National Park Service
U.S. Department of the Interior

Natural Resource Program Center
Biological Resource Management Division

Exotic Plant Management Team 2008 Annual Report

Cover Photos:

Top: En route to treatments at Grant-Kohrs Ranch National Historic Site, contributed by Chris Overbaugh of the Northern Rocky Mountain EPMT.

Bottom Upper Left: Preparing to cut down an invasive date palm tree (*Phoenix dactyolifera*) from the Middle East at Death Valley National Park. Some exotic palm tree species have spread into spring areas of the desert displacing native plants and increasing wildfire danger. Contributed by Curt Deuser of the Lame Mead EPMT.

Bottom Lower Left: Winged elm (*Ulmus alata*) removal at San Juan Island National Historical Park, contributed by Todd Neel of the North Cascades EPMT.

Bottom Right: Mid Atlantic EPMT Liaison mentoring young Mountain Laurel Montessori School volunteers removing garlic mustard (*Allaria petiolata*) along the Appalachian National Scenic Trail, contributed by James Åkerson of the Mid Atlantic EPMT.

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Introduction

The Exotic Plant Management Team (EPMT) program is part of the National Park Service (NPS) response to the growing invasive plant problem. The teams were established to provide a framework and a first response to exotic plant invasions within NPS. Each team is staffed by highly trained individuals with expertise in plant identification, plant ecology, weed management, and pesticide use. The Teams are funded through the National Resource Challenge, within the Biological Resource Management Division of the Washington Office. Each of the teams is headquartered in a region or park unit and operates over a wide geographic area, serving as many as 28 parks. The activities of each team are coordinated through a steering committee, which consists of representatives for each of the parks they serve. There are now sixteen teams operating across the country, serving more than 200 parks.

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 plants is changing the native landscape across North America. 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, modifying the physical structure of ecosystems, and altering water availability. These ecosystem changes can in turn lead to a loss in biodiversity, threaten rare species, alter the visual landscape, and modify habitat for indigenous wildlife and other native organisms.

Figure 1. Big bluestem (*Andropogon gerardii*), an important native range grass, at Devils Tower National Monument, Wyoming.

The increasing movement of people and goods across management, ecosystem, state, national, and international boundaries coupled with global climate change will likely accelerate problems with invasive plants and other invasive organisms. The response to this threat has been a growing awareness and focus on scientific research and management of invasive species by federal, state, and international governments, academic institutions, and private organizations.

Our National Park Units are not immune to this accelerating biological invasion. Invasive plants have been found on virtually all lands administered by the National Park Service. Current estimates are that more than 2.6 million acres or between 3-5 percent of park lands are dominated by non-native, invasive plant species.

The National Park Service is responding to this growing threat of invasive species by expanding programs and directing increasing resources toward the problem. It is the goal of invasive plant programs within the National Park Service to manage the sources of new infestations, reduce the effects of existing infestations, and to restore native plant communities and ecosystem functions.

Figure 2. Exposing kudzu (*Pueraria montana*) root crowns for herbicide application at Cowpens National Battlefield, South Carolina.

Within NPS, invasive plant management is a partnership among many programs including: park resource management, maintenance, interpretation, the Inventory and Monitoring Networks, and the Exotic Plant Management Teams - an integral part of the NPS response.

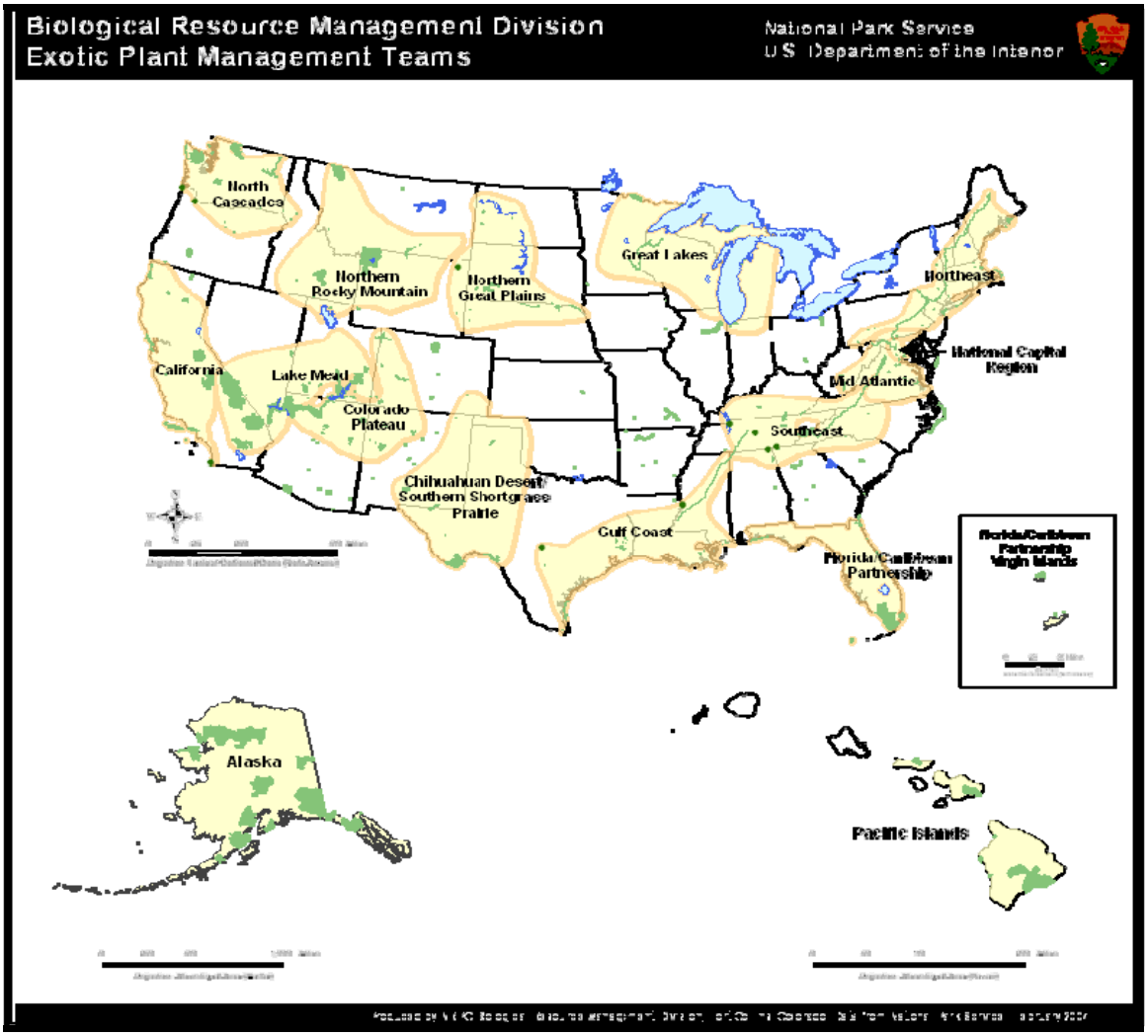


Figure 3. The Exotic Plant Management Teams.

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.

Managing invasive plants requires a combination of inventory, monitoring, prevention, restoration, control, and research. The teams contribute to all of these components in invasive species management. The EPMT program contributes to NPS invasive plant goals by working closely with other NPS programs and through cooperation and collaboration with other agencies, adjacent landowners, groups, and academic institutions. This annual report documents the activities and achievements of the Exotic Plant Management Teams in 2008.

2008 Accomplishments

The teams contribute in all facets of invasive plant management for the National Park Service. In 2008, the teams demonstrated this through accomplishments in prevention, inventory, monitoring, participation in research efforts, and treatment of invasive plants on 182 parks. In addition to this project work, teams provide advice and technical assistance to parks, regions, and the Inventory and Monitoring networks in all aspects of invasive plant management and ecological restoration. The teams provide invasive species training to park resource managers, maintenance, and staffs, as well as, other federal and non-federal partners. Teams also assist parks with general management plans, vegetation management plans, and environmental compliance.

2008 Accomplishments	
Inventoried Acres	169,729
Monitored Acres	85,611
Treated Acres	16,271
Gross Infested Acres	112,574
Infested Acres	18,105
Restored Acres	98
Maintained Acres	690

Figure 4. 2008 EPMT Program accomplishments.

Inventory and Monitoring

A critical component of invasive species management is knowing the location and distribution of invasive plants across the landscape. This information facilitates identifying treatment locations, setting priorities, identifying pathways of invasion, and developing management plans. Monitoring identifies changes in the size, location, density and distribution of invasive plants, and the efficacy of management practices. The teams work in close cooperation with park staff and the NPS Inventory and Monitoring program to gather this information. In 2008, the teams inventoried approximately 170,000 acres. These inventories recorded information on 366 invasive plant species. Over the last eight years, the EPMT program has inventoried more than two million acres and recorded information for more than 700 species.

Figure 5. CA-EPMT initiates a treatment of Harding grass (*Phalaris aquatica*) after inventorying a meadow at Redwoods National Park, California.

Figure 6. Inventorying purple loosestrife (*Lythrum salicaria*) along the Saint Croix River, Wisconsin.

Effective invasive management does not occur in isolation but rather requires coordinated management across ownerships and across landscapes. Managing invasive species across jurisdictions requires creating mechanisms to share information. Over the last eight years, there has been acceptance of national standards for the inventory and monitoring of invasive species; the North American Weed Management Association standards. The EPMT program has implemented these standards so that information can be shared with other parks, across agencies and across jurisdictions. Inventory and monitoring data collected by the teams can now be used in local and regional weed coordination efforts such as Cooperative

Weed Management Areas and local, county and state weed planning efforts. These efforts have resulted in local invasive species maps that include multiple ownerships and jurisdictions

Like inventories, monitoring is an important component of invasive species management. Monitoring can reveal changes in the size, location, density, and distribution of invasive plant populations. Monitoring can also identify pathways for the introduction and spread of invasive plants, efficacy of treatments, ecological changes prior to and following treatments, and the need for site restoration.

Figure 7. Treating remote locations at Grand Teton National Park, Wyoming.

The teams monitored more than 85,600 acres and 265 invasive plant species in 2008. The program is increasing monitoring as sustained treatments are beginning to show reductions in the number of infestations, reductions in the density of invasive plants within infestations, and recovery of native plant communities. When an invasive plant population occupies less than 1% of its initial size it is considered maintained or controlled. In 2008, 690 acres achieved this category. Monitoring at controlled sites is critical. Invasive species typically produce thousands of seeds annually, some remaining viable in the soil for more than 25 years. Even a single plant left untreated can repopulate a controlled site in only a few years. As more sites reach controlled levels monitoring will increase in the program.

The following examples demonstrate the inventory and monitoring activities by the teams:

- At North Cascades National Park, one of the greatest threats to native vegetation is the presence of a variety of invasive species along the park's section of the scenic North Cascades Highway. Completed in 1972, the highway serves as a major transportation corridor and a major pathway for the transport of invasive weed species such as diffuse and spotted knapweed (*Centaurea diffusa, C. maculosa*) to the western slope of the Cascade Mountains. In an effort to prevent the spread of these species to the park's backcountry, the EPMT has instituted a program of early detection and rapid response, where crews survey the entire roadway within the park, and control new invaders as they are identified.

Figure 8. Monitoring and subsequently treating the highway corridor through North Cascades National Park, Washington.

- The Florida team is working with partners to map invasive species across the region. Using aerial mapping techniques developed by USDA Forest Service the team has mapped more than 4 millions acres in south Florida.

Treatment and Control

Treatment and control of invasive plants continues to be the focus of the Exotic Plant Management Teams. Treatment comprises between 40 and 70 percent of the team's resources, depending on the needs of the parks they serve.

In 2008, the Teams treated more than 16,000 acres of invasive plants. The species treated varies greatly between teams. In 2000, with only a few teams in operation, only 17 taxa were treated. In 2001, the number of taxa treated had increased to 107 and in 2008 more than 347 taxa were treated. Since 2001, more than 600 taxa have been treated. The same trend is occurring in the number of parks serviced by the teams. In 2000, fewer than 20 parks were served by an EPMT; in 2008 teams operated in more than 182 parks for a total of more than 240 in the EPMT history.

Figure 9. Hand-pulling invasive plants in Alaska at Wrangell - St Elias National Park & Preserve.

Following are some highlights of EPMT programs in 2008:

- At Fort Laramie National Historic Site, the Northern Great Plains EPMT has historically spent over 300 hours treating more than 15 acres of Canada thistle in 200 acres of riparian habitat. This year, the crew spent approximately 180 hours and covered more than 550 acres but only had to treat the equivalent of 10 acres. The reduction in area actually treated is the result of the success of previous treatments.

- A few years ago Lewis and Clark National Historic Park (LEWI), acquired a new tract of land which was heavily infested with invasive plants. Since 2005, the North Cascades EPMT has worked with the park to control dense populations of Himalayan and evergreen blackberry (*Rubus discolor, R. lacinatus*). The large infestations have been dramatically reduced and now only require annual monitoring and minimal treatment maintenance to keep the area free of invasive plants. Native vegetation is being restored to the iconic Fort to Sea Trail, as well as contributing toward the eventual restoration of tidally influenced wetlands along the Lewis and Clark River.

- The Lake Mead team transplanted 500 native trees following two tamarisk removal projects at Lake Mead NRA. One of the projects included planting cottonwood and willow tree cuttings to help improve rare leopard frog habitat at Black Canyon Spring. This canyon, now a beautiful hiking destination for boaters, was previously inaccessible due to dense tamarisk thickets. The team also transplanted 200 catclaw acacia trees following a tamarisk prescribed burn to improve bird habitat.

Figure 10. Removing salt cedar (*Tamarix ramosissima*) from canyons at Hagerman Fossil Beds National Monument, Idaho.

- At Dry Tortugas National Park, the Florida Caribbean team in conjunction with park biologists cleared invasive Egyptian crows foot grass from sooty and noddy tern nesting sites. At Canaveral National Seashore, the Team controlled Brazilian pepper from federally listed Florida scrub jay habitat.

- The Pacific Island Team has taken the lead role in controlling the tropical super-weed miconia (*Miconia calvescens*) on the island of Maui. Miconia is being successfully contained across 35,000 acres.

- This year, the National Capital Region EPMT began working closely with C&O Canal National Historic Park and Montgomery County, Maryland on a canal restoration project. As the first step in restoring the aqueduct that carried the C&O Canal across the Catoctin River, the EPMT removed English ivy, garlic mustard, Japanese hops, Japanese stiltgrass, tree-of-heaven, and all other invasive plants on 18 acres in and around the work zone. This will prevent invasive plant propagules from being spread during the construction phase and will also allow the surrounding area to be more easily restored to native vegetation once the construction is completed.

The invasive plant program is focused on restoring natural landscapes; however, National Parks are mandated to protect both natural and cultural features. Invasive plants can destroy the native settings surrounding historic or archeological sites.

Figure 11. Working around Civil War artifacts poses special challenges at Fort Foote Park, Maryland.

Large root systems of invasive trees can destabilize historic structures and disrupt archeological features; conversely, extensive systems of smaller roots may hold old walls and other structures together. Soil disturbance from pulling plants can further displace artifacts and distort the information that can be gleaned from the site. Killing the roots of vegetation growing on structures can either improve or reduce the stability of the structure. Acidic herbicides, like glyphosate, can damage artifacts by reacting with stone, mortar, and metals. All these factors and more are considered when treating invasive species around sensitive historic sites and special consideration is given to timing of treatments, control methods, and the equipment used.

Figure 12. ATV application of herbicide at Fort Union Trading Post National Historic Site, North Dakota.

The Lake Mead Team has completed the first tamarisk removal project at Manzanar National Historical Site in California. The Superintendent of Manzanar NHS and staff coordinated this combined natural and cultural resource stewardship project to remove tamarisk that was uprooting and engulfing many of the cultural resources at Manzanar. The Lake Mead EPMT reversed adverse conditions formed by many years of tamarisk aggressively invading the grounds and altering the cultural sites.

Prevention

The most effective and economical approach to managing invasive plants is to prevent their introduction and spread. Prevention is a combination of early awareness, detection and prompt treatment of new populations, and using management practices that limit introduction and spread. Practices such as cleaning equipment and vehicles, monitoring and treating along weed dispersal pathways (roads, trails, parking lots and campgrounds), and using weed free material in construction and maintenance projects can significantly reduce invasive plant introductions. An important component of prevention is education and training. Educational programs can acquaint the public and park staff with the potentially devastating effects of biological invasions, how to recognize invasive species, and how simple practices can prevent or reduce the introduction and spread of invasive species. The teams spend between 5 and 15 percent of their time on prevention activities.

Examples of prevention practices implemented by the teams include:

- The Southeast team developed a series of Best Management Practices for park maintenance staff to reduce the introduction and spread of invasive plant materials in all park operations.
- Education can be as informal as talking with passers-by who stop to ask questions of invasive plant crews working in parks. The teams have developed brochures to explain activities to visitors and highlight the need for invasive plant inventory and control.
- The Mid Atlantic EPMT has increased public awareness by working with the news media, and publishing and presenting information in newsletters, parks, and at professional meetings.
- The Colorado Plateau team conducted training at Hubbell Trading Post National Historic Site for the youth corps and volunteers that conduct invasive plant control activities at the park and on

surrounding Navajo Nation tribal land. There were many young people in the group that showed a better appreciation for exotic plant management after the training concluded.

- In conjunction with the Midwest Invasive Plant Network, the Great Lakes EPMT produced an early detection flyer "AQUATIC INVASIVE PLANTS in the Midwest", and "Invasive Plants of the Eastern United States", a fold-out laminated guide available from Waterford Press. EPMT staff participated in a weed education booth at a local Farmer's Market throughout the summer.

- The National Capital Team Leader had the opportunity to exchange information with several international delegations:

1) In March, the team spoke with two visitors from Cyprus on how the National Park Service and the teams recruit and manage volunteers for invasive plant management projects. The two women have joined forces to develop park volunteer programs on Cyprus. This two-year alliance was brought about through HasNa Inc., a non-profit organization that seeks to break cycles of conflict and reduce tensions between disparate groups around the world.

2) In June, as one of several representatives from various federal land management agencies, the team introduced the issue of invasives and forest health to the People's Republic of China Joint Working Group on Forestry Restoration.

3) In August, through the University of Maryland chapter of Partners of the Americas, the Team compared urban parks issues between Rio De Janeiro parks and Maryland parks with a group of visiting Brazilian students.

Cooperation and Collaboration

One of the central tenants of invasive plant work is that weeds know no boundaries. Effective management of invasive plants requires cooperation and coordination across jurisdictions and property lines. To achieve the goal of coordinated management the EPMT program has focused on identifying opportunities for coordination, fostering partnerships with organizations and agencies, and removing any institutional boundaries.

The EPMT are leaders and active participants in regional and local cooperative efforts; the following examples illustrate this:

- The Northwoods Cooperative Weed Management Area, chaired by the Great Lakes Team Leader, received special recognition from Wisconsin Governor Doyle for its outstanding efforts in leading invasive species management in Wisconsin.

- The Lake Mead Team leveraged it's base funds by nearly a 3:1 ratio through development of many partnerships. The team has several cooperative agreements with other agencies that provided funding for an additional 20 crewmembers. The team has improved the capacity and efficiency of land management agencies to treat weeds following wildfires and provides timely accomplishments from other funding sources designated for weeds and restoration purposes.

- Funding secured through the Wisconsin Coastal Management Program allowed the Great Lakes team to control Japanese knotweed in Bayfield, WI, the gateway community of the Apostle Islands National Lakeshore.

- The leaders of the Mid-Atlantic, Northeast, and National Capital Region Teams share a seat on the Board of the mid-Atlantic Exotic Pest Plant Council (MA-EPPC). The group shares information and coordinates invasive plants species management in the area.

- The Alaska EPMT partnered with the Southeast Alaska Guidance Association (SAGA), an Americorps program. SAGA worked in seven Alaskan National Parks giving nine weeks of service in 2008 towards invasive plant control. The volunteer cooperative effort led to successful treatment of nearly sixty acres.

- The Colorado Plateau Team entered into inter-agency agreements with the Bureau of Indian Affairs and US Forest Service to provide exotic plant inventory, control and monitoring services for areas in northern Arizona during 2008 and into the future.

- The National Capital team is working to establish a Cooperative Weed Management Area in our nation's capital, one of the first in

a major metropolitan area. The group will coordinate invasive plant control efforts across various city agencies, private landowners and federal agencies. The first major project will remove invasive tree species along Canal Road, an important entrance and roadway into the capital.

- The Southeast, Florida, and California Team leaders (liaisons) are in leadership roles in regional and national Exotic Plant Pest Councils.
- The Mid-Atlantic EPMT has been a leader in enlisting volunteers in invasive plant management. Volunteers working on invasive plants have become an annual event at Shenandoah National Park, providing valuable resources to control invasive plants and opportunities for education.
- The North Cascades EPMT has been instrumental in the formation of a cooperative weed management area. Coordination with area tribal governments has lead to more effective treatment of advancing populations of knotweed along local rivers.
- The Alaska team is helping to create cooperative weed management areas to facilitate local activities with adjacent land owners. They are working to control orange hawkweed across the Kenai Peninsula.

Early Detection and Rapid Response

While virtually all park units have recorded the presence of invasive plants, the majority of NPS lands are still free of exotic vegetation. As mentioned previously, approximately 2.6 million acres (three to five percent) of NPS lands are currently infested with some invasive plant species. Conversely this translates to close to 95% of NPS lands are still free of invasive plant species. Prevention and early detection are the most efficient and effective mechanisms to manage invasive plants. The most effective time to treat invasive plants is when infestations are new to an area and infestations are small. This window of opportunity is often called Early Detection and Rapid Response (EDRR). Invasive plants can expand from a few plants to several hundred acres in less than five years. A new infestation of a few plants may require only a small investment of time and resources to control. Infestations of several hundred acres may take thousands of dollars. For very large infestations, eradication or control may no longer be possible. The Teams embrace the EDRR concept by helping parks identify and locate new infestations, and focusing priority treatment activities in these areas. Teams also work to protect uninfested area by closely monitoring pathways of introduction and treating new infestations as soon as they are detected.

Some examples of this work include:

- Gulf Islands National Seashore has suffered extensively since 2004 from a series of tropical storms that disturbed natural habitat allowing invasive plants to become established, such as torpedo grass and Chinese tallow. The team has been working on controlling these newly established invasive plants throughout the park.
- Pampass grass is a relatively recent invader to the Hawaiian Islands and is threatening rare pristine sites within Haleakala National Park. The Pacific Islands EPMT is working on an extensive five year survey and control program to prevent the establishment and proliferation of the species on Maui and the remainder of the Hawaiian Islands.
- Craters of the Moon National Monument and the Northern Rockies EPMT developed a quick response plan when dyer's woad was first located in the park. The plan called for a coordinated effort between park staff and the team to treat the entire infestation. This swift response treated all the plants prior to releasing seed.

Figure 13. Pampas grass (*Cortaderia selloana*) invading the East Maui watershed, displacing the groundcover of native ferns.

Invasive Plant Management Plans

In recent years the teams are playing a greater role by leading or assisting parks in strategic planning for restoration and invasive plant management. The threat to our national parks and wildlands from invasive plants will only increase in the coming years. The millions of annual visitors from across the country and around the world to our national parks increase the opportunity for plant introduction and dispersal. The teams are working closely with parks to anticipate and plan for this growing invasive plant problem though the development of long term prediction modeling, analyzing environmental consequences, and developing strategic plans.

Some examples include:

- Invasive plants are relatively rare in Alaska. Over the last few years the Alaska EPMT has focused on surveying the likely pathways and sites for invasive plant introduction. This information has been used to create a ten year management plan. The plan identifies strategies for prevention, early detection and treatment for invasive plants across all parks in the Alaska region.

- The Northern Great Plains EPMT led the effort to develop a management plan, including an environmental assessment for the management of invasive plants, for parks in the area. The plan outlines a strategic approach to controlling invasives while restoring native plant communities.

- The Northern Rocky Mountain EPMT is leading an effort at ten parks in the Northern Great Basin and Rocky Mountains. They are cooperating to establish a series of strategic management plans for the management of invasive plants within these parks. Similar plans are now under development in southwest parks.

- Guilford Courthouse National Military Park resource staff in partnership with the Southeast EPMT, the Cooperative Ecosystem Studies Unit, and North Carolina State University has developed a draft ten year exotic plant management plan. This plan will serve as a template for other park units and partners in the development of similar strategies. Ultimately the goal is to include the prevention and containment of exotic plants in all aspects of park management.

Safety

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

Figure 14. Traversing boulders to treat salt cedar in the Southwest.

To manage these hazardous working conditions safely the EPMT program emphasizes safety and caution in all operations. Each Team prepares a job hazard analysis for every type of operation. These analyses are updated frequently to reflect current conditions. On the job safety meetings are held frequently, reinforcing good safety practices. The teams work with each park to ensure that the safety plans and hazardous analyses meet park standards and local environmental conditions. The teams have recorded more than 750,000 field hours over the last eight years with very few lost time injuries, representing less than 0.03 percent of the field hours.

The EPMT program has become an integral part of managing invasive plants in the National Park Service. The teams are frequently called upon to provide services to parks, regions, and cooperators. The program has become a catalyst for invasive plant programs within National Park Units.

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*

While people may think of Alaska as too cold and remote for invasive species to become problematic; the past decade has demonstrated that Alaska is just as vulnerable as other states, and the invasion has truly begun.

2008 Accomplishments	
Inventoried Acres	310
Gross Infested Acres	716
Infested Acres	716
Treated Acres	58
Monitored Acres	4,122
Maintained	26

Alaska's 54 million acres of National Park lands preserve vast areas that have seen no addition or subtraction of species over the past century. However, invasive plants have gained footholds in the developed areas of the most highly visited Alaska parks. To meet this growing challenge in 2008, its sixth year, the Alaska EPMT (AK-EPMT) further developed its comprehensive and vigilant efforts to keep invasive plants from becoming major problems in Alaska's National Parks. An Invasive Plant Management Plan and environmental assessment were completed for the entire Alaska Region, the first of its kind in Alaska and a great achievement.

In the nine Alaska parks with documented invasive plants, just over half of the Region's units, 17 employees and interns inventoried, controlled, and monitored small, scattered invasive plant infestations. Two months of assistance provided by AmeriCorps crews from the Southeast Alaska Guidance Association enabled treatment within the seven parks having large infestations. This also provided work experience in National Parks for over 50 youth and an opportunity for education in natural resource management. Sixty-five infestations were eradicated this year, adding to the 35 eradicated in 2007. This prevented small infestations from increasing and becoming a widespread landscape issue.

Figure 15. The seasonal training at the beginning of the summer is the only time the Alaska EPMT gathers in one place before dispersing to keep invasive plants from doing so in the parks.

Examples of AK-EPMT's successes include the elimination of populations of annual sowthistle (*Sonchus oleraceus*) and oxeye daisy (*Chrysanthemum leucanthemum*) from the entrance area to Denali National Park and Preserve. These early efforts have kept numerous invasive plant species from spreading along the single road to the millions of uninfested acres beyond. At Glacier Bay National Park and Preserve, the AK-EPMT is eradicating populations of reed canary grass (*Phalaris arundinacea*) and creeping buttercup (*Ranunculus repens*) that can obstruct wetlands and damage fish and wildlife habitat. Populations have been treated and confined to the park entrance area. Work at Wrangell-St. Elias National Park and Preserve has resulted in the elimination of several invasive species that would have swiftly spread into the northern area of America's largest National Park. Sweet clover (*Melilotus spp.*) is a growing problem in

Alaska and now dominates stream banks along several rivers in Alaska. Ongoing efforts to control sweetclover have protected the Copper River from widespread infestations. The only known invasive plant infestation in Gates of the Arctic National Park and Preserve has been eradicated. Finally, eight invasive species have been purged from Kenai Fjords National Park, preserving the ability of native plants to colonize when glaciers recede.

The AK-EPMT participates regularly in the Alaska Committee for Noxious and Invasive Plants Management and in Cooperative Weed Management Areas across the state, serving a leadership role and sharing information on invasive plant management. In 2007 and 2008, this involved contributing to recommendations for the State Legislature about effective ways to address invasive plants statewide. In 2008, the Alaska House and Senate passed a bill to establish an Invasive Plant Program within the Alaska Department of Natural Resources. As Governor Palin signed the bill into law in June, she spoke of the importance of learning from the problems other states are facing by addressing invasive plants while they are still manageable.

Figure 16. AK-EPMT Liaison Jeff Heys teaches Alaska Governor Sarah Palin, her daughter Piper, and friends about spotted knapweed shortly after she signs Alaska's first legislation to deal with invasive plants.

To help provide national attention to invasive species issues in Alaska, the NPS Alaska Regional Office hosted the biannual Invasive Species Advisory Committee meeting in May. This group of experts was impressed by the level of Alaskan participation in the meeting and the opportunities and challenges presented by the early stages of invasion in an enormous and remote state.

Alaskan National Parks still face challenges garnering support and understanding for invasive plant management. Consequently, outreach and education programs are an active component of the AK-EPMT. Several community events occurred at Glacier Bay this summer. The fourth annual Fourth of July outreach event featured invasive plant arrangements, interactive invasive plant games, and a dandelion cookbook with a featured recipe - roasted dandelion root coffee served piping hot. At a separate event for local schoolchildren, the EPMT led a morning of invasive plant activities including listening to stories, playing games, and learning to identify non-native plants. Finally, for park staff, presentations and informative emails were presented throughout the summer. Similar activities across Alaska's parks are the avenues to long-term success for preventing invasive plant problems.

Figure 17. AK-EPMT Data Manager Whitney Rapp teaches the next generation at Glacier Bay to identify invasive plants.

Our method for keeping Alaska's National Parks free of invasive plants involves scouring the areas most likely to be invaded, such as campgrounds, trailheads, and parking lots, and locating small populations of invasive plants as soon as they are noticeable. They are then precisely mapped, immediately controlled, and closely monitored until they have been eliminated. It is a simple formula but one that now yields growing returns. After one to several years of treatment, a population fails to turn up, and another battle has been won. Since we also take steps to ensure that invasive plants are not introduced by park operations, we will face fewer battles in the future.

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 (CA-EPMT) serves 14 parks that reside within the California Floristic Province. This region is one of 25 world biodiversity hotspots, and is known for its unusually high concentration of endemic plants. Of the 3,500 vascular plants found in California's floristic hotspot, 2,124 species are found nowhere else in the world.

2008 Accomplishments	
Inventoried Acres	1,894
Gross Infested Acres	3,452
Infested Acres	199
Treated Acres	175
Monitored Acres	2,229
Maintained	0

In 2008, the CA-EPMT treated over 100 species that threaten the integrity of this international biological treasure. Project sites were extremely varied, ranging from the remote Channel Islands to the high Sierran forest in Yosemite National Park. After seven years of service to parks, and continued focus on increasing our field presence, the CA-EPMT 2008 season rendered some exciting results. In summary, we found a 76% increase in acres treated, a 156% increase in staffing available to parks and an increase in timing flexibility that bolstered overall effectiveness. Partnerships that stand out this season and helped make this possible include The Student Conservation Association, the American Conservation Experience, California Weed Management Areas, and creative within-park collaboration.

For instance, at Sequoia National Park, our Sierran SCA team was able to treat 100% of the Italian Thistle (*Carduus pycnocephalus*) infestations above Hospital Rock. It was crucial that these sites betreated to prevent their spread to higher elevation wilderness areas, where very few invasive plants exist. At one particularly infested area, of 41 targeted control sites, initial treatment in 2005 recorded 503,050 Italian thistle. This year we found only 3,676 individuals in a fraction of the time and expect to achieve maintenance status by the end of 2009. Many of the sites were so successfully treated that they had no Italian thistle at all. The gradual reduction of Hospital Rock commitments, combined with expanded CA-EPMT presence in Sequoia NP provided the resources needed to treat additional sites. Two particularly valuable projects that were possible included treatment of two critical vector sites - eight acres of campgrounds (a variety of invasives), and 7.4 acres of cheat grass (*Bromus tectorum*) at Cedar Grove Pack Station. By treating these primary vector populations, the team prevented the inadvertent transport of invasive plant seed into the heart of the park.

Figure 18. Sierra Team joins Yosemite Staff.

Our Klamath Network SCA Native Plant Corps assisted Whiskeytown NRA by treating all of the known infestations of tree of heaven (*Ailanthus altissima*). This was challenging because there were over 40 distinct infestations in the park, and the treatment required the use of chainsaws, loppers and the application of herbicide on steep, rocky slopes and along Highway 299. This comprehensive assault on such a tenacious species will enable easier

follow-up treatments, and is a monumental step towards control.

Whiskeytown NRA's careful planning, with an eye on prevention, was another success story this season. Their focus on treating vector areas that are conducive to transporting invasive seeds could not have been better timed. The CA-EPMT-sponsored crew of three seasonals treated 33 gross-infested acres of high priority weeds in boneyards, borrow areas, trailheads, and campgrounds. This treatment had an immediate payoff, as these same areas became staging areas, helispots, and the Incident Command Post for a series of wildfires that ignited much of the park this summer.

The Redwood NP Team treated 81 acres of Harding grass (*Phalaris aquatica*) in the Bald Hills prairies. CA-EPMT support was key to leveraging NPS regional funding and California Department of Food and Agriculture - Weed Management Area funding. The six-person crew, along with partners and volunteers, mapped, treated, and set up 10 effectiveness monitoring plots over the course of two extremely productive months. The treatment results were impressive and the anticipated acreage exceeded our goals. This year's treatment is part of a multi-year strategy to bring Harding grass in the Bald Hills to a maintenance level by 2010. We look forward to sharing the monitoring results as they become available, so others may benefit of these findings.

Figure 19. Treatment of Harding grass occurring at Bald Hills Prairie, Redwoods NP.

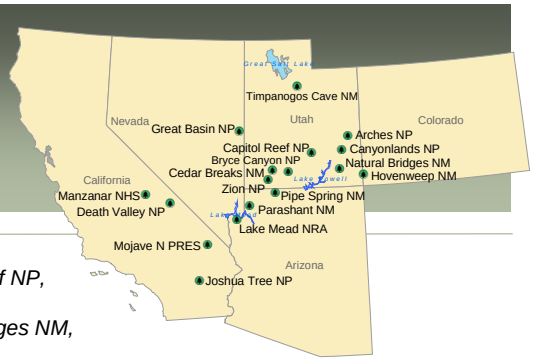
Another highlight is Santa Monica NRA's (SAMO) comprehensive treatment of three extremely disruptive species. Perennial pepperweed (*Lepidium latifolium*), terracina spurge (*Euphorbia terracina*), yellow starthistle (*Centaurea solstitialis*) are all targeted for eradication from park lands within five years. Santa Monica leveraged CA-EPMT dollars with NPS Water Resources Division and Public Lands Corps funding to sponsor a four-person SCA team dedicated to Santa Monica. The creative collaboration of resources helped sponsor a dedicated team allowing the park to treat species at the appropriate time of year, switch between projects as phenology and weather required, and adjust field plans to meet immediate needs of the park.

Figure 20. Hand-pulling Terracina spurge from around native plants in Solstice Canyon, SAMO. Hand pulling invasives was critical for allowing native plant post-fire regeneration. This was a joint project between EPMT funded staff, Burned Area Rehabilitation Staff, and Prison crews.

A trend that is surfacing within the CA-EPMT collective of parks is the use of triage in more impacted systems. Pinnacles NM used a CA-EPMT team to treat outlier populations of yellow starthistle, while in the same window of time working with the maintenance staff to strategically mow a heavy, fifteen-acre infestation in what had been a prized California oak-savannah grassland. In addition to this two-pronged strategy, a new population of whitetop (*Cardaria draba*) was discovered and promptly treated. Had it not been found - this incipient population had the potential to spread into several hundred acres of potential habitat. Additional field presence sponsored by the CA-EPMT helped make this discovery possible, and as a consequence saved the NPS untold thousands of dollars in control efforts. Overall, it is exciting to see the creative use of resources that expands our ability to fight invasives, and over time, witness the recovery of the ecosystems we are directed to protect.

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 EPMT has been in existence in one form or another since 1996, providing exotic plant control assistance to 28 parks in the Western U.S. over this period. During 2008, the team formed its largest crew ever, totaling 29 members including 24 seasonal and 5 full time members.

2008 Accomplishments	
Inventoried Acres	12,854
Gross Infested Acres	14,487
Infested Acres	295
Treated Acres	273
Monitored Acres	2,703
Maintained	77

This was accomplished by developing extensive partnerships with internal and external agencies. Multiple cooperative agreements have been established and are maintained in order to maximize government efficiency and to effectively control weeds across agency boundaries. Partnerships include the Southern Nevada Water Authority, Clark County Wetlands Park and Nature Preserve, United States Geologic Survey (USGS), multiple Bureau of Land Management Districts, US Fish and Wildlife Refuges, and National Forests. The majority of external partnership funds for the Lake Mead EPMT are provided through the Southern Nevada Public Lands Management Act, which supports weed control on 5 million acres of conservation land throughout Clark County, Nevada. These partnerships improve government efficiency, provide for habitat improvement, and protect park boundaries from weed invasions through the many projects adjacent to NPS Units . These partnerships and leveraged funds increase the capacity of our team resulting in more acres of weeds controlled in the National Park Units we serve.

None of this could be accomplished without the strong administrative support and cooperation provided by our host park at Lake Mead National Recreation Area. Due to our long-term commitment and focused strategy, many watersheds within our partner park units are now free of the weedy and water greedy tamarisk tree (*Tamarix spp)*. Tamarisk, or saltcedar, is a widespread invader of riparian areas throughout the West that displaces native plant communities. Monitoring for more than 15 years has proven that tamarisk control is effective and minimal follow up treatments are necessary to maintain the sites tamarisk free. This success allows us to move on to other project sites within the Park or to new weed projects in other Park Units.

The EPMT continues to coordinate and conduct weed control research in natural areas on many challenging weed species with the support and cooperation of the United States Geological Survey (USGS). Results of these studies benefit the management of weeds effectively in the NPS and provide information to other land management agencies and organizations. Some exciting new research related to restoration of tamarisk control sites following defoliation from bio-control is being coordinated by the EPMT, Bureau of Land Management (BLM), USGS and University of California Santa Barbara.

Figure 21. Lake Mead EPMT clearing tamarisk in the Upper Verde River, Prescott National Forest, AZ. One of many interagency projects and partnerships.

An exciting event this year was provided by supplemental Rio Grande Watershed funds that allowed our Team to assist with tamarisk control projects at Big Bend National Park in Texas. The Lake Mead EPMT assisted Big Bend National Park in the late 1990's by eliminating tamarisk from several springs and small drainages. It was rewarding to know that the team's accomplishments from 10 years ago were successfully maintained and this year tamarisk control efforts were focused on the last two high priority tributaries within the Park.

Another highlight was completing the first tamarisk removal project at Manzanar National Historical Site in California. The Superintendent of Manzanar NHS and staff coordinated this combination natural and cultural resource stewardship project to remove tamarisk that was uprooting and engulfing many of the cultural resources at Manzanar. The Lake Mead EPMT was able to reverse many years of tamarisk aggressively invading the grounds and negatively affecting the cultural sites.

Figure 22. Before treatment photo of tamarisk invading Manzanar National Historic Site, California. Tamarisk had invaded and impacted many of the historic resources on the site. The majestic Sierra Mountains are in the background.

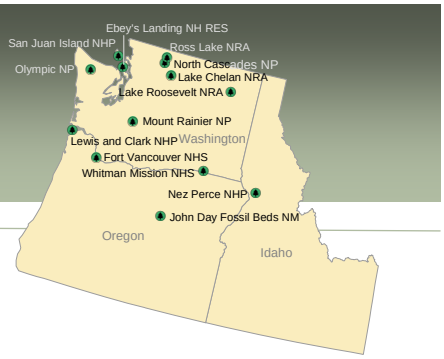
The Lake Mead EPMT is conducting control and research on Sahara mustard (*Brassica tournefortii*), an annual forb. This forb is spreading dramatically in the Mojave and Sonoran deserts and may threaten the beautiful native wildflower displays that are famous in the springtime. The EPMT and USGS obtained funding to analyze various chemical and mechanical treatments and their effects on native plant species. The research is being conducted at various NPS Units and the BLM Las Vegas District. The team is also actively controlling Sahara mustard at Mojave National Park, Joshua Tree National Park, and Lake Mead National Recreation Area. The goal at Mojave National Park is to keep the mustard out of the majestic Kelso Dunes, a popular visitor destination within the park. Last winter the team treated an infested area of 361 acres adjacent to the dunes totaling two acres of actual mustard cover (thousands of individuals). Due to these treatments, Sahara mustard populations have not established on the dunes.

Another big ecosystem challenge the Lake Mead EPMT is helping to address through research is the threat of exotic annual brome grasses. These grasses facilitate the spread of wildfires which can eventually replace native shrub cover and eliminate habitat for the rare desert tortoise. The team is partnering with the USGS, BLM and Parashant National Monument to evaluate herbicide treatments in combination with seeding following recent wildfire sites to determine the most effective method in restoring desirable plant communities and to prevent future wildfires and to maintain existing desert tortoise habitat.

Figure 23. Photo taken immediately after tamarisk removal from the same area. Tamarisk is cut with chainsaws and herbicide applied to the stumps. This method is very effective and will require minimal follow up treatments, providing long term preservation of the setting at the Historic Site. The crew continues to cut and treat other tamarisk in the background.

North 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*

Now in its seventh field season, the North Coast Cascades Network Exotic Plant Management Team (NCCN-EPMT) has contributed to weed management efforts at twelve National Park Service units across Idaho, Oregon, and Washington State. From the high desert of the upper Columbia Basin, to the rainforests of the Olympic Peninsula, team members initiated and maintained control of a diverse range of invasive plant species affecting nearly 3,000 acres of National Park lands.

2008 Accomplishments	
Inventoried Acres	2,851
Gross Infested Acres	2,587
Infested Acres	698
Treated Acres	492
Monitored Acres	151
Maintained	91

The NCCN-EPMT continued to expand the scope of its project work eastward in 2008. More than 200 acres at John Day Fossil Beds National Monument were scoured in cooperation with park staff; primarily to control Dalmatian toadflax (*Linaria dalmatica*). The team also initiated a survey at Whitman Mission National Historic Site, in preparation for work to begin in the 2009 field season. Four years of preparation and public outreach culminated in the initiation of a Eurasian water milfoil control program focused on public boat launches along the shores of Lake Roosevelt National Recreation Area. The team intends to expand the scope of this project in the coming seasons, in an effort to prevent the expansion of milfoil and other aquatic nuisance species that impact native aquatic communities and recreation opportunities around the lake.

On the western slope of the Cascades, the team began a series of new projects, while also making significant progress toward achieving maintenance control in several management areas. At San Juan Island National Historic Park, control of Himalayan (*Rubus discolor*) and evergreen blackberry (*Rubus lacinatus*) was initiated across 600 acres of the American Camp prairie. Removal of these rapidly spreading species is an integral component of the overall restoration of the park's native prairie flora. Additionally, the NCCN-EPMT assisted with the maintenance of the park's prairie restoration plots, and removed a dense thicket of non-native elm trees that impacted the scenic view-shed near the visitor center. On the iconic bluff trail at Ebey's Landing National Historical Reserve, several years of poison hemlock (*Conium maculatum*) control will culminate this fall with the planting of native coastal shrubs (snowberry, wild rose) grown over the previous three seasons.

Figure 24. Crew members search through native grasslands for Dalmatian toadflax in the Sheep Rock unit of John Day Fossil Beds National Monument.

Preventing the spread of invasive plants from roadsides and rights-of-way to wilderness areas continued to be a focus at several of the network's park units. Between North Cascades, Mount Rainier, and Olympic National Parks, team members treated new infestations along

over 100 miles of roadway. As part of this preventative effort, the team discovered and eradicated the only known population of orange hawkweed (*Hieracium aurantiacum*) along Mount Rainier's scenic Stevens Canyon road. At North Cascades National Park, team members eradicated the only known population of yellow toadflax (*Linaria vulgaris*) within the park's wilderness boundary. Early detection and eradication of small satellite populations such as these is an integral component in preventing the continued invasion NPS lands.

The control of knotweed species (*Polygonum cuspidatum, P. sachilenese*, and *P. bohemicum*) in riparian areas continues to be a focus at the three large park units in the network, and the NCCN-EPMT is a participant in a variety of interagency partnerships to facilitate this effort. Although the density of knotweed populations has been greatly reduced, follow-up monitoring and maintenance of treated populations is integral to the long term success of these projects.

Figure 25. A crew member performs initial control work on monocultures of Bohemian knotweed along the Dickey River in Olympic National Park, during August 2005. Note the forked tree in the background of the photo.

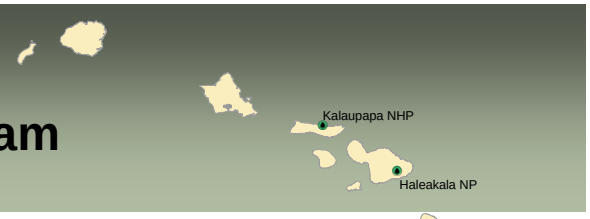
Control efforts over the last six years have demonstrated that while knotweed biomass can be greatly reduced, infestations are exceedingly difficult to eradicate from an ecosystem. The NCCN team continues to provide follow-up treatment and monitoring on these sites to ensure that knotweed populations remain at a maintenance level. Since 2005, the EPMT has reduced monocultures of knotweed along the coastal rivers at Olympic National Park to the point where follow-up monitoring and control can be conducted over a period of several days, rather than weeks. Additionally, as native vegetation begins to recover, and natural flood cycles return to sloughs and side channels that were previously choked with monocultures of knotweed, the ecosystem becomes both resistant to re-invasion, and serves as better spawning habitat for native salmon runs.

Figure 26. By August 2008 treatment of knotweed re-spouts in areas first treated in 2005 takes less than a day to accomplish. Native vegetation has begun to colonize areas that were once monocultures of Japanese, giant, and Bohemian knotweed.

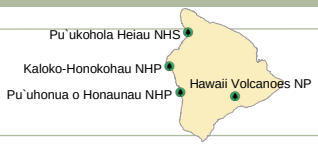
At Lake Roosevelt National Recreation Area, the lake's age is becoming evident with an increase of aquatic vegetation around the shoreline. In the decades since the completion of the Grand Coulee Dam, silt deposited by the Columbia River has accumulated in areas that would have previously been unable to support aquatic vegetation. Many of the rivers that feed Lake Roosevelt NRA are infested with a variety of submersed invasive plants, including Eurasian watermilfoil (*Myriophyllum spicatum*), and a number of introduced pondweeds (*Potomogeton spp.*). Over the past four years, the NCCN-EPMT has worked with Lake Roosevelt to implement an aquatic nuisance species program to prevent the spread of these species from areas of heavy visitation. In 2008, a targeted effort was made to control these species at several boat ramps and a public swimming area. Not only does this work prevent the continued spread of invasive plants throughout the lake, but also improves the visitor experience through better facilities, and increased access to the resource. In the coming seasons the EPMT will work with the park to continue to expand the scope of these treatments, until populations of aquatic nuisance species that adversely impact the lake's resources can be brought to a level of maintenance control.

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*



Since 2000, the Pacific Islands Exotic Plant Management Team (PI-EMPT) has been serving Hawaiian national parks spanning wide-ranging ecological zones from dry coastal native shrub-land through dense tropical rainforest to harsh alpine volcanic habitats. The PI-EPMT is structured to aggressively leverage funding through partnerships with county, state, other federal, and private entities. This structure results in excess of a five-fold increase in our ability to protect NPS lands from weed invasion.

2008 Accomplishments	
Inventoried Acres	17,211
Gross Infested Acres	13,427
Infested Acres	591
Treated Acres	591
Monitored Acres	62,199
Maintained	43

The PI-EPMT has retained the lead role in controlling the tropical super-weed miconia (*Miconia calvescens*) on the island of Maui. Miconia is being successfully contained across 35,000 acres. After at least six years of work, outlying infestations that receive timely visits are showing reduced recruitment from the existing weed seed-bank. Although progress toward island-wide eradication is demonstrable, the timeline is proving to be a long-term commitment. Reduced recruitment in the many peripheral miconia infestations is a tangible and significant measure of ongoing success.

Since inception, the Team has continually broadened its partner base and ability to leverage success through increasingly challenging fiscal times. Two additional watershed protection partnerships, one each on Maui and the Big Island, have recently collaborated with the Team. These partnerships increase the PI-EPMT capacity. In the past 5 years, PI-EPMT partners in Maui County identified locations of approximately 100 plant species known to be invasive while performing roadside surveys. Some of those species were targeted for extirpation, resulting in 14 species being successfully eradicated. An additional six species have been effectively contained.

Figure 27. Two enthusiastic interns display the day's trophy: A leaf from a mature invasive miconia tree located in the rugged East Maui rainforest.

Combining efforts with partner parks is a core component of the team's efficiency and effectiveness. Faya tree (*Morella faya*) is an aggressive nitrogen-fixing invader that is established across 30,000 acres of Hawaii Volcano National Park. Prolific seed production, bird-dispersed edible berries, high germination rates, and seedling success under a variety of light and moisture conditions account for its rapid spread and establishment. Dense, nearly single species stands have replaced over 1,000 acres of native rainforest. Lower density infestations in other areas threaten to replace seasonally dry native woodland. Since 2003, PI-EPMT has been instrumental in containing and pushing back the spread of this invader. Combined crews of PI-EPMT and Hawaii Volcano National Park staff have removed over 5,317 trees from 578 acres of seasonally dry ohia woodland. In addition, the team led park staff in

conducting experimental removal of dense stands of faya, totaling 15,428 individuals across 100 acres of rain forest. Specialized methods were developed so mature trees die slowly, creating a partial shade environment that facilitates re-establishment of native forest ferns and trees. Now that initial knockdown phases are complete, a five-fold reduction in effort to treat recruitment of faya is anticipated for 2009.

Prevention strategies have been a cornerstone to PI-EPMT operational success. The team has continually expanded the scope of its project work by not only focusing efforts on aggressive weed knockdown projects, but also on preventing unintentional distribution of invasive species. The PI-EPMT has built a strong reputation on strict decontamination and seed-dispersal prevention protocols and has continued to develop a common sense integrated approach to decontamination, containment, and isolation of equipment that has the potential to spread invasive weeds.

Figure 28. Following treatment of a fountain grass population; a cooperative weed control specialist has removed his protective jumpsuit that could be contaminated with seeds before hiking back through pristine areas and potentially spreading weeds. Four years of timely treatment can bring fountain grass infestations to maintenance levels.

Fountain grass (*Pennisetum spp*.) is a fire-adapted alien invasive grass that alters fire regimes on young lava flow ecosystems in Hawaii. It is responsible for increased wildfires at the wildland urban interface. Early detection, control, and prevention strategies have lead to success in the Kahuku unit of Hawaii Volcano. The species has been largely under control in the older units since the 1980's. In 2004, the park acquired the 116,000 acre Kahuku unit, expanding the park 50% in area. The PI-EPMT conducted surveys to identify and map invasive weed species in the new unit in 2002. Several hundred plants were found growing in small discrete infestations on lava flows and were promptly removed. Follow-up visits to remove new individuals are conducted annually. Approximately 350 plants were removed in 2004. Continued vigilance reduced the number of plants to 200 in 2005, less than 20 plants in 2006, and finally less than 10 in 2008. It appears that no further spread has occurred at Kahuku. This demonstrates that it is possible to reach a maintenance level of control when adequate resources are systematically applied to an invasive weed problem. PI-EPMT has continued to collaborate with the adjacent Hawaiian Ocean View community to conduct outreach and roadside control of this grass in the subdivision, thereby preventing re-invasion.

Restoring rainforest by removing invasive weeds is a proven management method in Hawaii. Weeds such as Kahili ginger, strawberry guava and Himalayan raspberry are capable of completely replacing native forest where they invade. Once dominant, these species alter nutrient and water cycles, and efficiency of carbon and water storage in Hawaiian rainforest, ultimately affecting the island watershed. In Hawaii Volcano, PI-EPMT combined forces with park staff to search and eliminate these invaders on the summit of Kilauea. Beginning in 2003 and continuing through 2008, the PI-EPMT crew (220 worker days) collaborated with park staff and volunteers from the community (577 worker days) removing individuals (75%-99% plant cover abundance) from across 258 acres of dense rainforest. Initial efforts spent ground searching rainforest areas to locate and treat plants were high, but the follow-up to treat recruitment can drop by up to four-fold as the infestation drops in subsequent years toward maintenance levels.

Figure 29. PI-EPMT and HAVO staff initiate collaborative knockdown phase of rainforest invaders. Initial efforts are labor intensive with a rapid reduction of effort in subsequent years as infestations come under long-term control.

Chihuahuan Desert / Shortgrass Prairie

Exotic Plant Management Team

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

The Chihuahuan Desert/Southern Shortgrass Prairie Exotic Plant Management Team (CDSP-EPMT) serves 13 partner parks located across 500 miles of southwest desert and prairie in the states of New Mexico, Texas, Colorado, and Oklahoma.

2008 Accomplishments	
Inventoried Acres	4,424
Gross Infested Acres	1,967
Infested Acres	1,086
Treated Acres	964
Monitored Acres	177
Maintained	0

Our partner parks include small cultural units (Washita Battlefield National Historic Site at 315 acres) and large wilderness parks (Big Bend National Park at 801,163 acres). The team operates in a wide variety of ecosystems including the gypsum dunes of White Sands, large riparian systems at Big Bend, arid plains of Lake Meredith, and high elevation forests at Guadalupe Mountains. Since its inception in 2000, the team has treated several thousand acres of invasive plants with 19 species of exotics currently under management. These invasives pose significant threats to the natural environments of the parks and their neighbors by altering fire regimes, degrading fish and wildlife habitat, and amplifying drought conditions.

The CDSP-EPMT culminated a very successful year by treating over nine hundred acres of invasive plants in thirty-three operations. In addition to operations conducted at all original partner parks, three additional national parks have been added to the CDSP-EPMT charter in 2008: Pecos National Historic Park, Fort Union National Historic Site, and Sand Creek National Historic Site. All units were visited by the EPMT this season.

Partner support remained high this season with parks contributing 178 person hours in direct field support as well as housing at several locations. Logistics support included pack trains, radios, specialized ATVs, maintenance and storage facilities, equipment repair, and herbicide contributions. Two Student Conservation Association interns also joined us for 186 hours of field work

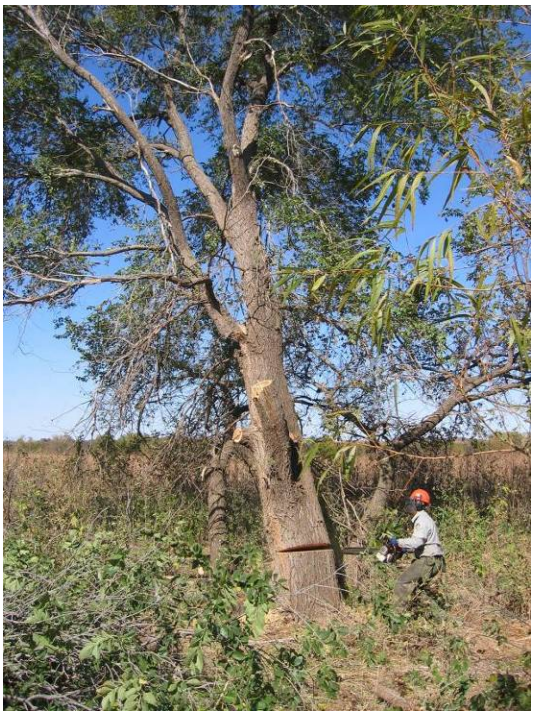


Figure 30. CDSP-EPMT Treating Siberian elm at Washita Battlefield NHS Spring 2008.

During the course of the season, CDSP-EPMT personnel provided operational training to 18 partner park staff and volunteers on exotic plant identification and life history, survey techniques, chainsaw operations, herbicide mixing and handling, application methods, decontamination, and all associated safety training.

CDSP-EPMT presented weed awareness training at the annual March for Parks celebration, during Earth Day weekend at Living Desert State Park in Carlsbad, New Mexico. The training explained the impacts caused to our natural and human resources by invasive plants.

CDSP-EPMT expertise was requested for several special projects this season, including:

- vegetation survey, hazard tree assessment and mapping projects at Camp Amache;
- saltcedar site assessment for the Colorado Dept. of Parks and Wildlife at John Martin State Park;
- tree felling and herbicide treatments for San Antonio Missions National Historic Site;
- a detail to Jean Lafitte National Park in Louisiana to train and supervise a 6 person team of National Wildlife Federation volunteers on a successful multi-species treatment project, and bi-lingual technical representative service for a Chinese Tallow contract.

An indicator of CDSP-EPMT long-term success in managing exotic plant threats is our progress against saltcedar (*Tamarisk ramoississima*). This highly invasive tree has drastically altered riparian areas throughout the southwest, and is a primary focus for the team. Utilizing adaptive management methods and new partnerships the team has functionally eradicated this species on three of our parks. Eradication of front country populations of saltcedar at White Sands National Monument enables us to concentrate on more complex and remote infestations and prevent other species, such as African rue, and Malta starthistle, from escaping containment. These successes have enabled the team to reduce saltcedar treatment time by 36 percent compared to 2000. With this reduction in annual saltcedar treatment time the team is able to dedicate more effort to the growing number of other invasive threats.

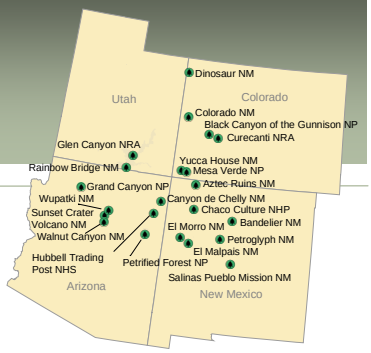
Continuing operations against long established exotic invasives such as saltcedar, buffelgrass, African rue, and Scotch thistle are proving successful; however, long term control of any well established species can be difficult at best. As an example, the Rattlesnake Springs area of Carlsbad Caverns National Park is nationally listed as an important birding area, serving as a stopover point for hundreds of neotropical migrants and a nesting area for threatened and endangered species. At the teams inception in 2000, this area contained a well established and increasing infestation of Russian olive trees (*Eleagnus angustifolium*) in excess of 17 acres. This aggressive species dominated the native floral component, so a gradual treatment program was required to maintain habitat requirements for the avifauna. This infestation required 170 person hours over three years to control to maintenance level. However, by 2007 the remaining trace population required only 8 hours of monitoring and seedling treatment.

Early detection and rapid response remains one of our key management tools. Many of our parks are near invasive weed dispersal pathways, such as interstate and rural roadways not covered by cooperative weed management agreements. Additionally, many of our parks are bordered by areas of degraded range and pastureland. These conditions result in a continuing threat for re-infestation by previously controlled species and the introduction of new invasive species. This season three new highly aggressive invasive species (hoary cress, diffuse knapweed, and field bindweed) were identified and treated before becoming widely established in our parks. Early detection and rapid response is vital in these highly dynamic settings.

Figure 31. Pedestaled saltcedar at White Sands NM before (left) and after (right) treatment.

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*

This year the Colorado Plateau (CP-EPMT) worked on project sites within 16 of our 23 partner parks. The CP-EPMT also assisted Saguaro National Park, Casa Grande National Monument and Tumacacori National Historical Park with cooperative projects.

2008 Accomplishments	
Inventoried Acres	3,140
Gross Infested Acres	4,512
Infested Acres	213
Treated Acres	136
Monitored Acres	100
Maintained	0

In 2008, CP-EPMT conducted our first non-NPS funded project with the USDA Forest Service on the Kaibab National Forest. We completed an inter-agency agreement with the Forest for continuing treatment projects on Dalmatian toadflax and musk thistle. Next year, we expect to have agreements with the Bureau of Indian Affairs and the Navajo Nation for tamarisk control on the Navajo Nation Reservation. CP-EMPT will continue to pursue agreements with other agencies to increase cooperation and control invasive plants on a landscape scale. Agreements allow us to increase our operating efficiency and cost effectiveness.

Throughout the Colorado Plateau parks, the primary target plant species continue to be woody riparian-related species such as tamarisk, Siberian elm, and Russian olive. Other species include perennial pepperweed, dalmatian toadflax, Russian knapweed, Russian thistle, yellow sweet clover, and a variety of invasive thistles. At Glen Canyon National Recreation Area, herbicide trials are being conducting to determine best management practices for controlling Ravenna grass, an emerging threat to southwest riparian systems. CP-EPMT also works directly with fire management staff at several parks to minimize invasion of cheat grass following prescribed and wildland fires. Aerial application of herbicide will be used in conjunction with cultural practices to reduce the extent of cheat grass following these fire events.

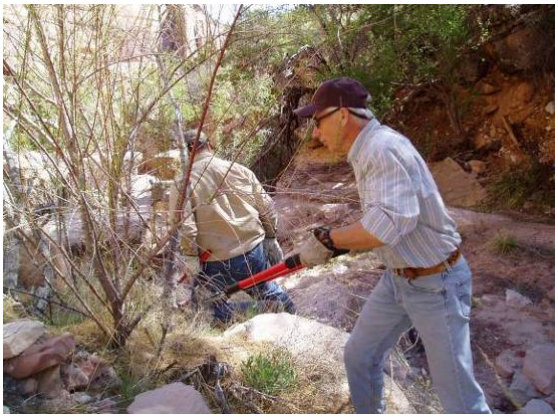


Figure 32. Volunteer cutting some of the last known tamarisk at Colorado National Monument.

At Colorado National Monument, all initial tamarisk and Russian olive removal is complete and activity has shifted to monitoring. These two species were treated and retreated and appear to be controlled to a maintenance level. CP-EPMT has begun to work closely with the Bureau of Land Management to create buffer zones around Colorado National Monument so re-invasion by tamarisk and Russian olive should be severely limited. We have also controlled tamarisk, tree of heaven, and Russian olive at Montezuma Castle, Montezuma Well,

and Tuzigoot National Monuments to maintenance levels.

CP-EPMT will complete the initial treatment phase of tamarisk, Siberian Elm, and Russian olive at Bandelier National Monument along the Rio Grande River this fall. These treatments will clear seven miles of riverbank. Russian knapweed and tamarisk have been treated over the past several seasons to monitoring levels at El Malpais National Monument. The southern half of Petrified Forest National Park has woody tree species infestations controlled to monitoring levels, after treating 23 miles of riparian washes. We are starting to see the results of our labor and will continue to monitor our maintained acres so that our restoration goals will be met.

Figure 33. Area cleared of tamarisk and Russian olive along the Rio Grande River at Bandelier National Monument.

The CP-EPMT controlled invasive species along the Rio Grande River corridor in Bandelier National Monument during the last two field seasons. This 33,000-acre park contains some of the southwest's most unique archeological sites. Invasive species such as tamarisk, Russian olive, Siberian elm, perennial pepperweed, and Russian knapweed have invaded the Rio Grande corridor within the park and continue to move up side drainages closer to these important archeological sites.

When initial treatment is concluded this fall, Frijoles, Loomis, Alamo Canyons, and the Rio Grande River corridor in Bandelier National Monument will have been treated for woody invasives;future trips will focus on invasive riparian associates such as perennial pepperweed. Extensive areas of native willows occur along this section of the Rio Grande River and the invasive trees were suppressing some stands. Completing this treatment should allow many of these stands to be released and provide excellent habitat for native wildlife including the endangered Southwestern Willow Flycatcher.

Figure 34. Coconino Rural Environment Corps personnel cut and treat Russian olive trees in Alamo Canyon at Bandelier National Monument.

Prevention of new infestations is one of the main tenets of the early detection-rapid response model of exotic plant management. To that end, we have been working closely with personnel in the wildland fire community to prevent new infestations related to wildland fire suppression activities. Our team actively supports the wildland fire mission of NPS by participating in wildland fire operations throughout the country. During the past year, we have actively worked with incident management teams during our fire assignments to prevent new weed infestations.

CP_EPMT has worked to educate fire personnel to decontaminate possible sources of seed vectors before mobilizing to the next incident. Incident management teams have done a good job setting up weed washes at incident command posts to decontaminate equipment moving from fire to fire.

There has been less concern for inadvertently moving invasive plants within a fire suppression area; this in an important issue because fires may cover hundreds of square miles. We have worked with teams and resource advisors to make them more aware that equipment and personnel moving from one area of the fire to another can detrimentally infest new areas with invasive plants. A plan to prevent this from occurring can then be developed by the team or responsible agency for the specific incident to mitigate this issue.

Prevention and education are important aspects to minimizing the movement and establishment of new invasive plant infestations.

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 (GC-EPMT) spans the Gulf Coast region from Mexico to Florida and is situated in a region of relatively warm annual temperatures, high precipitation, high plant diversity, and now supporting a large number of invasive species.

2008 Accomplishments	
Inventoried Acres	9,084
Gross Infested Acres	1,296
Infested Acres	428
Treated Acres	159
Monitored Acres	472
Maintained	7.6

As a result of our regional conditions, exotic plant invasions spread rapidly and early detection is critical. New infestations are discovered annually in our parks. Rapid response to eradicate new populations continues to supersede routine control operations. Well-established invasive species are addressed by a strategy of containment to avoid further spread. Invasives of concern in our western upland parks include Chinaberry tree, Japanese privet, giant cane, and Johnson grass. Coastal park concerns include Chinese tallow tree (particularly after hurricanes Katrina, Rita and Ike), Japanese climbing fern, cogon grass, Chinese privet, mimosa tree, and Japanese honeysuckle. Parks in the interior south are primary concerned with kudzu, but also include infestations of the species present in the coastal parks.

Major inroads into controlling infestations have occurred in several locations. Kudzu (*Pueraria montana*) is ceasing to dominate the landscapes of Vicksburg National Military Park and the southern regions of the Natchez Trace Parkway. Chinese tallow tree (*Triadica sebifera*) is no longer prevalent in the Mississippi portion of Gulf Islands National Seashore, and all exotic plant populations at San Antonio Missions National Historical Park have been reduced to a fraction of 2002 levels.

The GC-EPMT began invasive plant control activities at the San Antonio Missions San Juan Nature Trail in 2002. Chinaberry tree (*Melia azedarach*) and glossy privet (*Ligustrum japonica*) formerly dominated many sites. The area has been treated annually and now can be maintained with minimal effort. Replanting with native species followed invasive plant removal, leaving little evidence of the former infestation. Re-vegetation at other San Antonio Missions sites followed the success at the San Juan Nature Trail. The area in the photograph below was formerly a dense stand of golden bamboo (*Phyllostachys aurea*) that formed a screen along the park-urban interface. Planting with native species will restore the desired vegetative screen and provide shade for the understory, thus preventing future re-invasion by golden bamboo and other shade-intolerant invasives.

Figure 35. San Antonio Missions National Historical Park biologist inspects the condition of native plantings following control efforts by GC-EPMT.

Vicksburg National Military Park, Natchez Trace Parkway, and Natchez National Historical Park list kudzu as their principle exotic plant species of concern. Kudzu control is essential to these parks mandate to provide scenic viewsheds similar to what travelers and inhabitants would have experienced one or two centuries ago. Kudzu grows very aggressively, smothering native vegetation and obscuring cultural features that define these three cultural parks. The parks must insure that these viewsheds are kept clear of unsightly exotic vegetation.

Figure 36. Kudzu obscures the ground prior to treatment at Natchez National Historical Park.

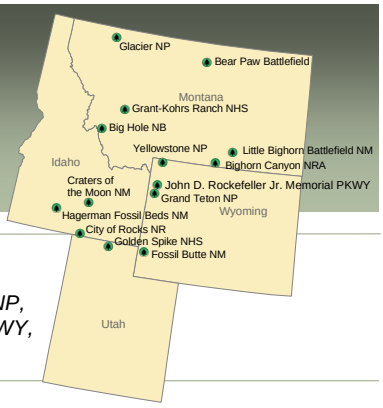
The recently completed six mile segment of the Natchez Trace Parkway, connecting Natchez, Mississippi to the rest of the Natchez Trace, contains the largest population of kudzu of the three parks. The GC-EPMT was asked to treat the newly completed segment of the parkway. The targeted 50 acre population of kudzu is situated along the banks of Saint Catherine's Creek a few miles upstream of the Saint Catherine Creek National Wildlife Refuge. We wanted to implement the project in a way that would satisfy the requirements of the park and protect downstream water resources. The site received an experimental application of an aquatic approved herbicide with very satisfactory results. This herbicide has not previously been used to treat kudzu and was not expected to be effective by many sources consulted. The results of this one-time application was monitored and proved to be effective. The same chemical formulation was used again this year with better than expected results. The treatments have been so successful that scope of work next year will be reduced to fifty percent of the 2002 – 2008 level of effort due to the reduction in kudzu infestations. The problem of not having enough kudzu to treat was not anticipated but also a problem we can heartily accept.

Figure 37. Kudzu area after treatment at Natchez National Historical Park. Foreground is maintained by mowing, background has been re-colonized by native plants. The remaining kudzu growing up trees will be cut from the trees and basally treated to avoid harming native vegetation.

Active restoration may be required after localized eradication of kudzu is achieved. The kudzu is growing on and currently concealing highly erosive steep loess slopes and bluffs. Native tree planting to form a shaded canopy cover and stabilize the soil will be employed in the event that active restoration is required. A shaded canopy cover is the only insurance that the area will not be re-invaded by kudzu. We are hopeful that the results of these efforts will achieve the park's mandate, restoration of the native wildlife habitat, and protection of downstream aquatic habitats. Restoration is crucial as these parks are important natural islands for native plants and wildlife in otherwise biologically impoverished urban ecosystems.

Northern Rocky Mountain

Exotic Plant Management Team



Partner Parks: *Bear Paw Battlefield, Big Hole NB, Bighorn 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 (NRM-EPMT) has been serving 15 partner national parks in the states of Idaho, Montana, Utah, and Wyoming for six years. The area managed is immense, making it more efficient for the NRM-EPMT to be separated into three crews based at Glacier National Park, Yellowstone National Park, and Craters of the Moon National Monument.

2008 Accomplishments	
Inventoried Acres	7,619
Gross Infested Acres	9,541
Infested Acres	610
Treated Acres	587
Monitored Acres	8,033
Maintained	0

The partner parks served by the NRM-EPMT consist of over four million acres of diverse terrain and ecosystems; encompassing high desert, forests, sub-alpine meadows, sagebrush-steppe, wetlands, and riparian areas. This year is the twentieth anniversary of the 1988 fires in Yellowstone National Park, and the team still copes with the exotic plant invasions following those fires. The absence of a tree canopy has, in many instances created ideal habitat for invaders. Following the fire, four different species of hawkweed (*Hieracium spp*.) became established within the burned areas of Yellowstone National Park.

The thermal areas and abundance of wildlife at Yellowstone also present several challenges for the team. Warm moist conditions around the hot springs create an ideal habitat for the invasives toadflax (*Linaria spp*) and St Johnswort (*Hypericum perforatum*). It is likely that large herds of bison and elk that frequent these areas transport and spread the seeds of these and other invasive species as the herds move around the park.

Figure 38. Treating spotted knapweed infestations at Lake Sherburn in Glacier National Park.

The NRM-EPMT is also responsible for managing native plant communities for invasives on hundreds of acres of sub-alpine meadows in Grand Teton National and Glacier National Parks. The incredible plant diversity within these meadows is compromised by such invasive species as spotted knapweed (*Centaurea maculosa*), musk thistle (*Carduus nutans*), houndstongue (*Cynoglossum officinale*), and St Johnswort. Roads, heavily traveled by millions of visitors annually, border many of these meadows. The constant disturbance along the roadsides, combined with the influx of seeds of invasive species from outside sources, presents an ongoing challenge.

Maintaining the unique native communities (kipukas) in the ancient lava flows at Craters of the Moon National Monument is an important goal for the NRM-EPMT. Infestations of Dyer's woad (*Isatis tinctoria*) and rush skeletonweed (*Chondrilla juncea*) are threatening many of the kipukas and receive priority attention from the team.

NRM-EPMT is also responsible for treating infestations to maintain cultural and historic sites. The team treats populations of spotted knapweed, babysbreath (*Gypsophilia paniculata*), and hoary cress (*Cardaria draba*) at Grant-Kohrs Ranch National Historic Site, Russian Knapweed at Minidoka NHS, dyer's woad at Golden Spike NHS, and field bindweed at Little Bighorn National Battlefield. Efforts at Grant-kohrs Ranch have enabled the team to reduce populations of spotted knapweed, babysbreath, hoary cress, and perennial pepperweed (*Lepidium latifolium*) by 90%.

Figure 39. Treatment of leafy spurge at Grant-Kohr's Ranch NHS.

For the third year in a row, the team treated leafy spurge (*Euphorbia esula*) and yellow toadflax (*Linaria vulgaris*) along the riparian zone of the Clark Fork River that flows through Grant-Kohrs Ranch National Historic Site. Encompassing approximately 200 acres, the riparian zone poses many challenges for the team including thick native vegetation and the presence of irrigation canals, wetland sloughs, and fallen trees. Since beginning treatment in 2006, the team has developed safety protocols for team members such as morning and afternoon briefings, examination of aerial photographs, and the use of radios to ensure safe working conditions. By tailoring our use of ATVs, backpack sprayers, and trailer-mounted spray units to a particular terrain, we have been able to conduct this project safely and efficiently. After three seasons of treatment, we are seeing reductions in the density of leafy spurge.

Overall results at Grant-Kohrs Ranch have enabled the team to focus attention on other priority species such as field bindweed and cheatgrass (*Bromus tectorum*). The recent increase of cheatgrass populations throughout the Ranch poses a substantial challenge for the team and resource management staff. The Park will be focusing on a project to restore native bunchgrass communities to the ranch while reducing exotic invasive grasses.

Figure 40. Treating salt cedar at Hagerman Fossil Beds NM.

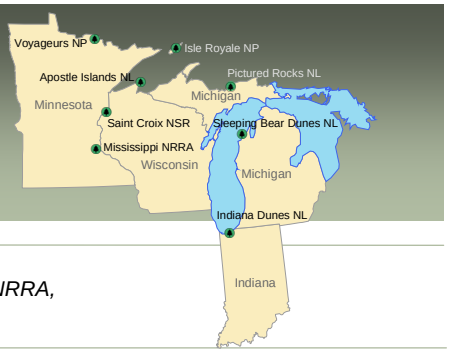
Irrigated farmlands adjacent to Hagerman Fossil Beds National Monument created ideal conditions for the establishment of salt cedar (*Tamarix spp.*) and Russian olive (*Elaeagnus angustifolia*). This year the team focused on the largest infestations of salt cedar. Cooperation with the park was essential to the success of this project.

The team visited Grand Teton National Park three times this season, and, despite inclement weather, had a very productive season treating over 300 acres. Utilizing ATV and UTV equipment, the team was able to treat large densely infested former farmlands, rangelands, and hayfields. Musk thistle, houndstongue, and Canada thistle were just a few of the invasive species treated at the park this season. Grand Teton's weed crew, led by Eric (Doc) Janssen, contributed greatly to our success by providing logistical support, maps, and equipment.

This season has been an extremely productive one for our team. The team's successes have been possible not only because of our treatment approach, but also because of effective relationships with our partner parks and the efforts of their staff. Additional group projects, large-acreage opportunities, and focusing on new priority species are essential to the effectiveness of our team and are goals we will continue to pursue in future seasons.

Great Lakes

Exotic Plant Management Team



Partner Parks: *Apostle Islands NL, 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 (GL-EPMT) provides support to eight 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.

2008 Accomplishments	
Inventoried Acres	2,382
Gross Infested Acres	2,384
Infested Acres	156
Treated Acres	122
Monitored Acres	64
Maintained	42

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. With the full support of the eight partner parks, the GL-EPMT strives to protect the health and integrity of these natural areas by managing sources of new infestations through an early detection rapid response approach, by reducing existing infestations, and by restoring native plant communities and ecosystem function.

In 2008, the field season marked the fifth anniversary of GL-EPMT field crews providing exotic plant management, control, and expertise to the parks in Great Lakes region. Over the last five years, the GL-EPMT has seen 1,325 acres of rapidly spreading baby's breath (*Gypsophilia paniculata*) begin to decline at Sleeping Bear Dunes National Lakeshore, purple loosestrife (*Lythrum salicaria*) populations dissipate in the bogs and sedge meadows at the Apostle Islands National Lakeshore, and Canada thistle controlled along the roadsides at Voyageurs National Park. Purple loosestrife populations along several stretches of the Saint Croix National Scenic Riverway have been reduced so that treatment is now limited to semi-annual efforts. On Isle Royale, populations of spotted knapweed (*Centaurea maculosa*) and mountain bluet (*Centaurea montana*) have also declined dramatically and are at near maintenance levels.

Continued support and participation from the Student Conservation Association (SCA) produced the team's largest volunteer staff yet. The GL-EPMT benefited from eight individuals located at four different parks: Voyageurs National Park, Isle Royale National Park, Sleeping Bear Dunes National Lakeshore, and Indiana Dunes National Lakeshore. The SCA interns were instrumental in mapping, preventing, and controlling invasive plant populations. In addition, biological technicians stationed in partner parks worked closely with park invasive species crews and local volunteers.

Figure 41. Student Conservation Association interns treating common tansy and wild parsnip in high visitor use areas at Voyageurs National Park.

At Saint Croix National Scenic Riverway, park teams also utilized volunteers from the Minnesota Conservation Corps to help initiate site restoration of native habitats by removing

invasive buckthorn (*Rhamnus cathartica*) and honeysuckles (*Lonicera spp.)* that threaten these communities. With the invasive shrubs controlled, several acres will now be able to be restored to native prairie and savanna.

Early detection and rapid response continue to be a high priority for the GL-EPMT. Continued monitoring and control of small populations of invasive species in areas of high visitor use, such as campsites and trailheads, have allowed the GL-EPMT to effectively prevent invasions in many remote locations that would be costly to manage on a larger scale. For example, annual treatments at Meyer's Beach in the Apostle Islands National Lakeshore have reduced exotic plant seed sources and have limited the spread of exotic plants to the islands that make up the archipelago. Many of the remote environments on the islands remain virtually unencumbered due to these efforts.

Figure 42. Threatened Pitcher's thistle (left) and Lake Huron tansy (right).

Areas within the parks that are seeing increases in invasive species have received special attention. Many threatened and endangered plants have benefited from this year's annual control effort, most notably in the dune ecosystems found at Sleeping Bear Dunes National Lakeshore, Indiana Dunes National Lakeshore, and Pictured Rocks National Lakeshore. Through GL-EPMT participation and funding, habitats containing Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum bipinnatum ssp. huronense*) have been targeted for spotted knapweed, black locust, and Lombardi poplar control. These plants, if left untreated, would out compete and degrade the habitat of these threatened plants.

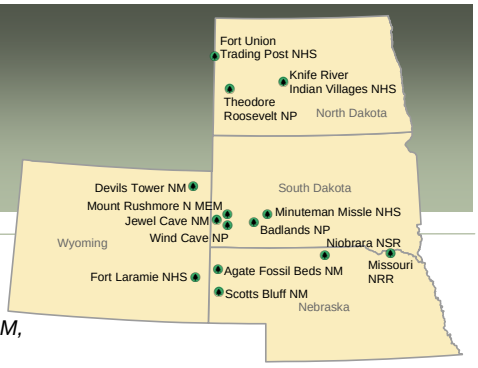
In other areas that have been over-run by invasive species, control efforts, in combination with targeted restoration, have been very successful. At the Mississippi National River and Recreation Area, buckthorn removal continued at Riverside Park in the city of St. Paul Park, Minnesota with the continued partnership and assistance of Fortin Consulting. After seven years of continually removing a severe infestation of buckthorn, most of the larger trees have been eliminated and control efforts can now be focused on buckthorn re-growth and continued depletion of the seed bank.

Since control efforts began at Riverside Park, the native plant community has started to rebound. Each year the list continues to grow. During the 2007 species inventory, over 130 species of plants were identified compared to 89 in 2001. Recently, new populations of threatened kitten tails (*Besseya bullii*) have emerged, due to the reduction of invasive buckthorn cover. Incorporation of Best Management Practices has contributed to the success at this site. Near the entrance of Riverside Park was the city's local mulch pile, which represented a significant vector for the spread of invasive plant seed. The pile was relocated and the remaining two-acre site was restored. Nine different species of native grasses and three different species of native trees were planted.

Figure 43. Riverside Park savanna restoration site before restoration began in 2007(top) and site as of September 2008 (bottom).

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 (NGP-EPMT) completed its 7th year of operation serving 14 partner parks in four states and two regions consisting of 452,567 acres.

2008 Accomplishments	
Inventoried Acres	65,733
Gross Infested Acres	9,520
Infested Acres	8,402
Treated Acres	8,400
Monitored Acres	0
Maintained	240

NGP-EPMT 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 techniques for systematic long-term management and control of invasive species. This approach resulted in the team completing a Northern Great Plains Exotic Plant Management Plan and Environmental Assessment, signed by the Midwest and Intermountain Regional Directors in September of 2005.

The team has concentrated the majority of its efforts on two particular species, Canada thistle (*Cirsium arvense)* and leafy spurge (*Euphorbia esula)*, although numerous other species such as tamarisk, Russian olive, eastern red cedar, purple loosestrife, black henbane, and common mullein are treated as well. The parks and the team are seeing tremendous control and recovery of native species on sites that were prioritized for treatment. The team is working closely with the fire program and maintenance staffs to conduct prescribed burns and/or mowing as a pretreatment for fall herbicide application of Canada thistle. This IPM approach is seeing maximum control in situations where terrain permits. At Agate Fossil Beds National Monument, this approach achieved 90% control of Canada thistle 12 months after treatment. Mowing, along with existing native competitive grasses, plus herbicide application is proving to be an effective long-term method for Canada thistle control there.

Since its inception, the team has conducted several projects resulting in dramatic decreases in certain invasive species populations. The team cut down and treated several thousand tamarisk (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*) trees at Fort Laramie National Historic Site, Scotts Bluff National Monument, Knife River Indian Villages National Historic Site and Fort Union Trading Post National Historic Site. Follow-up treatments will continue to be conducted at these locations to treat new infestations every other year for woody species. Fort Laramie NHS has also seen dramatic decreases in density and number of Canada thistle infestations since initial treatments were conducted in 2003.

Figure 44. Crew photo after prepping area for restoration of native plants at Fort Union Trading Post NHS.

At Fort Union Trading Post NHS, nearly all of the area has been seeded to native species with the exception of one 10 acre parcel. During the spring of 2008, the NGP-EPMT conducted the first herbicide treatment on this 10-acre site of smooth brome. In mid summer the NGP-EPMT, with maintenance, visitor protection, and administration staff from Fort Union Trading Post NHS, fence and trail crews from Theodore Roosevelt National Park, and staff from the McKenzie District of the US Forest Service, removed several dead and down trees and other debris to prep the area for seeding with a no-till drill in the upcoming years.

The largest tree removal project took place this year at Missouri National Recreational River. The park recently acquired 250 acres of Missouri River frontage, which had several thousand native but invasive eastern red cedars (*Juniperus virginiana*) that the park's natural resources staff identified for removal. The team, along with park staff and the Minnesota Conservation Corp spent a week, working 10-hour days, falling, limbing, and piling cedars.

At Devils Tower National Monument NGP-EPMT is working on several projects that involve both active and passive restoration. In 2006, the Team conducted herbicide application on four separate fields, the fields were again sprayed in 2007, and were disked in the summer of 2008. The fields will be prepped using a cultipacker in the spring of 2009 and seeded with native grasses and forbs shortly thereafter. The NGP-EPMT worked closely with resource management, maintenance, Natural Resource Conservation Service, and other federal agencies on this project. Active restoration projects similar to this are time consuming and require extreme patience to achieve the desired results. Most restoration projects in the northern Great Plains require at least three years before the native seed can be planted, mainly because of tenacious invaders such as smooth brome and Kentucky bluegrass.

Passive restoration is also being used at Devils Tower NM. Areas that were once dominated by leafy spurge and cheatgrass (*Bromus tectorum*) have been repeatedly treated. Native grasses now occupy the niches vacated by the exotic species. Follow-up treatments will be needed; however, the infestations are much smaller and only require spot treatments. Although it still takes time to thoroughly monitor and spot retreat these areas the NGP-EPMT and the park are seeing the positive results.

Figure 45. One of the 4 fields after disking at Devils Tower National Monument (July 2008).

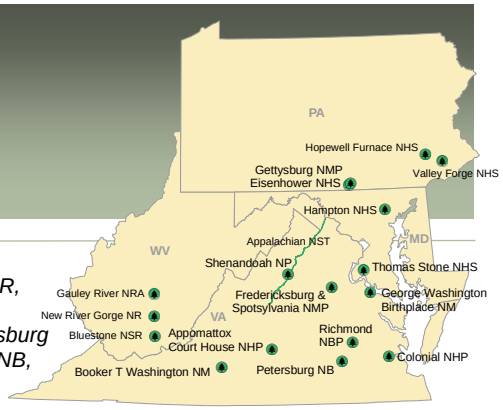
The NGP-EPMT also initiated and completed several restoration projects at Knife River Indian Villages National Historic Site in central North Dakota. In these active restoration projects, now five years old, native grasses and forbs are returning. The projects started in April 2004 with a prescribed fire, followed by two herbicide applications in May and September 2004. Selected areas were retreated with herbicide in May and seeded with 44 native species in June 2005.

As with any plant community in the northern Great Plains implementing "no management" or "do nothing" after seeding will lead to a deteriorated community and soil structure. Resource management and maintenance staff at Knife River Indian Villages NHS continue to use active restoration by issuing hay contracts in 2006, 2007, and 2008 on the 100 plus acres that have been restored. This approach is consistent with the parks Vegetation Management Plan that was completed in 2007. This management technique allows reduction or elimination of annual invasive species and promotes tillering and growth of the native cool- and warm-season grasses that were seeded.

Figure 46. Before/After photos (2003, 2005, 2008) at Devils Tower National Monument using passive restoration.

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 Cooperative (Cooperative) had an excellent year of field operations and public outreach. The Mid-Atlantic Exotic Plant Management Team (MA-EPMT) served 17 of its 18 partner park units in Virginia, West Virginia, Maryland, and Pennsylvania. A blend of fieldwork by federal, for-profit, nonprofit, and volunteers strengthened the program's base. Year 2008 was a celebration of increasing productivity, efficiency, and participation by outside agencies and the public.

2008 Accomplishments	
Inventoried Acres	8,213
Gross Infested Acres	8,232
Infested Acres	680
Treated Acres	506
Monitored Acres	497
Maintained	48

Treatment increased by 42% from the previous year, totaling 506 acres. This achievement is a direct result of control efforts and the changing complexion of invasive species at our parks. The MA-EPMT, composed of three permanent staff, two summer Student Conservation Association (SCA) interns, and participating park staff, performed the backbone of fieldwork. They treated 317 acres at 15 parks. A retained private contractor treated 160 acres at six parks. The Team also organized public volunteers at both Shenandoah National Park and the Appalachian National Scenic Trail where 4.5 acres were treated. Other contributions came from park units and carry-over SCA efforts, amounting to 24 treatment acres.

A noteworthy trend within the Cooperative is the changing suite of invasive species subsequent to initial treatments. Early in the program, parks and the Cooperative focused on dominant invasive overstories of tree of heaven (*Ailanthus altissima*), princess tree (*Paulownia tomentosa*), Oriental bittersweet (*Celastrus orbiculatus*), Japanese barberry (*Berberis thunbergii*), and autumn olive (*Elaeagnus umbellata*). In many of the treated areas, no other invasives were visible. Subsequent to initial canopy treatments, however, waves of invasives appeared. In many cases total dominance of invasive ground canopy species occurred. Some of the new species came from the soil seed bank, other seed was carried on the wind or by wildlife. Some heavy seeded species are eaten by wildlife and spread through their digestive systems. Some hitched rides on their fur. Representatives of these new invaders include mile-a-minute vine (*Polygonum perfoliatum*), Japanese stiltgrass (*Microstegium vimineum*), Oriental lady's thumb (*Polygonum caespitosum*), autumn olive, multiflora rose (*Rosa multiflora*), and tree of heaven.

Figure 47. Invasive dame's rocket (blue flowers) and winter cress (yellow) came in aggressively after initial control of Oriental bittersweet vine thus requiring further treatments for restoration of this area at Shenandoah NP.

The MA-EPMT increased public awareness of invasive species threats by participating in news media interviews, speaking at public or professional meetings, publishing articles, fliers,

posters in professional newsletters and conferences, and responding to public queries for information.

In its six-year history, the Cooperative brought 1,022 acres into a controlled status. Invasive plants no longer dominate those areas. Thus, they thrive and function in a native, natural condition. Benefits extend beyond the plant kingdom to animals, fungi, and other species that inhabit those areas. Effective treatments, annual monitoring, retreatment as needed, with the integral fieldwork of park partners created this accomplishment. The Cooperative has a proud history that leads it toward a strong future in land restoration.

A History of Collaboration

Collaboration is the hallmark for operations within the Cooperative. The energy, knowledge and skills of partner parks, private contractors, nonprofit agencies, and public volunteers enhance prevention and control activities.

Working alongside park staffs creates improved field treatment outcomes and corporate memory of management activity. Those in turn improve overall operational efficiency. Practical benefits come by utilizing local park equipment such as debris chippers, dump trucks, and other equipment that are not part of the team cache of tools. At the same time MA-EPMT members pass along their expertise to local staffs regarding invasive plant control, inventory methods, and risk management. Mini-training sessions take place amid the work of a day.

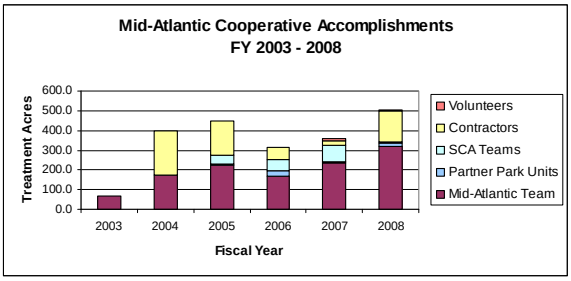


Figure 48. The Mid-Atlantic Team is the backbone of management activity, but collaboration is the hallmark for the Cooperative's success.

The flexible contract managed by the MA-EPMT is a tremendous benefit to the Cooperative. Donated year-end funds from the team, partner parks, and other EPMTs contribute to field treatments. During the years 2003-08, nearly 625 acres were treated, benefiting 13 parks on over 2,960 infested acres.

Nonprofit agencies are a tremendous boon to the program in these austere federal budget times. The first collaborative project took place when the Colonial Williamsburg Foundation worked alongside the team to restore a 4-acre patch of kudzu vine (*Pueraria montana var. lobata*) infesting adjoining Foundation/NPS properties. Today the area is free of troubling invasives.

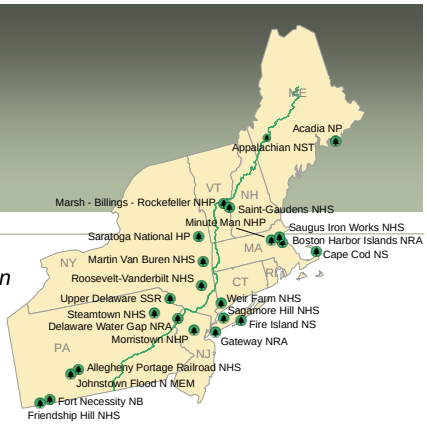
The National Park Foundation and Tauck Foundation contributed funds to develop a short-term volunteer program at Shenandoah National Park. The Team managed the program for its first three years and then turned it over to the park. In two and one-half years of field operations (2006-08), nearly 1,200 volunteers contributed over 2,500 hours of invasive fieldwork as they worked on 97 infested acres. In 2008, collaborative funding from Together-Green Foundation of Toyota with the National Audubon Society of Virginia supported the start up of a similar volunteer program for the Appalachian National Scenic Trail. In it first year, 367 volunteers contributed 853 hours while working to restore 13.5 infested acres. These programs provide real value in management and public relations.

Figure 49. Volunteers at Shenandoah National assist in controlling spring ephemerals such as garlic mustard where uprooting is as effective as herbicides.

The MA-EPMT aggressively reaches out to the public to enhance invasive species awareness and prevention. Through their contacts, the public learns that as consumers they can make a difference in slowing the introduction and spread of invasives by purchasing native plant nursery stock for their homes. They are invited to participate in field treatments and public advocacy against invasive species. The Cooperative aims to reduce future invasive species problems through these and other efforts. The Mid-Atlantic EPMT motto is "Keep it beautiful, native and natural!"

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 (NE-EPMT) has been serving 23 parks in the upper Northeast Region, from Pennsylvania and New Jersey north to Maine, since 2003. Services include on-site control work, technical advice, planning, and funding assistance. Its host park is Delaware Water Gap NRA.

2008 Accomplishments	
Inventoried Acres	4,081
Gross Infested Acres	4,891
Infested Acres	181
Treated Acres	71
Monitored Acres	168
Maintained Acres	7

A 12-week Student Conservation Association (SCA) Invasive Species Project Team (ISPT) joined NE-EPMT in June and served five smaller parks in New England, as well as sites on the Appalachian Trail in Massachusetts.

At Minute Man NHP, NE-EPMT and the ISPT teamed up with Town of Lincoln Conservation Department at a restoration site on the park's border (Figure 50). The area, choked with Oriental bittersweet (*Celastrus orbiculatus*) and other invasive woody plants, looked remarkably different after a few days of tough work. As exotic vines and shrubs die back, existing grasses and other native vegetation should fill in naturally.

The Northeastern Weed Science Society hosted its first Noxious and Invasive Vegetation Management Short Course. Patterned after the popular Western Society of Weed Science's Noxious Weed Management Short Course, the class was well received. Four attendees were NPS park staff sponsored by NE-EPMT. There are plans to hold the course annually at other locations in the east.

NE-EPMT targeted several invasive species new to the team. The most notable was kudzu (*Pueraria montana var. lobata*), generally considered a southern invasive. The team treated a patch on a Boston Harbor island and hopes to eradicate it. Only one other location from recent inventory work is noted this far north in New England.

Figure 50. NE-EPMT crew working with Town of Lincoln Conservation Dept. cutting back bittersweet vines at a streamside restoration site at Minute Man National Historical Park.

Work continues on a long-term project to eradicate invasives on 200 acres of old farmland at Delaware Water Gap. NE-EPMT joined forces with Delaware Water Gap's Fire Management Office so manual, chemical and burn operations are coordinated. One outcome will be habitat creation beneficial to shrub and grassland birds whose numbers are rapidly declining.

NE-EPMT's work has been increasingly focused on specific restoration/rehabilitation sites at its parks. Although this often means more intense efforts are concentrated on fewer acres, restoration of natural areas and their functions is the ultimate goal of invasive plant control. As extensive control tasks are replaced by more intensive restoration projects, it may mean higher dollars per acre for a time; however, long-term results are meaningful and cost-effective.

Cut, Burn & Spray: Fort Hill gets a new "DO"

A multi-pronged management strategy is now employed in Cape Cod National Seashore to restore Fort Hill to its historic condition - native grass and shrub lands with a sweeping vista of the Atlantic Ocean. Prescribed burns and mowing were used in areas which had succeeded to shrubs and woodland. Burns pruned the vegetation, killing back some invasive species, while mowing prevented some invasives from blooming and depressed woody plant growth. Neither effectively controlled some of the tougher perennial invasives like Oriental bittersweet and Canada thistle (*Cirsium arvense*).

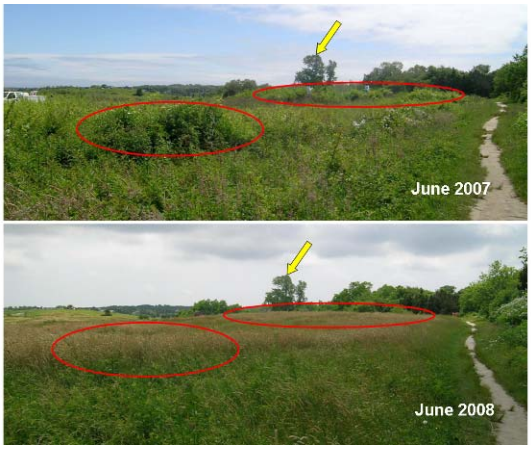


Figure 51. View of Field Unit #1 at Fort Hill, Cape Cod NS. June 2007 (upper): Prior to herbicide treatment. June 2008 (lower): Results of 2007 treatment. Red ovals outline large bittersweet patches in 2007, notably reduced in 2008. Yellow arrows indicate same tree for orientation..

The park asked NE-EPMT to introduce herbicides into the management equation, and the control technique combination was a winner. Between 2006 and 2008, there were noticeable changes; Oriental bittersweet, Canada thistle, multiflora rose, and other perennial invasive species declined while grasses and native forbs increased (Figure 51).

This 3-pronged management approach will continue at Fort Hill until maintainable native plant communities are established. Once invasive species are under control, herbicide use will be phased out. Cape Cod will then continue using fire and mowing operations for site maintenance.

Turning Basin Restoration at Saugus

At Saugus Iron Works National Historic Site (SAIR), an on-going major project is restoring the turning basin. The turning basin is where shallow draft boats once brought in raw materials and took out finished products via the tidally influenced Saugus River. The restoration has been ongoing for the past 2 years. To assist in the restoration, NE-EPMT was asked to control 3-acres of common reed (*Phragmites australis*) growing along and within the basin. Control work began in FY07 and continued in FY08 with help from the SCA ISPT. The Basin was dredged during the summer of 2008.

Results of the weed control and dredging combination have been dramatic (Figure 52). The original common reed infestations are reduced to a fringe along the river's upland edge and scattered patches on the mud flats, significantly minimizing future control and maintenance efforts.

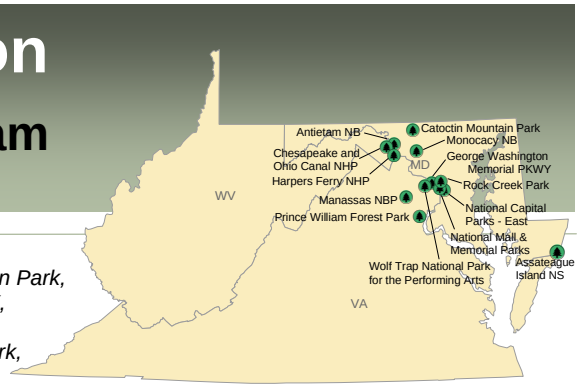
Figure 52. View of turning basin at Saugus Iron Works NHS in August 2007, prior to common reed control and basin dredging operations (upper picture), and in September 2008, after reed control and dredging operations (lower picture).

Restoration: Cultural vs. Natural Resources

Cultural resources can take precedence over natural ones at some of NE-EPMT's parks, however there are important interconnections between 'natural' and 'cultural' resources which restoration projects help clarify. For example, returning the Saugus Iron Works turning basin to a historic condition required manipulating a heavily impacted natural environment. Once invasives were controlled, native species could be replanted, providing the basis to re-establish a diverse freshwater/brackish tidal marsh, a rare community in Massachusetts. Supporting restoration and rehabilitation efforts with lasting positive effects on the landscape, both ecological and cultural, is fundamental to NE-EPMT's work.

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*

The National Capital Region Exotic Plant Management Team (NCR-EPMT) continues to serve its 13 partner parks and the Appalachian Trail. The team works closely with park staff to integrate our efforts into the parks' natural resource management programs, advising resource managers on best practices, developing treatment plans, and coordinating or conducting control projects in biologically important areas.

2008 Accomplishments	
Inventoried Acres	23
Gross Infested Acres	29
Infested Acres	254
Treated Acres	205
Monitored Acres	1,385
Maintained	13

During 2008, the NCR-EPMT identified 52 non-native species in 40 locations where we conducted projects. Inventory or monitoring surveys documented that these species covered more than 1,408 acres. The NCR-EPMT treated 56 species with a total canopy cover of 205 acres. Emphasis this year has been on herbaceous invaders, because past efforts have reduced the populations of woody vines, shrubs and trees at many sites.

The NCR-EPMT would like to acknowledge and thank our partner parks and staff at the Center for Urban Ecology for all the help they provide us. Each year, we receive more assistance from park staff, including better maps and background information on new sites, as well as field personnel who work with our team. Most parks have now developed clearer plans for managing non-native invasive plants. Monocacy National Battlefield and Prince William Forest Park hired their own SCA Native Plants Corps Teams to work on invasives this year. Many parks now have resource management personnel whose responsibilities include invasives management.

Figure 53. NCR-EPMT spray Asiatic tear thumb while the CATO Job Corps crew pulls outlier populations on the Chimney Rock ridge in Catoctin Mountain Park, August 2008.

For several years, the NCR-EPMT has engaged the assistance of a Job Corps team to attack Asiatic tear-thumb (*Polygonum perfoliatum*) in Catoctin Mountain Park in northern Maryland. Chimney Rock ridge at Catoctin Mountain Park is accessed by a mile-long switch-back trail. The EPMT started treating this area in 2002 to control tree-of-heaven (*Ailanthus altissima*), bush honeysuckles (*Lonicera spp*), Japanese barberry (*Berberis thunbergii*), and tear-thumb. These species invaded a canopy opening created by a storm that toppled a patch of trees at the popular hiking destination. While we are making progress, the herbaceous tear-thumb will take more effort to control. On the other hand, we have successfully controlled the extensive barberry and bush honeysuckle invasions and are close to controlling the tree-of-heaven.

The NCR-EPMT continues to work with other partners to more effectively control invasives. The Nature Conservancy (TNC) has been an invaluable partner and the District of Columbia Department of the Environment is beginning to give priority to invasives control.

Work in the ecologically unique Potomac Gorge has been greatly expanded through a Cooperative Agreement between TNC (which owns portions of the area), the Chesapeake & Ohio Canal National Historic Park on the Maryland side, and George Washington Memorial Parkway on the Virginia side of the gorge. TNC and the parks have recruited a cadre of volunteers to greatly increase management efforts. Mary Travaglini of TNC has developed a high quality training and coordination program for the "Weed Warriors" who work on both sides of the Potomac River. The TNC program has been such a great asset that Rock Creek Park and National Capital Parks East have enlisted Ms Travaglini to train their volunteers.

The District of Columbia and the EPMT are working together to establish a Cooperative Weed Management Area (DC CWMA). A draft Memorandum of Understanding is being reviewed by all the parks and other interested parties. Cooperation and coordination among all effected landowners and management agencies are vital to controlling invasives that spread across administrative boundaries. The group has planned its first major project to enhance the work in the Potomac Gorge by controlling tree-of-heaven and other non-native trees along Canal Road. A commuter route that follows the C&O Canal from downtown DC into Maryland, Canal Road is considered one of the most scenic entrances to the nation's capital. The invasive trees are destroying the views as well as the ecosystems along the heavily used corridor that cuts across three national parks, DC property, and Washington Metropolitan Transit Authority Rights-of-Way.

Until this year, the trees have simply been mowed along the road edge. Mowing actually makes the situation worse by stimulating the trees to form root sprouts. Staff and volunteers from the NCR-EPMT, The Nature Conservancy, George Washington Memorial Parkway, C &O Canal National Historic Park, Rock Creek, and several District of Columbia departments will be working together to kill the invasive trees before removal. This should be effective in controlling these invasives and make road and canal maintenance easier in the future.

Cooperative work between Prince William Forest Park (PRWI) staff and the NCR-EPMT has successfully restored a key part of that park. Taylor Farm was one of the historic farms that now comprise Prince William Forest Park, in east-central Virginia. The fields of the abandoned farm had become overrun with invasives, especially Chinese wisteria (*Wisteria sinensis*). Park staff developed a restoration plan to create a warm-season grass meadow. This is one of the first projects the NCR-EPMT became involved in when they were created in 2000.

Figure 54. Winter view of vine-covered fields at Taylor Farm, Prince William Forest Park in October 2000.

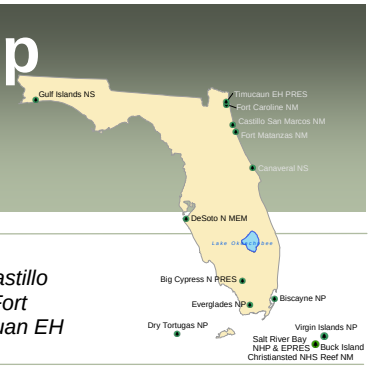
Seven years of effort, by EPMT and park staff, killing wisteria plants, removing or chipping debris, and sowing native grass seeds brought the plan to successful completion. Annual maintenance will be needed to remove any seedlings that sprout from the extensive seed bank. Visitors now have the opportunity to enjoy a pleasant native meadow nestled among the trees on their hikes through the forest.

Figure 55. Native meadow replaces vines after successful restoration at Taylor Farm, August 2008.

Several other sites within parks around the National Capital Region are close to being fully restored. It is gratifying to see the hard work and careful planning finally coming to fruition.

Florida Caribbean Partnership

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*

Florida and the Caribbean have the dubious distinction of having one of the worst invasive species problems in the country with over 1.5 million acres of conservation areas infested with invasive plants. These invasive plants are having detrimental effects on native plant communities by reducing native plant diversity, altering ecological processes such as fire behavior and surface water conveyance.

2008 Accomplishments	
Inventoried Acres	28,524
Gross Infested Acres	34,190
Infested Acres	3,254
Treated Acres	3,234
Monitored Acres	2,100
Maintained	0

In Florida and the Caribbean over 400,000 acres of the approximately 2 million acres of National Park Service lands are infested with invasive plants. The Florida and Caribbean EPMT (FLC-EPMT) supports National Park Service units in Florida and the Caribbean by augmenting existing exotic plant control efforts including inventory and monitoring, control, education and research.

Since its inception, the team has been extremely successful in controlling invasive plants and has brought invasive plant infestation under control at several parks including; Dry Tortugas, Desoto National Memorial, Buck Island Reef National Monument, Fort Matanzas National Monument, and Gulf Island National Seashore. The team continues to make strides in reducing invasive plants in other parks. The teams' success is due in part to its partnerships with federal, state, local governments, and non - profits and continues to forge new partnerships by participating in the establishment of Cooperative Invasive Species Management Areas (CISMA) or Cooperative Weed Management Areas (CWMA) throughout Florida and the Caribbean. Two examples are the First Coast CWMA and the Everglades CISMA. These Cooperatives provide many benefits to the parks in their invasive species management efforts. By working together with our partners, these CISMA's and CWMA's help us to increase effectiveness and decrease costs.

In 2008, team treatment highlights include the aerial application of over 1,000 acres of old world climbing fern (*Lygodium microphyllum*) in the Cape Sable region of Everglades National Park. This highly invasive fern is regarded as one of the worst invasive species in Florida. The fern spreads rapidly by minute wind dispersed spores and is rapidly colonizing intact ecosystems throughout Florida.

Figure 56. Private contractor re-treating melaleuca (*Melaleuca quinquenervia*) in the Everglades.

In Biscayne National Park, the team worked on Elliott Key and other barrier islands controlling lather leaf (*Colubrina asiatica*), thespesia (*Thespesia populnea*), and sapodilla (*Manilkara zapota*) on tropical hardwood hammocks. These tropical hardwood hammocks are critical habitat for

the federally listed Schaus swallowtail butterfly and are one of the sites selected for the reintroduction of the federally listed Miami blue butterfly.

In the Dry Tortugas, the team in conjunction with park biologists cleared the invasive Egyptian crows foot grass (*Dactyloctenium aegyptium*) from sooty and noddy tern nesting sites. At Canaveral National Seashore, we continued to control Brazilian pepper (*Schinus terebinthifolius* var. raddianus) from federally listed Florida scrub jay habitat.

Gulf Islands National Seashore has suffered extensively since 2004 from a series of tropical storms that has disturbed natural habitat allowing invasive plants such as torpedo grass (*Panicum repens*) and Chinese tallow (*Triadica sebifera*) to become established. The team has been working on controlling these newly established invasive plants throughout the park.

Figure 57. The team assisted Puerto Rico Natural Resource Department with melaleuca control project at Tortugueros Reserve. This was the first control of terrestrial invasive plant in Puerto Rico.

Big Cypress National Preserve continues to aggressively control Brazilian pepper using a variety of control methods to address the varied habitat types in the Preserve. These techniques include the use of heavy equipment for grubbing and mulching the plants. We have also worked with the park during the year on adapting aerial spot spraying technology for south Florida invasive plant species. This method will allow us to treat incipient populations of invasive plant species in a cost effective manner, while reducing impacts to native vegetation. Based on the success of this method we plan on using the aerial spot spray technology on an operational basis throughout south Florida in 2009.

In addition to invasive plant control at Florida and Caribbean parks the team has been working in collaboration with our Everglades CISMA partners to establish a Memorandum of Understanding (MOU) for cooperative invasive species efforts in the greater Everglades. This cooperative effort includes representatives from federal, state, tribal and non-governmental organizations.

In July 2008, the team co-hosted the Everglades Invasive Species Summit. This well attended two day summit brought together land managers, researchers, and policy makers to plan and coordinate invasive species management efforts for the Everglades region. Results of this summit included agreement among participants to adopt a standardized treatment and reporting database, as well as a draft rapid response plan for plants and animals.

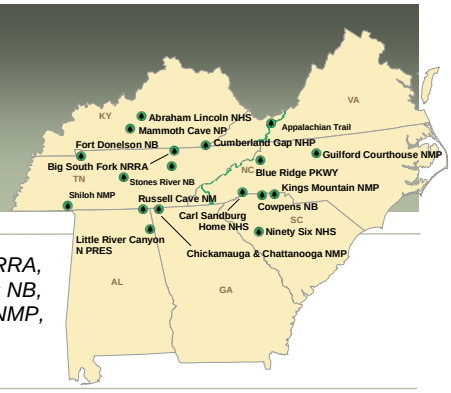
Figure 58. Everglades Invasive Species Summit held at Florida International University, Miami, FL.

To facilitate greater coordination and cooperation the Everglades CISMA established a website (http://www.evergladescisma.org). The website provides users with links for information on Everglades invasive species. The site also hosts the EDDMaps (early detection and distribution mapping system), and allows registered users to report new invasive species using a Google map interface.

The team has also worked with our Everglades CISMA partners to implement digital aerial sketch mapping technology for invasive plant monitoring. This mapping technique was adapted from the United States Forest Service Forest Health Monitoring Program. Digital aerial sketch mapping allows biologists to map invasive plant infestation rapidly and cost effectively from the air using pen/tablet computers. In 2008, working in collaboration with the South Florida Water Management District, over 4 million acres of the Everglades were mapped. The data is available online at the Everglades CISMA website.

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 (SE-EPMT) has been assisting 18 national park units in the states of Kentucky, Tennessee, Virginia, North Carolina, South Carolina, Alabama, and Georgia since the spring of 2004. Since inception, the team has been based in Asheville, North Carolina at the Blue Ridge Parkway.

2008 Accomplishments	
Inventoried Acres	1,386
Gross Infested Acres	1,343
Infested Acres	342
Treated Acres	298
Monitored Acres	1,211
Maintained	96

The partner parks served by the SE-EPMT together total over 500,000 acres and lie primarily in the Piedmont, Appalachian Highlands, and the 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.

In 2008, the SE-EPMT continued to assist partner parks in the inventory of invasive plants, the identification of priority treatment species, and 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 employed individually, and in combination, are presently the most common control techniques. Currently, biological controls for invasive plant management are not used in our partner parks.

The invasive plant species of primary concern for the SE-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 umbellata*) in open disturbed sites and Nepal grass (*Microstegium vimineum*), garlic mustard (*Allaria petiolata*), and Japanese honeysuckle (*Lonicera japonica*) in closed canopy woodlands. Over 145 acres of these species were treated in 2008 by the SE-EPMT. Thirty-one additional species were also treated on over 180 acres.

Figure 59. Japanese honeysuckle control Big South Fork National River and Recreation Area, Tennessee.

During 2008, Best Management Practices for partner parks were developed in an effort to prevent the introduction of new invasive plant species and to limit the spread of those species already present. This has resulted in the opportunity to integrate invasive plant prevention and control into other NPS division operations including maintenance and planning. Cross training between the SE-EPMT and other park divisions has also been developed to include safe power tool operations, invasive plant

control techniques, ATV Safety Institute certified training, and clean vehicle and equipment transport.

Guilford Courthouse National Military Park resource staff, in partnership with the SE-EPMT, the Cooperative Ecosystem Studies Unit, and North Carolina State University, has developed a draft ten year invasive plant management plan. This plan will serve as a template for other park units and partners in the development of similar strategies. Ultimately, the goal is to include the prevention and containment of invasive plants in all relative aspects of park management.

As in previous years, the SE-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 NHS, Cowpens National Battlefield, and Kings Mountain National Military Park.

Workshops open to public participation were held at the Blue Ridge Parkway (North Carolina) and the Appalachian Trail (North Carolina). Other partners the SE-EPMT continues 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. Developing partnerships and educational opportunities are key components to the success of the SE-EPMT in invasive plant management.

Figure 60. Foliar treatment of Japanese privet infestation at Chickamauga and Chattanooga National Military Park.

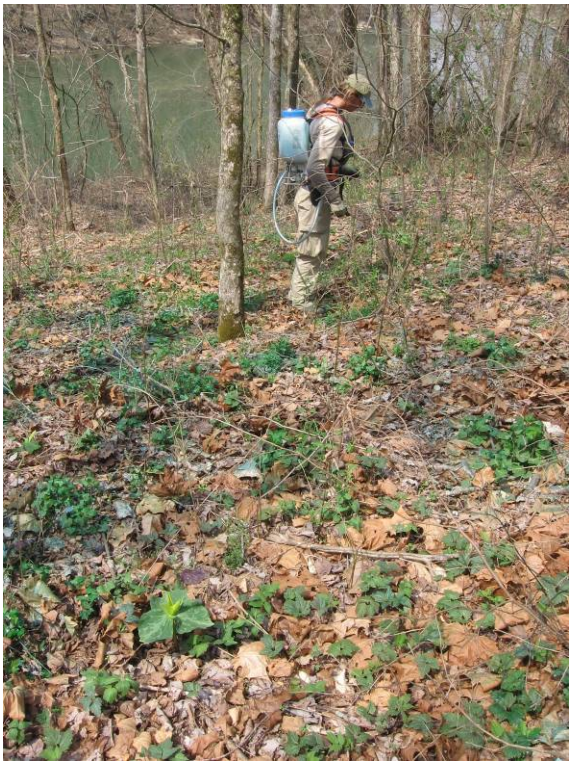


Figure 61. Spot treatment of garlic mustard Big South Fork River and Recreation Area, Kentucky.

Appendix A 2008 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 2007 achievements described in the report.

Alaska EPMT
Admin: Jeff Heys (Liaison), Whitney Rapp (GLBA, Data Manager)
Crew: Wendy Mahovlic (DENA), Charlotte Ely (GLBA), Sarah Kindschuh (GLBA), Deborah Kurtz (KEFJ), Dashiell Feierabend (KLGO), Kristi Link (SITK), Lil Gilmore (WRST), and Tamara Harper (WRST)
Fieldwork Assistance: Jennifer Allen (AKRO), Jennifer Mitchell (AKRO), Roy Wood (KATM), Dave Schirokauer (KLGO), Jason Welz (KLGO), and Jobe Chakuchin (YUCH)
Interns: Katie Weidman (DENA) and Ashley Jacobs (GLBA)
Volunteers: Southeast Alaska Guidance Association, Scott Young (Program Director)
Park and regional contacts: Jennifer Allen (AKRO), 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), Roy Wood (KATM), Shelley Hall (KEFJ), Christina Kriedeman (KEFJ), Dave Schirokauer (KLGO), Geof Smith (SITK), Eric Veach (WRST), and Jobe Chakuchin (YUCH)
Steering Committee: 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), and Tim Hudson (AKRO Assoc. Regional Director)

California EPMT
Admin: Bobbi Simpson (Liaison), Sara Hammond (Data manager)
Contractors: American Conservation Experience (ACE), Bureau of Land Management (BLM), California Department of Parks and Recreation (CDPR), Cameron Colson, Great Tree Tenders (GCC), 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)
Student Conservation Association: Marisa Alvarado, Jarrod Barkhuff, Dan Crossett, Paul D'Agnolo, Ann Gustafson, Timothy Marsh, Megan Reitz, Gail Snowden, Sam Wohl

Chihuahuan Desert / Shortgrass Prairie EPMT
Admin: Luis J. Florez (Liaison) Eric Worsham (Temp. Liaison), Kelly Mathis (Crew Leader) Amorita Brackett (Temp. Crew Leader)
Crew: Patrick Wharton, Ray Chapler, Tree Escalanti
Park and Regional Contacts: Gerald McCrea, IPM coordinator
Student Conservation Corp Interns: Dusty Jenkins, Sean Leisure
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Florida / Caribbean Partnership EPMT
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Crew: Geoffery Geier, Brad Jones, James Lange, Brian Lumley, Lauren Alnwick-Pfund, Mickey Pierce, Ruth Slade, Heather Smith, Chris Starkweather, Adam Throckmorten, Brian Black, Mike Blount, Daniel Bracken, Hillary Cimino, Justin Gilbert, Dennis Hoots, Tamberlain Jacobs, Felipe Mendez, Ryan Murdoff, Jacob Rigby, Jacob Wisdom, Joe Castello, Jeff Glossop, Sam Smyrk.
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Mid Atlantic EPMT
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Student Conservation Association Interns: Amy Kratz, Ruthanne Coffey, and Travis Williams.
Student Conservation Association Corp Team: Jesse Rogers (crew leader), Jenni Poliseno, Alaina MacEachern, Julie Yeung, and Nichleson Cook.
Volunteers: 489 individuals contributed 903 fieldwork hours. Participating organizations included Mountain Laurel Montessori, Sherando High School, Frederick County High School, Girl Scouts, Friends of the National Zoo, Defenders of Wildlife, National Audubon Society of Virginia, Wetsel Middle School, Virginia Governor's School, Virginia Native Plant Society, Wye River School, University of Richmond, James Madison University, Oberle School, Tandem Friends High School, and Eastern Mennonite High School.
Contractor: Invasive Plant Control, Inc., Steve Manning (President), Lee Patrick (Co-owner), Chris Marquess, Drew Gentry, Scott Snell, Spencer Johnson, Bobby Servis, Josh Rosenspire, and David Matthis.
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Sponsoring Organizations: National Park Foundation, Tauck Foundation, Together-Green Foundation of Toyota, National Parks Conservation Association, Virginia Native Plant Society, Shenandoah National Park Association, Student Conservation Association, Public Land Corps, Appalachian Trail Conference, Potomac Appalachian Trail Club, National Audubon Society of Virginia, Defenders of Wildlife, National Environmental Education Foundation, Leave No Trace, Dow AgroSciences, BASF, ARAMARK, Inc., McKee Foods, Inc., and many others.

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*MISC: Maui Invasive Species Committee

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Appendix B Glossary

Exotic, Invasive, Noxious, and Weed
The terms exotic, invasive, noxious weed, and weed are used in this report and the literature. These are related terms with variations in meaning. Exotic refers to organisms including plants that are not native to an ecosystem. Not all exotic organisms are invasive. For this report, invasive species are exotic organisms that can reproduce, persist, and even dominate ecosystems. The National Park Service along with others uses the term Invasive species as defined by Executive Order 13112; Plants that are: 1) non-native (or alien) to the ecosystem under consideration, and2) 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 these 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.

Appendix C Common Acronyms

EPMT: Exotic Plant Management Team

GIS: Geographic Information System

GPS: Geographic Positioning System

NPS: National Park Service

National Park Service

U.S. Department of the Interior

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