarily along boundaries with private landowners. The EPMT also continued to support Lake Roosevelt NRA's aquatic plant management program, treating Eurasian watermilfoil (*Myriophyllum spicatum*) and various non-native pondweeds (*Potomogeton* sp.) at visitor use facilities along the lake.

Figure 1: A crew member falls a lone English holly tree (*Ilex aquifolium*), deep in the Quinault rainforest of Olympic National Park (September 2009).

Preventing the spread of invasive plants by controlling incipient populations continues to be a focus of the North Coast Cascades Network EPMT. Working with the Federal Highways project to improve the iconic Hurricane Ridge Road at Olympic National Park (NP), the North Coast Cascades Network EPMT was called upon to control weed populations throughout the road corridor, potentially reducing their spread due to construction activities. In the Quinault and Queets river drainages of the park, the Olympic NP field crew continued to work to extirpate several species of non-native trees from the rainforest, as well as assisting in the restoration of elk habitat through the removal of Himalayan and evergreen blackberry (*Rubus discolor,* R. *lacinuatus*). Control work along corridors also continued to be important at North Cascades and Mount Rainer National Parks, with crews endeavoring to prevent the escape of herb Robert, St. Johnswort (*Hypericum perforatum*), oxeye daisy (*Leucanthamum vulgare*), knapweeds (*Centaurea* sp.), and several species of non-native hawkweed (*Hieracium* sp.) along almost 100 miles of roadside.

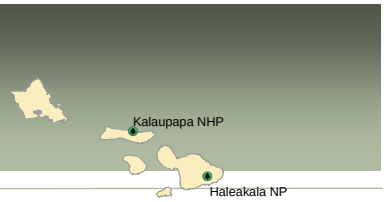
Figure 2: Controlling yellow flag iris (*Iris pseudacorus*), a species recently added to Washington State's noxious weed list, in newly acquired wetlands along Cape Disappointment (Lewis and Clark NHP, September 2009).

The acquisition of new properties at Lewis and Clark National and State Historic Parks presented an opportunity for the team to conduct EDRR on newly discovered infestations. Crews began control of laurel spurge (*Daphne laureola*) on lands acquired near the coastal section of the park's iconic Fort-to-Sea trail, and, in cooperation with Washington State Parks, began working to remove yellow flag iris (*Iris pseudacorus*) from the wetlands around Cape Disappointment.

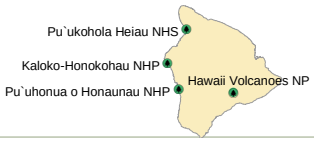
Over the past eight field seasons, the development of the North Coast Cascades Network Exotic Plant Management Team has led to greater efficiency, improved cooperation between parks and partners, and a focus that incorporates current scientific research to implement invasive species management based upon desired future conditions.

Pacific Islands

Exotic Plant Management Team



Partner Parks: *Hawaii Volcanoes NP, Haleakala NP, Kalaupapa NHP, Kaloko-Honokohau NHP, Pu`uhonua o Honaunau NHP, Pu`ukohola Heiau NHS*



Extreme geographic isolation of the Hawaiian Islands created an environment where over 90% of the native plants and animals are endemic. Communities of unique island species are especially sensitive to depredation caused by invasive species. In this age of global commerce, species are arriving at a rate 500 times greater than would naturally occur. As a result, Hawaii is now the endangered species capital of the world, harboring more invasive species per square mile than anywhere on earth.

2009 Accomplishments	
Inventoried Acres	271,353
Gross Infested	23,345
Infested Acres	23,347
Treated Acres	1,274
Monitored Acres	400,281

The Pacific Islands Exotic Plant Management Team (EPMT) has continued to make progress by developing a result-oriented reputation based on sound biological information and quality work. The Pacific Islands EPMT has accomplished this through cultivation of island specific approaches to invasive plant problems. In Hawaii Volcanoes National Park (NP), the Pacific Islands EPMT has demonstrated success by: 1) controlling weeds as a rapid control force in newly established management units, enabling park-based resource managers to follow up, and 2) serving as an effective rapid response and prevention resource to augment the efforts of park-based staff.

The Pacific Islands EPMT has been instrumental in facilitating control of weeds in some of Hawaii Volcanoes NP most valued places, known as Special Ecological Areas (SEA). Unique biological communities and a relatively low cover of disruptive invasive plants characterize the SEAs, totaling 76,000 acres. The Pacific Islands EPMT continues to expand invasive plant management in existing SEAs and provides crucial initial treatment of invasive plants in newly designated SEAs. I2009, the Pacific Islands EPMT completed initial treatment in a new 400-acre rainforest SEA.

Destructive invasive plants in the native dominated forest were removed for the first time, including almost 35,000 individual Himalayan raspberry (*Rubus ellipticus*), Kahili ginger (*Hedychium gardnerianum*) and banana poka plants (*Passiflora mollissima*). Park staff will now be able to maintain long-term biological integrity of the area.

Figure 1: Invasive plant management at Hawaii Volcanoes NP in high value areas, EPMT personnel remove woody exotics to facilitate long term ecosystem health, May 2009.

The Pacific Islands EPMT has also been influential in the aggressive control of localized weeds. Two notable accomplishments are the control of common nasturtium (*Tropaeolum majus*) vines across 140 acres of native forest and knotweed control along 65 miles of roadside in the park. Control of these two species with restricted distribution is essential to preventing the buildup of larger populations and preventing spread into more pristine areas. The Pacific Islands EPMT also led efforts in detection, control, and monitoring of recently established invasive plants in Hawaii Volcanoes NP, including Australian tree fern (*Cyathea cooperi*), cat's claw (*Uncaria tomentosa*), and the noxious weed Koster's curse (*Clidemia hirta*), all unknown from the park prior to 2001.

A common trend runs through the team's success stories: progress through collaboration and cooperation. Invasive species are not simply an environmental problem. Invasive agents cause millions of dollars in economic harm each year in Hawaii, and undermine the cultural heritage of the Islands. For the past nine years, the Pacific Islands EPMT has been protecting National Parks in Hawaii from both incipient and established weeds threatening to overrun treasured natural areas. The Pacific Islands EPMT, along with numerous partnership entities, has been helping to protect the economy and lifestyle unique to Hawaii.

The Pacific Islands EPMT collaborates with local conservation groups, providing an essential link leveraging effort to protect fractured remnant native ecosystems of the Hawaiian Islands. A collaborative effort with the Maui Invasive Species Committee (MISC) has resulted in an effective rapid response program and at least a six-fold increase in capacity for controlling invasive plants, such as pampas grass (*Cortaderia selloana*) and miconia (*Miconia calvescens*). Both species jeopardize critical ecosystem functions, such as watershed integrity and habitat for endangered species.

Pampas grass is a habitat generalist. On Maui, small, naturalized populations have been found thriving in a variety of ecosystems, ranging from the pristine alpine habitat of Haleakala National Park, to the rain soaked forest of the windward slopes, and the dry, barren slopes of the leeward side. Rain forest areas have provided the most challenging conditions to control of the populations of pampas grass due to remoteness, persistent clouds, and lack of access to support ground crews. Control efforts occur in areas of native-dominated forest sensitive to disturbance by heavy foot traffic. Since 2006, intensive aerial surveys have been used to define areas suitable for tactical based sweeps and strategic control. Spot application of herbicide using a helicopter augments ground sweeps. These efforts, supported by Haleakala National Park, the Pacific Islands EPMT, MISC, and three influential watershed protection and restoration consortiums has resulted in dramatic decreases in mature breeding plants as well as reduced seedling recruitment.

Facilitating success with pampas grass are the strong partnerships between several management groups. The East Maui Watershed Partnership (EMWP) is illustrative of community-wide support for successful land management, boasting 10 partners in the private, state, federal, county and non-profit arenas.

Miconia is an invasive plant threatening wet forest from sea level to at least 6,000 feet elevation. It has been described as the one invasive plant that can destroy the Hawaiian forest. Miconia has established numerous infestations on Maui. Due to the continuing efforts of the Pacific Islands EPMT, MISC and other partners, the total number of sexually mature miconia plants on the island has been significantly reduced. Additionally, repeated systematic coverage of specific infestations over time has resulted in reduced recruitment. The partnership effort demonstrated adequate success in 2009 to justify entering previously unmanaged infestations in the East Maui area under the unified command of the Pacific Islands EPMT and MISC.

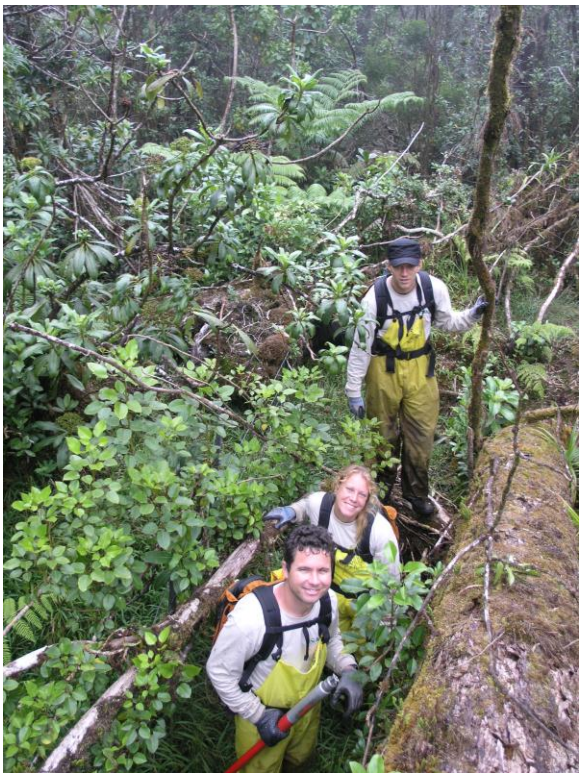


Figure2: Controlling invasive wet forest weeds on Maui. A partnered NPS and MISC crew protect Haleakala National Park from miconia,the worst threat to rainforests in Hawaii. Kipahulu Valley 2009.

In the next few years, the greatest challenge for the Pacific islands EPMT will be to maintain momentum gained over almost a decade of leveraging success through collaboration, despite increasingly challenging economic conditions for our diverse group of partners.

Chihuahuan Desert / Shortgrass Prairie

Exotic Plant Management Team

Host Park: *Carlsbad Caverns National Park*
Partner Parks: *Alibates Flint Quarries NHS, Amistad NRA, Bent's Old Fort NHS, Big Bend NP, Capulin Volcano NM, Fort Davis NHS, Fort Union NM, Guadalupe Mountains NP, Lake Meredith NRA, Pecos NHP, Sand Creek Massacre NHS, Washita Battlefield NHS, White Sands NM*

The Chihuahuan Desert/Southern Shortgrass Prairie Exotic Plant Management Team (EPMT) provides service to 13 partner parks in New Mexico, Texas, Oklahoma, and Colorado spread across 500 miles of Southwest prairie and desert. Partner parks range in size from small cultural units at 300 acres to large wilderness parks such as Big Bend at 801,163 acres. The partner parks encompass over one million acres, including 363 miles of international border with Mexico.

2009 Accomplishments	
Inventoried Acres	3,248
Gross infested Acres	1,183
Infested Acres	542
Treated Acres	327
Retreated Acres	72
Monitored Acres	306

The Chihuahuan Desert/Southern Shortgrass Prairie EPMT has continued to develop its invasive plant management strategies since it was created in 2000. Early work focused primarily on the control of damaging riparian species, such as saltcedar (*Tamarix ramosissima*), arundo (*Arundo donax*), and Russian olive (*Eleagnus angustifolium*), using chainsaw and backpack sprayer operations. Today, many of these populations are able to be controlled and maintained by parks.

Acquisition of additional equipment has enabled the team to increase the number of acres treated per site visit. The use of watercraft and boat mounted equipment allowed the team to reduce the populations of arundo on the Rio Grand Wild and Scenic River by approximately 80% in two years. The addition of a 4x4 mounted 200 gallon skid sprayer enabled the team to reduce buffelgrass (*Pennisetum ciliare*) populations at Big Bend National Park by approximately 50% in two years and, in combination with a change of herbicide, helped reduce the infested acres of Scotch thistle (Onopordium acanthium) at Pecos National Historic Park by approximately 93% in three years of single visit treatments. The team is actively managing 19 invasive plant species on park lands. The goals of the team are to adapt existing management strategies to treat very large and very small scale exotics populations.

One distinguishing characteristic of many of our arid southwest parks is generally poor natural re-colonization of treated sites by native plants. This is of special concern in rights-of-way which are perfect habitat for invasive species such as yellow sweetclover (*Melilotus officinalis*), kochia (*Kochia scoparia*), and Russian thistle (*Salsola kali*). Fortunately, parks are increasing seed collection operations to initiate restoration activities in coming years, and improve long term restoration success. Selecting for native drought and fire tolerant species could give us an important competitive advantage as we face the challenges of climate change.

Figure 1: Fall 2009-Seed collection at CAVE.

2009 was a challenging year for the team due to vacancies in key positions. The program remained productive using an interim agreement in which Chihuahuan Desert/Southern Shortgrass Prairie EPMT funded six seasonal positions at four partner parks in addition to other cooperative efforts to ensure continuity of treatment operations. Our partner parks also increased support with 705.5 person hours of direct field support, a 76% increase from 2008.

Public Education and Outreach focused on the ecological and economic impacts of escaped ornamental species, and the contemporary and historic effects of exotic species in the United States. Presentations were given at three public venues and at a training session for interpretive staff.

Throughout the year, Chihuahuan Desert/Southern Shortgrass Prairie EPMT expertise was called upon in a variety of projects to provide operational planning advice, training, equipment, and data management to ensure that all operations were conducted with consistent standards in Best Management Practices, materials and methods, safety, and tracking.

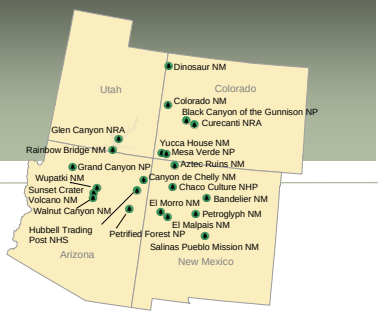
EPMT staff provided formal and informal field training on invasive plant identification, and control strategy and tactics to ten staff members from partner parks. Team staff served as the contracting officer technical representative staff translator on five treatment contracts, provided chemical handling and field supervision on an experimental treatment project at Coronado National Monument in Arizona, provided chainsaw training for staff from three park units, and served as a member of a focus group on Range Management topics at the invitation of the University of Idaho and the BLM.

2009 proved that Chihuahuan Desert/Southern Shortgrass Prairie EPMT is able to adapt to rapidly changing situations and provide service to our partners and collaborators under the most trying circumstances. Longterm strategic plans, park invasive species plans, close collaboration with our Fire and Inventory & Monitoring networks, as well as training for all park staff and volunteers, are key to optimizing early detection and rapid response to new invaders.

Figures 1&2: Before and After Russian olive treatments at CAVE. Infestation has been reduced to less than .5 acre. Fall 2009.

Colorado Plateau

Exotic Plant Management Team



Partner Parks: *Aztec Ruins NM, Bandelier NM, Black Canyon of the Gunnison NP, Canyon De Chelly NM, Chaco Culture NHP, Colorado NM, Curecanti NRA, Dinosaur NM, El Malpais NM, El Morro NM, Glen Canyon NRA, Grand Canyon NP, Hubbell Trading Post NHS, Mesa Verde NP, Petrified Forest NP, Petroglyph NM, Rainbow Bridge NM, Salinas Pueblo Mission NM, Sunset Crater Volcano NM, Walnut Canyon NM, Wupatki NM, Yucca House NM*

Colorado Plateau partner parks received invasive plant management assistance from two Exotic Plant Management Teams in 2009. The Lake Mead EPMT and Northern Rocky Mountain EPMT both contributed significantly to maintaining effective invasive plant management within the region while the Colorado Plateau EPMT was reorganized.

2009 Accomplishments	
Inventoried Acres	937
Gross Infested Acres	890
Infested Acres	50
Treated Acres	34
Monitored Acres	1

In 2009, efforts were focused on treatment and monitoring, with the incorporation of early detection and rapid response (EDRR) actions as well. Work was completed in four partner parks, resulting in successful treatment of multiple invasive plants, including Russian olive (*Eleagnus angustifolia*), tamarisk (*Tamarix spp*.), perennial pepperweed (*Lepidium latifolium*), Russian knapweed (*Rhaponticum repens*),Canada thistle (*Cirsium arvense*), ravenna grass (*Erianthis ravennae*), and many others.

Bandelier NM

In 2009, isolated remote infestations were treated at Bandelier National Monument (NM). These remote infestations required the team to build in additional time and planning for water delivery and site accessibility. The isolated nature of the infestations also allowed the team to complete treatment and control actions relatively quickly.

Along the Rio Grande corridor at the mouth of Frijoles Canyon, the team was able to complete monitoring and treatment efforts. This project followed initial treatment of tamarisk, Russian olive, and Siberian elm (*Ulmus pulmila*) in 2007. During the site visit in 2009, the team recorded successful control of tamarisk, with resprouting Russian olive and Siberian elm. Since 2007, this area has experienced a significant increase in all herbaceous invasive plant species, and the establishment of a new infestation of Canada thistle. The infested area consisted primarily of perennial pepperweed, Russian knapweed, and bull thistle (*Cirsium vulgare*),but also contained a large infestation of Canada thistle. Follow up treatment will be required at this site.

Figure 1: Treatment of bull thistle at Bandalier NM, 2009.

Dinosaur National Monument

In Dinosaur National Monument (NM) team efforts focused on treating Russian olive infestations clustered along the Green River. Dinosaur NM has experienced dramatic reductions in tamarisk infestations resulting from the migration of the tamarisk leaf beetle into the park. Removal of tamarisk had the potential to allow increased invasion of Russian olive. EPMT and park treatment efforts over the past few years have put eradication of Russian olive within reach.

Figure 2: Final treatment efforts of Russian olive and tamarisk at Dinosaur NM, September 2009.

Final eradication efforts and followup maintenance will be completed by park staff. Removal of these two invasive trees represents a major step towards restoration of a native riparian ecosystem along the Green River within the park.

Glen Canyon Ravenna project

Ravenna grass was the focus of treatment efforts at Glen Canyon National Recreation Area (NRA) in 2009. Three remote canyons, (Llewellyn Gulch, Reflection Canyon, and Cottonwood Gulch) were treated for ravenna grass. Using backpack sprayers, team members were able to access and treat dense populations as well as isolated emerging populations. In Llewellyn Gulch, three miles of dense continuous infestations of ravenna grass were treated, covering an estimated 10,000 individual plants.

Team members employed an early detection and rapid response strategy in Reflection Canyon, identifying and treating 12 isolated clumps of ravenna grass. These efforts will ideally lead to early eradication of this highly invasive grass from this canyon.

Treatments from previous years show a 90% success rate after one year. It is critical to continue treatment and monitoring efforts to prevent this grass from dominating the riparian systems within Glen Canyon NRA. Dense infestations exist within many of the drainages and shoreline of Lake Powell.

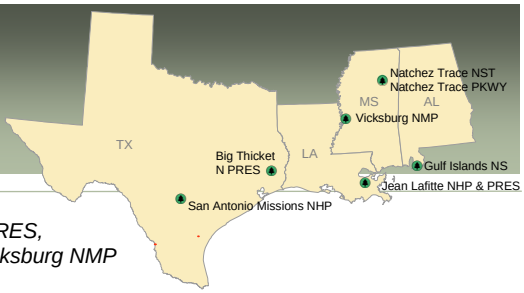
Figure 3: At Glen Canyon NRA, team members treat Ravenna grass along a canyon bottom, 2009.

Mesa Verde

The team and park based crews combined efforts this year at Mesa Verde National Park (NP). Treatment efforts were completed for multiple invasive plants within the park. One of the main target species was pepperweed. Pepperweed was treated along the main entrance road, as well as on the Morefield Lagoons. Additional species treated included plumeless thistle (*Carduus nutans*), on the Mesa Top Loop; Russian knapweed along the Mancos River and on the entrance road and a long section of the Mancos River was treated for tamarisk and Russian olive.

Gulf Coast

Exotic Plant Management Team



Partner Parks: *Big Thicket N PRES, Gulf Islands NS, Jean Lafitte NHP & PRES, Natchez Trace PKWY, Natchez Trace NST, San Antonio Missions NHS, Vicksburg NMP*

The Gulf Coast Exotic Plant Management Team (EPMT), serving the Gulf Coast region from Mexico to Florida, is situated in a region of relatively warm year round temperatures, high precipitation, and high plant diversity. The regional climate creates conditions suitable for many invasive plant species. Recent severe weather events, such as hurricanes and drought, have exacerbated the spread of invasive plants in the region. As a result, early detection rapid response (EDRR) strategies to exotic plant invasions have become critical to successful invasive plant management in the region.

2009 Accomplishments	
Inventoried Acres	14,885
Gross Infested Acres	10,132
Infested Acres	1,599
Treated Acres	681
Monitored Acres	386

New species of exotic vegetation are discovered annually in our parks. The Gulf Coast EPMT makes every effort to control those new exotic populations before they have a chance to spread to a larger area. Early Detection-Rapid Response efforts to eradicate new exotic plant populations supersede other planned control operations of established infestations. Exotic species that are well established in our partner parks are addressed through a strategy of containment to prevent spreading into undisturbed native plant communities. Invasive plant species of concern in the Gulf Coast region vary with location. Western upland parks contain Chinaberry tree (*Melia azedarach*), Japanese privet (*Ligustrum japonicum*), giant cane (*Arundinaria gigantea*), golden bamboo (*Phyllostachys aurea*), old world bluestem (*Diachantium sp*), and Johnson grass (*Sorghum halepense*). Coastal park concerns include Chinese tallow tree (*Triadica sebifera*) (particularly after hurricanes Katrina, Rita and Ike),

Japanese climbing fern (*Lygodium japonicum*), cogon grass (Imperata cylindrical), Chinese privet (*Ligustrum sinense*), mimosa tree (*Albizia julibrissin*), and Japanese honeysuckle (*Lonicera japonica*). Parks in the interior, humid south are primarily concerned with Kudzu (*Pueraria Montana*), as well as populations of Chinese tallow tree, Japanese climbing fern, cogon grass, Chinese privet, mimosa tree, and Japanese honeysuckle.

Major inroads into existing exotic plant populations have occurred in several partner parks. Kudzu dominance is declining in the landscapes of Vicksburg National Military Park and the southern regions of the Natchez Trace Parkway. Chinese tallow tree is no longer prevalent in the Mississippi portion of Gulf Islands National Seashore, and all populations at San Antonio Missions National Historical Park have been reduced to a fraction of their 2002 population levels.

Figure 1: Photograph following Hurricane Ike (October, 2008) demonstrating the plant material transport capabilities of hurricane force winds. Intact power lines were equally festooned with plant materials originating from coastal marshes 10 to 20 miles to the south.

Despite these successes, Chinese tallow populations exploded in the Big Thicket National Preserve and the Jean Lafitte Barataria Preserve following hurricanes Katrina, Rita and Ike. The hurricane force winds stripped seeds from mature trees and scattered them across the region. In response, these parks have received increased funding over the past two years to mitigate these new invasions. Additional hurricane recovery relief funding from the NPS Southeast Region has been directed towards these efforts, culminating in an impressive eradication effort at the Barataria Preserve. Over 508 canopy acres of Chinese Tallow have been removed from the Barataria Preserve this year, with another 1,000 acres projected to be treated next year. It will still take many years of follow up treatments to control this invasion.

Following Hurricane Katrina, volunteers facilitated early efforts of exotic vegetation control at the Barataria Preserve. Volunteers from many sources poured out in laudable numbers to assist in the control effort. Due to the absence of basic services, such as food, lodging, electricity and running water, contract operations were not possible. The volunteers were housed at hurricane relief camps and public campgrounds. The Gulf Coast EPMT supplied leadership, training, equipment, and supplies to assist the volunteers in their mission.

Although actual invasive plant removal acreage was small, these efforts helped pave the way to expanded volunteer impacts using hurricane relief grant money. Significant contributions to the effort came from partnerships with nonprofit organizations such as the Barataria Terrebonne National Estuary Program and AmeriCorps. Following restoration of basic services, contract operations resumed to control Chinese tallow at the Barataria Preserve, using hurricane restoration funding from the NPS Southeast Region. These operations continue today.

Today, Big Thicket National Preserve is responding to similar issues. Major contract Chinese tallow operations have been launched in the last two years. Outside funding sources will need to be secured, as was the case with Jean Lafitte, to facilitate a large-scale eradication campaign. One of the strengths of the EPMT structure is the ability to share experience and expertise with partner parks, creating a learning network. Through this network, parks receive valuable information in a more timely and applicable manner. This fact, as much as any other, accounts for our acclaimed operational efficiency.

Figure 2. AmeriCorps volunteers work with Gulf Coast EPMT to remove post hurricane Katrina Chinese tallow saplings under a cooperative agreement with the Barataria Terrebonne National Estuary Program (October 2008).

Native tree canopies have been replaced by Chinese tallow following repeated hurricanes. Active restoration, such as planting mature native plants, may be required after eradication of Chinese tallow. It is interesting to note that Chinese tallow does not appear to be affected by strong winds, simply bending over with the winds and resuming normal growth shortly after the storm. Native tree planting, to form a shaded canopy cover, can facilitate restoration in the event that active restoration is required. Providing shaded canopy cover is the only insurance that a treated area will not be re-invaded by Chinese tallow, or other light seeking exotic species.

It is hoped that the results of these treatment strategies will result in the restoration of native wildlife habitat and protection of valuable aquatic habitats. These parks have become important natural islands for protection of native plants and wildlife in otherwise biologically impoverished urban ecosystems. These conditions warrant an investment in active restoration.

Northern Rocky Mountain

Exotic Plant Management Team

Partner Parks: *Bear Paw Battlefield, Big Hole NB, Big Horn Canyon NRA, City of Rocks N RES, Craters of Moon NM, Fossil Butte NM, Glacier NP, Golden Spike NHS, Grand Teton NP, Grant-Kohrs Ranch NHS, Hagerman Fossil Beds NM, John D. Rockefeller Jr. Memorial PKWY, Little Bighorn Battlefield NM, Minidoka Internment NM, Yellowstone NP*

The Northern Rocky Mountain Exotic Plant Management Team (EPMT) serves 15 national park units in the states of Idaho, Montana, Utah, and Wyoming. The area the team manages is quite large, making it more efficient for the team to be separated into three crews based out of Glacier National Park (NP), Yellowstone National Park (NP), and Craters of the Moon National Monument (NM). The partner parks served by the Northern Rocky Mountain EPMT contain over four million acres of some of the most diverse terrain and ecosystems within the EPMT program, encompassing high desert, forests, sub-alpine meadows, sagebrush-steppe, and wetland and riparian areas.

2009 Accomplishments	
Inventoried Acres	4,041
Gross Infested Acres	4,931
Infested Acres	85
Treated Acres	85
Monitored Acres	2,925

Since the inception of the Northern Rocky Mountain EPMT in 2003, many of our infestations there have been up to a 98% reduction in resulting from treatment. Some of the team's greatest successes have occurred at Grant-Kohr's Ranch, Grand Teton National Park (NP), and City of Rocks National Reserve (NPre)). At Grant-Kohr's, the team has been able to reduce infestations of spotted knapweed (*Centaurea maculosa*) by 95% in 120 acres of grazing fields using boom spray applications. In 2006, the team began treating infestations of baby's breath (*Gypsophila paniculata*) scattered over 235 acres of the dry upland fields throughout the ranch. By 2009, the initial infestated 40 acres was reduced to .6 acres. Our annual group project focusing on treating weeds in the riparian zone of Grant-Kohr's has also yielded impressive results. Since 2006, populations of leafy spurge (*Euphorbia esula*) and yellow toadflax (*Linaria vulgaris*) have declined by 60%.

For the fourth year in a row, the team took part in a project to treat leafy spurge and yellow toadflax in the riparian zone of the Clark Fork River that runs within Grant-Kohrs Ranch. Encompassing approximately 200 acres, the riparian zone poses many challenges for the team, including thick native vegetation, the presence of irrigation canals, wetland sloughs, and downed trees.

Following the initial treatment in 2006, we have observed a 40% reduction in the density of leafy spurge and yellow toadflax. The team's goal is that in subsequent years, required treatment time will be reduced so that more attention can be placed on other invasives in this park, such as field bindweed (*Convolvulus arvensis*) and cheatgrass (*Bromus tectorum*).

Figure 1: Aspen Hunter Ranch at Grand Teton (NP). Photo taken in the summer of 2009 showing the site of thistle treatments.

At Grand Tetons NP, the team has had significant success at the Aspen Hunter Ranch site. In 2007, an initial treatment was completed on 200 infested acres of musk and Canada

thistle (*Cirsium arvense*). By 2009, this infestation had been reduced to 2.5 acres.

At City Of Rocks National Reserve, the team's most significant accomplishment was with treatments of Canada thistle and spotted knapweed. The thistle infestation in one of the riparian zones has declined by 80% since 2006, allowing for the re-establishment of native plants in this area. In the "Bread Loaves" area, an infestation of spotted knapweed has been completely eradicated since the initial treatment in 2004.

These and other success have been due to the flexibility of our methods, the cooperation from our partner parks, and our use of group projects to undertake the largest and most complex infestations.

The Northern Rocky Mountain EPMT began the 2009 field season with a group trip to Bighorn Canyon National Recreation Area (NRA). The focus was on treating Russian olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix spp*.) in the Yellowtail riparian habitat. This is an ongoing, cooperative restoration project between the National Park Service and Wyoming Fish and Game. Using heavy machinery private contractors ground down tamarisk and olive trees. The Northern Rocky Mountain EPMT crew was responsible for treating the stump sprouts and cutting trees that were inaccessible to the contractor's machinery. Six acres of olive and one acre of tamarisk were treated during the initial visit. This trip also served as the team training trip. Subjects such as herbicide handling, chainsaw operation and maintenance, and general safety procedures were discussed. In September, the Yellowstone NP and Glacier NP crews returned to perform follow-up treatments.

Figure 2. Lisa Chetney cutting Russian olive at Big Horn Canyon NRA. May 2009.

In May, all three crews met at Craters of the Moon National Monument to treat Dyer's woad (*Isatis tictoria*). This plant has invaded the kipukas (vegetated islands surrounded by ancient lava flows). Many kipukas contain rare plants endemic to this type of environment. Due to the remoteness of the area, water had to be packed in to the various work sites. The team's initial visit was a success, and work will continue on this project in 2010.

Figure 3. Crew staging area for Dyer's woad project. May 2009.

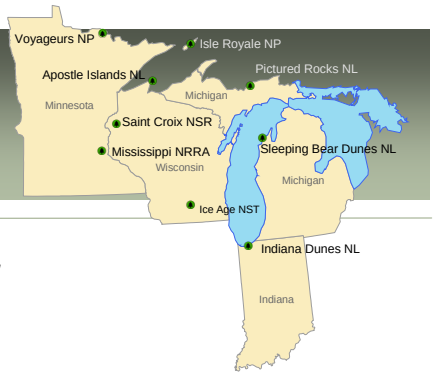
In Glacier NP, the crew has been treating 120 acres in Big Prairie area in the northwest corner of the park. After seven years of treating leafy spurge and yellow toadflax, the team is seeing slight reductions in toadflax infestations and a more significant reduction in the spurge populations. Due to concern that a fall herbicide application still allows the target plants to set seed, and is not as effective as was hoped, the team has switched to a summer application. For treatment of yellow toadflax, Glacier NP staff has set up plots to test the effectiveness of a new herbicide combination.

The Northern Rocky Mountain EPMT continued to contribute to the management of invasive plants in parks outside of the team's network, within the Colorado Plateau region. The team completed treatments of Russian olive and Russian knapweed in Dinosaur National Monument.

This season has been a safe and productive one for the Northern Rocky Mountain EPMT. Success has been possible because of the team's treatment approach and the efforts of staff from partner parks. Additional group projects and a focus on new priority species are essential to the effectiveness of the team and are trends the team will continue to pursue in future seasons.

Great Lakes

Exotic Plant Management Team



Partner Parks: *Apostle Islands NL, Ice Age NST, Indiana Dunes NL, Isle Royale NP, Mississippi NRRA, Pictured Rocks NL, Saint Croix NSR, Sleeping Bear Dunes NL, Voyageurs NP*

The Great Lakes Exotic Plant Management Team (EPMT) provides support to nine different national parks located across four states in the Western Great Lakes Region of the United States. These parks encompass a combined total of nearly 600,000 acres. From the Boreal Forests of Northern Minnesota, to the dunes along the eastern shores of Lake Michigan, and west to the scenic riverways of Wisconsin and Minnesota, this region lays claim to many diverse aquatic and terrestrial ecosystems. The Great Lakes EPMT is co-located with the Great Lakes Inventory and Monitoring Network in Ashland, WI. This provides the opportunity for the two programs to work closely together, taking advantage of shared positions and functions to accomplish program goals.

2009 Accomplishments	
Inventoried Acres	2,315
Gross Infested Acres	2,332
Infested Acres	158
Treated Acres	89
Monitored Acres	143

The 2009 field season was marked by many success stories and some new challenges. After years of treatment, the population of purple loosestrife (*Lythrum salicaria*) at Apostle Islands National Lakeshore has been dramatically diminished. Likewise, areas of the Grand Sable Dunes in Pictured Rocks National Lakeshore (NL) have a fraction of the spotted knapweed (*Centaurea maculosa*) that they once had, and the open fields at the Ice Age National Scenic Trail have been cleared of buckthorn (*Rhamnus cathartica*), autumn olive (*Elaeagnus umbellata*) and mulitflora rose (*Rosa multiflora*). At Indiana Dunes National Lakeshore (NL) the team wrapped up treatment of previous wetland sites and began treating established stands of *Phragmites* in new areas. The Great Lakes EPMT continues to treat on-going threats such as Canada thistle at Isle Royale and Voyageurs National Parks. In other parks the Great Lakes EPMT is battling increasing populations of new invaders such as garlic mustard (*Alliaria petiolata*) at St. Croix National Scenic Riverway.

Climate change has directly affected the way Great Lakes EPMT parks manage invasive species. Early spring species that were present, yet not invasive on the landscape have now increased exponentially. The timing of management activities has shifted to accommodate the changing behavior of invasive species. Species such as garlic mustard, need to be treated earlier in the spring while others, such as buckthorn, are now still green and growing late into the fall. Many of the parks are also less constrained by harsh winter temperatures that prevented new species establishment.

Figure 1: Foliar spraying of *Phragmites australis* in a panne wetland habitat at Indiana Dunes NL. For accurate control a ladder is needed to reach the tops of the reeds which can grow as high as 10 feet.

As a result, the team is especially vigilant in locating new invaders. The Great Lakes EPMT has been part of the first response team identifying and treating new species such as narrow leaf bittercress (*Cardamine impatiens*) in the Mississippi National River and Recreation Area, cypress spurge (*Euphorbia cyparissias*) in

Pictured Rocks National Lakeshore, and oriental bittersweet (*Celastrus orbiculatus*) in Sleeping Bear Dunes National Lakeshore.

The Great Lakes EPMT continues to assist parks with restoration activities. This year the team worked in concert with staff at Sleeping Bear Dunes National Lakeshore (NL) to control black locust (*Robinia pseudoacacia*) as part of a cultural landscape restoration.In the late 19th century, non-native black locust trees were extensively planted along the streets of Glen Haven, a historic logging settlement located within Sleeping Bear Dunes NL.

These locust trees gradually spread from the street plantings into the forests, dunes, and fields throughout the lakeshore and region, crowding out native vegetation. Resource managers with the park recognized detrimental impacts the black locust was having on the dunes this park was created to protect. The park faced an increasingly common and difficult question; How to manage a culturally significant, yet invasive species. The locust tree was damaging the resources the park was mandated to protect, yet represented the cultural landscape of the park.

Figure 2: Removal of black locust trees by GL-EPMT crew near historical buildings in the Glen Haven district, Sleeping Bear Dunes National Lakeshore. These trees are considered part of the cultural landscape but are extremely invasive.

The park identified the extent of the natural resource issue. Thousands of black locusts are present within the park. Funding for a large-scale restoration of the Glen Haven district allowed the park to start planning site restoration. Restoration strategies include removing the congestion of younger trees and identifying potential replacements for the larger historical black locusts.

The biggest challenge encountered in this restoration project was the sheer volume of tree removal. The Great Lakes EPMT has been removing thousands of trees from the region. Communicating the necessity of the project to the public was also a significant issue. Community members and park visitors had never seen the landscape without the locust trees. Outreach efforts were delivered by the park and Great Lakes EPMT to educate visitors on site about the issue.

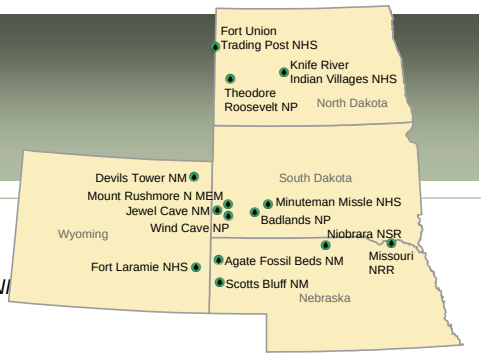
The impact of culturally significant, yet invasive species is an increasingly common issue in parks. Several other Great Lakes EPMT partner parks are struggling with how to maintain invasive species as part of a cultural landscape. At Sleeping Bear Dunes, the community was not prepared for the dramatic change resulting from extensive tree removal. Public education and awareness is critical in these large scale efforts.

The Great Lakes EPMT will continue to assist the park in planning restoration of the landscape, and managing the remaining black locust trees.

Figure 3: Black locust control near the old cannery building Glen Haven district, Sleeping Bear Dunes National Lakeshore. The park actively controls the offspring from these trees and will eventually replace the mature trees with non-invasive species to retain the character of the landscape.

Northern Great Plains

Exotic Plant Management Team



Partner Parks: *Agate Fossil Beds NM, Badlands NP, Devils Tower NM, Fort Laramie NHS, Fort Union Trading Post NHS, Jewel Cave NM, Knife River Indian Villages NHS, Minuteman Missile NHS, Missouri NRR, Mount Rushmore NM, Niobrara NSR, Scotts Bluff NM, Theodore Roosevelt NP, Wind Cave NP*

The Northern Great Plains Exotic Plant Management Team (EPMT) completed its 8th year of operation in 2009, serving 14 partner parks in four states and two regions consisting of 452,567 acres. The team has multiple goals, all of which revolve around controlling the spread of invasive species and restoring areas to native plant communities. The team emphasizes and uses integrated pest management (IPM) techniques for systematic long-term management and control of invasive species.

2009 Accomplishments	
Inventoried Acres	74,279
Gross Infested Acres	11,337
Infested Acres	10,330
Treated Acres	10,320
Monitored Acres	0

The Northern Great Plains EPMT concentrates the majority of its efforts on two species Canada thistle (*Cirsium arvense*) and leafy spurge (*Euphorbia esula*); although numerous other species such as tamarisk (*Tamarix spp*.), Russian olive (*Elaeagnus angustifolia*), eastern red cedar (*Juniperas virginiana*), purple loosestrife (*Lythrum salicaria*), black henbane (*Hyoscyamus niger*) and common mullein (*Verbasum Thapsus*) are treated as well. The parks and the team are seeing tremendous success in the control of invasive plants and the recovery of native species on sites that have been prioritized for treatment.

The team is working closely with the fire program and maintenance staffs at partner parks to incorporate prescribed burns and/or mowing as a pretreatment for fall herbicide application of Canada thistle. This IPM approach is providing maximum control in situations where terrain permits. At Agate Fossil Beds National Monument (NM), this approach achieved 90% control of Canada thistle 12 months after treatment. Mowing treatments, herbicide applications, and native competitive grasses are proving to be an effective long-term control method for Canada thistle control at Agate Fossil Beds NM. In 2008, 135 acres of Canada thistle were treated at Agate Fossil Beds NM. An even more thorough search in 2009 resulted in 13 acres of Canada thistle being treated.

Since its inception, the team has conducted several projects that resulted in dramatic decreases in certain invasive species populations. The team has cut down and treated several thousand tamarisk and Russian olive trees at Fort Laramie National Historic Site (NHS), Scotts Bluff National Monument (NM), Knife River Indian Villages National Historic Site (NHS) and Fort Union Trading Post National Historic Site (NHS). Follow-up treatments have been, and will continue to be conducted at these locations to treat new infestations every other year for woody species.

Beginning in 2004, treatment of tamarisk and Russian olive has occurred annually at Fort Laramie NHS. Initially, in 2004, the team cut down and treated 26 tamarisk and 1,077 Russian olive trees. This treatment was followed in 2005 with retreating 42 Russian olive trees and 21 new trees cut and treated. In October 2005, 58 new tamarisk trees were identified near the confluence of the Laramie and North Platte Rivers. October is a perfect time to search for young tamarisk. In dense canopies of willows, tamarisk is easily located by the reddish tint on the leaves and stems. In 2006, the park acquired additional land and the EPMT returned to rid the area of 176 Russian olive trees and 115 tamarisk trees.

Follow-up treatments were conducted in 2008 and resulted in treatment of another 277 Russian olive and 30 tamarisk trees. In October of 2009, the team conducted follow-up treatments again at Fort Laramie NHS for tamarisk and Russian olive. In all, 70 Russian olive and 10 tamarisk trees were treated**.** Like

Agate Fossil Beds NM, Fort Laramie NHS has also seen dramatic decreases in density and number of infestations of Canada thistle. This success has allowed the team to treat the entire park each year.

Figure 1: Treating smooth brome and crested wheatgrass at Knife River Indian Villages National Historic Site (2009).

At Fort Union Trading Post NHS, nearly all treated acres have been seeded to native species, with the exception of one 10-acre parcel. During the springs of 2008 and 2009, the Northern Great Plains EPMT conducted herbicide treatments on this 10 acre site of smooth brome (*Bromus inermis*). Follow-up treatments were completed in September. The seed mix used at Fort Union Trading Post NHS was developed using the Natural Resource Conservation Service Ecological Site descriptions, careful consultation with the Plant Materials Center out of Bismarck, ND, and private industry. Drawing upon the Northern Great Plains EPMTs previous restoration project experience, only warm-season grasses and forb species that are tolerant of herbicide will initially be seeded. The tenacity of the invasive grasses present at these sites, such as smooth brome, Kentucky bluegrass (*Poa pretensis*) and other annual and perennial invaders, will require multiple follow up treatments with herbicide.

The largest tree removal project again took place this year at Missouri National Recreational River (NRA). The park recently acquired 250 acres of Missouri River frontage, which had several thousand native but invasive eastern red cedars that the park's natural resources staff identified for removal. The team, along with park staff and the Minnesota Conservation Corp, spent the week of July 20-27, 2009 working 10-hour days, falling, limbing, and piling cedars. The project was located on steep terrain overlooking the Missouri River requiring boat access and then a long steep climb to the project area. Mulberry Bend near Vermillion, SD was also treated.

Badlands National Park once again received a flexible base increase for invasive species control. Resource management staff and the Northern Great Plains EPMT worked collaboratively on extensive Canada thistle treatments using ATVs, backpacks, and helicopter operations. The staff concentrated on previously treated areas to keep these areas in control and deplete any of the seedbank that is left.

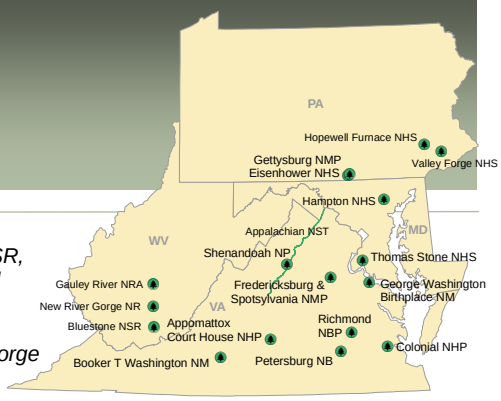
Figure 2: Treating leafy spurge at Theodore Roosevelt National Park (September 2009).

Working in remote locations, rough terrain and wilderness areas, ground crews cannot cover as much ground as efficiently as the helicopters. Evaluation of the minimum tool analysis shows that aerial spraying is an effective and environmentally preferred means of treating invasive plants in the 2003 Integrated Weed Management Plan (IWMP) for Badlands National Park. Use of aerial treatment is the least disruptive means in areas designated wilderness because it does not affect the terrestrial resources and has relatively short-term noise and visual impacts for visitors and wildlife.

In working collaboratively and being proactive, the parks and Northern Great Plains EPMT were able to request and receive additional funds. The parks are seeing a direct, positive impact on diminished invasive species throughout the Northern Great plains parks.

Mid-Atlantic

Exotic Plant Management Team



Partner Parks: *Appalachian NST, Appomattox Court House NHP, Bluestone NSR, Booker T. Washington NM, Colonial NHP, Eisenhower NHS, Fredericksburg and Spotsylvania NMP, Gauley River NRA, George Washington Birthplace NM, Gettysburg NMP, Hampton NHS, Hopewell Furnace NHS, New River Gorge NR, Petersburg NB, Richmond NBP, Shenandoah NP, Thomas Stone NHS, Valley Forge NHP*

The Mid-Atlantic EPMT (EPMT) works with 18 partner parks in Virginia, West Virginia, Maryland and Pennsylvania as a cooperative. Together, they are mobilizing people, knowledge, and tools to effectively manage invasive exotic plants. This year, the team was able to increase efficiency and effectiveness.

2009 Accomplishments	
Inventoried Acres	5,468
Gross Infested Acres	5,595
Infested Acres	700
Treated Acres	556
Monitored Acres	231

Several partner parks increased their involvement in invasive plant management by directing funds to conduct treatments with contractors, volunteers, and park staff. The Mid-Atlantic EPMT was able to increase treated acreage through adapting field techniques and equipment. Through effective use of the media and public outreach, the team was able to increase public awareness and volunteer fieldwork.

Despite the high number of invasive plants found in the mid Atlantic region, it remains one of the most species rich regions in North America. The potential for catastrophic species loss is great if these areas remain untreated. With strategic species preservation efforts, the region will remain an important contributor to biodiversity.

The Mid-Atlantic EPMT assisted Colonial National Historic Park (NHP) in protecting the Chesapeake Bay through treatments in heavily invaded riparian habitats. Aerial spraying was conducted within the park to treat and control 29 acres of phragmites reed along a segment of the James River. In a similar project, the team coordinated with Petersburg National Battlefield to execute a ground spray contract to treat Japanese stiltgrass in areas deemed essential for preservation. The Mid-Atlantic EPMT is cooperating closely with the park for follow-up monitoring and spot treatments. Volunteers are helping several parks augment invasive plant management efforts. The Appalachian National Scenic Trail, Colonial NHP, Shenandoah National Park, and Valley Forge National Historic Park continue to work with volunteers to control invasives in and near biologically important areas. The combined work of parks, contractors, volunteers, and the Mid-Atlantic EPMT are making impressive progress toward the recovery of natural areas, native species protection, and cultural landscape preservation.

Figure 1: A contractor used a Bell Ranger helicopter to apply herbicide on 29 acres of invasive Phragmites reed along the James River at Colonial NHP, September 2009.

The National Audubon Society of Virginia collaborated with the Mid Atlantic EPMT in the start up of a volunteer program at the Appalachian National Scenic Trail. In its first year, 484 volunteers contributed 1,477 hours to restore 26.2 gross infested acres. Volunteer

assistance programs such as these provide real value in invasive plant management and public relations.

The Mid-Atlantic EPMT increased public awareness of invasive species threats by speaking directly to the public, creating news media interview opportunities, publishing articles, fliers and posters for professional outlets, and responding to public queries for information. Reaching the public is key to reducing future infestations and utilizing their help to control existing infestations. To spread the message about invasive plant challenges facing National Parks, the Mid-Atlantic EPMT liaison spoke in public forums on 26 occasions, reaching 867 people. Audiences included school groups, environmental clubs, summer campers, professional groups, and the public. The liaison was interviewed for TV, radio, and print media, reaching a potential audience of 1.2 million people in Northern Virginia and Maryland. The objectives of public speaking were to inform and engage the public about the dangers posed to our native habitats by invasive species, to transform public thinking to appreciate native plants for landscaping, and encourage their involvement in the public sphere to help control local infestations and speak out for native species protection.

Figure 2: EPMT Liaison J. Åkerson speaks with high school volunteers about ecological impacts caused by invasive plants, April 2009.

This year, the Mid-Atlantic EPMT focused on increasing their effectiveness and efficiency. By taking a fresh look at the types of invasives being treated at each park, the team began using equipment that best suited the vegetation and terrain at hand. As examples, longer hoses were installed on ATV sprayers to enable longer reaches, thus decreasing downtime of moving vehicles; and using larger capacity tanks and pumps to enable large-scale applications on heavily infested sites. The team members also challenged themselves to increase the application time during a workday. Such measures enabled the EPMT to increase their application rate by a full 0.4-acre each day.

The Mid-Atlantic EPMT controlled 64 plant species in 2009. The top ten species by order of treated acreage includes Japanese stiltgrass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), tree of heaven (*Ailanthus altissima*), autumn olive (*Eleagnus umbellate*), spotted knapweed (*Centauea maculosa*), multiflora rose (*Rosa multiflora*), privets (*Ligustrum spp*.), Oriental bittersweet *(Celastruc orbiculatus*), tall fescue (*Lolium arundinaceum)*, and mile-a-minute vine (*Persicaria perfoliata*). Every species and infestation was treated to contain infestations and prevent the spread to other areas, both within and outside of the park boundaries.

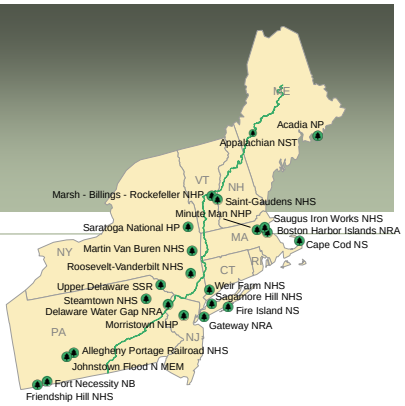
In its seven years, the Mid-Atlantic EPMT has contributed to bringing 1,165 acres into controlled status. Invasive plants no longer dominate those areas; they are able to recover and function in a native, natural condition. Benefits of restored native plant communities extend beyond the plant kingdom, to other species and ecosystem health. The Mid-Atlantic EPMT has a strong history of protection efforts leading to land restoration.

Figure 3: Crew Leader C. Bentley cuts lanes through a kudzu infestation to facilitate subsequent herbicide application at New River Gorge NR, August 2009.

The Mid-Atlantic Team is focused on field treatments. The objective of the team is invasive plant control, but the essential goal is natural and cultural resource preservation.

Northeast

Exotic Plant Management Team



Partner Parks: *Acadia NP, Allegheny Portage Railroad NHS, Appalachian NST, Boston Harbor Islands NRA, Cape Cod NS, Delaware Water Gap NRA, Fire Island NS, Fort Necessity NB, Friendship Hill NHS, Gateway NRA, Johnstown Flood N MEM, Marsh-Billings-Rockefeller NHP, Martin Van Buren NHS, Minute Man NHP, Morristown NHP, Roosevelt-Vanderbilt NHS, Sagamore Hill NHS, Saint-Gaudens NHS, Saratoga NHP, Saugus Iron Works NHS, Steamtown NHS, Upper Delaware SRR, Weir Farm NHS*

The Northeast Exotic Plant Management Team (EPMT) has been serving 23 partner parks in seven states, running from Pennsylvania north to Maine, since August 2003. Each year, the Northeast EPMT visits 12-15 of their partner parks. The team's host park is Delaware Water Gap National Recreation Area (NRA).

2009 Accomplishments	
Inventoried Acres	1,524
Gross Infested Acres	1,510
Infested Acres	210
Treated Acres	174
Monitored Acres	75

The Northeast EPMT assists partner parks with all aspects of invasive plant management, including on-site control work, revegetation, technical advice, planning assistance, facilitating partnerships, outreach, and contract assistance. From the beginning, the Northeast EPMT has focused on restoring native communities. Using both active and passive restoration approaches, every attempt is made to facilitate the restoration of native vegetation on managed acres within the partner parks. At Saratoga National Historic Park (NHP), active restoration strategies restored a former agricultural field to a native dominated grassland. The field was initially treated with herbicide to remove existing invasive plants. Following herbicide treatment, seeds of native grasses and forbs were drilled into the soil. Within one year, the results have been impressive; a native grassland has replaced a field of invasive woody plants.

At Delaware Water Gap NRA, similar restoration techniques have been used to restore open spaces dominated by invasive vegetation. In October 2008, the Northeast EPMT began treatment of an old agricultural field. The field was left untouched for two years to build up a fuel load. In March 2009, Delaware Water Gap NRA's Fire Management Office conducted a controlled burn to remove dead exotics and kill undesirable woody plants. This field will be allowed to naturally regenerate native vegetation. Depending upon site needs and available resources, similar approaches will be used in future restoration efforts.

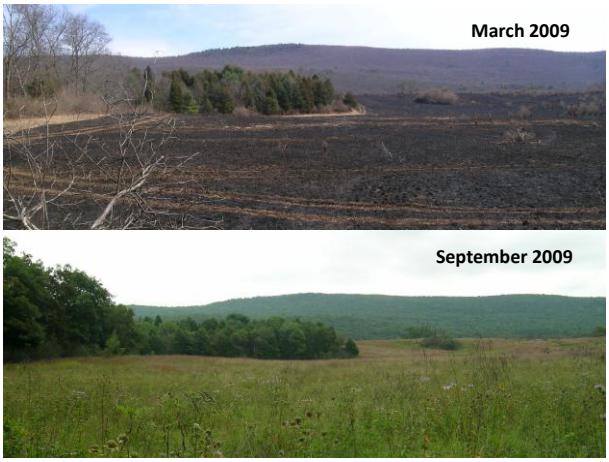


Figure 1: Delaware Water Gap NRA, Darrones Fields, 2009: Before and after of pictures of field burned to kill woody invasives in March 2009, with resulting regrowth in September 2009.

At Sagamore Hill National Historic Site, an invasive plant inventory and monitoring plan for the park was completed in 2006. In 2009, the Northeast EPMT worked closely with the park and the Olmsted Center for Landscape Preservation to prepare a detailed scope of work that incorporated a historical landscape restoration plan. The collaboration resulted in lower overall costs, tailored approaches, and more efficient implementation of both plans. Following completion in 2010, a sizeable portion of the park will be relatively free of invasives, with two fields planted to native plants and forbs.

The Sandy Hook Unit of Gateway National Recreation Area, has a significant infestation of

Asian sand sedge (*Carex kobomugi*) along its dunes. In 2009, the Northeast EPMT worked to consolidate a partnership between the Sandy Hook Unit and a local university who has been conducting long-term studies on Asian sand sedge. This sedge is affecting nesting sites of the federally endangered piping plover. Both the Sandy Hook Unit and the Northeast EPMT are benefitting from the ongoing long-term research and incorporating the research into on-the-ground control work. In September, university students laid out new study plots so the team could test the efficacy of different application rates for two herbicides. The students will collect and analyze the data from these plots.

Figure 2: A plot of Asian sand sedge treated with herbicide (blue dye in the herbicide makes the plot darker). This area is >90% sand sedge. Gateway-Sandy Hook Unit, 2009.

A new collaborative effort for the Northeast EPMT is a streamside restoration project. The team has been working with the Town of Lincoln Conservation Department (LCD) and Minute Man National Historic Park (NHP) on restoring stream banks along the border between Minute Man NHP and the town of Lincoln. The team hopes to initiate more restoration projects in this area through the newly developed Cooperative Weed Management Area (CWMA) that surrounds the town of Lincoln and Minute Man NHP. The CWMA is working to facilitate invasive plant projects, such as early detection and rapid response efforts (EDRR), on member properties.

In New Jersey, a coalition of public-private groups created the Central Jersey Invasive Species Strike Team, the state's first comprehensive effort toward invasive plant management. The coalition is mapping and ranking infestations of newly emerging populations of invasive plants in central New Jersey to prepare for future treatment operations. Morristown National Historic Park (NHP) has joined this effort. The park, New Jersey Strike Team, and the Northeast EPMT are planning a joint control operation at Morristown NHP in 2010, focusing on infestations of kiwi vine (*Actinidia arguta*).

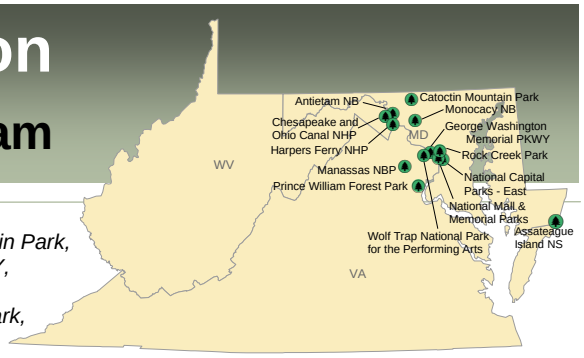
Volunteers in Parks (VIPs) are an important source of assistance for parks and the Northeast EPMT. In Delaware Water Gap NRA, a former park employee now volunteers to operate the team's tractor and mower. These efforts assist the team in keeping old farm fields from becoming overrun with invasive trees and shrubs like autumn olive (*Elaeagnus umbellata*), shrub honeysuckles (*Lonicera* spp.), and multiflora rose (*Rosa multiflora*). In 2009, the volunteer mowed 116 acres, a noteworthy feat.

Figure 3: VIP mowing old agricultural field planted to native grasses. Mowing, occasional spot spraying by Northeast EPMT and prescribed burns keep the fields "clean." Delaware Water Gap NRA, 2009.

EDRR is a critical strategy for preventing the spread of invasive plants by catching incipient invasive plant populations before they become rampant. This strategy is cost-effective and offers the rare opportunity to eradicate an invasive species in an area. Over the last two years, the Northeast EPMT has worked with two of the Inventory & Monitoring Networks in its region on EDRR in the parks. Because of the vital importance of EDRR, the team will be working toward expanding the program in the coming year.

National Capital Region

Exotic Plant Management Team



Partner Parks: *Antietam NB, Assateague Island NS, Catoctin Mountain Park, Chesapeake & Ohio Canal NHP, George Washington Memorial PKWY, Harpers Ferry NHP, Manassas NB, Monocacy NB, National Mall and Memorial Parks, National Capital Parks-East, Prince William Forest Park, Rock Creek Park, Wolf Trap National Park for the Performing Arts*

In 2009, the National Capital Region Exotic Plant Management Team (EPMT) continued its mission to assist parks in the management of exotic invasive plants species that threaten to destroy and degrade native ecosystems. The team worked closely with park staff to develop treatment plans for the year, coordinate treatment efforts, and share resources and information.

2009 Accomplishments	
Inventoried Acres	371
Gross Infested Acres	342
Infested Acres	212
Treated Acres	183
Monitored Acres	807

The National Capital Region EPMT worked with 13 partner parks, as well as nearby sections of the Appalachian Trail. The National Capital Region encompasses a wide variety of ecosystems from the barrier island of Assateague Island National Seashore, to urban sites such as Rock Creek Park, located in the center of Washington DC, to Catoctin Mountain Park in the heart of the Appalachian Mountains. Throughout the region, the National Capital Region EPMT treated 56 species of non-native invasive plants, with a total canopy cover of 183 acres

In addition to our normal projects scheduled with our partner parks, the National Capital Region EPMT worked with many groups inside and outside of the park service to expand our ability to treat known infestations of invasive exotic species and to support early detection and rapid response (EDRR) on new infestations, and newly discovered species.

The National Capital Region EPMT worked with two Student Conservation Association (SCA) Invasive Species Project Teams this season, in addition to having one SCA member working directly with the team. The National Capital Region EPMT provided training and assistance to the SCA groups working at National Capital East and Prince William Forest Park. Both teams did outstanding work aiding the efforts of the parks and the National Capital Region EPMT. In an effort to control common reed (*Phragmites australis*) growing along the Potomac River in the George Washing Memorial Parkway (MP), the National Capital Region EPMT worked with staff from the George Washington MP, the city of Arlington, and Fairfax County to treat a large stand that spread across park, city, and county lands. Due to previous successful efforts by the team in reducing the amount of common reed in this area, this was the only common reed infestation requiring treatment this year.

Figure 1: Crew member treating Phragmites australis along George Washington Memorial Parkway" September 2009.

Treatment of this remaining population was crucial to our long term efforts. Phragmites spreads most commonly by fragments of rhizomes breaking off and moving downstream. Careful monitoring will be required to identify any remaining plants missed in the initial

treatment and to prevent common reed from re-establishing. The National Capital Region EPMT will also continue to work with its partners on this project, providing assistance and guidance on treating stands of Phragmites that occur off of park lands.

The National Capital Region EPMT worked with a number of partners this year supporting each other in early detection and rapid response to new invaders. Two species of particular concern in the National Capital Region, wavy-leaf basket grass (*Oplismenus hirtellus ssp. undulatifolius*) and black swallowwort (*Cynanchum louiseae*), were the focus of collaborative efforts. These two species invade native ecosystems, quickly forming dense monocultures that crowd out native vegetation. Both species can colonize a wide variety of habitats, posing a significant threat to our natural areas.

Figure 2: NCR-EPMT confers with Park and Appalachian Trail Club staff on treatment of black swallow-wort, Hunters Run, Pennsylvania.

Wavy-leaf basket grass, first identified around a decade ago at Patapsco Valley State Park in Maryland, has shown up as far away as Shenandoah National Park in southwest Virginia. The National Capital Region EPMT worked with other members of the Wavy Leaf Basket Grass Task Force to treat a small population discovered in the Greenbelt section of National Capital Parks East. Marc Imlay of the Anacostia Watershed Society led a group of volunteers to locate and flag the isolated groups in the park. Kerrie Kyde of the Maryland Department of Natural Resources advised the team on how and when wavy-leaf basket grass should be treated. The team will continue to work with our partners on the task force to monitor this area for the presence of this perennial grass.

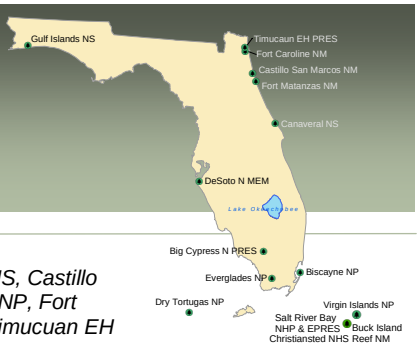
Black swallowwort, recorded in Massachusetts as far back as 1854, is only now approaching the National Capital Region. The National Capital Region EPMT had its first experience treating black swallowwort at two sites on the Appalachian Trail in Pennsylvania, including a chance to do some EDRR at the Hunters Run site. The team worked with members of the Appalachian Trail Club and local volunteers to locate and treat black swallowwort.

In addition to the EDRR work, the team has attempted to improve the early detection of these two species by providing information packets with photographs and descriptions of wavy-leaf basket grass and black swallowwort to our partner parks. We are hoping to get this information into the hands of all park employees and volunteers who are in position to do early detection.

Many of the National Capital Region parks are small and, consequently, have a high percentage of edge zones. These areas experience high rates of introduced disturbance and are highly susceptible to invasion by non-native species. With a dense human population and altered landscape, the National Capital Region is under constant threat from newly introduced plants. Early detection and rapid response will continue to be essential to the successful management of invasive non-native plants.

Florida and Caribbean

Exotic Plant Management Team



Partner Parks: *Big Cypress NP, Biscayne N PRES, Buck Island Reef NM, Canaveral NS, Castillo de San Marcos NM, Christiansted NHS, DeSoto N MEM, Dry Tortugas NP, Everglades NP, Fort Caroline N MEM, Fort Matanzas NM, Gulf Islands NS, Salt River Bay NHP & EPRES, Timucuan EH PRES, Virgin Islands NP*

The large number and extent of invasive species found in Florida and the Caribbean coupled with the great distances between parks presents a significant challenge to the success of the Florida and Caribbean Exotic Plant Management Team (EPMT). The distance between the western most Florida Park, Gulf Islands National Seashore and Buck Island National Monument in the US Virgin Islands is 1665 miles!

2009 Accomplishments	
Inventoried Acres	8,023,319
Gross Infested	25,489
Infested Acres	3,229
Treated Acres	2,817
Monitored Acres	23,317

Despite these challenges, the team has been extremely effective in managing invasive plants. The team has significantly reduced invasive plant species on National Park Service units in Florida and the Caribbean by treating over 700,000 acres. Ten out of the team's fifteen park units are considered under maintenance control for invasive plants. The other five parks have seen significant reductions of invasive plant species through large- scale control efforts.

The success of the Florida and Caribbean EPMT comes from the teams project management approach and network of partners. The teams project management is based upon a two-pronged approach to invasive plant control. Large projects are accomplished through cost effective regional private contractors. Smaller projects and scheduled annual park maintenance are completed by the small projects hit squad. This squad, led by the liaison, consists of staff from parks and other agencies. The squad provides the partner parks with much needed annual maintenance, as well as providing participants with valuable experience in the identification and treatment of invasive species.

More than any other factor the success of the team can be directly attributed to its many partners, including federal, state, and local governments, tribes, non-governmental organizations as well as Cooperative Weed and Invasive Species Management Areas (CWMAs). These partnerships enable the team to collaborate effectively to identify new invasive species threats, respond rapidly, and effectively treat these new threats before they become widespread and problematic.

Figure 1: Aerial Spot Spray (*Melalueca quinquenervia).*

Partnerships have also been vital in the monitoring and management of existing populations. In addition, these partnerships, in particular a partnership with the State of Florida Wildlife Conservation Commission, have enabled the team to leverage its funds to obtain over 5 million dollars in additional funds since 2000 for invasive plant control on National Park Service units.

A major regional partner is the Everglades Cooperative Invasive Species Management Area (ECISMA). ECISMA is a partnership of 21 federal, state and local government agencies, tribes, and organizations, with the primary goal of integrating control and management of invasive species at regional, multi-jurisdictional levels within the Everglades ecosystem. By sharing information, technology, and resources,

ECISMA seeks to elevate the successes of individual invasive species programs while simultaneously implementing regionally-based control strategies.

Early detection and rapid response (EDRR) for emerging threats is a central focus for ECISMA. ECISMA has conducted region-wide aerial mapping of invasive plants, created a web-based invasive species reporting system (see www.evergladescisma.org), drafted an EDRR implementation plan, and conducted rapid response efforts aimed at the sacred ibis (*Threskironis aethiopicus*), the Nile monitor (*Varanus niloticus*), and most recently, black mangrove (*Lumnitzera racemosa*).

Early Detection and Rapid Response

Land managers and biologists often do not have an opportunity to eradicate an invasive species. Invasive species are often identified only after a self-sustaining population has been established. Early detection and rapid response is a strategy that recognizes the importance of identifying and treating an infestation early on to prevent establishment of self-sustaining populations and distribution across a landscape. In the case of black mangrove*, a* non-native tree invading native mangrove habitat in south Florida, it appears that the early detection and rapid response strategy may make eradication possible.

Figure 2. Control of *Lumnitzera racemosa* at Fairchild Tropical Botanic Garden.

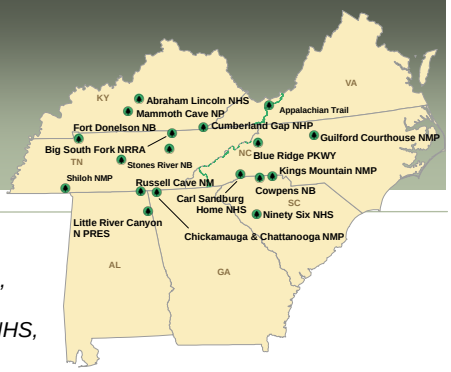
Black mangrove is a mangrove tree native to east Africa, southern Asia, and the western Pacific. It is a member of the Combretaceae family, the same family as mangrove species native to south Florida: the white mangrove (*Laguncularia racemosa)* and the buttonwood (*Conocarpus erectus*). Black mangrove was introduced to the Miami area 40 years ago at Fairchild Tropical Botanic Garden (FTBG). The 83 acre botanic garden planted 14 individual trees throughout the property, between 1966 and 1971. Black mangrove spread unnoticed for decades into adjacent native mangrove habitat. In 2008, the infestation was identified, and documented at over 15 acres, growing within the botanic gardens and onto a neighboring Miami-Dade County park, Matheson Hammock Park (MHP). Discovery of the invasion caused immediate alarm for several reasons. Black mangrove was a "new" invasive species, previously unknown in south Florida mangroves. This species posed an imminent threat to South Florida's ecosystems, including adjacent Biscayne National Park and Everglades National Park. Mangrove habitat is not easily or often traversed by biologists or resource managers, facilitating undetected infestations. The infestation developed undetected in an area actively managed for invasive species.

Once discovered, the Fairchild Tropical Botanic Garden (FTBG), Matheson Hammock Park (MHP), and the Everglades Cooperative Invasive Species Management Area (ECISMA) began to formulate a plan to manage the newly discovered infestation. Together, Fairchild and ECISMA developed a strategy to eradicate black mangrove. They organized workdays attended by more than 50 individuals from all over the state of Florida including the Florida and Caribbean EPMT. After completing three workdays over six acres of black mangrove were removed from FTBG and MHP.

There are still nine acres remaining that contain dense seedling infestations,densities of hundreds of individuals per square meter. A private contractor, under the guidance of the EPMT, has volunteered to provide the labor at no cost to complete the treatment. The Florida Fish and Wildlife Conservation Commission will provide the herbicide for the treatment of the remaining seedlings.

Southeast

Exotic Plant Management Team



Partner Parks: *Abraham Lincoln Birthplace NHS, Appalachian NST, Big South Fork NRRA, Blue Ridge PKW, Carl Sandberg NHP, Chickamauga and Chattanooga NMP, Cowpens NB, Cumberland Gap NHP, Fort Donelson NB, Guilford Courthouse NMP, Kings Mountain NMP,Little River Canyon N PRES, Mammoth Cave NP, Ninety Six NHS, Obed WSR, Russell Cave NM, Shiloh NMP, Stones River NB*

The Southeast Exotic Plant Management Team (EPMT) has been assisting 18 national park units in Kentucky, Tennessee, Virginia, North Carolina, South Carolina, Alabama, and Georgia since 2004. The team is based in Asheville, North Carolina at the Blue Ridge Parkway. The partner parks served by the Southeast EPMT encompass over 500,000 acres and lay primarily in the Piedmont, Appalachian Highlands, and Cumberland Plateau physiographic provinces of the southeast US. All of these park units are located within the NPS Appalachian Highlands and the Cumberland Piedmont Inventory and Monitoring Networks. 2009 marked the sixth year of safe operations with no hours lost due to injury for the Southeast EPMT.

2009 Accomplishments	
Inventoried Acres	2,026
Gross Infested	1,826
Infested Acres	271
Treated Acres	237
Monitored Acres	59

In 2009, the Southeast EPMT continued to assist partner parks in the inventory of exotic plants, the identification of priority treatment species, and the implementation of control measures. An Integrated Pest Management approach to control provides the framework for all management strategies employed by the team. Mechanical and chemical control methods used separately and in combination, are the most common control techniques. Currently, no parks served by the Southeast EPMT utilize biological controls for exotic plant management.

The invasive plant species of primary concern for the Southeast EPMT continue to be those that thrive in disturbed habitats or those that can adapt readily to areas of low light and moisture extremes. These include such species as privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*) and autumn olive (*Elaeagnus umbellate*) in open disturbed sites and Nepal grass (*Microstegium vimineum*), garlic mustard (*Allaria petiolata*) and Japanese honeysuckle (*Lonicera japonica*) in closed canopy woodlands. Almost half of the acres treated this year by the Team were dominated by these six species.

Figure 1. Treating 'satellite' kudzu infestations after larger infestation has been controlled at Fort Donelson National Battlefield, Dover, TN.

During 2009, the Southeast EPMT focused on developing early detection and rapid response (EDRR) protocols for our partner parks. This included developing a list of possible new invasive plant species for each park and providing identification and treatment materials. Emphasis was placed on prevention strategies including protocols for the movement of equipment and/or personnel within and outside of park boundaries. Criteria developed by Yellowstone National Park and Great Smokey Mountains National Park, for the selection of gravel and fill dirt sources for park construction and maintenance, have been adapted to serve our partner parks. The team is working to integrate exotic plant prevention and control into

all National Park Service operations and to develop effective strategies to prevent the introduction of new invasive plant species and limit the spread of species already present.

Cross training between the Southeast EPMT and other park divisions continued throughout this year including: safe power tool operations, exotic plant control techniques, ATV Safety Institute certified training, clean vehicle and equipment transport, safe and effective herbicide use, and plant identification.

Figure 2. Treating Chinese privet (*Ligustrum sinense*) seedlings in floodplain at Ninety-Six National Historic Site, Greenwood, SC.

As in previous years, the Southeast EPMT sought to develop partnerships that result in more efficient control efforts and provide training opportunities for park staff and adjoining land managers. Invasive plant identification and control methods training programs were held for park staff at Abraham Lincoln Birthplace National Historic Site (Kentucky), Cowpens National Battlefield (South Carolina), Kings Mountain National Military Park (South Carolina), Blue Ridge Parkway North Carolina), and Fort Donelson National Battlefield (Tennessee). Workshops open to public participation where again held at the Blue Ridge Parkway (North Carolina) and Mammoth Cave National Park (Kentucky). Other partners the Southeast EPMT has continued to work with include the US Forest Service, Tennessee, North Carolina, and Southeast Exotic Pest Plant Councils, The Nature Conservancy, and the Student Conservation Association. In August 2009, the Southeast EPMT received funding through the American Recovery and Reinvestment Act to place a temporary team on the Blue Ridge Parkway. The goals of this project include: providing employment, experience, and training opportunities to youth in natural resource management; enhancing the visitor experience by reestablishing native vegetation in a highly used and visible segment of the parkway; and to foster the development of a cooperative in the Asheville basin focusing on natural resource management. Developing partnerships and educational opportunities are key components to the success of the Southeast EPMT in invasive, exotic plant management.

Figure 3. Removing princess tree (*Paulownia tomentosa*) from cliff faces at Cumberland Gap National Historic Park Middlesboro, KY.

Appendix A 2009 EPMT Program Participants

The Exotic Plant Management Teams (EPMT) 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 program and the EPMT Team 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 2009 achievements described in the report.

Alaska EPMT
Administration: Bonnie Million (Liaison), Whitney Rapp (GLBA, Data Manager)
Crew: Deborah Kurtz (KEFJ), Kristi Link (SITK), Lil Gilmore (WRST)
Fieldwork Assistance: Wendy Mahovlic (DENA), Addison Kasmarek (GLBA), Mike Fitz (KATM), Christina Kriedeman (KEFJ), Dashiell Feierabend (KLGO), Shelby Surdyk (KLGO), Tamara Harper (WRST), Miranda Terwilliger (WRST)
Crew Interns: Jerolyn Byrne (DENA-SCA), Adam DiPietro (GLBA-SCA), Jessica Wilbarger (KLGO-SCA),
Fieldwork Assistance Interns: 2 YCC interns (KEFJ), Joe Donohue (WRST-CBG), Katie Laushman (WRST-SCA), Dave Turner (WRST-SCA), Jesse Amo (WRST-SCA), Mark Henspeter (WRST-SCA), Matt Smith (WRST-SCA)
Volunteers: Southeast Alaska Guidance Association, Need for Seed (DENA), Denali Discovery Camp (DENA), Max Gerth (GLBA - International Volunteer), Resurrection Bay Conservation Alliance (KEFJ), Green EdVentrues (KEFJ), American Hiking Society (KEFJ), Alaska Sea Life Center (KEFJ), Skagway Summer Camp (KLGO), Taiya Inlet Watershed Council (KLGO)
Park and regional contacts: Joel Cusick (AKRO), Greg Daniels (AKRO), Russ Kucinski (AKRO), Bud Rice (AKRO), Guy Adema (DENA), Pat Owen (DENA), Carl Roland (DENA), Lewis Sharman (GLBA), Craig Smith (GLBA), Troy Hamon (KATM), Roy Wood (KATM), Shelley Hall (KEFJ), Christina Kriedeman (KEFJ), Dave Schirokauer (KLGO), Page Spencer (LACL), Geof Smith (SITK), Peter Neitlich (WEAR), Miranda Terwilliger (WRST), Eric Veach (WRST), Jobe Chakuchin (YUGA), and Tom Liebscher (YUGA).
Steering Committee: Susan Boudreau (KLGO), Page Spencer (LACL), Carl Roland (DENA), Eric Veach (WRST), Michael Shephard (SWAN I&M Coordinator), Jennifer Allen (AKRO Fire Ecologist), Sara Wesser (AKRO I&M Coordinator), Tim Hudson (AKRO Assoc. Regional Director), Jeanne Standley (BLM), and Larry Johnson (AK DOT)

California EPMT
Administration: Bobbi Simpson (Liaison), Sara Hammond (Data manager)
Contractors: American Conservation Experience, Bureau of Land Management, California Department of Parks and Recreation, Cameron Colson, Great Tree Tenders, Native Range (John Knapp).
Park and Regional Contacts: Jay Goldsmith (Natural Resources Specialist) and Paul Reeburg (Fire Ecologist)
Steering Committee: Jay Goldsmith (Pacific West Regional Office) Athena Demetry (Sierra Network), Christy Brigham (Mediterranean Network), Sue Fritzke (San Francisco Bay Area Network), Stassia Samuels (Klamath Network), Paul Reeburg (PWR), Andrea Williams (I&M SF Bay Area Network)

Chihuahuan Desert / Shortgrass Prairie EPMT
Administration: Patrick Wharton
Crew: Chris Amos, Kyger Veatch (Northern Team); Ethan Sommers (GUMO); Charles Roybal, Mario Armijo (PECO STEP); Amorita Brackett, Wendy Weckesser(BIBE); Jon West(WHSA)
Park and Regional Contacts: Myron Chase IPM Coordinator
Steering Committee: David Bustos (WHSA), Fred Armstrong(GUMO), John Hiener(FODA), Karl Zimmermann(SAND), Fran Pannebaker(BEOL), Joe Sirotnak(BIBE), Arlene Wimer(LAMR/ALIB), Chris Moos(CAVO), Greg Garetz(AMIS), Ted Benson(PECO), Marie Frias(FOUN), Dick Zahm(WABA), Renee West(CAVE)

Colorado Plateau EPMT
Administration: See Lake Mead EPMT
Crew Partners/Contractors: Coconino Rural Environmental Corps, Rocky Mountain Youth Corps, Southwest Youth Corps, Olathe Spraying Service, Far Flung Adventures, BIA, USFS, Navajo Nation
Park and regional contacts, fieldwork assistance, and various types of technical assistance: Terry Nichols, Karen Beppler-Dorn, Cliff Spencer, Pat Thompson, Danguole Bockus, BLCA Ranger Staff, Tom Clark, CACH restoration crew, Brad Shattuck, Dana Backer, Dave Price, Liz Rodgers, Lou Lorber, Dan Miller, Tamara Naumann, Andy Bundshuh, Lori Makarick, Andy Shulman, Nancy Skinner, Anne Worthington, George San Miguel, Dennis Casper, Steve Mitchelson, John Spence, Jenny Shrum, Brian Jacobs, Kaibab NF-Williams Ranger District

Florida / Caribbean Partnership EPMT
Administration: Tony Pernas (Liaison)
Park and regional contacts, fieldwork assistance, and various types of technical assistance:
Jimi Sadle (EVER), Jonathan Taylor (EVER, Keith Bradley (Institute for Regional Conservation), Jennifer Possley (Fairchild Tropical Garden)
Steering Committee: Hillary Cooley (EVER), John Stiner (CANA), Jim Burch (BICY), Shelby Moneysmith (BISC), Richard Bryant (TIMU), Riley Hoggard (GUIS), Andrew Rich (FOMA), Scott Pardue (DESO), Leroy Rodgers (South Florida Water Management District), Jon Lane (US Army Corp of Engineers), Greg Jubinsky (FL Department of Environmental Protection), Bill Thomas (US Fish and Wildlife Service)

Great Lakes EPMT
Administration: Carmen Chapin (Liaison),
Crew Leader: Isaiah Messerly
Crew: Dan Bracken, Addison Manning, Ethan Kaiser
Data Manager: Rebecca Key
Park and Regional Contacts: Carmen Thomson
Student Conservation Corp Interns: Nathan Gainer, Joshua Ribar, Blake Lytle, Marissa Vine, Stephen Fricke, Tim Parry
Steering Committee: Mark Romansky, acting (ISRO), Nancy Duncan (MISS), John Kwilosz (INDU), Bruce Leutscher (PIRO), Robin Maercklein (SACN), Julie Stumpf (Midwest Regional Office), John Snyder (VOYA), Julie Van Stappen (APIS), Steve Yancho (SLBE), Dean Gettinger (IATR)

Gulf Coast EPMT
Administration: Eric Worsham (Liaison), Pat Wharton (Intermittent Crew Leader).
Partners/Contractors: American Youth Works, Barataria Terrebonne National Estuary Program, AmeriCorps, Student Conservation Association, Arrowhead Star Company.
Volunteers: Saint Michaels College, National Wildlife Federation, Sierra Club, AmeriCorps, Student Conservation Association.
Park and Regional Contacts: Craig Hauke, Intermountain Region IPM; Chris Furqueron, Southeast Region IPM; Dave Roemer, Brian Lockwood and Dusty Pate (BITH); Greg Mitchell and Greg Smith (SAAN); Dusty Pate, Nancy Walters and David Muth (JELA); Riley Hoggard and Gary Hopkins (GUIS); Virginia Dubowy (VICK); Kurt Foote and Lisa McInnis (NATR), Rolando Garza (PAAL).

Lake Mead EPMT
Administration: Curt Deuser (Liaison)
Crew Leader: Tarl Norman
Admin Assistant: Sue Knowles (shared position with LAME RM)
Data Manager: Ryan Tietjen
Squad Leaders: Dwayne Coleman, Beth Points, and Joe Castello
Crew Members: Lauren Alnwick-Pfund, Amorita Brackett, Hillary Cimino, Tamberlain Jacobs, Ed Kloehn, Brian Lumley, Kelly Mathis, Erin Niedringhaus, Anna O'Brien, Jacob Rigby, Ruth Slade, Heather Smith, Sam Smyrk, Beth Stein, Frank Szajko, Adam Throckmorton
Park and Regional Contacts: Jay Goldsmith (PWR), Kent Turner (LAME)
Steering Committee: Matt Brooks (USGS Research Botanist), Ron Hiebert (NAU/CPSU), Todd Esque (USGS Research Ecologist), Pam Benjamin (NPS/IMR Plant Ecologist), Gayle Marrs-Smith (BLM Plant Ecologist)

Mid Atlantic EPMT & Cooperative

Administration: James Åkerson (Liaison), Craig Bentley (Crew Leader).

Crew: Robert Jennings and Nathan Wender.

Student Conservation Association Interns: Travis Williams, Kyle Titus, and Eugene Kobayashi.

Regional Contacts: David Reynolds (Chief, Natural Resources and Science Division) and Wayne Millington (IPM Specialist).

Steering Committee: Brian Eick (APCO), Kent Schwarzkopf and C. Casey Reese (APPA), Timothy Sims (BOWA), Dorothy Geyer (COLO), Gregg Kneipp (FRSP), Randy Krichten (GETT/EISE), Rijk Moräwe (GEWA/THST), Paul Bitzel (HAMP), Steven Ambrose (HOFU), John Perez (NERI/BLUE/GARI), Dave Shockley (PETE), Kristen Allen (RICH), Gordon Olson (SHEN), and Kristina Heister (VAFO).
Volunteers: 463 individuals contributed 1,430 fieldwork hours. Participating organizations in the field included Culpeper Christian School, Defenders of Wildlife, Friends of the National Zoo, Girl Scouts USA, James Wood High School, Mountain Laurel Montessori, National Audubon Society of Virginia, Oberle School, Sherando High School, Virginia Governor's School, Warren County High School, Appalachian Trail Conservancy, Potomac Appalachian Trail Club, and the Virginia Native Plant Society.

Sponsoring Organizations: Together-Green Foundation of Toyota, National Audubon Society of Virginia, Defenders of Wildlife, National Environmental Education Foundation, Shenandoah National Park Association, Student Conservation Association, Public Land Corps, Appalachian Trail Conference, Potomac Appalachian Trail Club, and Leave No Trace.

Contractor: Invasive Plant Control, Inc., Steve Manning (President), Lee Patrick (Co-owner), Chris Marquess, and Adam Zellmer.
Park contacts & participants for fieldwork and various types of technical assistance: B. Eick, R. Tillotson (**APCO**); K. Schwarzkopf, C. Reese, M. Miller, L. Parriott, M. Gray, M. Elfner, D. Bryon, T. Pryor, R. Williams, W. Ebersberger, S. Mayes, S. Schaffer, and P. Dennison (**APPA**); T. Sims, (**BOWA**); D. Geyer, (**COLO**); G. Kneipp, D. Smith, L. Blake, M. Soper, (**FRSP**); J. Johnson, R. Krichten, C. Brown, G. Thomas, A. Roach, B. Robinson (**GETT/EISE**); R. Moräwe (**GEWA/THST**); P. Bitzel, M. Lynch, A. Klopka, J. Hicks (**HAMP**); S. Ambrose, G. Martin (**HOFU**); J. Perez, C. Bishop, J. Childress, D. DeFillips, S. Demaio (**NERI/BLUE/GARI**) D. Shockley, T. Blumenschine (**PETE**); K. Allen, M. Prowatzke, J. Harrington, S. Olson, B. Werth, H. Huntsberger, (**RICH**); G. Olson, W. Cass, J. Hughes, T. Pryor, J. Sylvia (**SHEN**); K. Heister, K. Jensen, H. Paulson, P. Rudolph (**VAFO**).

National Capital Region EPMT

Administration: Sue Salmons (Liaison), Frank Archuleta (Team Leader), Geoff Clark (Data Manager)
Crew: Ana Chuquin, Erik Kramer, Allen Dupre, Matt Rhodes
Park and Regional Contacts: Dan Sealy (Deputy Chief of Natural Resources and Sciences)
Volunteers: Gary Sikora, Mark Imlay
The Nature Conservancy Volunteer Coordinators: Mary Travaligni, Jamie Weaver
Other Federal Agencies: Phil Pannill (USFWS – NCTC Grounds Manager), Karin Christensen (ISFWS NCTC)
Steering Committee: Jim Sherald (NCR Chief of Natural Resources and Sciences), Diane Pavek (NCR Botanist and Research Coordinator), Jil Swearingen (NCR Integrated Pest Management Specialist), Ed Wenschof (ANTI), Sean Denniston (CATO), Scott Bell(CHOH), Brent Steury (GWMP), Bill Hebb (HAFE), Bryan Gorsira (MANA), Andrew Banasik (MONO), Steve Syphax (NACE), Mary Willeford Bair (NAMA), Paul Petersen (PRWI), Ken Ferebee (ROCR), Duane Erwin (WOTR)
Park Contacts, technical and field assistance: Joe Calzarette (ANTI), Kent Schwarzkpof (APPA), Jonathan Chase (ASIS), Becky Loncosky (CATO), P. Scott Bell (CHOH), Michele Carter (CHOH), Erik Oberg (GWMP), Dale Nisbet (HAFE), Eric Kelley (MONO), Mikaila Milton (NACE), Joe Kish (ROCR), Betsy Chittenden (WOTR), Phil Goetkin (WOTR), Matt Gilford (CATO)

North Cascades EPMT
Administration: Todd Neel (Liaison), Dan Campbell (Data Manager)
Crew: (OLYM) Daniel Lucero, Kelsey Johnson, Gus Johnson, Sarah Waldo; (LARO) Emily Flynn, James VanGeystel, Eric Walker, McLean Worsham.
Steering Committee / NCCN Park Contacts: Jack Oelfke (NOCA), Mignonne Bivin (NOCA), Regina Rochefort (Network Science Advisor), Steve Acker (OLYM), Lou Whiteaker (MORA), Carla Cole (LEWI), Craig Holmquist (EBLA), Chris Davis (SAJH), Erv Gasser (IPM Coordinator)
UCBN Park Contacts: Nate Krohn, Ray Dashiell (LARO); Shirley Hoh (JODA), Jason Lyon (NEPE), Roger Trick (WHMI).

Northeast EPMT
Administration: Betsy Lyman (Liaison), Brian McDonnell (Crew Leader)
Crew: Jeff Balles (Student Conservation Association Intern), Susan McCormick, Brad Romano
National Contact: Special thanks to Rita Beard, Invasive Plant Coordinator for the Exotic Plant Management Program, for her week-long visit, productive discussions with parks and EPMT, and many useful insights and information.
Regional Contacts: Wayne Millington, NER IPM Coordinator; Sheila Colwell, Senior Natural Resource Program Manager; Nigel Shaw, NER GIS Coordinator
Park contacts, fieldwork assistance, and various types of technical assistance (alpha by organization): Kathy Penrod (ALPO/JOFL); Casey Reese (APPA), Kent Schwarzkopf (APPA); Adam Brown (Appalachian Trail Conservancy); Marc Albert (BOHA/SAIR), Valerie Wilcox (BOHA), Al Hebb (BOHA), Anna Hines (BOHA), Amanda Ciardi (BOHA), Ed Pitcavage (BOHA Partner: Trustees of Reservations), John Dziegel (BOHA Partner: Trustees of Reservations); Stephen M. Smith (CACO); Jon Bugan (DEWA), Larry Hilaire (DEWA), Jeff Shreiner (DEWA), Tom Witter (DEWA VIP); Mike Bilecki (FIIS), Jordan Raphael (FIIS), Erin Lehnert (FIIS SCA intern), Jamie McCann (FIIS SCA intern); Connie Ranson (FONE/FRHI); Doug Adamo (GATE), Mike Byer (GATE), Dave Avrin (GATE-SHU), Hollis Provins (GATE-SHU), Bruce Lane (GATE-SHU), Deirdre Whelan (GATE-SHU), Dr. Louise Wootton (researcher, Georgian Court University—partner, GATE-SHU), David Taft (GATE-SIU); Geff Grossman (MIMA), Jeff Kangas (MIMA), Lou Sideris (MIMA), Anna Wilkins (Town of Lincoln, partner, MIMA); Robert Masson (MORR); Tim Layton (Olmsted Center); Tom Ross (SAHI), Scott Gurney (SAHI), Amy Verone (SAHI); Chris Martin (SARA), Linda White (SARA), Cindy VanDerwerker (SARA); Jamie Myers (UPDE); Greg Waters (WEFA)

Northern Great Plains EPMT
Administration: Chad Prosser (Liaison), Taryn Flesjer (Biologist/Data Manager), Mark Slovek (Crew Leader), Jared Burian (Crew Leader)
Crew: John Shoup, Lee Vaughn, Matt Rigge, Robert Walters, Michael Nelson, Adam Miller
Park contacts: Dean Reasoner (FOLA), Bob Manasek (SCBL), Mark Biel (DETO), Rod Skalsky (NDFMO), John Moeykens (KNRI), Andy Banta (FOUS), Pamela Sprenkle (NIOB), Stephen Wilson (MNRR), John Black (MIMI), Bruce Weisman (MORU), Bill Mathews (AGFO),
Steering Committee: Brian Kenner (BADL), Ken Hyde (WICA), Bill Whitworth (THRO), Dan Swanson (NGP Fire Ecologist), Kara Paintner (NGP I&M Coordinator), Carmen Thomson (Midwest Regional Office)

Northern Rocky Mountain EPMT
Administration: Chris Overbaugh (Acting Liaison), Gary Ludwig (Crew Leader), Mickey Pierce (Acting Crew Leader)
Crew: Samantha Arneberg, Dave Bates, Arley Cantwell, Lisa Chetney, Jacob Rigby
Volunteer: Nick Pierce
Park and Regional Contacts: Erv Gasser, Daniel Reinhart, Dawn LaFleur, Mike Wissenbach
Steering Committee: Jason Lyon (BEPA & BIHO), Cassity Bromley (BICA), Tim Bennett (CIRO), John Apel and Steve Bekedem (CRMO), Arvid Aase (FOBU), Dawn LaFleur (GLAC), Tammy Bensen (GOSP), Chris Ford and Jason Smith (GRKO), Kelly McCloskey (GRTE & JODR), Ray Vader (HAFO), Gary Jackson (MIIN), Melana Stichman (LIBI), Dan Reinhart (YELL)

Pacific Islands EPMT
Administration: Jeremy Gooding (Liaison),
Crew Leaders: Sean Grossman (HAVO, PUHO, PUHE, KAHO), Imi Nelson (Interagency Miconia Management Crew – Interim Leader, MISC Hana Crew), Michael Ade (MISC Piiholo Crew), Adam Radford (MISC Peripheral Miconia and Vertebrate Crew)
Data Managers: David Benitez (HAVO, PUHO, PUHE, KAHO), Sean Birney (Interagency Miconia Management Program Maui Crew, HALE), Brooke Mahnken (MISC)
MISC Field Technicians: Brooke Mahnken (MISC)
Steering Committee: Dr. Rhonda Loh (HAVO), Steve Anderson (HALE), Teya Penniman (MISC Manager), Lloyd Loope (USGS), Elizabeth Anderson (MISC Admin), Randy Bartlett (Puu Kukui Watershed Mgr Maui Pineapple Co, MISC Chair), Fern Duvall (Hawaii Division of Forestry and Wildlife, MISC Vice Chair), Pat Bily (The Nature Conservancy Hawaii, Maui Program)

*MISC: Maui Invasive Species Committee

Southeast EPMT
Administration: Nancy Fraley (Liaison), Toby Obenauer (Team Leader)
Crew: Jeff Stewart, Brent Stoltz, Marc Weller, Danny Stewart, Ian Mulrennin,
Regional Contacts: Chris Furqueron (Chief - IPM, Invasives, and EPMT Program)
Volunteers: Jane Hargreaves, Arthur Miller, Diane Riggs
Steering Committee, Park Contacts, technical and field assistance: Sandy Brue (ABLI), Jim Small (ANJO), Marie Kerr (BISO), Chris Ulrey (BLRI), Irene Van Horn (CARL), Jim Scyjkowski (CHCH), Kathy McKay (COWP), Jenny Beeler (CUGA), Michael Manning (FODO), Vicki Boyce (GUCO), Chris Revels (KIMO), Mary Shew (LIRI & RUCA), Bob Ward (MACA), Eric Williams (NISI), Rebecca Schapansky (OBED), Marcus Johnson (SHIL), Terri Hogan (STRI), Kris Johnson (GRSM).

Natural Resource Program Center, Biological Resource Management Division
Jerry Mitchell (Division Chief)
Rita Beard (Invasive Species Coordinator)
Ric Hupalo (Invasive Species Database Administrator)
Louisa Gibson (Program Assistant)
Debi Reep (Administrative Assistant)

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 the 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
Monitored Area is the collection and analysis of repeated observations or measurements over time. The collection of information overtime by measuring changes in the density, distribution, abundance, or location of an invasive plant. Monitoring may include ecological factors such as soils and plant composition. Monitored area is reported in acres.

Retreated Area
This term refers to areas that have previously been treated. The retreated are 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 or 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

EPMT: Exotic Plant Management Team

GIS: Geographic Information System

GPS: Geographic Positioning System

NPS: National Park Service

EDRR: Early detection and rapid response

NHS: National Historic Site

NRA: National Recreation Area

CWMA: Cooperative Weed Management Area

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

NPS 909/111437, October 2011

National Park Service
U.S. Department of the Interior

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

www.nature.nps.gov