Inventory of Invasive/exotic Flora at Herbert Hoover National Historic Site

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February 2004

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Summary

A survey of invasive/exotic plants was conducted in the reconstructed prairie habitat at Herbert Hoover National Historic Site in the summer of 2003 to document species composition and distributions. Plant locations were documented by walking throughout the prairie. Forty-nine problematic and invasive/exotic taxa were found as isolated plants, localized populations, or to cover extensive areas. The most common taxa include bush honeysuckles, white mulberry, dogwoods, cherries/plums, and sweet clover. Five species were found to cover at least 5% of a prairie management unit and include brome grass, sweet clover, reed canary grass, and wild parsnip.

Acknowledgments

Special thanks to Dr. Paul Christiansen for help and his institutional knowledge of the park; thanks to Phyllis Adams, Midwest Region I&M Coordinator, for field assistance; Peter Budde, Sarah McGuire, Eric Compas of the Midwest Region GIS support office, Madison, WI for developing the ArcGIS geodatabase.

Introduction

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 this challenge and a concern regarding the status of invasive/exotic plants at Herbert Hoover NHS, 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 and Humphries 1995; Mack et al. 2000).

Some information regarding species distribution and composition existed prior the inventory (Owoski 1993). An initial list of exotic species was developed from a site visit to Herbert Hoover National Historic Site in 1989 (Stubbendieck et al. 1992) and annual vegetation monitoring in a restored prairie (Christiansen 1989-2000). Along with this list, eternal vigilance is kept for several other invasives (leafy spurge, *Euphorbia esula*; garlic mustard, *Alliaria petiolata*) whereas others are of concern. The list has several Iowa primary and secondary noxious plants; however, adequate information (distribution and abundance) does not exist for occurrence of invasive/exotic plant species on the site.

The inventory described in this report describes the distribution and composition of invasive/exotic flora, and of potentially invasive ("problematic") flora at Herbert Hoover NHS. 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 and problematic species.

Study Area

Herbert Hoover National Historic Site is located in east-central Iowa within the incorporated city of West Branch, adjacent to businesses, residences, agricultural fields, and Interstate 80 (Figure 1). The 75.6 ha (186.80 ac) tract, includes the historic buildings, the Presidential Library Museum, park facilities, and infrastructure. Additional resources include a tributary to the west branch of Wapsinonoc Creek, a 30.8 ha (76 ac) reconstructed tallgrass prairie, Village Green, picnic area, and open space. Approximately 21 ha (52 ac) are parkland grounds including landscape with sparse trees, shrubs, and grass.

The site is roughly rectangular with very irregular sides. Most of the cultural resources are located within the flood plain of the creek. The area is within the Southern-Iowa Drift Plain, where drainages cut a pattern of abruptly rolling countryside. Erosion and fracturing are constant problems in these friable clay/loess (Tama-Downs) soils. Streams that did not exist 150 years ago, such as the creek on site, have cut paths through areas that were once wetlands and seeps and are very susceptible to flash flooding or going dry during periods of drought (Boetsch et al 2000).

Interstate-80 passes along the southern border and downtown West Branch shares the northern and eastern borders of the site. A working row-crop farm, belonging to the NPS, but on a life-time lease to a private farmer, lies on the western border. The prairie separates the Gravesite from the Interstate to its south and farm to the west. The prairie should "maintain the landscape adjacent to the Presidential Library and Gravesite in a manner appropriate to the memorial character of these areas." The prairie covers upland areas and a portion of the flood plain.

The park originally seeded 30.8 ha (76 ac) of the prairie buffer to five species of native grasses (big bluestem, *Andropogon gerardii*; little bluestem, *A. scoparium*; switchgrass, *Panicum virgatum*; Indian grass, *Sorghastrum nutans*; side oats grama, *Bouteloua curtipendula*) in spring of 1971 (Robinson). Managers added forbs in 1976, and made subsequent additions of forbs and Canada wild rye (*Elymus canadensis*) in 1992 and 1994. In 1997, a savanna was shaped on the southeast ridge of the prairie. This savanna was intended to further buffer the Gravesite from development along the Interstate. A nut tree grove was planted in spring of 2000 as another eventual savanna area immediately south and west of the Gravesite.

Surrounding landscape and land uses provide a potential source of exotic weeds and invasive plants for the prairie and creek bed. Agricultural runoff enters the prairie along three drainages on the western border. Some of the most extensive invasions of exotic plants occur along these drainages and the flood plain to the creek. Fencerows and mowed areas of the park are planted to Kentucky bluegrass (*Poa pratensis*), fescue (*Festuca spp.),* and smooth brome grass (*Bromus inermis*). Reed canary grass (*Phalaris arundinacea*) and various woody plants, including escaped ornamentals from the cultural area of the site, have invaded the prairie. The watershed above the site consists of agricultural land, residential areas, a golf course, and abandoned agricultural land being developed for commercial and residential purposes.

The reconstructed prairie represents one of the largest protected prairies in the vicinity. Only about 2,833 ha (7,000 ac) of tallgrass prairie are currently protected in the public domain in Iowa. The expansive mowed area mimics savanna conditions and attracts birds associated with the oak-hickory savanna. No threatened or endangered species have been identified on site, but the site provides a significant island of habitat for native plants, neo-tropical migrant birds, and numerous other species in a highly developed agricultural landscape.

Materials and Methods

Herbert Hoover NHS was surveyed August 8-9, 2003 for invasive/exotic and problematic plants. The area of concern includes approximately 32.8 ha (81 ac) of a natural zone consisting of prairie and a riparian corridor.

The area of study was surveyed via methods modified from Eads (2000). An east-west (or appropriate orientation) baseline was established within Prairie Management Units (PMU) 2-7 (see Figure 3). Surveyors (3-4) then walked perpendicular to the baseline covering approximately a 50 meter belt searching for targeted problematic and invasivespecies (Table 1). Navigation of the belt was aided with a spatial background layer imported into a global positioning system (see Figure 2). 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 or GeoExplorer 3 (Trimble@) 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

Forty-nine problematic and invasivetaxa were found to be either isolated plants, localized populations, or covered extensive areas (Table 2).

A total of 1,168 individual points reflecting a taxon position were collected; the majority of which were represented by woody species (Table 3, Figure 4). The most common included: bush honeysuckles (*Lonicera morrowii* & *tatarica*), white mulberry (*Morus alba*), dogwoods (*Cornus* spp.), cherries/plums (*Prunus* spp.), and sweet clover (*Melilotus* spp.).

Twenty-five taxa were found to occur in patches ranging from <1 ha to 2.1 ha (Table 4, Figure 5). Of these the most common (occurring with at least 14 patches) were dogwoods, white sweet clover (*Melilotus alba*), reed canary grass, brome grass, and wild parsnip (*Pastinaca sativa*). Five species were found to cover at least 5% of the area within a prairie management unit. These include: brome grass (PMU 5a, 7), sweet clover (PMU 2, 3, 7), reed canary grass (PMU 2, 7), wild parsnip (PMU 7) and dogwoods (to a lesser extent). Brome grass and reed canary grass completely covered PMU1.

Discussion

This survey provides information of the current distribution of a set of problematic and invasive species at Herbert Hoover NHS. Eight invasive and problematic taxa appear to be of concern regarding their impact to the long-term viability of the reconstructed prairie habitat. Each are either found as single plants, localized populations, or large expanses in the prairie management units (PMU).

Bush honeysuckles (*Lonicera morrowii* & *tatarica*), white mulberry (*Morus alba*), and cherries/plums (*Prunus* spp.) were found in mainly scattered locations and not really developing into any expansive population. Cherry/plum trees appear to be mostly congregated in PMU 3 possibly as a result of bird dissemination downhill of a nearby fence.

There were several scattered locations (single trees) of dogwoods; these were also one of the most common taxa covering small patches, however no population covered >5% of any PMU.

Sweet clover (*Melilotus* spp.) was found in many single locations, was one of the most commonly occurring expanses, and covered at least 5% of the area in three PMUs. Both PMUs 2&3 had the largest expanses, populations that appeared to be vigorous - often to the exclusion of other invasive/exotic plants (see Figure 3) and native cover.

Reed canary grass was found only in large expanses; one of the most common taxa to cover a large expanse, it also covered at least 5% of the area in two PMUs. It was found primarily in swales and followed the drainage. PMU 1 was almost entirely covered with reed canary grass and brome. This PMU was never planted in native species, but allowed to become part of the natural area without management action. The PMU will undergo intensive management in 2004, consisting of prescribed fire, contact herbicide treatment, and planting with native seed. Brome grass and wild parsnip were also two of the most common species to occur in large expanses.

Conclusion

This survey establishes baseline patterns in the composition and distribution problematic and invasive plants at Herbert Hoover NHS. Following are some recommendations for future surveys and management.

PMU 1 This unit requires intensive restoration efforts. Prescribed fire and herbicide treatment will be necessary to control exotic grasses. Few native plants occur in this unit and it will need to be planted with native seed. Subsequent dormant season herbicide treatment may be necessary to control the cool season grasses and permit the establishment of warm season grasses.

PMU 2 This unit is a diverse mosaic of native species with several problem areas. Spot treatment of reed canary grass and shrubs must be continued. Prescribed fire should be continued on an odd year rotation.

PMU 3 This unit has a good mosaic of prairie plants, but the swale is developing reed canary grass areas that should be aggressively treated. Woody plants should be cut and stump treated. Prescribed fire should continue.

PMU 4 This unit has potential for serious intrusion of exotic invasive plants from the road right-or-way and must be closely watched. The few woody plants in this unit are becoming large and should be removed. Prescribed fire is the primary treatment, but spot treatment with herbicide may be necessary to control Canada thistle, crown vetch, and other potential invasive plants.

PMU 5 This unit is also subject to invasive encroachment and must be watched. Prescribed fire will continue to improve quality of native cover, but fire must be consistent. The 5a portion of the unit is covered in brome with only moderate native representation. This small section should be aggressively treated to remove excess woody plants and exotic grasses. Some trees will remain to provide a savanna-like cover.

PMU 6 This unit is a mosaic of native species, but has significant invasions of reed canary grass, white sweet clover, and other problem species. Prescribed fire and herbicide spot treatment after frost would control the invasion.

PMU 7 This unit has poor soil and recent disturbance. Some of the unit was never planted in native seed. The area should be burned, treated with contact herbicide in areas where brome and reed canary grass occur, woody plants cut and stump treated, and the area reseeded to a diverse mix of natives. This is a very visible location and a high forb seed mix would provide visual appeal.

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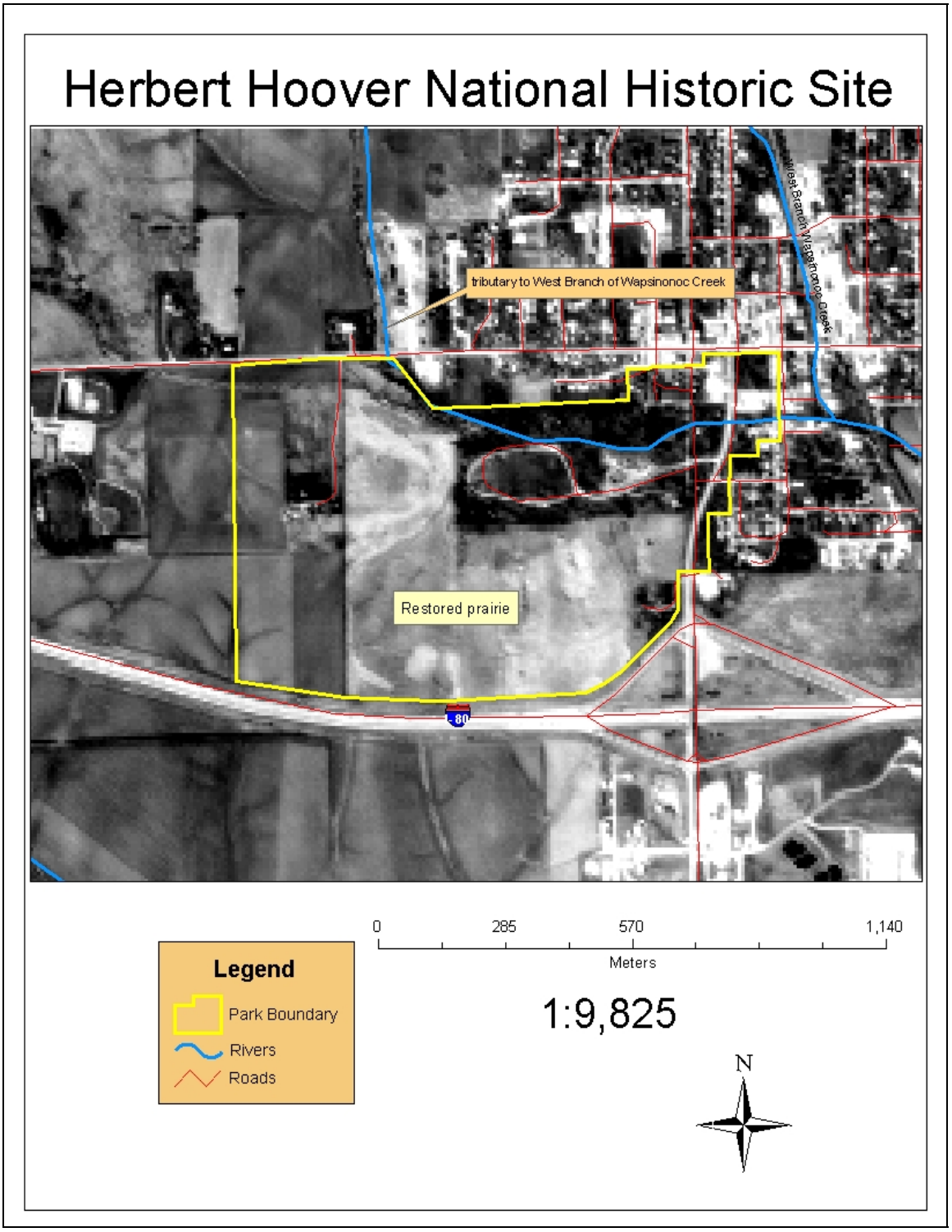

Figure 1. Location of Herbert Hoover NHS.

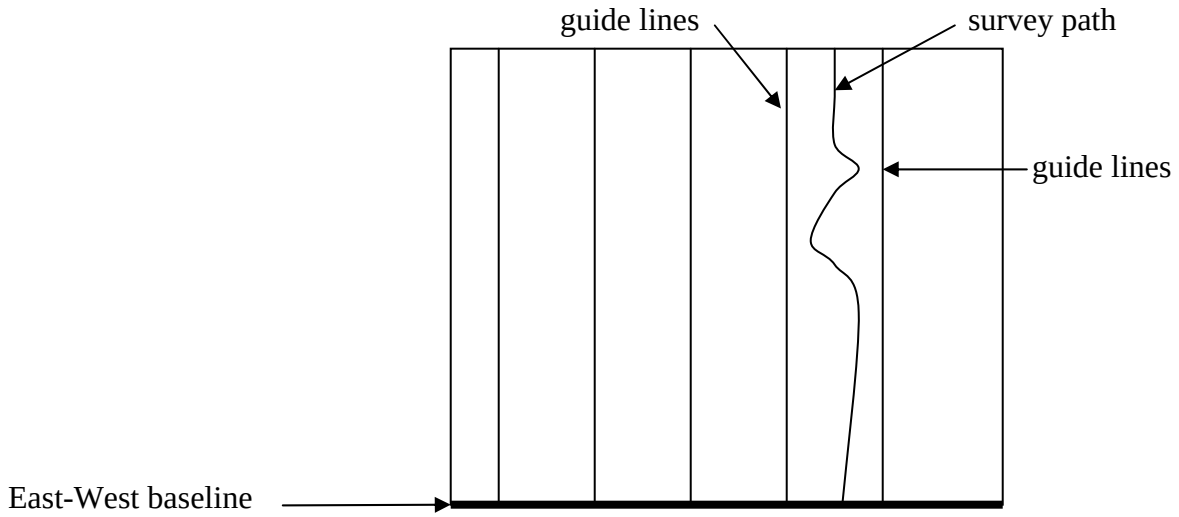

Figure 2. Diagram of survey technique at Herbert Hoover NHS.

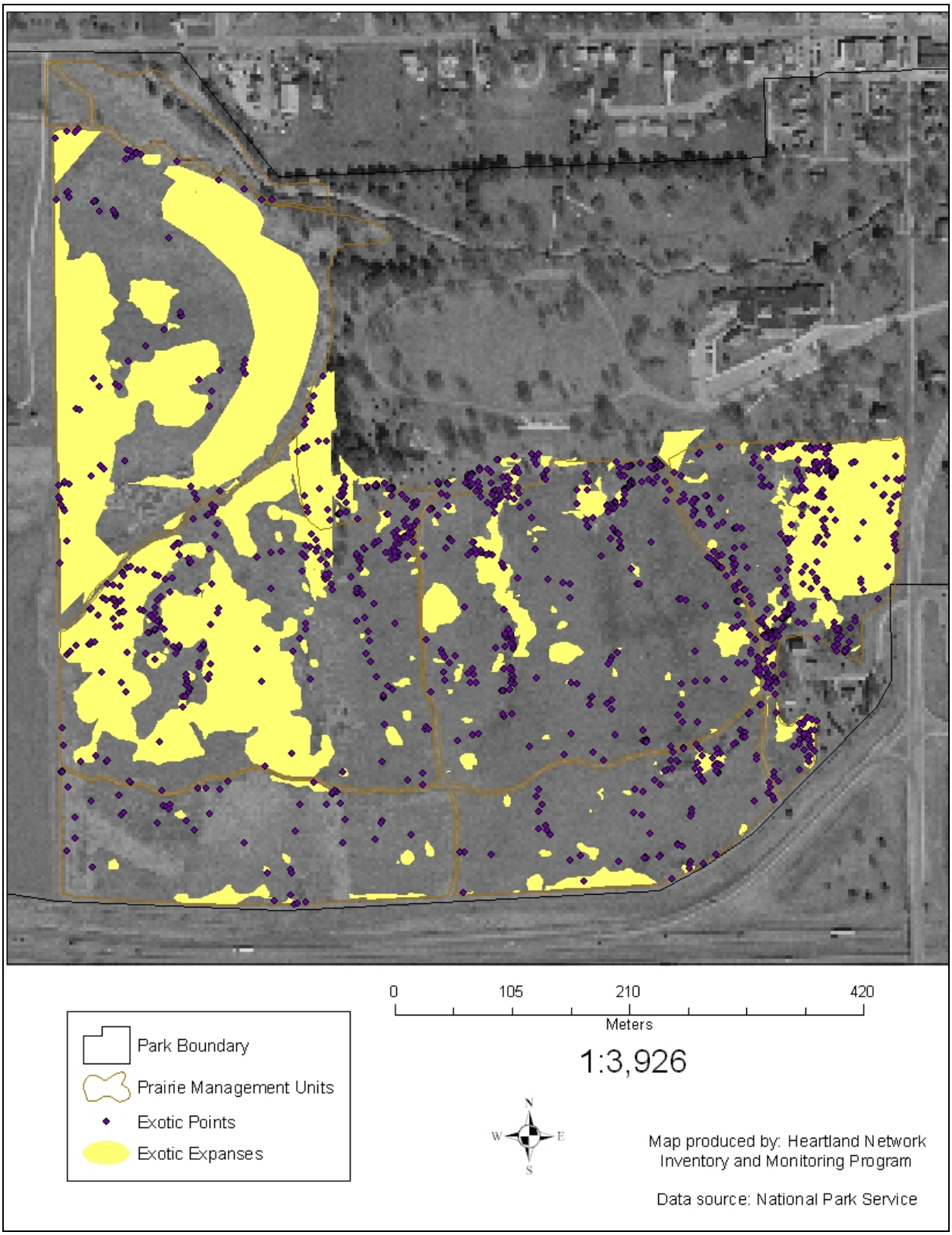

Figure 3. Location of infested sites within prairie management units at Herbert Hoover NHS.

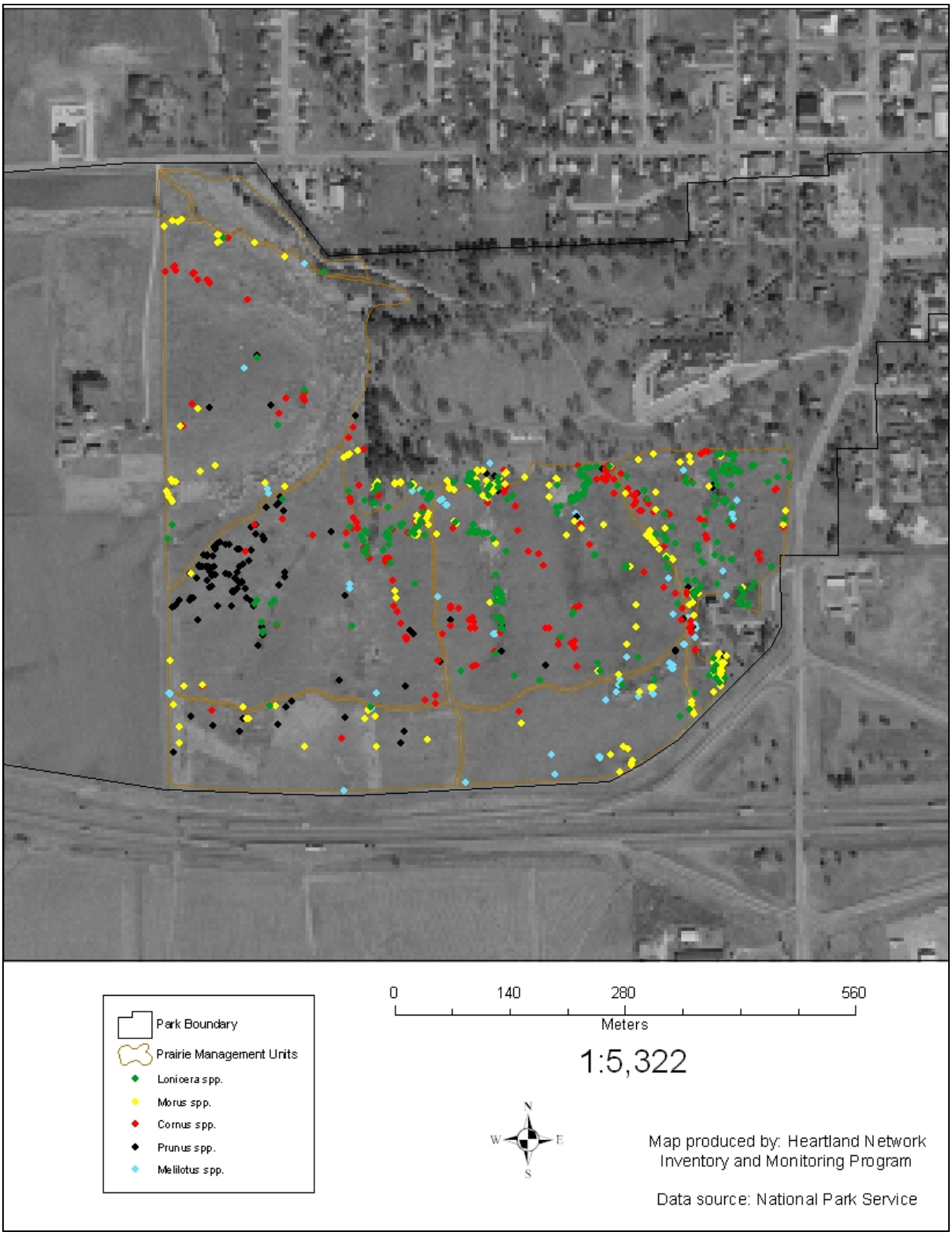

Figure 4. Location of the most common invasive plants at Herbert Hoover NHS.

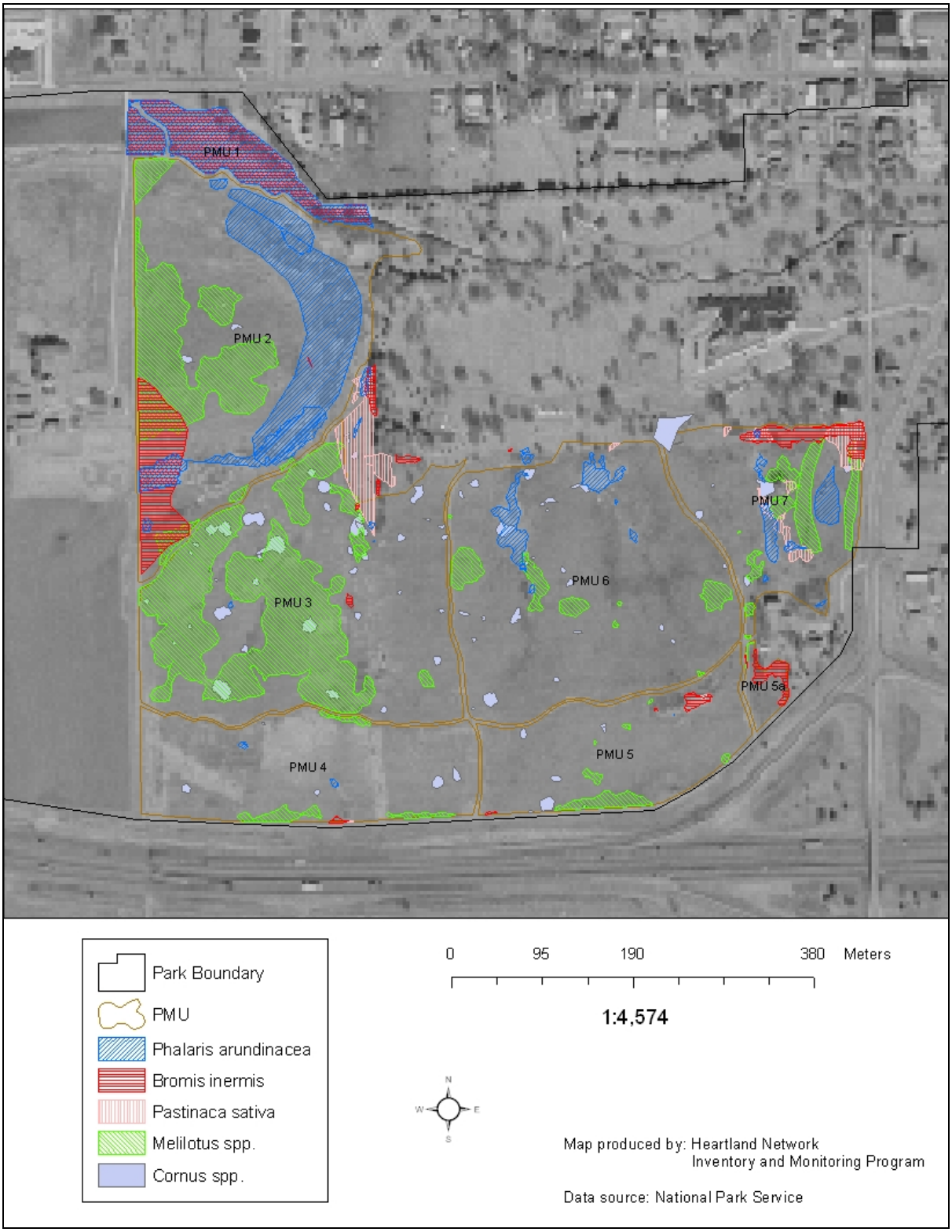

Figure 5. Location of the most extensive invasive plants at Herbert Hoover NHS.

Table 1. List of targeted invasive plants surveyed at Herbert Hoover National Historic Site.

Scientific Name	**Common Name**	**Family**
Abutilon theophrastii	Velvet leaf	Malvaceae
Barbarea vulgaris	Yellow rocket	Brassicaceae
Bromus inermis	Smooth brome	Poaceae
Calystegia sepium	Field bindweed	Convolvulaceae
Cirsium arvense	Canada thistle	Asteraceae
Cornus stolonifera	Red-osier dogwood	Cornaceae
Daucus carota	Queen Anne's lace	Apiaceae
Lactuca serriola	Prickly lettuce	Asteraceae
Lonicera tatarica	Tartarian honeysuckle	Caprifoliaceae
Lotus corniculatus	Bird's-foot trefoil	Fabaceae
Melilotus alba	White sweet clover	Fabaceae
Melilotus officinalis	Yellow sweet clover	Fabaceae
Morus alba	White mulberry	Moraceae
Pastinaca sativa	Wild parsnip	Apiaceae
Phalaris arundinacea	Reed canary grass	Poaceae
*Prunus americana	Wild plum	Rosaceae
*Prunus serotina	Black cherry	Rosaceae
*Prunus virginiana	Choke cherry	Rosaceae
Rosa multiflora	Multiflora rose	Rosaceae
Rubus cf. fondosus	Raspberry	Rosaceae
Ulmus pumila	Siberian elm	Ulmaceae

*indicates a native species considered invasive

Table 2. List of problematic and invasive plants found at Herbert Hoover NHS.

Scientific Name	Common Name	PMU	Status	Distribution
Acer negundo	Box elder	7	Problematic	Isolated
Arctium minus	Common burdock	7	Problematic/exotic	Isolated
Bromus inermis	Smooth brome	2*,3*,4*, 5*,5a*,6*,7*	Invasive/exotic	Extensive
Celtis occidentalis	Hackberry	7	Of concern	Isolated
Cercis canadensis	Eastern redbud	5a	Of concern	Isolated
Cirsium arvense	Canada thistle	5, 6*,7*	Invasive/exotic	Localized
Convolvulus arvensis	Field bindweed	4, 7	Problematic/exotic	Isolated
Cornus sp.	Dogwood	2, 3*, 4*, 5*, 5a,6*, 7*	Invasive	Extensive
Cornus racemosa	Gray dogwood	2*, 3*, 6*,7	Invasive	Extensive
Cornus stolonifera	Red-osier dogwood	2, 3, 4, 6*,7*	Invasive	Extensive
Coronilla varia	Purple crown-vetch	5	Invasive/exotic	Isolated
Daucus carota	Queen Anne's lace	5*, 7	Invasive/exotic	Isolated
Elaeagnus umbellata	Autumn olive	2, 3, 4, 5*, 5a, 7*	Problematic/exotic	Patchy
Euonymus sp.	Burningbush	7	Invasive/exotic	Isolated
Euonymus atropurpureus	Eastern wahoo	3*, 4, 7*	Invasive/exotic	Isolated
Fraxinus sp.	Ash	3	Of concern	Isolated
Juglans nigra	Black walnut	7	Of concern	Isolated
Lonicera sp.	Honeysuckle	5*,6*,7	Invasive/exotic	Extensive
Lonicera morrowii	Morrow's honeysuckle	7	Invasive/exotic	Extensive
Lonicera tatarica	Bush honeysuckle	2, 3*, 4, 5*, 5a, 7*	Invasive/exotic	Extensive
Lotus corniculatus	Birdsfoot trefoil	3*, 5, 7*	Invasive/exotic	Isolated
Malus sp.	Apple	7	Problematic/exotic	Isolated
Melilotus sp.	Sweetclover	5, 7	Invasive/exotic	Extensive
Melilotus alba	White sweetclover	2*, 3*, 4*, 5*, 5a*,6*, 7*	Invasive/exotic	Extensive
Melilotus officinalis	Yellow sweetclover	3, 5, 7*	Invasive/exotic	Extensive
Morus sp.	Mulberry	2	Invasive/exotic	Extensive
Morus alba	White mulberry	2*, 3, 4, 5*, 5a, 7	Invasive/exotic	Extensive
Pastinaca sativa	Wild parsnip	2*, 3*, 4*, 5*, 6*,7*	Invasive/exotic	Patchy

Table 2. List of problematic and invasive plants found at Herbert Hoover NHS (cont.).

Scientific Name	Common Name	PMU	Status	Distribution
Phalaris arundinacea	Rreed canary grass	2*,3*,4*, 5*,6*, 7*	Invasive/exotic	Extensive
Populus deltoides	Cottonwood	5, 7	Of concern	Isolated
Prunus sp.	Prunus	3, 4, 7*	Problematic	Patchy
Prunus Americana	American plum	3*, 7*	Problematic	Isolated
Prunus serotina	Black cherry	2, 3, 4, 5, 7	Problematic	Extensive
Prunus virginiana	Chokecherry	3, 4, 5a, 7	Problematic	Patchy
Rhamnus sp.	Buckthorn	7	Invasive/exotic	Isolated
Rhus sp.	Sumac	3*	Invasive	
Rhus glabra	Smooth sumac	3*, 5,6*, 7	Invasive	Localized
Rosa multiflora	Multiflora rose	3, 5, 7	Invasive/exotic	Extensive
Rubus sp.	Blackberry	3, 4*	Problematic	Isolated
Rumex crispus	Curly dock	4*	Problematic/exotic	Isolated
Salix sp.	Willow	5	Of concern (exotic and native species)	Isolated
Sambucus Canadensis	American elder	7	Of concern	Isolated
Spiraea sp.	Spirea	7	Of concern/exotic	Isolated
Syringa vulgaris	Common lilac	7	Of concern/exotic	Isolated
Ulmus pumila	Chinese elm	6*,7*	Invasive/exotic	Localized
Viburnum sp.	Viburnum	7	Problematic	Isolated

* = found in PMU as a large expanse
Invasive = agressively competes with and excludes prairie cover; usually exotic, but may be a native plant inconsistent with the prairie.
Problematic = potentially invasive, but can be controlled with maintenance level management.
Of concern = potential for invasion into prairie is uncertain at this time.

Table 3. List of the most common invasive and problematic plants (by point) at Herbert Hoover NHS.

Scientific Name	Common Name	Number	%
Lonicera tatarica	bush honeysuckle	297	25.4
Morus alba	white mulberry	201	17.2
Prunus serotina	black cherry	106	9.1
Cornus sp.	dogwood	97	8.3
Melilotus alba	white sweetclover	64	5.5
Ulmus pumila	Chinese elm	62	5.3
Cornus racemosa	gray dogwood	49	4.2
Pastinaca sativa	wild parsnip	41	3.5
Cornus stolonifera	red-osier dogwood	37	3.2
Rosa multiflora	multiflora rose	34	2.9
Elaeagnus umbellata	autumn olive	31	2.7
Prunus virginiana	chokecherry	15	1.3
Rhus glabra	smooth sumac	15	1.3
Daucus carota	Queen Anne's lace	11	0.9
Phalaris arundinacea	reed canarygrass	11	0.9
Juglans nigra	black walnut	9	0.8
Prunus sp.	prunus	9	0.8
Euonymus atropurpureus	eastern wahoo	6	0.5
Lotus corniculatus	birdsfoot trefoil	6	0.5
Prunus americana	American plum	6	0.5
Bromus inermis	smooth brome	5	0.4
Convolvulus arvensis	field bindweed	5	0.4
Cirsium arvense	Canada thistle	4	0.3
Lonicera morrowii	Morrow's honeysuckle	4	0.3
Melilotus officinalis	yellow sweetclover	4	0.3
Rubus sp.	blackberry	4	0.3
Syringa vulgaris	common lilac	4	0.3
Arctium minus	common burdock	3	0.3
Celtis occidentalis	hackberry	3	0.3
Melilotus sp.	sweetclover	3	0.3
Sambucus canadensis	american elder	3	0.3
Coronilla varia	purple crown-vetch	2	0.2
Euonymus sp.	burningbush	2	0.2
Populus deltoides	cottonwood	2	0.2
Acer negundo	box elder	1	0.1
Cercis canadensis	eastern redbud	1	0.1
Fraxinus sp.	ash	1	0.1
Lonicera sp.	honeysuckle	1	0.1
Morus sp.	mulberry	1	0.1
Rhamnus sp.	buckthorn	1	0.1
Rumex crispus	curly dock	1	0.1
Salix sp.	willow	1	0.1
Spiraea sp.	spirea	1	0.1
Viburnum sp.	viburnum	1	0.1

Table 4. List of taxa by prairie management unit, area covered, and % of unit taxon covers.

Scientific Name		PMU 2	PMU 3	PMU 4	PMU 5	PMU 5a	PMU 6	PMU 7
Bromus inermis	Ha	0.73	0.01	0.01	0.03	0.07	0.09	0.30
	%	0.09	<1	<1	1	25	1	10
Cirsium arvense	Ha						0.02	0.05
	%						<1	2
Cornus sp.	Ha		0.17	0.03	0.04		0.11	0.05
	%		2	1	1		2	2
Cornus racemosa	Ha	0.01	0.13				0.07	
	%	<1	2				1	
Cornus stolonifera	Ha						0.01	0.01
	%						<1	<1
Daucus carota	Ha				<1			
	%				<1			
Elaeagnus umbellata	Ha				0.01			0.01
	%				<1			<1
Euonymus atropurpureus	Ha		<1					0.01
	%		<1					<1
Lonicera spp.	Ha				<1		0.01	
	%				<1		<1	
Lonicera tatarica	Ha		<1		0.01			0.04
	%		<1		<1			1
Lotus corniculatus	Ha		<1					1.10
	%		<1					37
Melilotus alba	Ha	1.68	2.95	0.12	0.13	<1	0.30	0.41
	%	22	39	3	4	1	4	14
Melilotus officinalis	Ha							18
	%							6
Morus alba	Ha	<1			0.02			
	%	<1			1			
Pastinaca sativa	Ha	0.01	0.07	<1	<1		<1	0.23
	%	<1	1	<1	<1		<1	8
Phalaris arundinacea	Ha	2.13	0.01	0.01	<1		0.24	0.20
	%	28	<1	<1	<1		3	7
Prunus spp.	Ha							<1
	%							<1
Prunus americana	Ha		0.01					0.06
	%		<1					2
Rhus glabra	Ha		0.01				0.01	
	%		<1				<1	
Rubus sp.	Ha			<1				
	%			<1				
Rumex crispus	Ha			<1				
	%			<1				
Ulmus pumila	Ha						0.01	0.13
	%						<1	4