

Invasive Plant Inventory of Marsh-Billings-Rockefeller NHP

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Introduction

The Issue at Large:

Invasion of native habitats by non-indigenous species is one of the leading global threats to biodiversity. (Walker and Steffen 1997). A recent Cornell University study estimated that invasive plants and animals cost the U.S. economy \$137 billion annually. The management and control of this problem may be the greatest challenge faced by resource managers and conservation biologists in the coming decades (Allendorf and Lundquist 2003). Invasive exotic plants affect over 2.6 million acres in the national parks (<http://www.nature.nps.gov/biology/invasivespecies/index.htm>), making the control of exotic species one of the National Park Service's most significant land management issues and a core part of the Park Service's larger mission to protect our parks' natural resources. (<http://www.nature.nps.gov/biology/invasivespecies/index.htm>)

Invasive species are represented in almost every taxonomic group; among the more notably destructive species are zebra mussels (*Dreissena polymorpha*), green crabs (*Carcinus maenas*), hydrilla (*Hydrilla verticillata*), feral cats (*Felis catus*), Indian mongoose (*Herpestes auropunctatus*), brown tree snakes (*Boiga irregularis*), woolly adelgid (*Adelges piceae*), cholera (*Vibrio cholerae*), gypsy moths (*Lymantria dispar*), and kudzu (*Pueraria lobata*).

Once viable populations of invasive plants become established in new habitats, they inflict a range of ecological damage to native species including loss of habitat and biodiversity, decreased nutrition,, and alteration of biomass, energy cycling, productivity, and nutrient cycling (Dukes and Mooney 1999). Invasive plant species can also affect hydrologic function and balance, making water scarce for native species (Enright 2000).

Mandated NPS Priorities:

The NPS is mandated to protect native species while controlling invasive species. NPS *Management Policies 2001* prohibit parks from permitting non-native species to displace native species when it can be prevented (section 4.4.4, *Management of Exotic Species*, in NPS 2001). The NPS policy states that "exotic plant species. . .will be managed - up to and including eradication - if. . .the exotic species interferes with natural processes and the perpetuation of natural features, native species or native habitats; or...disrupts the accurate presentation of a cultural landscape."

The National Leadership Council's 1999 *Action Plan for Preserving Natural Resources* further addressed threats posed by non-native species and recommended that the NPS "act aggressively with a well-targeted effort to control non-native species" (NPS 1999).

In addition, Executive Order # 13112 requires that federal agencies must "prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts the invasives cause" (Federal Registry 64[25]: 6183-6186).

NPS Response:

The National Park Service has embraced the challenge of invasive species control through the Natural Resource Challenge and the establishment of Northeast Exotic Plant Management Teams. This team is one of 16 response teams established throughout the country to address invasive plant management issues at the parks. The Team provides technical guidance and personnel support in addressing high priority invasive plant populations in all of the parks throughout the Northeast Region. This effort will provide the necessary long-term management and control of invasive plants within National Parks throughout the country.

The first step in managing for invasive species is to inventory the present populations within the area of concern and establish priorities and management objectives. This report provides the baseline for the priority invasive plant species at Marsh-Billings-Rockefeller NHP and can be used to track the success of management actions and introductions of new invasive over time.

Invasive Plant Inventory and Management at Marsh-Billings-Rockefeller NHP

An invasive plant survey was conducted at the Marsh-Billings-Rockefeller National Historical Park (Park) during the summer of 2003 to generate baseline data to assess the spatial impact of invasive plants and develop approaches for invasive plant management at the park. The primary goals of this inventory were to 1) determine which invasive plant species were present in the park; 2) map the location and relative abundance of the dominant invasive plant species; and 3) identify priority treatment areas.

Materials and Methods

A systematic survey of the entire park was conducted to quantify the relative abundance and distribution of terrestrial invasive plant species. A 100 m x 100 m grid was generated using GIS software (ESRI ArcView 3.3). The grid was overlaid on the park orthophoto to create a systematic sampling scheme. Each grid was uniquely numbered and surveyed at least once for the presence of invasive plants between June and Sept 2003 (Figure 1). When an invasive plant was identified within a grid, the location was referenced on the map and the grid cell and plant species were recorded. The primary objective of this survey was to document the presence and location of invasive plants within the park in preparation for the Exotic Plant Management Team. We did not attempt to estimate percent cover or density of any species. Therefore, locations presented may be an individual plant or a patch of individuals. For example, Norway maple (*Acer plantanoides*) occurs in a few dense stands within the park. This survey identified the location of those stands but did not attempt to estimate the number of stems within each stand. More robust sampling would be required to estimate the effects of any management actions taken to reduce or eliminate any invasive plants. This survey does however, provide a baseline for the extent and relative abundance of invasive plants

within the park and can be used to not only guide the Exotic Plant Management Teams but also to track the relative abundance and number of invasive species over time. We did not include the mansion grounds in this survey but this area is a possible source for species that occur within the forested areas of the park.

The data was summarized using GIS in two ways. First, we determined the number of times we detected each species and used this value as a measure of relative abundance. Second, we determined the number of invasive plant species that were detected in each 100 m x 100 m grid cell to determine the proportion of grid cells with a certain number of species present. This can be used as a park scale metric to estimate the level of invasive plant issues within the park and can be used to set and monitor objectives related to invasive plant management.

Results

We detected 12 species of invasive plants at Marsh-Billings-Rockefeller NHP during this survey (Table 1). Japanese barberry (*Berberis thunbergii*) was the most common species and detected 66 times within the park (Figure 2). Glossy Buckthorn (*Frangula alnus*) and honeysuckle (*Lonicera sp.*) were the next most common invasive plants, detected 21 and 20 times, respectively (Figure 2). Other species were detected less frequently (Table 1, Figure 2) however, Norway maple (*Acer plantanoides*) is present in dense stands where it occurs and is not shown in this analysis.

Detections of invasive plants were not distributed evenly throughout the park with the majority of detections occurring around the old fields, parking areas, and the compost site (Figure 2). Only 1 grid cell had more than 7-9 species detected and was associated with the parking area on Prosper Road (Figure 3). We detected at least 1 invasive plant species in 67 of the 229 grid cells (29%, Figure 3). Thirty-one grid cells (14%) had only 1 species detected, 29 grid cells (13%) had 2-3 species detected, 6 grid cells (3%) had 4-6 species detected, and 1 grid cell (<1%) had 7-9 species detected (Figure 3).

Table 1: Invasive Species Detected

Scientific Name	Vernacular Name	Number of Detections
<i>Berberis thunbergii</i>	Japanese barberry	66
<i>Frangula alnus</i>	glossy buckthorn	21
<i>Lonicera sp.</i>	Honeysuckle	20
<i>Alliaria petiolata</i>	garlic mustard	5
<i>Acer plantanoides</i>	Norway Maple	4 (patches)
<i>Aristolochia macrophylla</i>	Dutchman's Pipe	1 (patch)
<i>Vinca minor</i>	Periwinkle	2
<i>Robinia pseudoacacia</i>	yellow/black locust	1
<i>Polygonum cuspidatum</i>	Japanese knotweed	1
<i>Chelidonium majus</i>	Celandine	1
<i>Elaeagnus umbellata</i>	Autumn Olive	1
<i>Hedysotis caerulea</i>	Bluets	2

Discussion

Generally, the level of invasion by exotic plants at Marsh-Billings-Rockefeller NHP is presently in a manageable state and should be a top priority for control. After a complete survey of the park, we only detected invasive plants in 29% of the area and many of these detections were of 1 or 2 individuals. Removing invasive species early in establishment, before the species become a real management problem, is the best opportunity for long-term success in maintaining the area in a relatively native state. After an invasive species becomes established, begins to spread, and ecological effects are apparent, the possibility for control greatly diminishes.

Exotic Invasive Plants Treatment Approach

Table 2. Invasive plant species identified during the 2003 inventory at Marsh-Billings-Rockefeller NHP, Vermont. Additions added for plants around the Mansion grounds that were not inventoried as part of the 2003 site survey. Management Priority ranking is based on “invasive potential” of listed plants and extent of infestations:

- 1 = plants that are highly invasive and/or population that are recently established and controllable.
- 2 = plants that are recognized invasives by the NPS, but are not an immediate threat to the forest ecology if not treated within 2 – 5 years.
- 3 = plants that are invasive, but do not pose a great risk to the forest ecology or park cultural resources at this time (these are often plants that thrive in disturbed sites, and do not compete well with native vegetation in areas where forests are well-managed).

Common Name	Scientific Name	Location	Management Priority	Potential Treatment Approach
Norway maple	<i>Acer plantanoides</i>	West of Belvedere; around Bungalow and Pony Pasture; along Route 12;	1	Cut stump treatment
Goutweed	<i>Aegopodium podagraria</i>	Along Mansion Grounds border	2	Mechanical removal, replace with native species
Garlic mustard	<i>Alliaria petiolata</i>	North of compost area	1	Herbicide
Wild chervil	<i>Anthriscus sylvestris</i>	Along Route 12	1	Repeat mowing
Japanese barberry	<i>Berberis thunbergii</i>	Scattered throughout the park	1	Mechanical removal, repeat cuttings, and cut stump treatment

Oriental bittersweet	<i>Celastrus orbiculatus</i>	Eastern border of Pony Pasture and near Bungalow	1	Mechanical removal, followed by cut stump treatment
Celandine	<i>Chelidonium majus</i>	Around Mansion Ground borders	2	Mechanical removal, replace with native species
Autumn olive	<i>Elaeagnus umbellata</i>	Overlook south of 1952 Red Pines	1	Mechanical removal and cut-stump treatment
Winged euonymus	<i>Euonymus alata</i>	Mansion Grounds planting; seedlings around compost area and hillside gardens	1	Mechanical removal (under 1.5" dbh) and cut stump treatment
Glossy buckthorn	<i>Frangula alnus</i>	Scattered throughout the park; particularly along field edges and mansion grounds area	1	Cut stump treatment
Japanese honeysuckle	<i>Lonicera japonica</i>	Around Bungalow	1	Mechanical removal and cut-stump treatment
Shrub honeysuckle	<i>Lonicera morrowii</i> , <i>L. x bella</i> ,	Scattered throughout the park	1	Mechanical removal and cut-stump treatment
Japanese knotweed	<i>Polygonum cuspidatum</i>	Seep by Elm Lot (also on adjacent properties)	1	Foliar treatment with herbicide
Periwinkle	<i>Vinca minor</i>	East of compost area	2	Mechanical removal, foliar treatment if mechanical removal is ineffective
Black swallow-wort	<i>Vincetoxicum nigrum</i>	Northern border of Woodbarn opening	1	Foliar treatment with herbicide

General Best Management Practices for Invasive Plant Management at MABI

The management practices should be considered in day to day park operations to prevent the introduction and spread of exotic invasive plants:

1. Harvesting, Thinning, and Clearing: Prior to any forest treatment that will alter the amount of light in a stand or disturb the forest floor, any priority 1 and 2 invasive plants listed above should be removed from the area. Following any forest management activity, the treated area should be monitored intensely for the introduction of invasive plants for 5 years following treatment. Use “weed-free” certified seed mixes for any reseeding needed for skid roads and landings. Monitor site annually until native vegetation is well established.

2. Composting Program: Any invasive plants with fruit or that are known for vegetative propagation should not be composted using the park’s on-site facilities. The park’s composting program does not measure the temperatures of composting operations and therefore can not guarantee that invasive seeds and vegetation will be destroyed through the composting process. Invasive plants with seeds or that propagate vegetatively should be bagged and removed from site.

3. Construction: Use only clean-fill or stock-piled soil when bringing soil on-site. If moving soil from one location to another, assess area for presence of invasive plants before implementing treatment. Use only “weed-free” seed mixes for reseeding disturbed areas. Monitor disturbed areas annually after construction project until native vegetation is well established.

4. Roads and Trails: Prevent erosion and disturbances that creates opportunities for invasives to become established. Monitor the trail corridor for the introduction of invasive - hikers, horses, and contractor vehicles can all inadvertently introduce invasiveplants.

5. Agricultural Fields: Sanitize equipment prior to mowings

6. Monitoring:

Park-wide transects sampling – every 3 years

Forest Treatment areas and areas treated for Invasive Plants: annual re-visits and follow-up treatments

Construction sites – annual assessments after implementation of project

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