

Inventory of Invasive/exotic Flora at Lincoln Boyhood National Memorial

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Summary

A survey of invasive/exotic plants was conducted at Lincoln Boyhood National Memorial in the summer of 2003 to document targeted species distributions. Seven of the eleven targeted invasive exotic plants were found as either isolated, individual plants or populations, or covered extensive areas. Japanese honeysuckle is found throughout the park as either large, dense expanses or as seedlings. Others that were more frequently encountered include multiflora rose, privet, and common periwinkle-each in either large expanses or individual plants. *Sericea lespechea*, Chinese yam, and Japanese knotweed were found in scattered locations as individual plants or isolated patches. Two plants not on the initial target list include English ivy and forsythia. Potential control methods of these invasive exotics and their management implications and recommendations are discussed.

Acknowledgments

Thanks to everyone involved with this project and previous surveys of the vegetation at Lincoln Boyhood National Memorial. Special thanks to Gia Wagner of Lincoln Boyhood National Memorial not only for the field work but for taking the lead and organizing a concerted effort involving park staff from various park units; thanks to Constance Jones of Hopewell Culture National Historical Park, Eddie Dengg of Cuyahoga Valley National Park and KellyAnn Gorman of Voyageurs National Park for assisting with field work; thanks to Peter Budde, Sarah McGuire, Heather Loree Kelley, and Eric Compas of the Midwest Region GIS support office, Madison, WI for developing the ArcGIS geodatabase.

Introduction

National Parks are refugia for complex ecosystems that are threatened by the invasion of exotic species whose introduction into Parks are “an emerging global problem” and their control is considered “one of the most significant land management issues facing national parks” (National Park Service 2004).

In 1998 Congress passed the National Parks Omnibus Management Act in response to concerns about the condition of natural resources within the national parks. The act requires each park to gather baseline inventory data on pertinent natural resources, data that will provide a pivotal step toward establishing an effective monitoring program furthering the ability to effectively manage and protect park resources. The National Park Service (NPS) responded with the Natural Resource Challenge program, including the establishment of biome-based inventory and monitoring networks. The Heartland Network, as part of the NPS Inventory and Monitoring (I&M) program, has undertaken inventories of vascular plants and vertebrates within fifteen parks in eight Midwestern states.

Stemming from the Natural Resource Challenge and a concern regarding the status of invasive/exotic plants at Lincoln Boyhood National Memorial, an inventory was deemed necessary to determine patterns of species presence and distribution. Invasive/exotic plants are a resource management concern due to the impact each has on native ecosystems. Invasive plants tend to encroach and compete with native plants, changing the ecosystem and thereby altering the interaction of both plants and animals. Invasive plants can negatively impact ecosystems by altering fire regimes, nutrient cycling, hydrology, and energy budgets, while negatively impacting communities by diminishing the abundance and persistence of native species (Hobbs & Humphries 1995; Mack et al. 2000).

Some information regarding species composition and distribution existed prior the inventory (plant community analyses by Pavlovic & White 1989 and species list by Boetsch et al 2000). Using these resources, an initial list of invasive/exotic species was developed. Recently, historical plant data has been converted into an Access database (Pavlovic & Forste 2004).

The inventory described in this report describes the distribution and composition of invasive/exotic flora at Lincoln Boyhood National Memorial. This inventory 1) pinpoints some areas that should be monitored closely, and 2) establishes baseline data for understanding the distributional patterns of the targeted invasive/exotic species.

Study Area

Lincoln Boyhood National Memorial is located in Spencer County, Indiana (Figure 1) and encompasses the western 32.4 ha (80 ac) of the original quarter section owned by Thomas Lincoln. The park was established by an Act of Congress on February 19, 1962. The enabling legislation states the purpose of the Memorial is to "...preserve the site...associated with the boyhood and family of Abraham Lincoln..." Currently, 80.1 ha (198 ac) have been acquired for the Memorial and the remaining area is comprised of railroad and county road right-of-ways that dissect the Memorial.

The park contains several cultural and interpretive elements within a mosaic of successional oak-hickory forest and old-field vegetation (Boetsch et al 2000). Vegetation composition reflects the park's past use as exotic species comprise 17% of the species present (Pavlovic & White 1989).

Changes in the region from an agricultural to industrial land use is cause for environmental concern at the park due to changes in air quality from local industrial emissions. Furthermore, relocation of a major transportation route (4-lane highway) near the park's boundary will add to this environmental concern.

Since the "enhancement and protection" of the park's resources are high priorities in the park General Management Plan, Resource Management Plan, and Cultural Landscape Report, continued management of these resources will support the resource diversity and further support the broad NPS policies for natural resource management. With an estimated 175,000 visitors entering the park annually and growing concern regarding future trends in adjacent land management, exotic species control will continue to be at the forefront regarding resource management concerns.

Materials and Methods

Lincoln Boyhood National Memorial was surveyed during August 4-6, 2003 for targeted invasive/exotic plants. The area of study includes the majority of the park where natural resource management practices were emphasized and excluded cultural/administrative areas (i.e. visitor's center, maintenance area, and the allee) and the portion of the park west of County Road A (Figure 2) containing primarily fescue/pasture.

Areas were surveyed via methods modified from Eads (2000). An east-west (or appropriate orientation) baseline was established within the park (see Figure 3). Surveyors then walked perpendicular to the baseline covering approximately a 50 meter belt searching for targeted invasive exotic species (Table 1). Due to the dense and/or scattered growth of Japanese honeysuckle (*Lonicera japonica*), location data for this species were not collected.

Navigation of the belt was aided with a spatial background layer imported into a global positioning system. A compass and flagging was used to delineate starting and stopping points throughout this process so that the possibility of missing an area or duplicating work was reduced.

When located, a Trimble GeoXT GPS unit was utilized (NAD83 Conus) to map individual plants and the area of all grouped plants (i.e., the drip line of each group of invasive species). Individual plants were mapped as a point whereas plants that occupied more than one plant per square meter were mapped as a polygon. Data was corrected via Pathfinder, attributes reviewed, and developed into an ArcGIS geodatabase.

Results

Seven of the eleven targeted invasive exotic plants were found as either isolated, individual plants or populations, or covered extensive areas (Figure 2). Japanese honeysuckle is found throughout the park as either dense expanses or individual seedlings. No bush clover (*Lespedeza virginica*), lilac (*Syringa vulgaris*), knotweed (*Polygonum casespitosum*) or mock orange (*Philadelphus coronarius*) was found. Two plants not on the list were documented and include English ivy (*Hedera helix*) and forsythia (*Forsythia sp.*).

A total of 1,067 individual points reflecting a taxon position were collected; the majority (98% of the points) were multiflora rose (*Rosa multiflora*) and privet (*Ligustrum sp.*) (Table 2, Figures 4 & 5). Periwinkle (*Vinca minor*), Chinese or sericea lespedeza (*Lespedeza cuneata*), forsythia (*Forsythia sp.*), and Chinese yam (*Dioscorea oppositifolia*) were found in scattered locations as individual plants or isolated populations (Figures 6-10).

Privet, multiflora rose, and periwinkle were the most common species (in clumps) and accounted for 83% of the expanses encountered (Table 3). However, periwinkle was found to cover the most area (2.3 ha, 5.6 ac) with less area covered by privet and multiflora rose (Table 4). Sericea lespedeza and Japanese knotweed (*Polygonum cuspidatum*) accounted for only 9 and 4 % of the expanses encountered, respectively. For all expanses encountered, these two species covered less than one ha.

Discussion

This survey provides information of the current distribution of a set of targeted invasive exotic species at Lincoln Boyhood National Memorial. Some general patterns of distribution can be identified on a per species basis but collectively, the infestations appear to be throughout the Memorial and associated with habitat disturbance (i.e. near trails and impacted areas). The following discussion is by order of infestation magnitude.

Japanese honeysuckle (*Lonicera japonica*)

By far, the most frequently encountered and distributed of the target species. Field work for this inventory began in the extreme southeast portion of the park and it was soon discovered that Japanese honeysuckle had heavily infested this area and areas extending south of the visitor's center. Countless seedlings were also found throughout the park but the greatest concentration (seedlings and dense growth) were observed in this infested area (Figure 2) often to "choking out" the adjacent native vegetation (Figure 11). Due to this, it was deemed impossible to collect location data for this species.

Wagner (2003) revisited twelve of the sites where Japanese honeysuckle had been found in previous surveys and found it in eleven of the sites. It was missing from an upland hardwood forest site (plot 5). Pavlovic and White (1989) also found this invasive exotic throughout the park and it was found to be most common/frequent in bottomland successional forest, bottomland forest, mixed maple/tulip-tree forest, and upland successional forest.

Japanese honeysuckle is classified as an invasive exotic by the Invasive Plant Species Assessment Working Group (2004). It is found to occur in a variety of habitats ranging from forest (dry to dry mesic upland, mesic floodplain, wet floodplain), prairie, and wetlands-many of which are at the Memorial. In their assessment of Japanese honeysuckle, ecological impacts and the potential for expansion (distribution) were high. Difficulty of management was medium (bordering on high) as the species is 1) difficult to control without significant damage to native species and 2) costly to get rid of. They suggested possible treatment during the dormant season as damage to non-target species (i.e. native vegetation) should be minimized. Currently the Group is not aware of any government land management agency (federal, state, or private) that recommends or plants Japanese honeysuckle or any of its cultivars. However, private commercial agencies (nursery professionals, landscape architects, arboreta) or the general public use Japanese honeysuckle (and cultivars). The Group recommends that Japanese honeysuckle stop being sold and purchased-a recommendation that is in conflict with sportsman's groups such as Quail Unlimited and Whitetail Limited (the plant was recommended for quail cover and deer forage).

Pavlovic and White (1989) demonstrated management experiments to eliminate Japanese honeysuckle may be most successful under a forested canopy where "prolific growth is absent." A possible treatment regime could include use of glyphosate applied in the fall with the introduction of nursery herbaceous plants to restore the ground cover. The NPS Exotic Plant Management Team (EPMT 2004) reported no natural enemies for this species but suggest using a variety of techniques (cutting vines to ground level, use of fire, mechanical removal, and

grazing) to eliminate the species. Regardless of the control method used, care must be taken to prevent re-invasion from nearby areas, or by seeds transported by birds or other wildlife.

Multiflora rose (*Rosa multiflora*)

This plant is scattered throughout the park growing primarily as small shrubs (< 2 m tall). The area south and southeast of the visitor's center (i.e. the infested area) and the area in the extreme northwest portion of the park ("North 40 West") appear to have the highest concentrations (Figures 2 & 4). It is also scattered throughout the park. Wagner (2003) revisited two of the sites multiflora rose had been found in previous surveys and found it in only one of the sites; however, it was found in four of Wagner's other sites adding to the dispersal of the species.

Classified by the state of Indiana as a noxious weed (USDA 2004), multiflora rose is difficult to control since it produces several flowers, is hardy in a variety of habitats, and is dispersed via a variety of birds that feed on the hips in the fall and winter (Amrine 2002). Possible prevention and control techniques include pulling young plants, cutting/mowing mature shrubs, herbicide, or use of biological control agents (Amrine 2002; Swearingen et al 2002). An initial step in reducing the number of future plants is to remove the larger shrubs in open/edge areas that are seedbanks (Figure 11).

Privet (*Ligustrum sp.*)

This plant, like multiflora rose, is scattered throughout the park growing primarily as small shrubs (< 2 m tall). The area south and southeast of the visitor's center (the infested area) appears to have the highest concentration of privet with some additional clumps northward and individual plants scattered throughout the park (Figures 2 & 5). Pavlovic and White (1989) reports this plant (*L. vulgare*) in upland successional forest and upland hardwood forest but in relatively low densities. Wagner (2003) revisited two of the sites privet had been found before and found it in those sites again and in another site.

Although not classified by the state of Indiana as noxious, this plant can be very troublesome and difficult to eradicate when established. Swearingen et al (2002) recommend that the plant not be planted, that small plants could be dug out, and spraying larger plants with glyphosate herbicide. Due to the widespread distribution of the plant at the park this may not be feasible. The Nature Conservancy had success in two southern states (Alabama and Florida) when using fire to eradicate privet. However, due to the re-sprouting ability of privet, persistent annual burning was required (USFS 2004).

Periwinkle (*Vinca minor*)

Periwinkle tended to occur near trails as dense, expansive carpets extending into the adjacent forest. The majority of locations were in the southern portion of the park (south of the railroad) with larger carpets west and northwest of the visitor's center (Figure 6). Pavlovic and White (1989) found this plant in upland hardwood forests whereas Wagner (2003), in revisiting two of the sites where periwinkle had been found in previous surveys, found it in just one of the sites.

It's probable this plant was introduced to the park when planting periwinkle near the visitor center (Figure 11). It was originally introduced into the United States for ornamental purposes but has escaped cultivation and is posing threats to native plants due to its habit of spreading and forming dense carpets and shading out native vegetation (Swearingen et al 2002). Possible prevention and control measures include plant removal by digging or cutting and application of glyphosate herbicide.

Five other species appear to be distributed in localized populations and vary in density and cover (Figures 7-10). This includes Chinese yam with extensive cover and variable density (often shading out native ground vegetation) found on both sides of one trail at the park and extending into the canopy (Figure 11; problems occurred with post processing the GPS data so these locations should be considered approximate); bush clover was found to be associated with open, impacted areas and in isolated areas; Japanese knotweed was found in two areas with limited density and cover. Current prevention and control of Japanese knotweed is extremely difficult and the plant must be treated with both mechanical and chemical methods (Swearingen et al 2002). Plants are pulled, roots and runners removed, and glyphosate and triclopyr herbicides applied either to freshly cut stems or to foliage. English ivy and forsythia are both localized and appear to be relics of historic cultural use areas (i.e. gates or entranceways). Future spread of these species is unknown but it is known that English ivy can pose serious ecological impacts similar to other species that grow into dense carpets.

Conclusion

This survey establishes baseline patterns in the composition and distribution of invasive exotic plants at Lincoln Boyhood National Memorial. Following are some recommendations for future surveys and management.

1. Establish an invasive exotic plant management plan that identifies natural resource problems as they relate to invasive exotics.
2. Develop management practices that reduce/eliminate invasive exotics.
3. Work with cooperating agencies to reduce/eliminate populations of invasive exotic plants.
4. Take care to prevent re-invasion from nearby areas by planting the area with fast-growing native vegetation.
5. Develop a monitoring plan that will allow park resource managers to evaluate the effectiveness of management plans.

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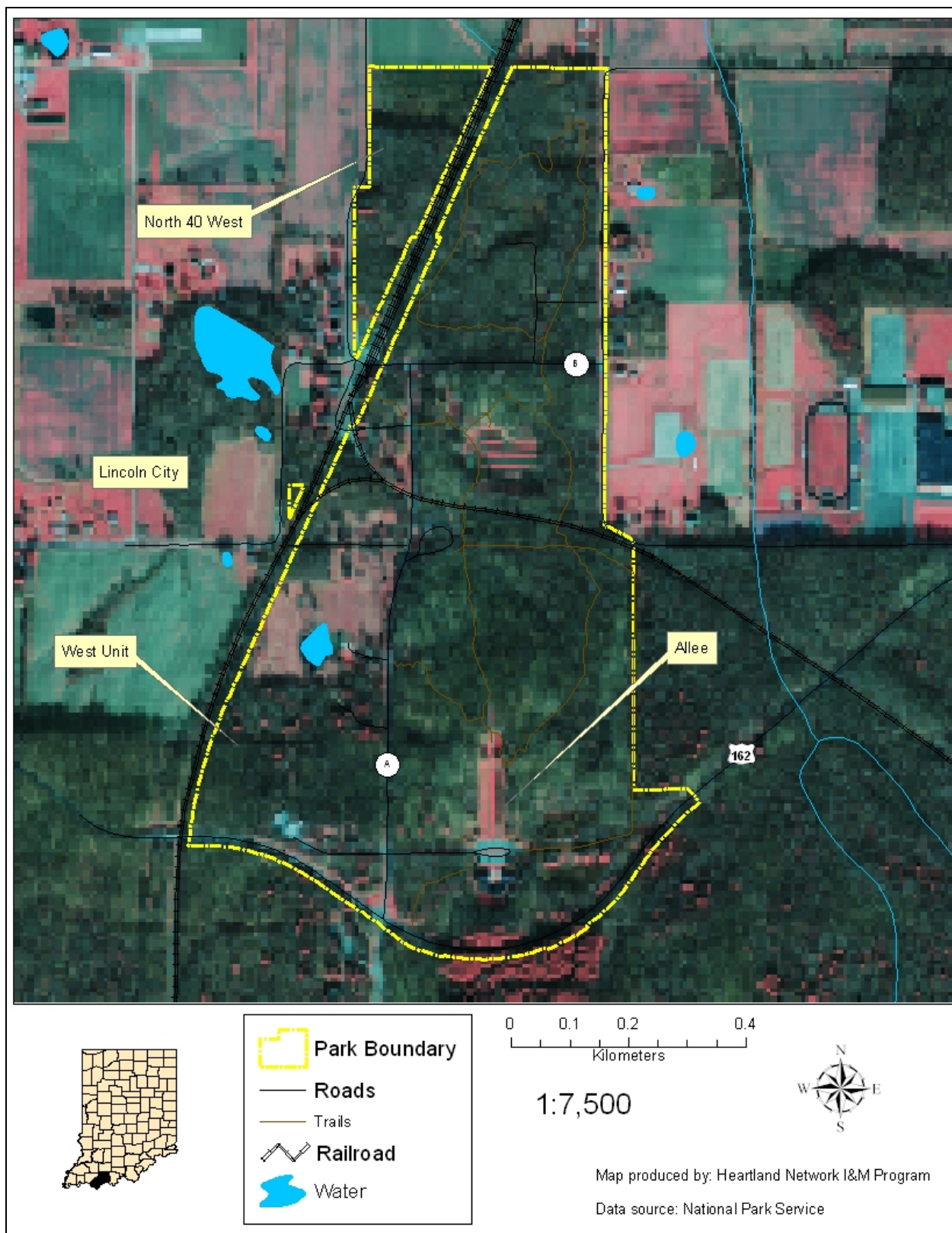


Figure 1. Location of Lincoln Boyhood National Memorial, Spencer County, Indiana.

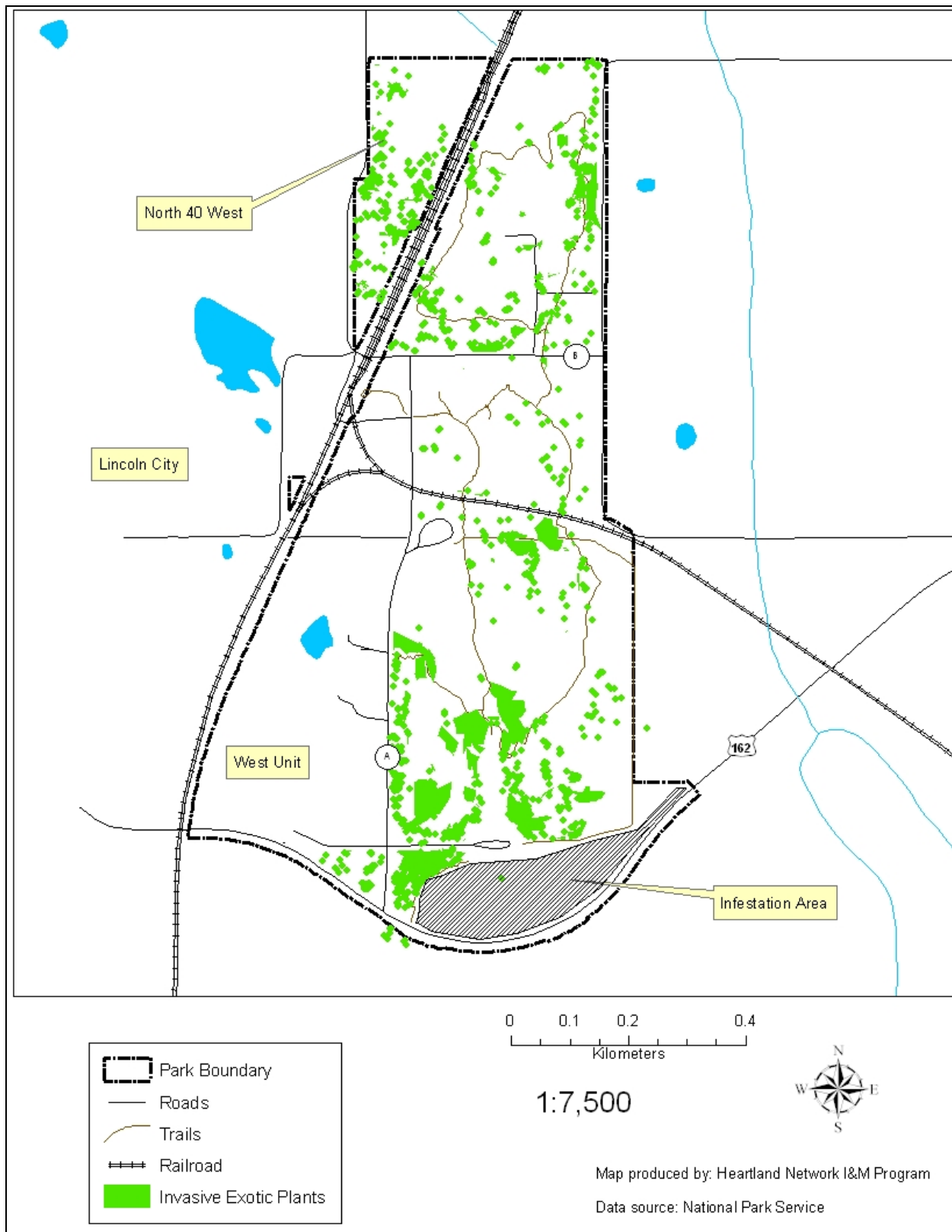


Figure 2. Distribution of invasive exotic plants at Lincoln Boyhood National Memorial.

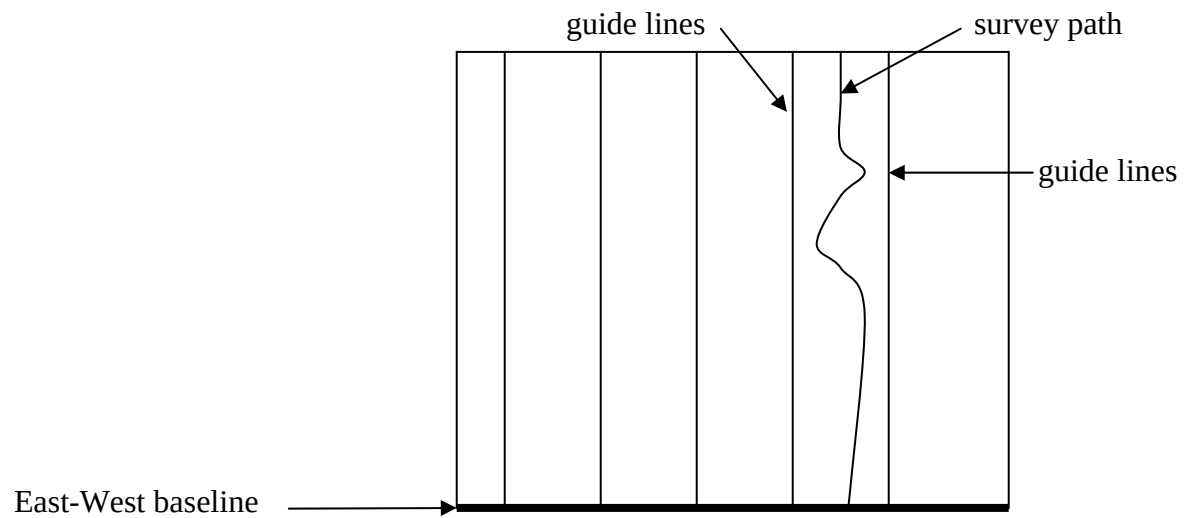


Figure 3. Diagram of survey technique at Lincoln Boyhood National Memorial.

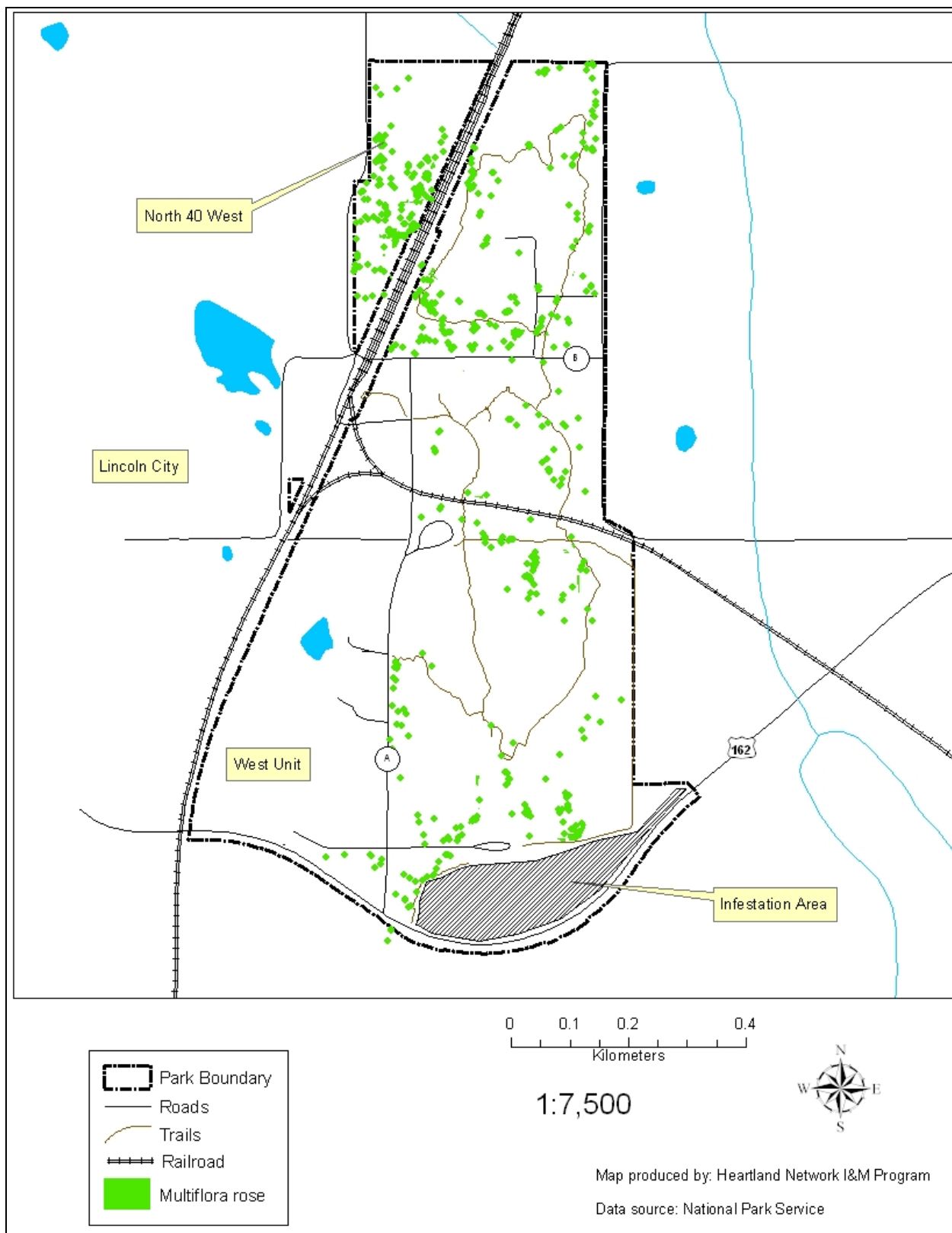


Figure 4. Distribution of multiflora rose at Lincoln Boyhood National Memorial.

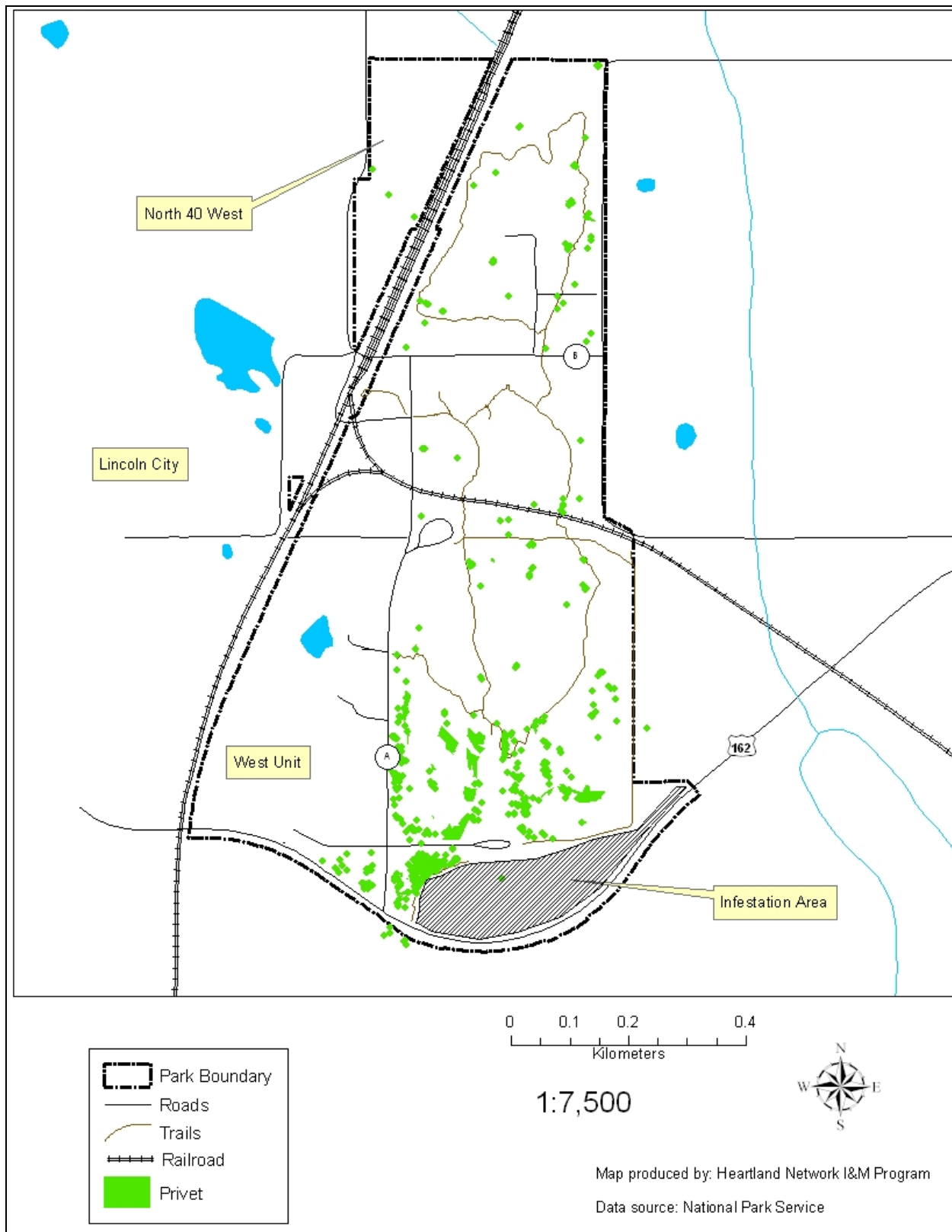


Figure 5. Distribution of common privet at Lincoln Boyhood National Memorial.

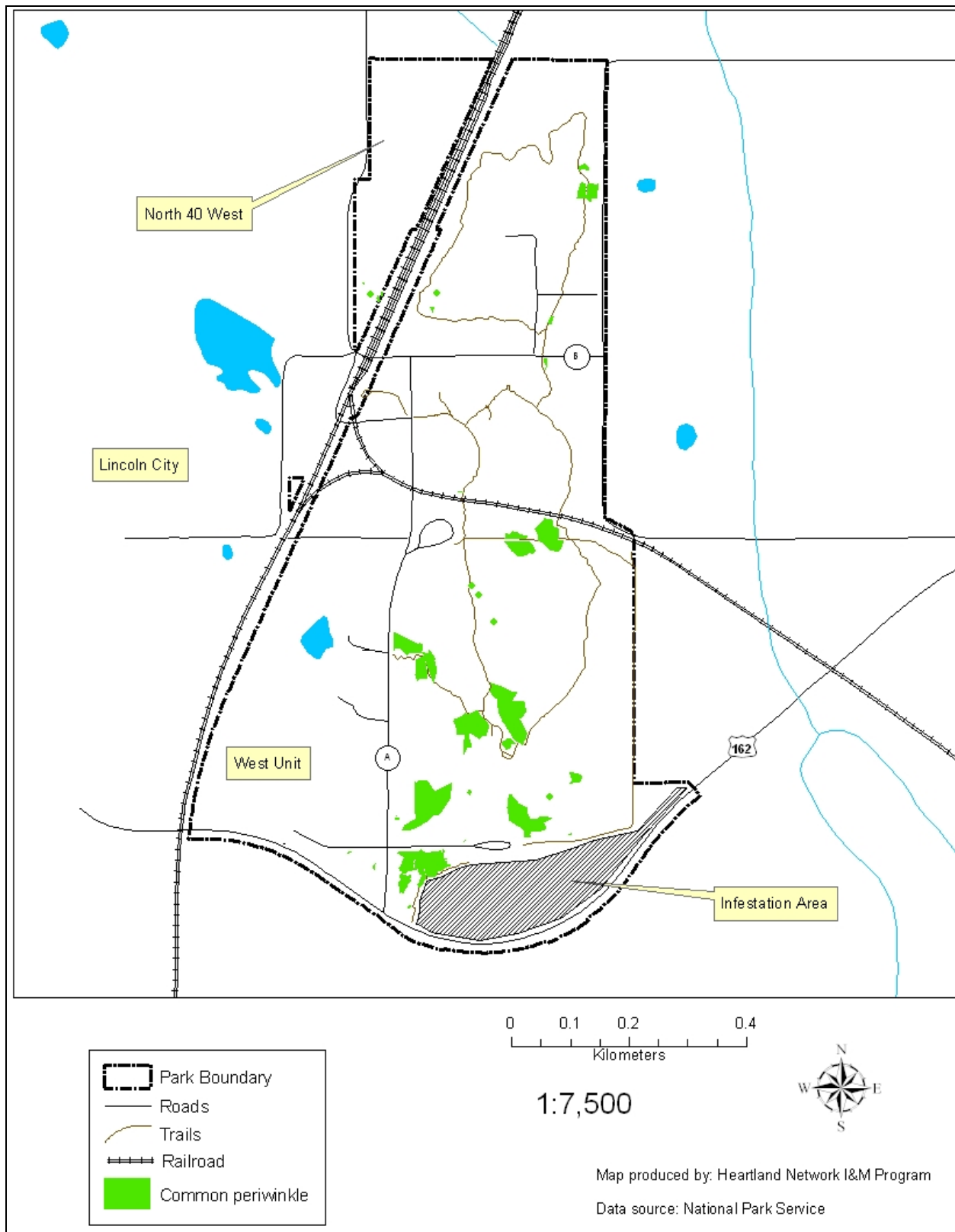


Figure 6. Distribution of periwinkle at Lincoln Boyhood National Memorial.

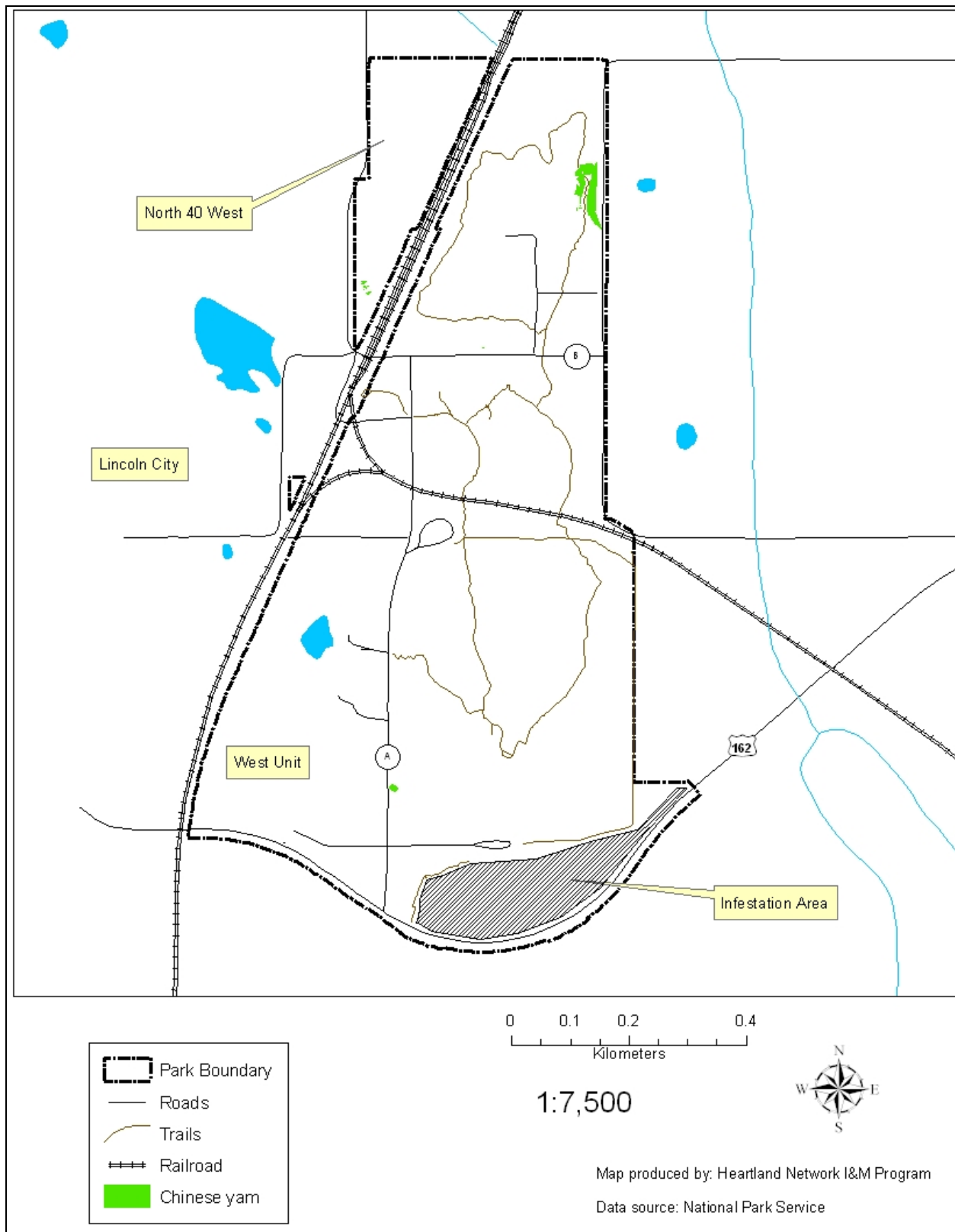


Figure 7. Distribution of Chinese yam at Lincoln Boyhood National Memorial.

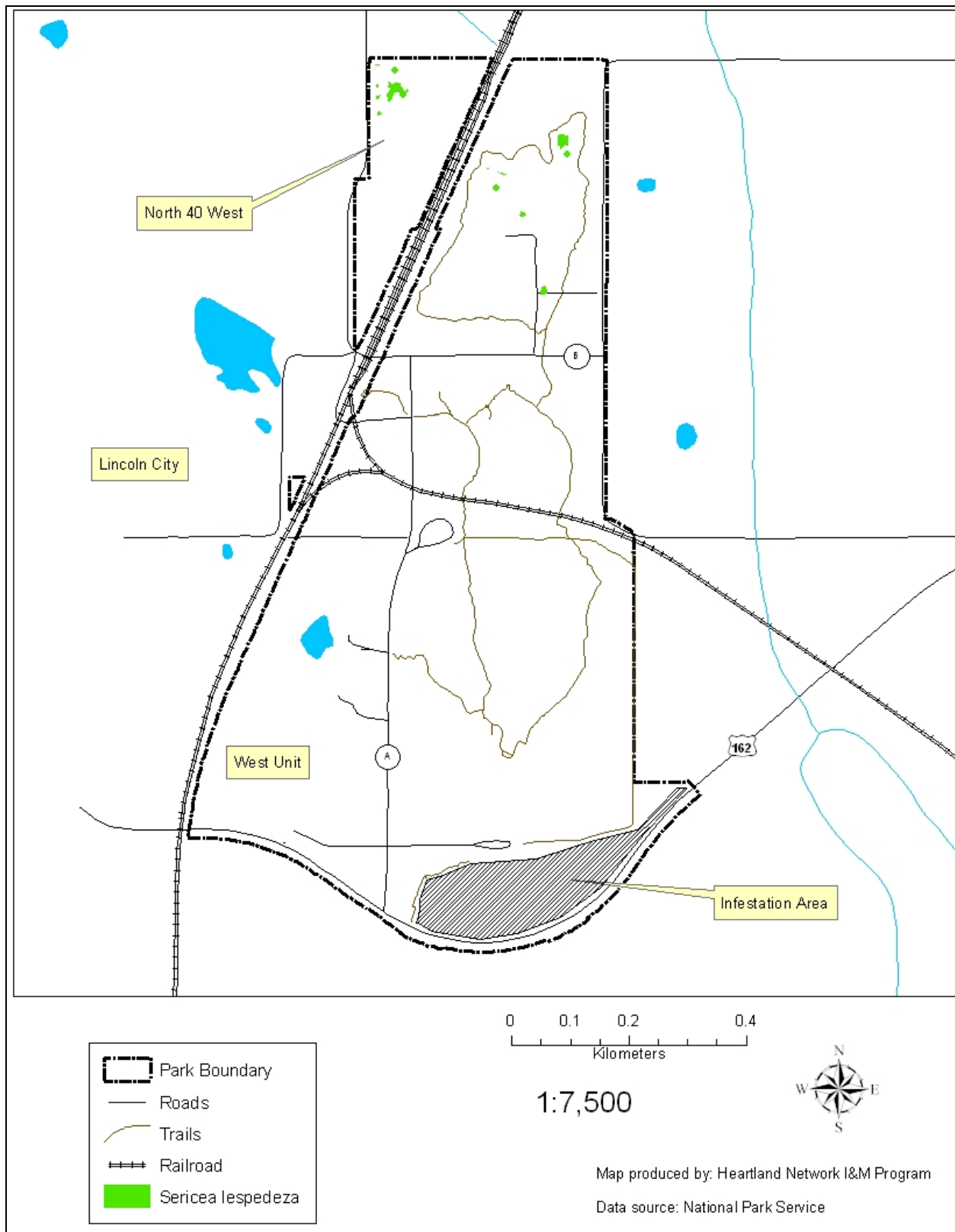


Figure 8. Distribution of *sericea lespedeza* Lincoln Boyhood National Memorial.

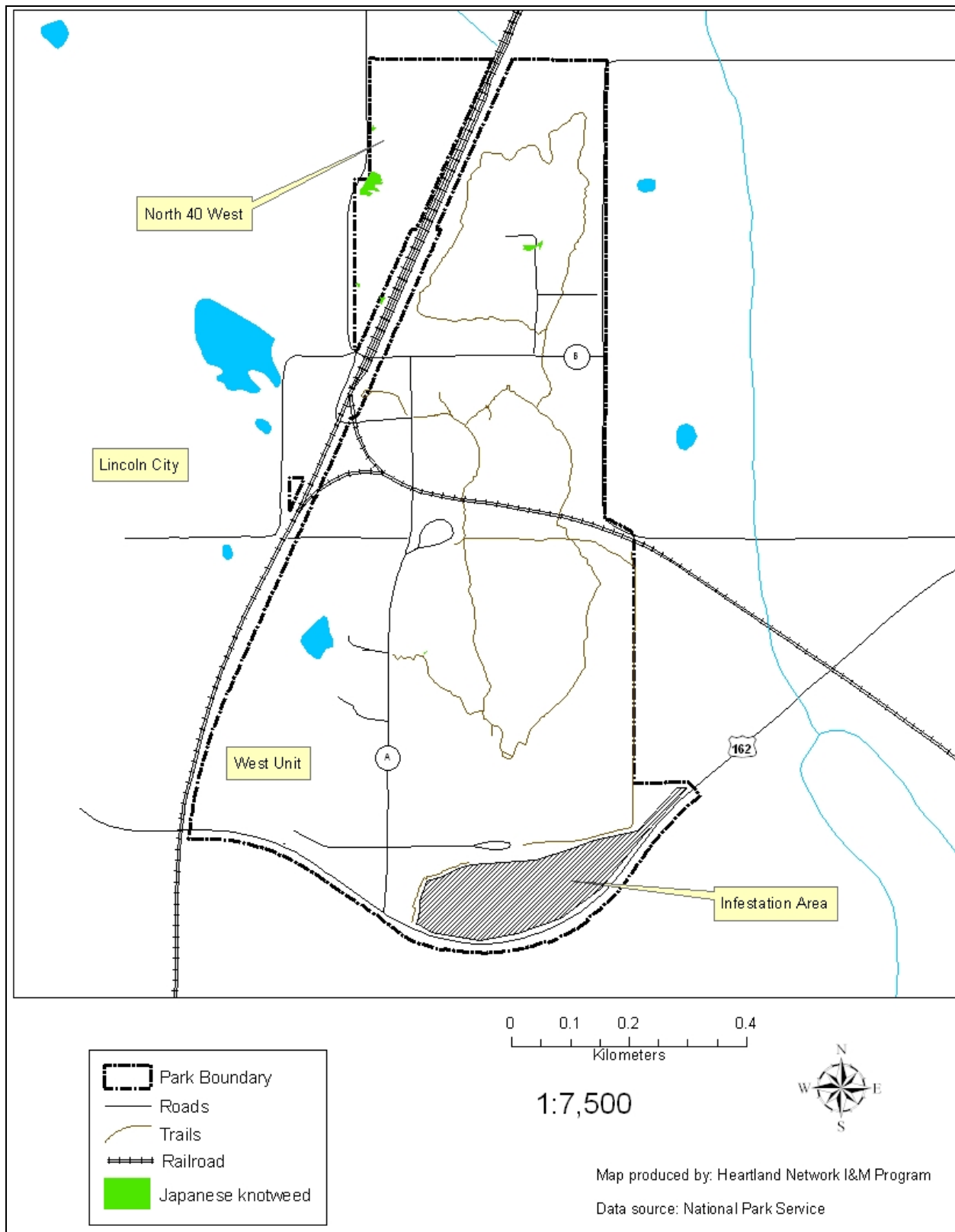


Figure 9. Distribution of Japanese knotweed Lincoln Boyhood National Memorial.

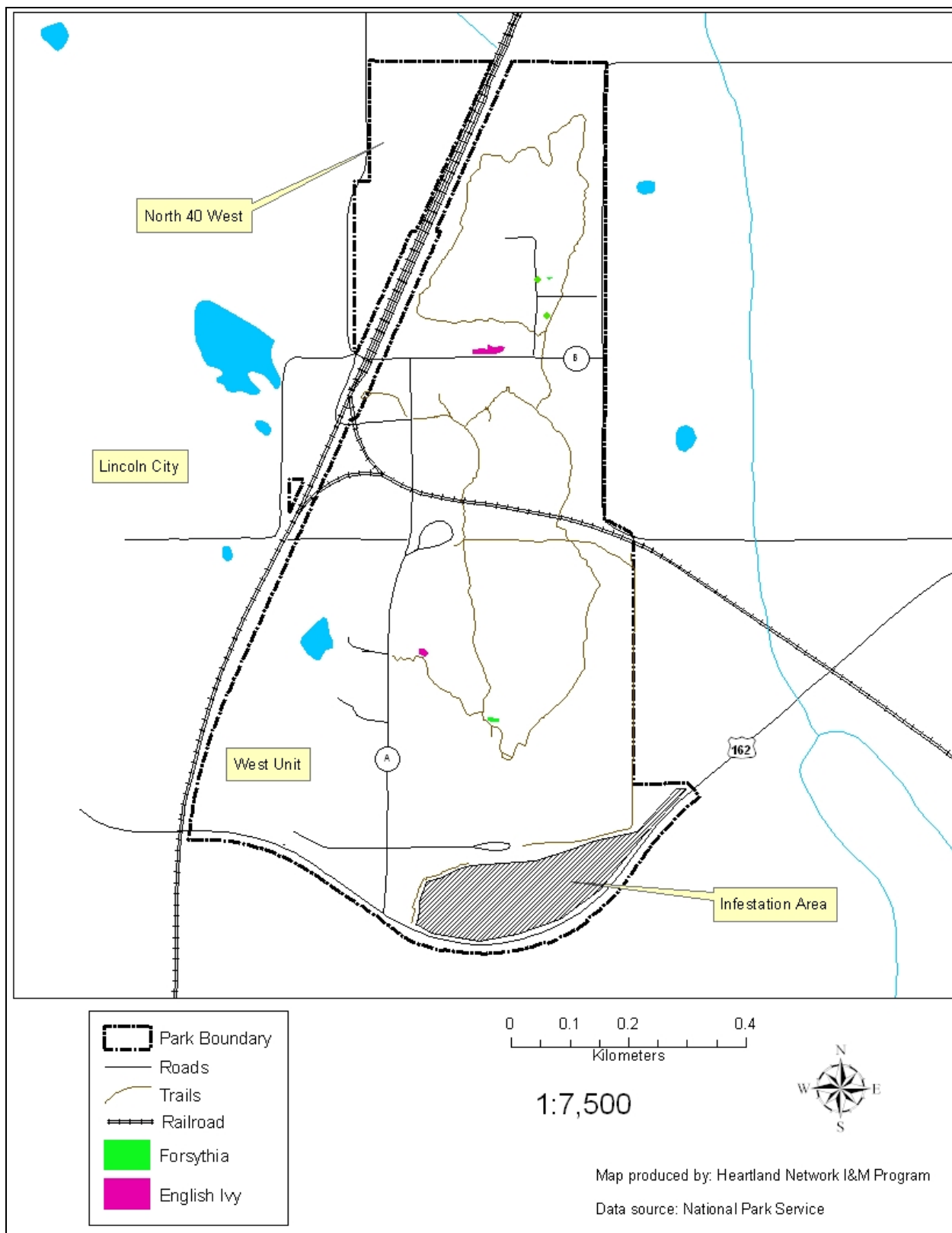


Figure 10. Distribution of forsythia and English ivy at Lincoln Boyhood National Memorial.



Left to right: Japanese honeysuckle, periwinkle near visitor's center, periwinkle in forest, Chinese yam shading ground cover, Chinese yam growing into the canopy, fruiting Chinese yam, typical privet shrub, Constance Jones standing amidst periwinkle and privet, multiflora rose seedbank.

Figure 11. Example of invasive exotic plants at Lincoln Boyhood National Memorial.

Table 1. List of targeted invasive plants surveyed at Lincoln Boyhood National Memorial.

Common Name	Scientific Name	Family
Bush clover	<i>Lespedeza cuneata</i>	Fabaceae
Bush clover	<i>Lespedeza virginica</i>	Fabaceae
Chinese yam	<i>Dioscorea oppositifolia</i>	Dioscoreaceae
Common lilac	<i>Syringa vulgaris</i>	Oleaceae
Japanese honeysuckle¹	<i>Lonicera japonica</i>	Caprifoliaceae
Japanese knotweed	<i>Polygonum cuspidatum</i>	Polygonaceae
Knotweed	<i>Polygonum caespitosum</i>	Polygonaceae
Mock orange	<i>Philadelphus coronaries</i>	Rosaceae
Multiflora rose²	<i>Rosa multiflora</i>	Rosaceae
Periwinkle	<i>Vinca minor</i>	Apocynaceae
Privet	<i>Ligustrum</i> sp.	Oleaceae

¹ classified as an invasive exotic by the Invasive Plant Species Assessment Working Group (2004); ² classified by the state of Indiana as a noxious weed (USDA 2004)

Table 2. List of the commonality of invasive exotic plants (by point) at Lincoln Boyhood National Memorial.

Common Name	Scientific Name	Number	%
Multiflora rose	Rosa multiflora	536	50
Privet	Ligustrum sp.	517	48
Periwinkle	Vinca minor	7	<1
Sericea lespedeza	Lespedeza cuneata	3	<1
Forsythia	Forsythia sp.	2	<1
Chinese yam	Dioscorea oppositifolia	1	<1

Table 3. List of the commonality of invasive exotic plants (by polygon) at Lincoln Boyhood National Memorial.

Common Name	Scientific Name	Number	%
Privet	Ligustrum sp.	39	30
Multiflora rose	Rosa multiflora	32	25
Periwinkle	Vinca minor	30	23
Sericea lespedeza	Lespedeza cuneata	11	9
Japanese knotweed	Polygonum cuspidatum	6	5
Chinese yam	Dioscorea oppositifolia	5	4
English ivy	Hedera helix	2	2
Forsythia	Forsythia sp.	2	2

Table 4. List of targeted invasive exotic plants and total area covered at Lincoln Boyhood National Memorial.

Common Name	Scientific Name	Hectare/Acres
Periwinkle	<i>Vinca minor</i>	2.3/5.6
Privet	<i>Ligustrum</i> sp.	.63/1.6
Multiflora rose	<i>Rosa multiflora</i>	.24/.58
Chinese yam	<i>Dioscorea oppositifolia</i>	.22/.54
Sericea lespedeza	<i>Lespedeza cuneata</i>	.14/.34
Japanese knotweed	<i>Polygonum cuspidatum</i>	.13/.31
English ivy	<i>Hedera helix</i>	.07/.18
Forsythia	<i>Forsythia</i> sp.	.02/.04