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Invasive Exotic Plant Monitoring at Effigy Mounds National Monument: Year 1 (2006)

Natural Resource Technical Report NPS/HTLN/NRTR—2007/022
NPS D-58

ON THE COVER
Forests in early spring at Effigy Mounds National Monument

Invasive Exotic Plant Monitoring at Effigy Mounds National Monument: Year 1 (2006)

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Executive Summary

While targeting garlic mustard during surveys in 2006, we documented five additional invasive plant species on Effigy Mounds National Monument: common buckthorn, Japanese barberry, multiflora rose, sericea lespedeza, and shrub honeysuckle. Garlic mustard was the most abundant species with an estimated park-wide coverage of 21.8 acres. The invasive species on the park are noted as potentially problematic plants. However, the size of many of the populations and the costs associated with control suggests that control is feasible. The acreage estimates presented in the report may be used to plan management activities leading to control of exotic plants and accomplishment of GPRA goal IA1b.

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Introduction

Author's note. In this report, we use the term invasive exotic plant to refer to plants that are not native to the park and that are presumed to pose environmental harm to native plant populations and/or communities based on a review of numerous state and regional invasive exotic plant lists. The great majority of the introductory text was taken from Welch and Geissler (2007) with slight modification.

Scope of invasive exotic plant problem for National Parks. Globalization of commerce, transportation, human migration, and recreation in recent history has introduced invasive exotic species to new areas at an unprecedented rate. Biogeographical barriers that once restricted the location and expansion of species have been circumvented, culminating in the homogenization of the Earth's biota. Although only 10% of introduced species become established and only 1% become problematic (Williamson 1993, Williamson and Fitter 1996) or invasive, nonnative species have profound impacts worldwide on the environment, economies, and human health. Invasive species have been directly linked to the replacement of dominant native species (Tilman 1999), the loss of rare species (King 1985), changes in ecosystem structure, alteration of nutrient cycles and soil chemistry (Ehrenfeld 2003), shifts in community productivity (Vitousek 1990), reduced agricultural productivity, and changes in water availability (D'Antonio and Mahall 1991). Often the damage caused by these species to natural resources is irreparable and our understanding of the consequences incomplete. Invasive species are second only to habitat destruction as a threat to wildland biodiversity (Wilcove et al. 1998). Consequently, the dynamic relationships among plants, animals, soil, and water established over many thousands of years are at risk of being destroyed in a relatively brief period.

For the National Park Service (NPS), the consequences of these invasions present a significant challenge to the management of the agency's natural resources "unimpaired for the enjoyment of future generations." National Parks, like other land management organizations, are deluged by new exotic species arriving through predictable (e.g., road, trail, and riparian corridors), sudden (e.g., long-distance dispersal through cargo containers and air freight), and unexpected anthropogenic pathways (e.g., weed seeds in restoration planting mixes). Nonnative plants claim an estimated 4,600 acres of public lands each year in the United States (Asher and Harmon 1995), significantly altering local flora. For example, exotic plants comprise an estimated 43% and 36% of the flora of the states of Hawaii and New York, respectively (Rejmanek and Randall 1994). Invasive plants infest an estimated 2.6 million acres of the 83 million acres managed by the NPS.

More NPS lands are infested daily despite diligent efforts to curtail the problem. Impacts from invasive species have been realized in most parks, resulting in an expressed need to control existing infestations and restore affected ecosystems. Additionally, there is a growing urgency to be proactive—to protect resources not yet impacted by current and future invasive species (Marler 1998). Invasive exotic species most certainly will continue to be a management priority for the National Parks well into the 21st Century. Invasive exotic plants have been consistently ranked as a top vital sign for long term monitoring as part of the NPS Inventory & Monitoring (I&M) Program. During the vital signs selection process in 2003, Heartland Network parks recognized the need for exotic plant monitoring (DeBacker et al. 2004). Nine parks (CUVA,

EFMO, GWCA, HEHO, HOCU, HOME, LIBO, OZAR, PERI) identified invasive exotic plants as their most important management issue, two parks (TAPR, WICR) identified invasive exotic plants as their second most important management issue, and PIPE identified invasive exotic plants as its third most important management issue. During this process, invasive exotic plant monitoring was recognized across all network parks as the most important shared monitoring need.

Prevention and early detection as keys to invasive exotic plant management. Prevention and early detection are the principal strategies for successful invasive exotic plant management. While there is a need for long-term suppression programs to address very high-impact species, eradication efforts are most successful for infestations less than one hectare in size (Rejmanek and Pitcairn 2002). Eradication of infestations larger than 100 hectares is largely unsuccessful, costly, and unsustainable (Rejmanek and Pitcairn 2002). Costs, or impacts, to ecosystem components and processes resulting from invasion also increase dramatically over time, making ecosystem restoration improbable in the later stages of invasion. Further, in their detailed review of the nonnative species problem in the United States, the US Congress, Office of Technology Assessment (1993) stated that the environmental and economic benefits of supporting prevention and early detection initiatives significantly outweigh any incurred costs, with the median benefit-to-cost ratio being 17:1 in favor of being proactive.

Although preventing the introduction of invasive exotic plants is the most successful and preferred strategy for resource managers, the realities of globalization, tight fiscal constraints, and limited staff time guarantee that invaders will get through park borders. Fortunately, invasive exotic plants quite often undergo a lag period between introduction and subsequent colonization of new areas. Managers, then, can take advantage of early detection monitoring to make certain invasive exotic species are found and successfully eradicated before populations become well established.

This strategy requires resource managers to: (1) detect invasive exotic species early (i.e., find a new species or an incipient population of an existing species while the infestation is small (less than 1 hectare), and (2) respond rapidly (i.e., implement appropriate management techniques to eliminate the invasive plant and all of its associated regenerative material).

Invasive exotic plant management at Effigy Mounds National Monument. While a complete history of park invasive exotic plant management issues is beyond the scope of this report, a few important highlights are given:

1. Garlic mustard (*Alliaria petiolata*) is widespread at Effigy Mounds National Monument and is considered a major forest management problem. Field staff observations suggest that the population has increased over the past ten years.

2. In 2006, park natural resource staff identified a small number of sericea lespedeza (*Lespedeza cuneata*) stems in a restored prairie at the monument. The park rapidly responded to the finding with chemical control designed to eradicate the species from the park.

3. Resource management staff at Effigy Mounds National Monument continue to view invasive exotic plant management as an essential component of the park's resource management program.

Methods

Search transects. Using a grid, we mapped continuous east-west running lines across Effigy Mounds National Monument. The lines were spaced at a 200 m interval in the north-south direction. The lines were then divided into 200 m transects. A total of 272 transects were established. Of these, seven transects were 0-50 m in length, 25 were 50-100 m in length, 15 were 100-150 m in length, and 225 transects were 150-200 m in length. Transects less than 200 m in length were truncated due to the park boundary. Line transects were loaded as adapt files on to GeoXT GPS units.

Field methods. Two staff members conducted a survey for garlic mustard (*Alliaria petiolata*) during October 24-26, 2006. The survey was conducted in late October to maximize detection of garlic mustard. The leaves of garlic mustard remain green after the majority of surrounding vegetation had senesced. The survey did not cover the entire park (Figure 1). Because a number of invasive exotic plants are semi-evergreen or senesce later than the majority of plants, the location of these plants, such as sericea lespedeza (*Lespedeza cuneata*) and shrub honeysuckles (*Lonicera* spp), were also documented to the extent possible. Surveyors used GPS navigation along line transects and recorded the location of invasive exotic plants using a GeoXT GPS unit. Invasive exotic plants were documented in as wide a belt as possible. Surveyors left the transect as needed to confirm plant identification. The collected GPS point represented the observation location and did not necessarily represent the actual location of the invasive exotic plant. The observation radius around the observation point varied based on terrain visibility and search logistics. Invasive exotic plant cover was estimated in 10 m^2 increments.

Analytical methods. Data analysis involved the production of simple maps (Figures 2-7), as well as a calculation of observed plant cover for each invasive exotic plant encountered on Effigy Mounds National Monument.

Invasiveness ranks. In order to provide additional information on the invasiveness of the exotic plants identified at Effigy Mounds National Monument, the I-rank was listed. The I-rank considers the ecological impact, current distribution and abundance, trend in distribution and abundance, and management difficulty (Morse et al. 2004). The management difficulty sub-rank was also provided as an indicator of the management challenges that the invasive exotic plants pose. I-ranks and sub-ranks are given as high (H), medium (M), low (L), insignificant (I), unknown (U), or a combination of ranks.

Results and Discussion

In 2006, a total of six invasive exotic plant taxa were found during the survey at Effigy Mounds National Monument (Table 2): common buckthorn (*Rhamnus cathartica*), garlic mustard (*Alliaria petiloata*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), sericea lespedeza (*Lespedeza cuneata*), and shrub honeysuckle (*Lonicera* spp). The distribution and abundance of the species varied widely. Garlic mustard was the most abundant invasive plant with an estimated park-wide cover of 21.8 acres. Garlic mustard was distributed widely throughout the park, although few occurrences were observed in the monument's south unit. Sericea lespedeza was only observed at a single location in a restored prairie in the north unit. Japanese barberry, multilflora rose, common buckthorn, and shrub honeysuckle are invasive shrubs that were documented in the forest understory. Shrub honeysuckle was the most widespread invasive shrub with an observed cover of 390 m^2. The other shrubs were observed in six or fewer locations.

The I-ranks given for the species showed that four of the six IEPs may have a high I-rank. The I-rank of sericea lespedeza was medium, although the plant is known to invade grasslands. The management difficulty for all invasive exotic species encountered was characterized as medium or less. Given these ranks and the relatively small size of most of the invasive exotic plant populations, control of these species appears to be feasible.

In summary, this report provides information on invasive, exotic plants at Effigy Mounds National Monument to assist park natural resource managers in planning invasive exotic plant management. The following links may further assist managers: http://www.nature.nps.gov/im/units/htln/monitoring/projects/inp.htm and http://www.natureserve.org/explorer/.

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Table 1. Overview of invasive exotic plants found on Effigy Mounds National Monument. I-Ranks and management difficulty sub-ranks are given as high (H), medium (M), low (L), insignificant (I), unknown (U), or a range of ranks (indicated by multiple letters) (see Morse et al. 2004).

Scientific Name	Common Name	Observed Plant Cover	I-Rank	Management difficulty
Berberis thunbergii	Japanese barberry	150 m^2	HM	I
Lespedeza cuneata	Sericea lespedeza	10 m^2	M	ML
Lonicera spp	Honeysuckle (shrub)	390 m^2	H/HM*	M
Rhamnus cathartica	Common buckthorn	20 m^2	HM	M
Rosa multiflora	Multiflora rose	100 m^2	ML	L
Alliaria petiolota	Garlic mustard	7070 m^2	HM	M

* Species assumed to be *Lonicera maackii* or *Lonicera morrowii*

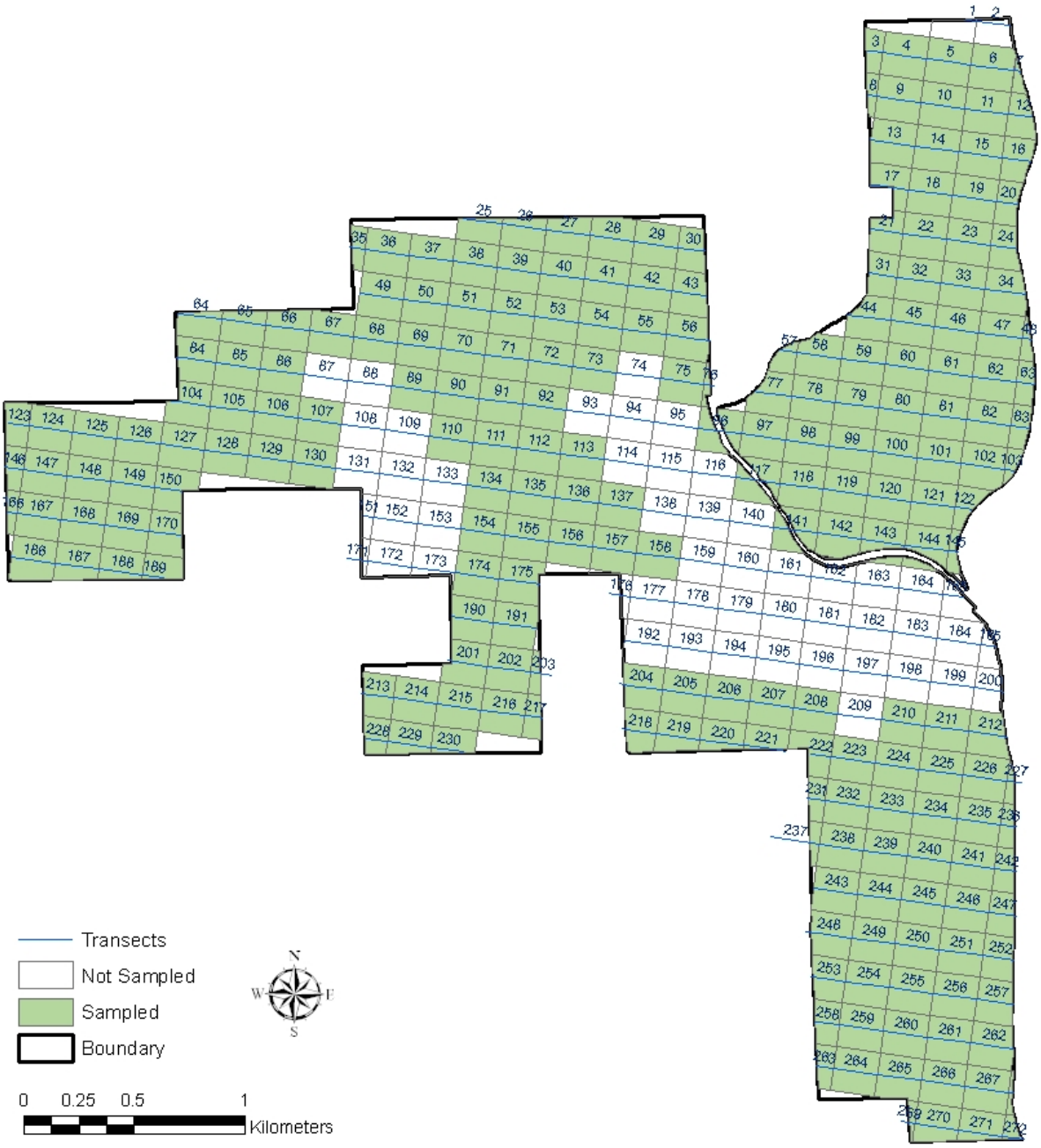

Figure 1. Invasive exotic plant line transects (blue lines) at Effigy Mounds National Monument. Line transects were sampled in the green-shaded cells in 2006. The green cells comprise approximately 80.1% of the monument.

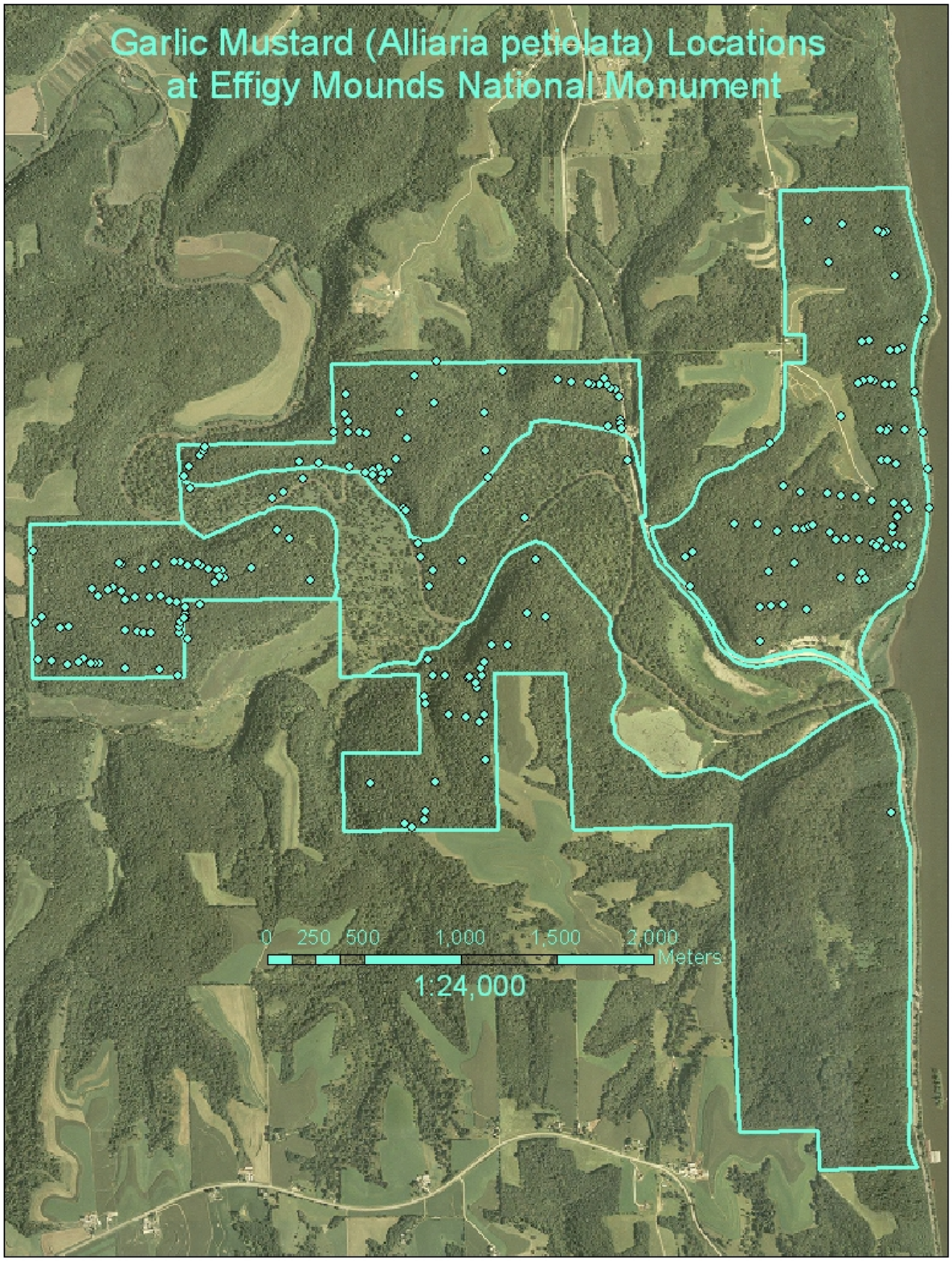

Figure 2: Distribution of garlic mustard (*Alliaria petiolata*) at Effigy Mounds National Monument in October 2006.

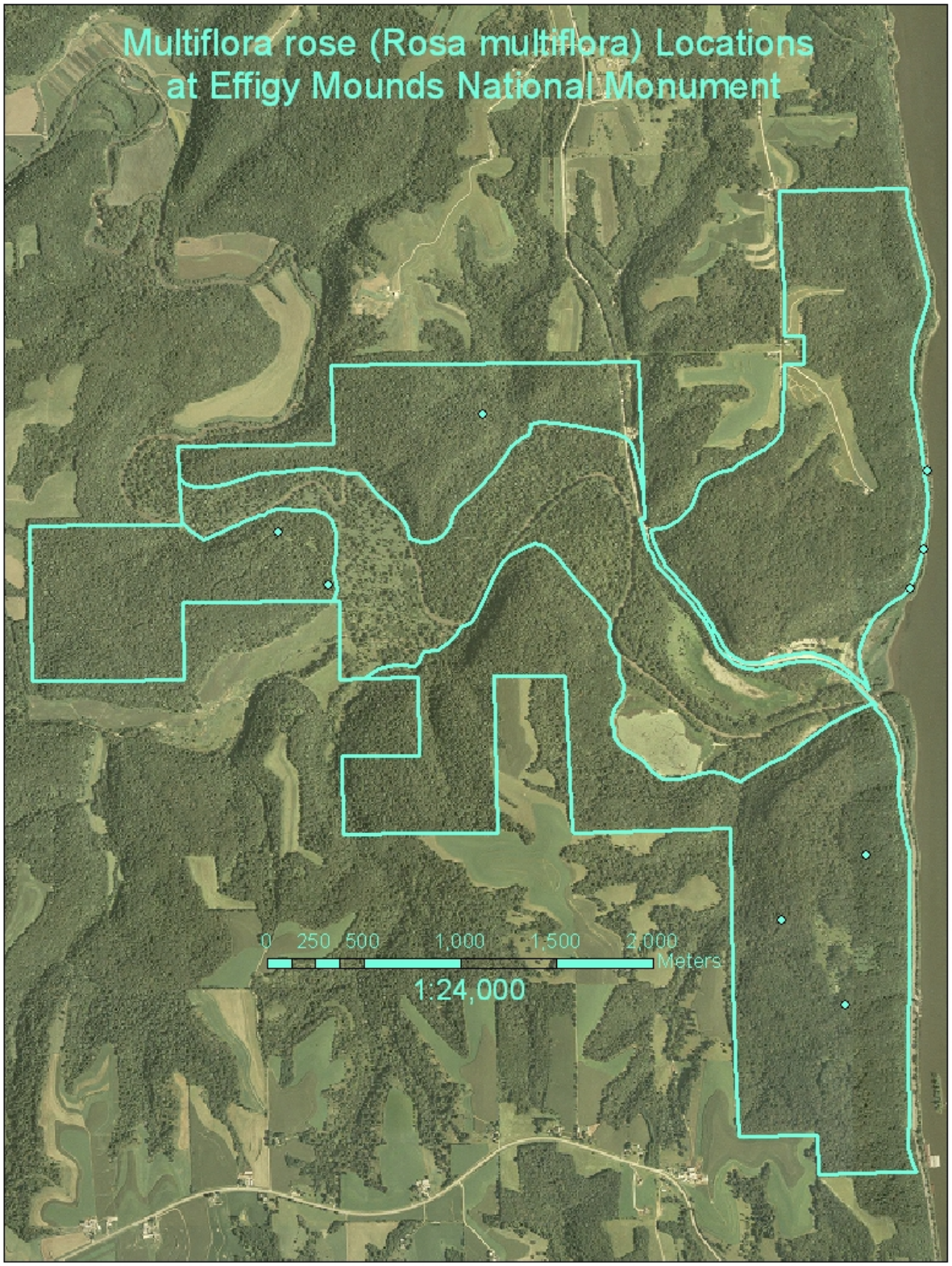

Figure 3: Distribution of multiflora rose (*Rosa multiflora*) at Effigy Mounds National Monument in October 2006.

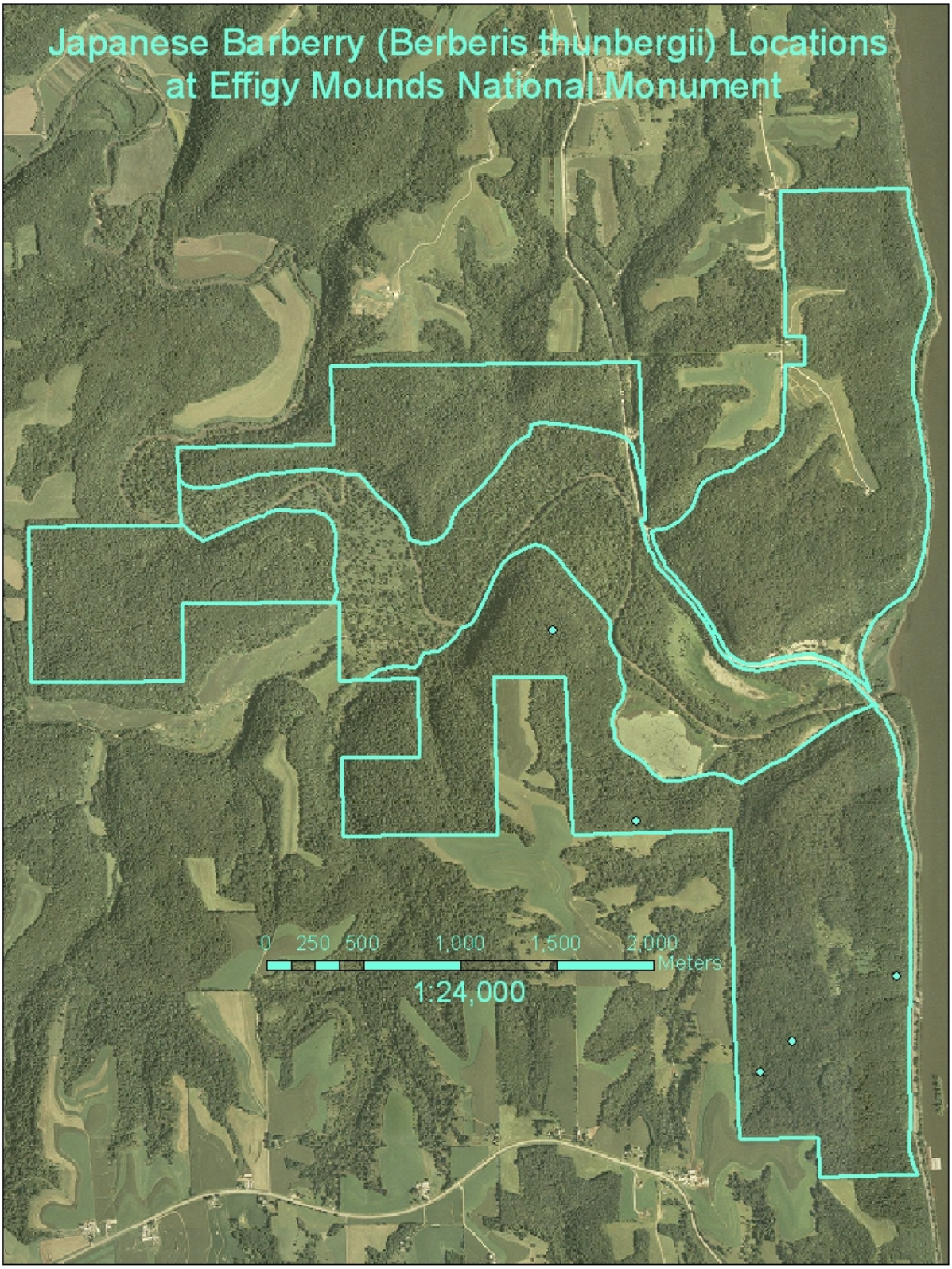

Figure 4: Distribution of Japanese barberry (*Berberis thunbergii*) at Effigy Mounds National Monument in October 2006.

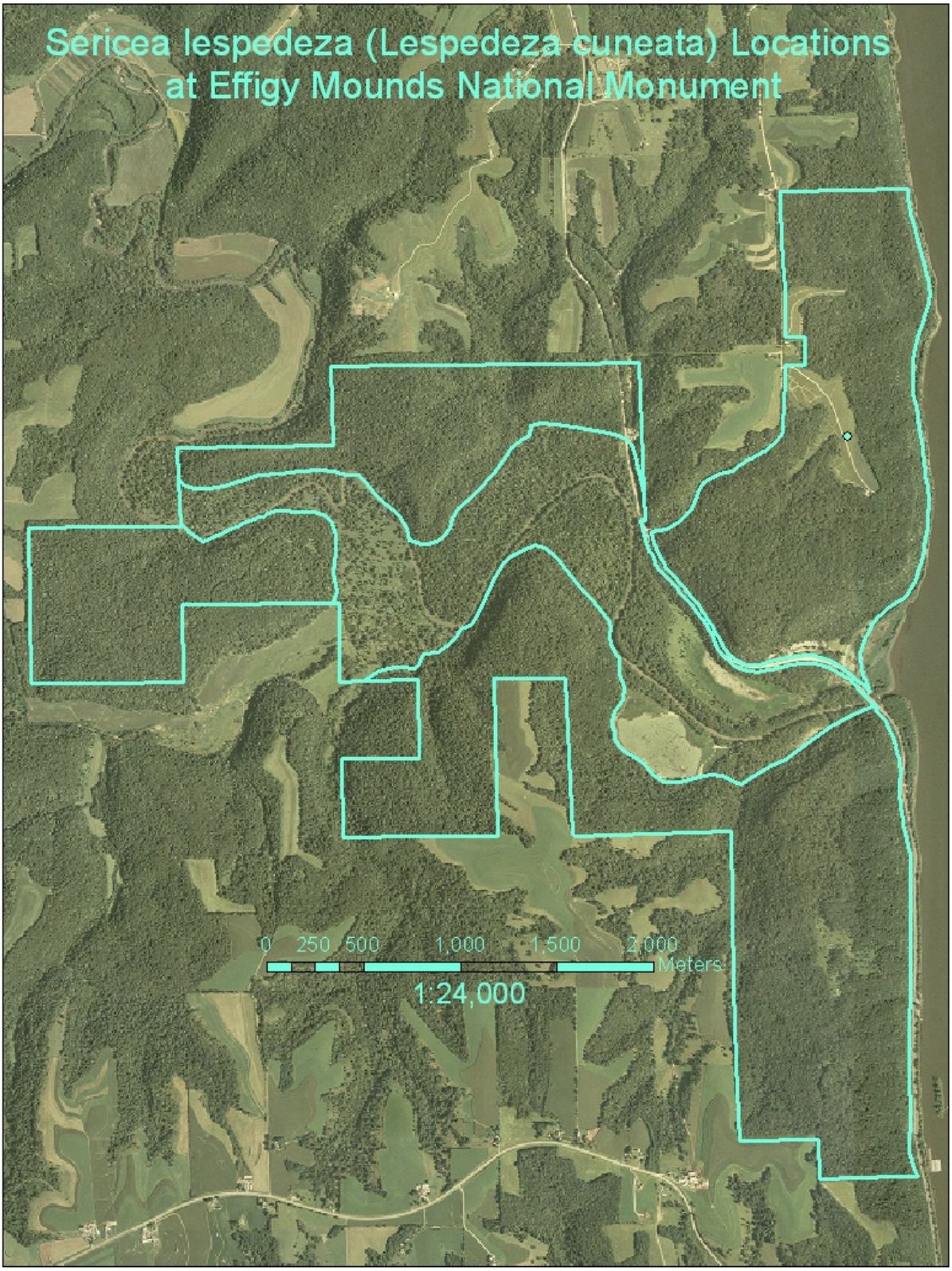

Figure 5: Distribution of sericea lespedeza (*Lespedeza cuneata*) at Effigy Mounds National Monument in October 2006.

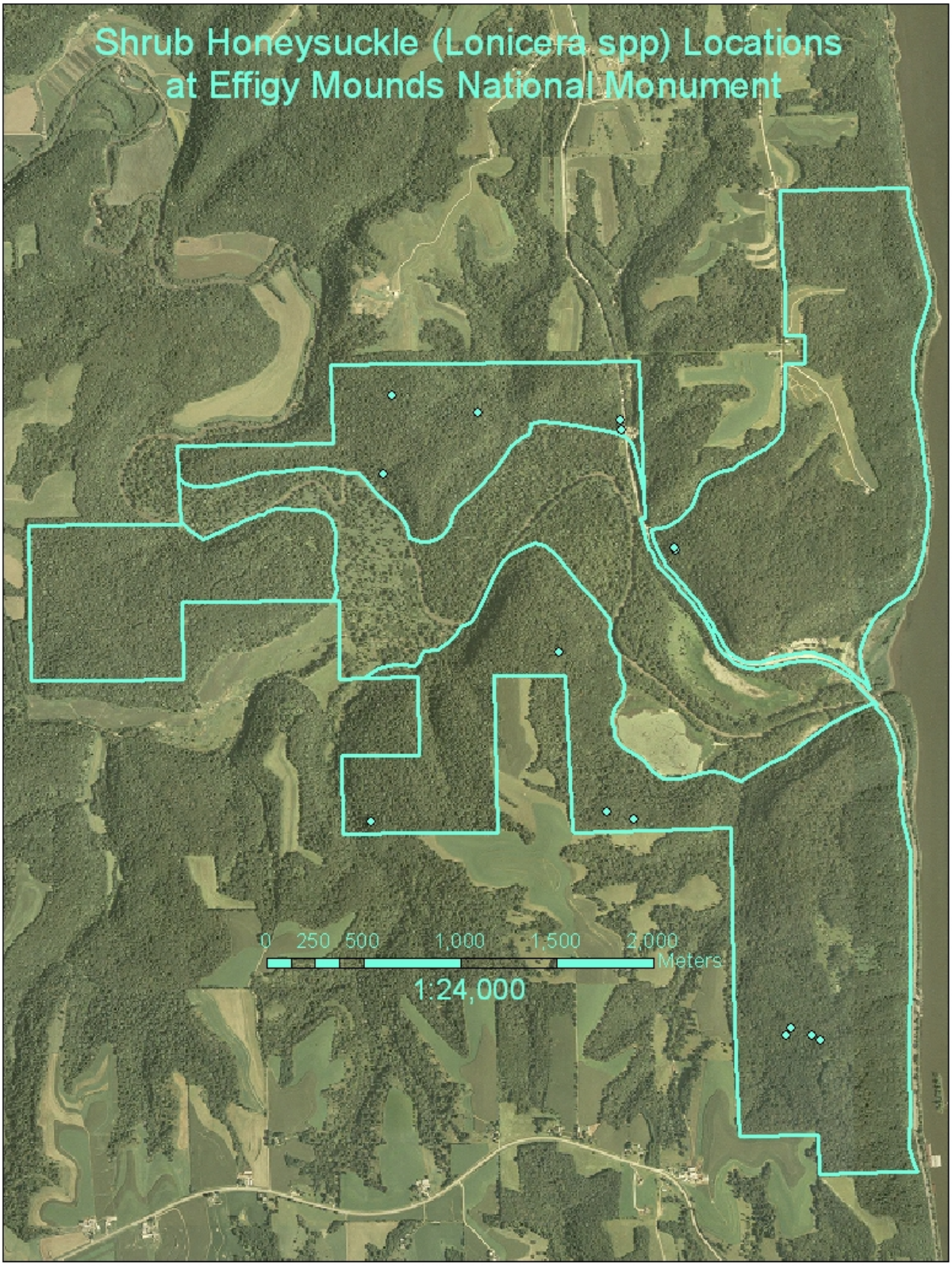

Figure 6: Distribution of shrub honeysuckle (*Lonicera* spp) at Effigy Mounds National Monument in October 2006.

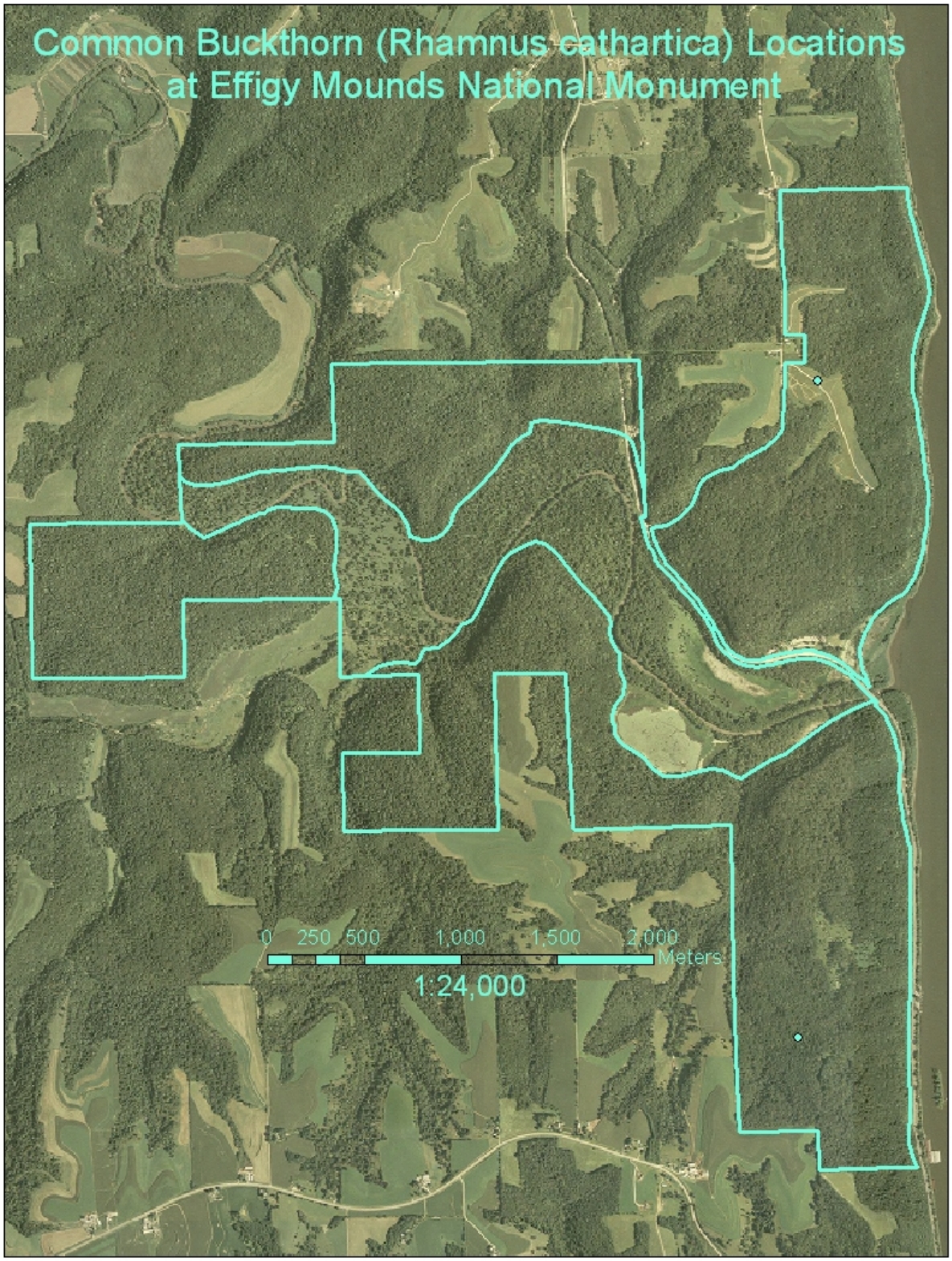

Figure 7: Distribution of common buckthorn (*Rhamnus cathartica*) at Effigy Mounds National Monument in October 2006.

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The NPS has organized its parks with significant natural resources into 32 networks linked by geography and shared natural resource characteristics. HTLN is composed of 15 National Park Service (NPS) units in eight Midwestern states. These parks contain a wide variety of natural and cultural resources including sites focused on commemorating civil war battlefields, Native American heritage, westward expansion, and our U.S. Presidents. The Network is charged with creating inventories of its species and natural features as well as monitoring trends and issues in order to make sound management decisions. Critical inventories help park managers understand the natural resources in their care while monitoring programs help them understand meaningful change in natural systems and to respond accordingly. The Heartland Network helps to link natural and cultural resources by protecting the habitat of our history.

The I&M program bridges the gap between science and management with a third of its efforts aimed at making information accessible. Each network of parks, such as Heartland, has its own multi-disciplinary team of scientists, support personnel, and seasonal field technicians whose system of online databases and reports make information and research results available to all. Greater efficiency is achieved through shared staff and funding as these core groups of professionals augment work done by individual park staff. Through this type of integration and partnership, network parks are able to accomplish more than a single park could on its own.

The mission of the Heartland Network is to collaboratively develop and conduct scientifically credible inventories and long-term monitoring of park "vital signs" and to distribute this information for use by park staff, partners, and the public, thus enhancing understanding which leads to sound decision making in the preservation of natural resources and cultural history held in trust by the National Park Service.

www.nature.nps.gov/im/units/htln/

Heartland Network
Natural Resource Monitoring

The U.S. Department of the Interior (DOI) is the nation's principal conservation agency, charged with the mission "*to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian tribes and our commitments to island communities."* More specifically, Interior protects America's treasures for future generations, provides access to our nation's natural and cultural heritage, offers recreation opportunities, honors its trust responsibilities to American Indians and Alaska Natives and its responsibilities to island communities, conducts scientific research, provides wise stewardship of energy and mineral resources, fosters sound use of land and water resources, and conserves and protects fish and wildlife. The work that we do affects the lives of millions of people; from the family taking a vacation in one of our national parks to the children studying in one of our Indian schools.

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