

National Park Service  
U.S. Department of the Interior

Natural Resource Program Center  
Fort Collins, Colorado



## Invasive Exotic Plant Monitoring at Tallgrass Prairie National Preserve: Year 1 (2006)

Natural Resource Technical Report NPS/HTLN/NRTR—2007/014  
NPS D-31



**ON THE COVER**

Autumnal prairies at Tallgrass Prairie National Preserve in the Flint Hills of Kansas.

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March 2007

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## **Acknowledgements**

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## **Executive Summary**

During surveys in 2006, we documented 16 invasive, exotic plant species on Tallgrass Prairie National Preserve. Six of these exotic plant species were not previously documented as occurring on the park based on NPSpecies, the service-wide database for plant information. Smooth brome, the most abundant invasive plant at Tallgrass Prairie National Preserve, covered between 106 and 226 acres. The grass occurred primarily in improved pasture. Out of the 16 invasive plants, 12 plants occupied less than one acre. In general, invasive, exotic plants are not a major problem at the preserve. 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 Tallgrass Prairie National Preserve.** 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. *Sericea lespedeza* (*Lespedeza cuneata*) was documented at Tallgrass Prairie in 2006. The invasion was relatively small.
2. Caucasian bluestem (*Bothriochloa bladhii*) was planted to control erosion and is known from pond dams and developed areas at the park.
3. The park is restoring a large field on the eastern side of the park that was planted in smooth brome (*Bromus inermis*).
4. Disturbance associated with roads, trails, and, possibly, cattle feeding areas may facilitate the invasion of exotic plants.

## Methods

**Watch lists.** The invasive exotic plants on three watch lists were sought during monitoring (Table 1). Invasive exotic plants not known to occur on the park based on NPSpecies (the national NPS database for plant occurrence registration) constitute the early detection watch list. Invasive exotic plants known to occur on the park based on NPSpecies constitute the park-established watch list. Invasive exotic plants from the park-based watch list included plants selected by park managers or network staff which may not have been included on the other lists due to incomplete information in NPSpecies (e.g., not documented) or USDA Plants (e.g., state distribution information inaccurate) databases or due to differing opinions regarding network designation of a plant as a high priority. While aquatic species are listed on the watch lists, terrestrial plants were the focus of this survey. Aquatic plants were documented occasionally.

**Field methods.** Invasive exotic plant species on designated watch lists (Table 1) were sought in high priority areas on Tallgrass Prairie National Preserve (Figure 1). Dan Tenaglia, the contract botanist for this project, used a Thales GPS unit to navigate along 400 m line transects, identified invasive exotic plants in an approximately 6-m belt, and attributed a coarse cover value to each species (0=0, 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1000-4999.9 m<sup>2</sup>, 8=5000-9999.9 m<sup>2</sup>, and 9=10,000-14999.9 m<sup>2</sup>). A total of 301 transects were surveyed at Tallgrass Prairie National Preserve. Of these, 274 transects were 400 m in length, while 27 were clipped by the park boundary. The observer had discretion to search a larger belt if feasible, to search additional areas up to a 200 m perpendicular distance from the transect, to target locations likely to support exotic plants (e.g., field edges, roads), and to circumvent extremely difficult or hazardous terrain when needed. However, in most cases, the observer maintained the established line transect. Cover was estimated for all plants observed while navigating along the transect (i.e., not restricted to the 6-m belt).

**Analytical methods.** Data analysis involved simple displays, as well as calculation of plant frequency and cover. The invasive exotic plants encountered on Tallgrass Prairie National Preserve were attributed to line transects in a GIS. Polygons surrounding occupied line transects were highlighted on maps for each invasive exotic plant encountered (Figures 3 – 18). Note that entire polygons were not fully searched. The park-wide frequency of invasive exotic plants was calculated as the percentage of occupied transects. A park-wide cover range was estimated using the high and low values of the cover classes for each invasive exotic plant encountered, assuming that 3 % of the park was searched and that the areas searched were representative of the entire park. As a check on our estimates, we also estimated the extent of smooth brome (*Bromus inermis*) with a mapping approach (Figure 2). Because smooth brome is largely restricted to improved pastures at Tallgrass Prairie National Preserve, mapping these pastures provided a relatively accurate estimate of its extent.

**Invasiveness ranks.** In order to provide additional information on the ecological impact and feasibility of control, the ecological impact and general management difficulty sub-ranks that constitute the invasiveness rank (I-rank), as determined by NatureServe (Morse et al. 2004), were listed when available. The ecological impact characterizes the effect of the plant on ecosystem processes, community composition and structure, native plant and animal populations, and the conservation significance of threatened biodiversity. General management difficulty ranks are

assigned based on the resources and time generally required to control a plant, the non-target effects of control on native populations, and the accessibility of invaded sites. 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 16 invasive exotic plant taxa were found during the survey at Tallgrass Prairie National Preserve (Table 2). Of these plants, seven taxa were known to occur on the park based on the NPSpecies database. Three plants not designated as high priority species by the network were added to the watch list based on the survey: bald brome (*Bromus racemosus*), buffalobur nightshade (*Solanum rostratum*), and the invasive native eastern redcedar (*Juniperus virginiana*). The species identified on the early detection list will be entered in NPSpecies and should subsequently be included on the park-established watch list.

The distribution and abundance of the invasive exotic plant species at Tallgrass Prairie National Preserve varied widely. One species was moderately widespread and abundant with cover between 106 and 226 acres: smooth brome. However, smooth brome (*Bromus inermis*) was restricted to or near areas where the grass was intentionally planted. Bald brome was more widespread, but only occupied between five and 28 acres on the park. The most widely distributed exotic plant, buffalobur nightshade, only occupied less than three acres and is weedy, but not highly invasive. Johnsongrass (*Sorghum halepense*) was moderately widespread and abundant, occurring primarily in improved pasture. Twelve species occupied less than one acre and were encountered with a relatively low frequency.

After mapping the improved pastures (Figure 2), we estimated that smooth brome dominated 518 acres on Tallgrass Prairie National Preserve. This estimate most accurately characterizes the extent of smooth brome on the preserve, especially for the purposes of restoration planning. The variance of this estimate with the sampling estimate of 106 to 226 acres suggests that the sampling estimate may be off by some factor. This difference likely arises from a combination of sampling error, measurement error, and scaling error. The difference may also reflect a difference in definitions: the sampling approach tries to estimate only the area covered by smooth brome within pastures.

No species were noted as having unambiguously high ecological impact. Narrowleaf cattail (*Typha angustifolia*) and black locust (*Robinia pseudoacacia*) may have a high ecological impact (Table 2). Seven species were characterized as having a medium or medium-low ecological impact. Johnsongrass and spotted knapweed were noted as being potentially difficult to manage, while management difficulty was medium or less for the remaining species.

In summary, this report provides information on invasive, exotic plant abundance and distribution as well as ecological impacts and management difficulty 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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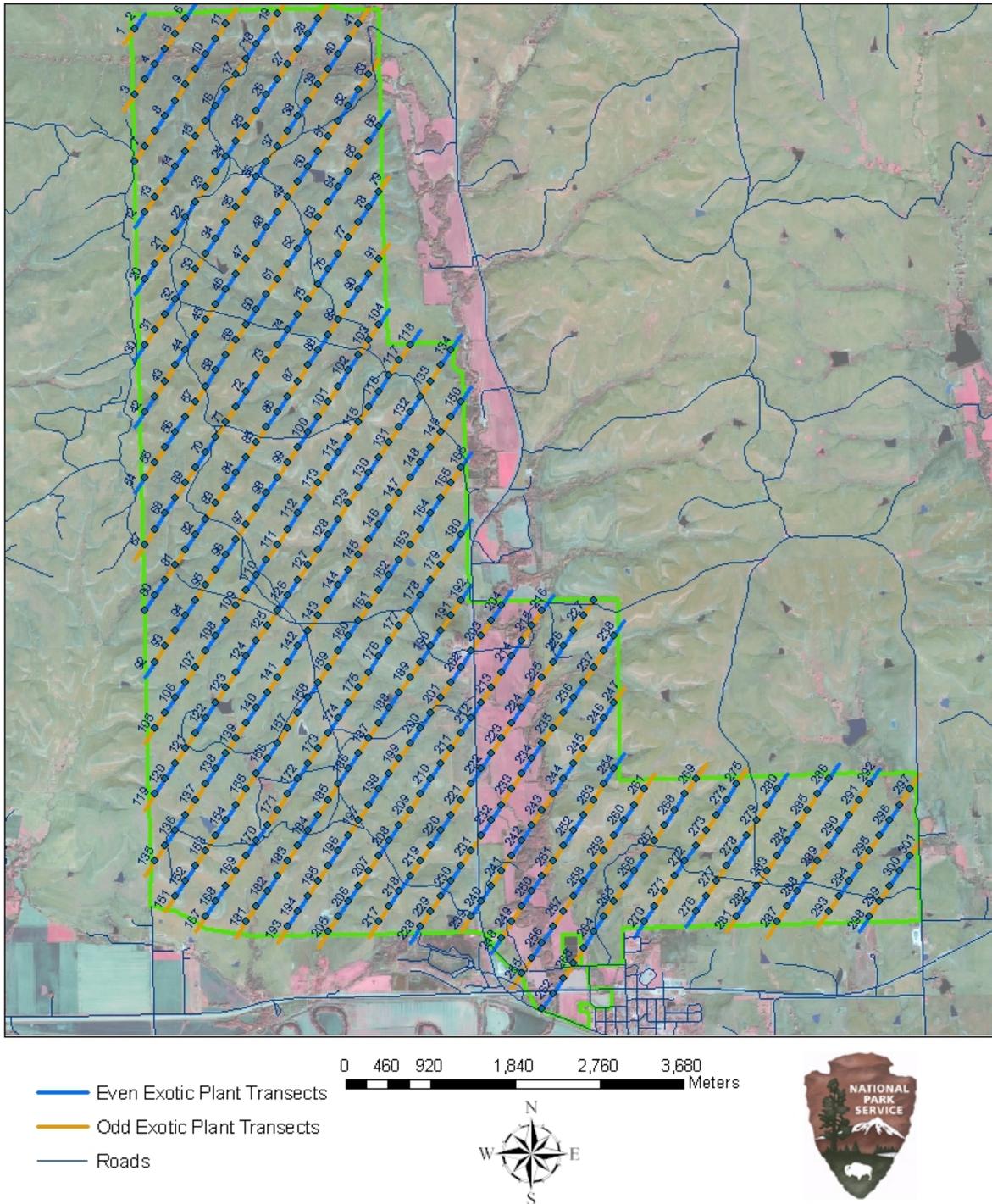
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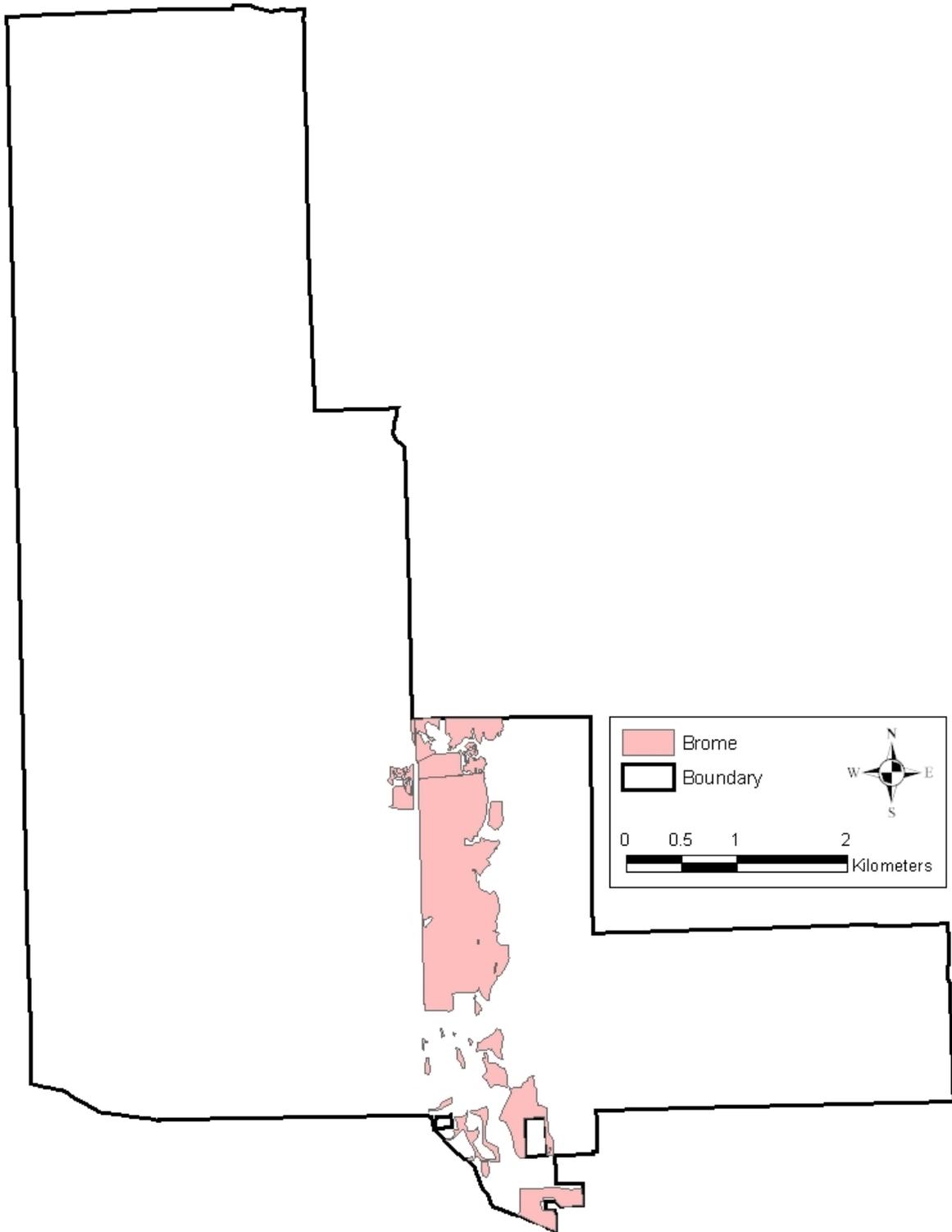
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# Tallgrass Prairie National Preserve Exotic Plant Search Line Transects



**Figure 1. Invasive exotic plant line transects at Tallgrass Prairie National Preserve. The blue (even numbered) and orange (odd numbered) transects indicate the search locations for invasive exotic plants in 2006.**



**Figure 2.**Smooth brome (*Bromus inermis*) locations at Tallgrass Prairie National Preserve. Total acreage of smooth brome is estimated as 518 acres.

**Table 1. Watch lists for Tallgrass Prairie National Preserve**

Early Detection Watch List		Park-Established Watch List		Park-Based Watch List	
<i>Ailanthus altissima</i>	Tree of heaven	<i>Alliaria petiolata</i>	Garlic mustard	<i>Bassia scoparia</i>	Burningbush
<i>Alnus glutinosa</i>	European alder	<i>Arctium minus</i>	Lesser burdock	<i>Bromus racemosus</i>	Bald brome
<i>Arundo donax</i>	Giant reed	<i>Bromus inermis</i>	Smooth brome	<i>Cirsium arvense</i>	Canada thistle
<i>Azolla</i>	Mosquitofern	<i>Bromus tectorum</i>	Cheatgrass	<i>Juniperus virginiana</i>	Eastern redcedar
<i>Berberis thunbergii</i>	Japanese barberry	<i>Carduus nutans</i>	Nodding plumeless thistle	<i>Solanum rostratum</i>	Buffalobur nightshade
<i>Bothriochloa bladhii</i>	Caucasian bluestem	<i>Holcus lanatus</i>	Common velvetgrass		
<i>Centaurea solstitialis</i>	Yellow star-thistle	<i>Melilotus officinalis</i>	Yellow sweetclover		
<i>Centaurea stoebe ssp. micranthos</i>	Spotted knapweed	<i>Morus alba</i>	White mulberry		
<i>Cirsium vulgare</i>	Bull thistle	<i>Poa pratensis</i>	Kentucky bluegrass		
<i>Cynanchum louiseae</i>	Louise's swallow-wort	<i>Robinia pseudoacacia</i>	Black locust		
<i>Dactylis glomerata</i>	Orchardgrass	<i>Rosa multiflora</i>	Multiflora rose		
<i>Dioscorea oppositifolia</i>	Chinese yam	<i>Sorghum halepense</i>	Johnsongrass		
<i>Dipsacus fullonum</i>	Fuller's teasel	<i>Ulmus pumila</i>	Siberian elm		
<i>Dipsacus laciniatus</i>	Cutleaf teasel	<i>Verbascum thapsus</i>	Common mullein		
<i>Egeria densa</i>	Brazilian waterweed				
<i>Elaeagnus angustifolia</i>	Russian olive				
<i>Elaeagnus umbellata</i>	Autumn olive				
<i>Euonymus fortunei</i>	Winter creeper				
<i>Euphorbia esula</i>	Leafy spurge				
<i>Glechoma hederacea</i>	Ground ivy				
<i>Hesperis matronalis</i>	Dames rocket				
<i>Humulus japonicus</i>	Japanese hop				
<i>Lespedeza bicolor</i>	Shrub lespedeza				
<i>Lespedeza cuneata</i>	Sericea lespedeza				
<i>Lonicera japonica</i>	Japanese honeysuckle				
<i>Lonicera maackii</i>	Amur honeysuckle				
<i>Lonicera tatarica</i>	Tatarian honeysuckle				
<i>Lotus corniculatus</i>	Bird's-foot trefoil				
<i>Lotus glaber</i>	Narrow-leaf bird's-foot trefoil				
<i>Lysimachia nummularia</i>	Creeping jenny				

**Table 1. Watch lists for Tallgrass Prairie National Preserve (cont.)**

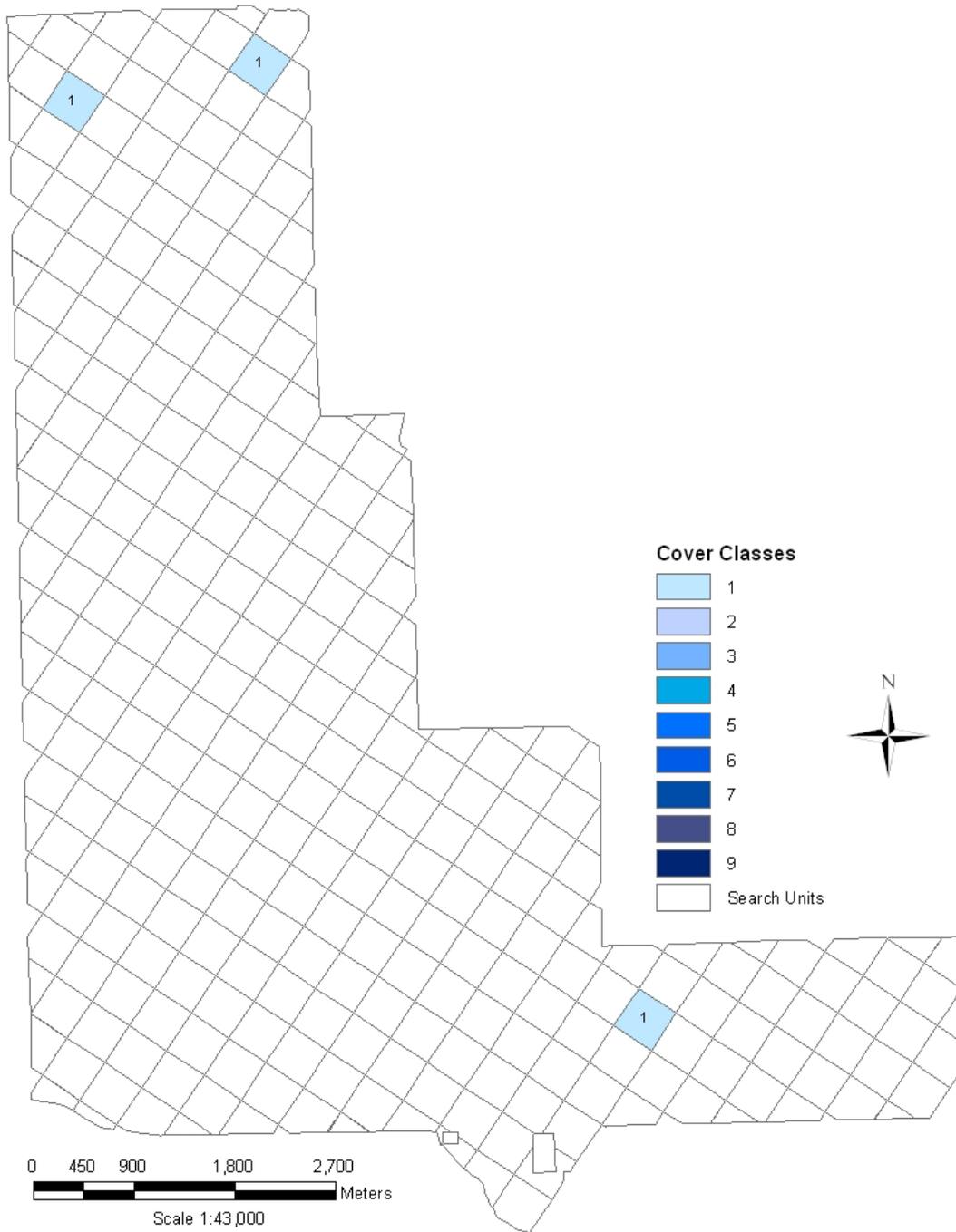
Early Detection Watch List		Park-Established Watch List		Park-Based Watch List	
<i>Lythrum salicaria</i>	Purple loosestrife				
<i>Myriophyllum aquaticum</i>	Parrot feather watermilfoil				
<i>Pastinaca sativa</i>	Wild parsnip				
<i>Phalaris arundinacea</i>	Reed canarygrass				
<i>Phragmites australis</i>	Common reed				
<i>Plantago lanceolata</i>	Narrowleaf plantain				
<i>Poa compressa</i>	Canada bluegrass				
<i>Polygonum cuspidatum</i>	Japanese knotweed				
<i>Populus alba</i>	White poplar				
<i>Potamogeton crispus</i>	Curly pondweed				
<i>Potentilla recta</i>	Sulphur cinquefoil				
<i>Pueraria montana var. lobata</i>	Kudzu				
<i>Pyrus calleryana</i>	Callery pear				
<i>Rhamnus cathartica</i>	Common buckthorn				
<i>Schedonorus phoenix</i>	Tall fescue				
<i>Schedonorus pratensis</i>	Meadow fescue				
<i>Securigera varia</i>	Crownvetch				
<i>Solanum dulcamara</i>	Climbing nightshade				
<i>Tamarix ramosissima</i>	Saltcedar				
<i>Torilis arvensis</i>	Spreading hedgeparsley				
<i>Torilis japonica</i>	Erect hedgeparsley				
<i>Typha angustifolia</i>	Narrowleaf cattail				
<i>Vinca minor</i>	Common periwinkle				

**Table 2. Overview of invasive exotic plants found on Tallgrass Prairie National Preserve. Ecological impact and general management difficulty based on NatureServe I-Rank subranks, Morse et al. 2004. Subranks are given as high (H), medium (M), low (L), insignificant (I), unknown (U), a range of ranks (indicated by /), or not available (--).**

Scientific Name	Common Name	Watch list	Park-wide cover (acres)	Frequency (percent)	Ecological impact	Management difficulty
<i>Bromus inermis</i>	Smooth brome	Park-established	106.2 – 225.5	7.0	M	ML
<i>Bromus racemosus</i>	Bald brome	Add to park-based	11.6 – 56.2	14.0	----	----
<i>Sorghum halepense</i>	Johnson grass	Park-established	0.9 – 3.7	4.0	ML	HM
<i>Solanum rostratum</i>	Buffalobur nightshade	Add to park-based	0.3 – 2.9	22.6	----	----
<i>Schedonorus</i> spp.	Fescue species	Add to park-based	< 1.0	1.0	----	----
<i>Alliaria petiolota</i>	Garlic mustard	Park-established	< 0.75	1.7	ML	M
<i>Robinia pseudoacacia</i>	Black locust	Park-established	< 0.5	0.3	HM	M
<i>Juniperus virginiana</i>	Eastern redcedar	Park-based	< 0.5	2.3	----	----
<i>Morus alba</i>	White mulberry	Park-established	< 0.5	1.0	ML	ML
<i>Pyrus calleryana</i>	Callery pear	Early detection	< 0.5	0.3	LI	ML
<i>Torilis japonica</i>	Erect hedgeparsley	Early detection	< 0.5	2.3	----	----
<i>Typha angustifolia</i>	Narrowleaf cattail	Early detection	< 0.25	1.0	HM	M
<i>Cirsium vulgare</i>	Bull thistle	Early detection	< 0.25	1.0	ML	ML
<i>Melilotus officinalis</i>	Sweetclover	Park-established	< 0.1	0.7	M	M
<i>Arctium minus</i>	Lesser burdock	Park-established	< 0.1	1.0	LI	MI
<i>Centaurea stoebe</i> ssp. <i>micranthos</i>	Spotted knapweed	Early detection	< 0.01	0.3	M	HL

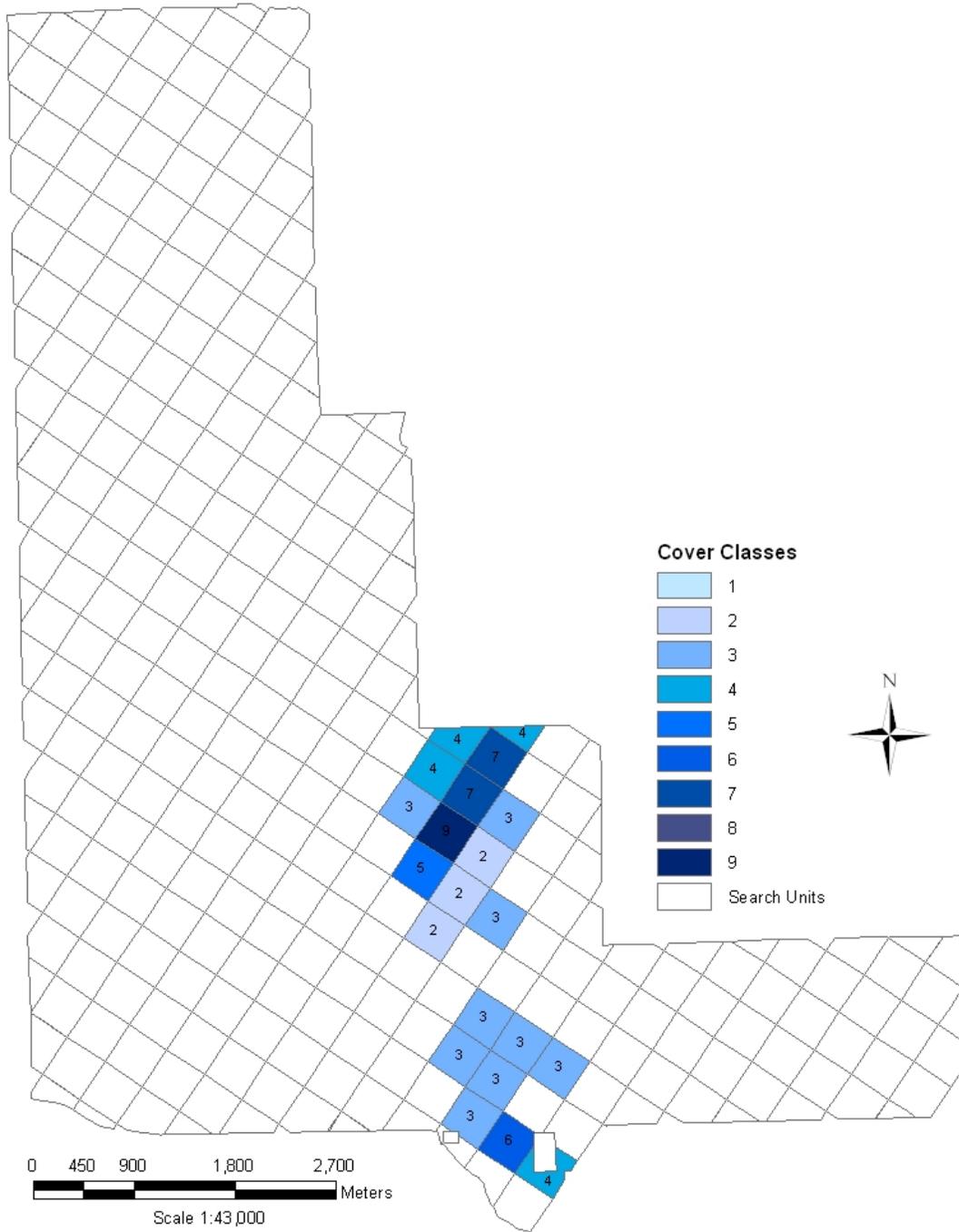


## *Arctium minus* - 2006



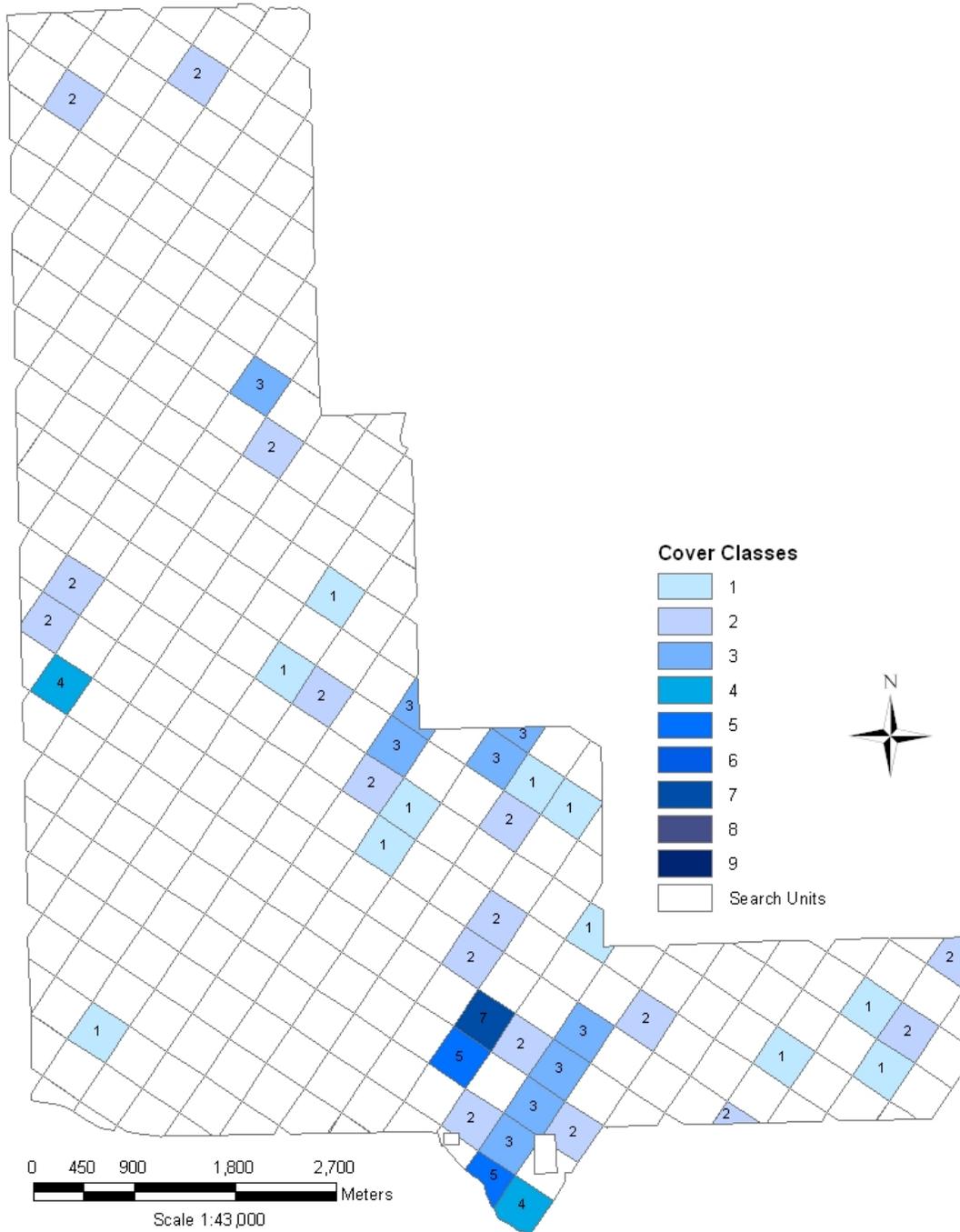
**Figure 4. Abundance and distribution of *Arctium minus* (lesser burdock) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## Bromus inermis - 2006



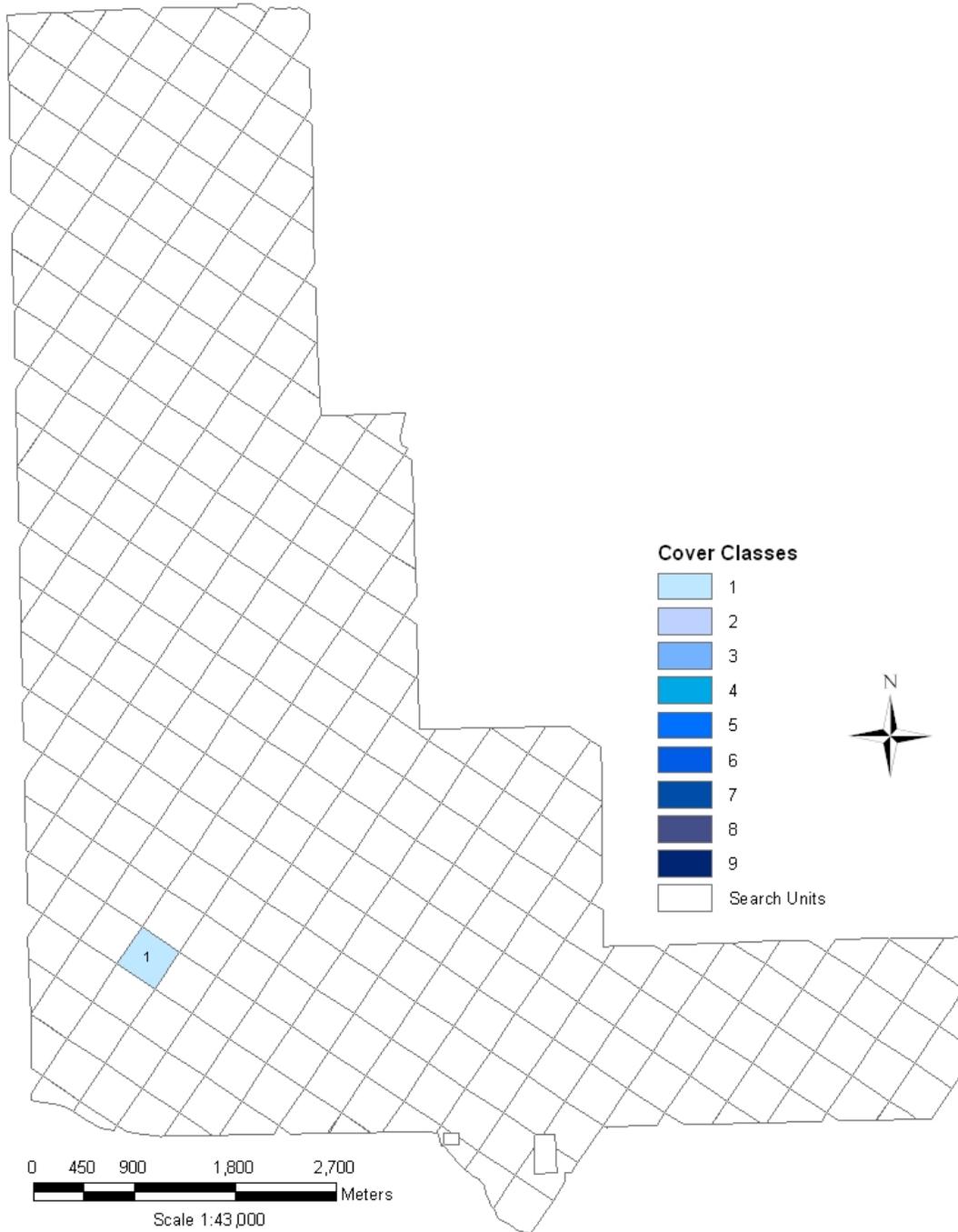
**Figure 5. Abundance and distribution of *Bromus inermis* (smooth brome) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## Bromus racemosus - 2006



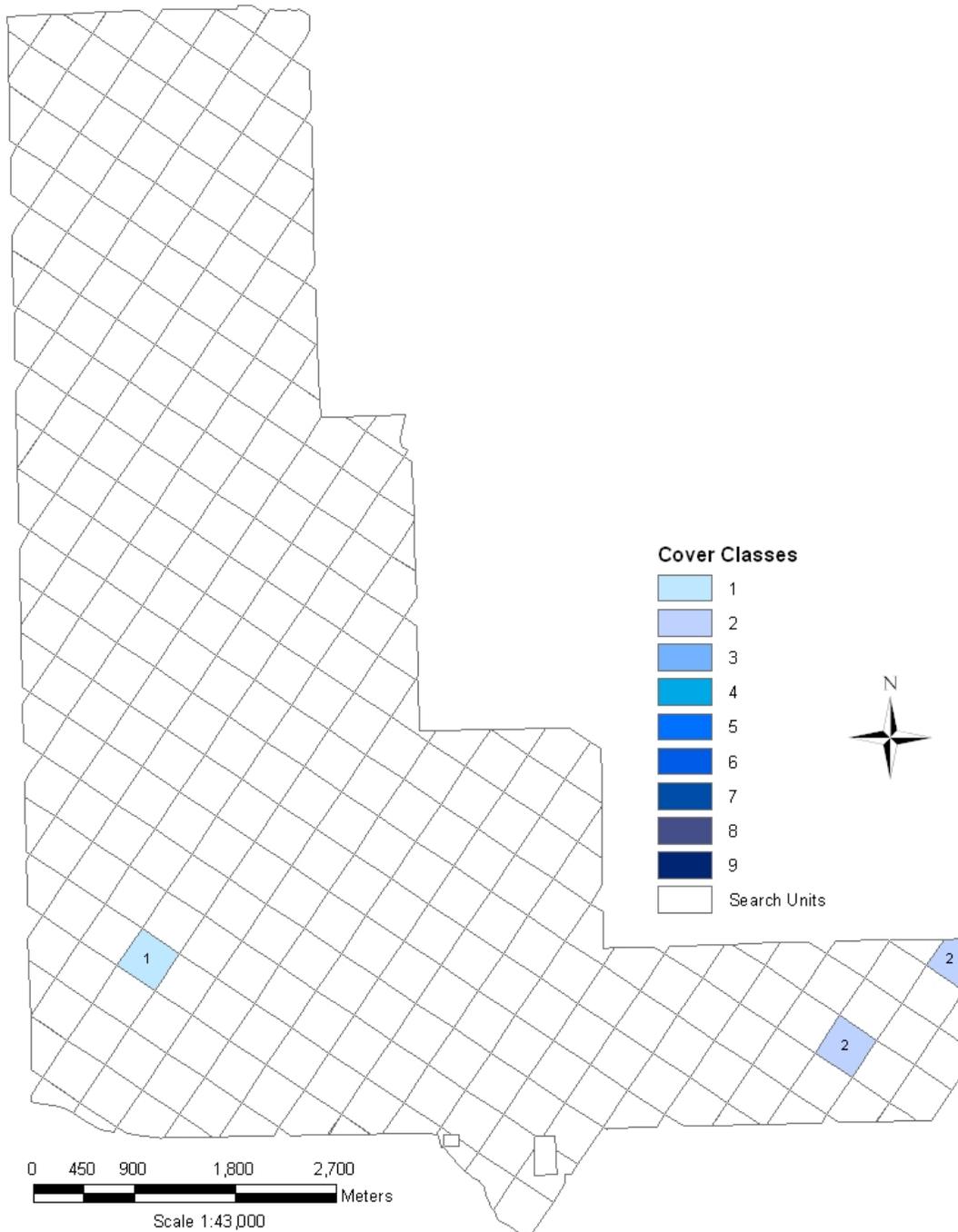
**Figure 6. Abundance and distribution of *Bromus racemosus* (bald brome) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## *Centaurea stoebe ssp micranthos* - 2006



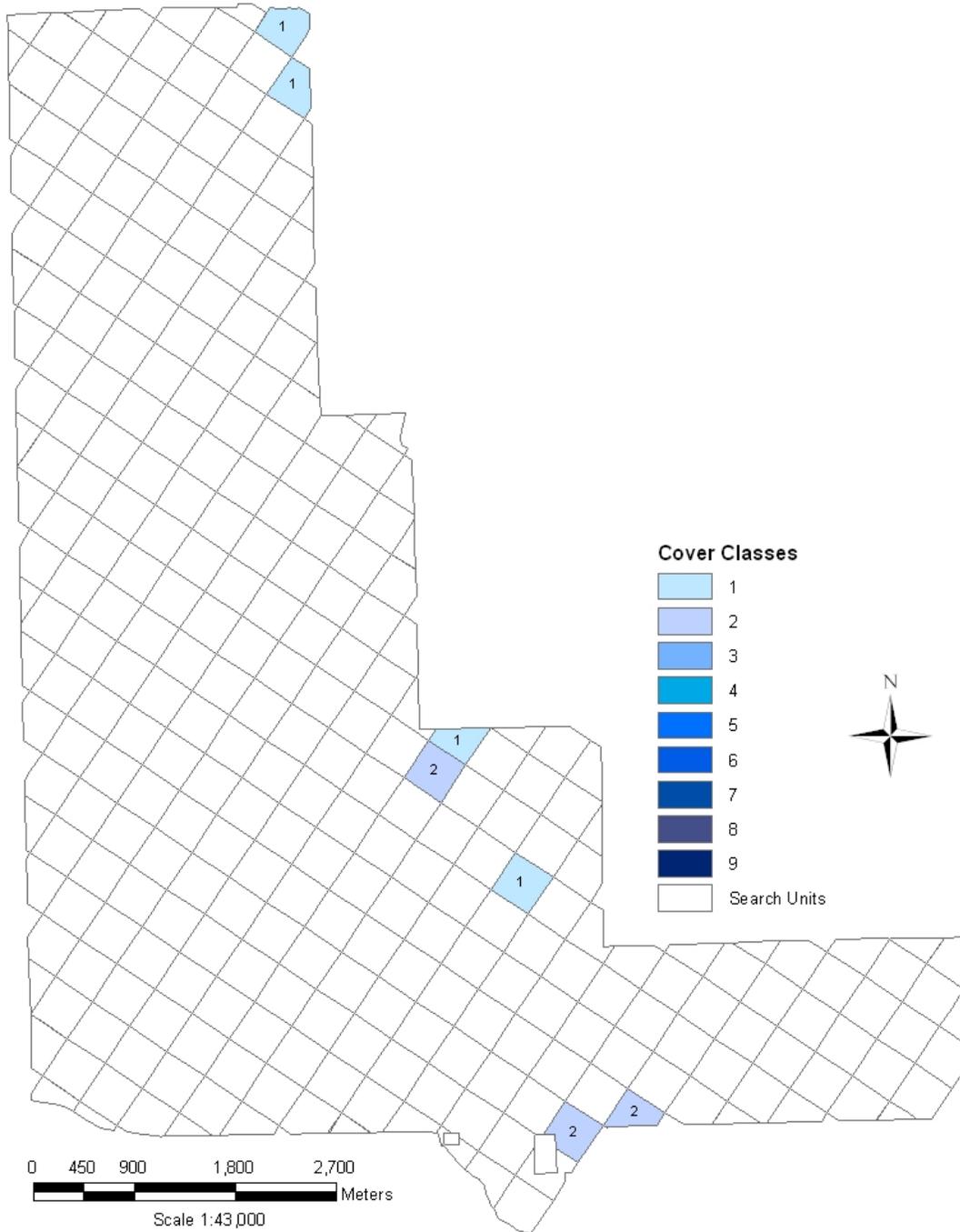
**Figure 7. Abundance and distribution of *Centaurea stoebe ssp. micranthos* (spotted knapweed) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## *Cirsium vulgare* - 2006



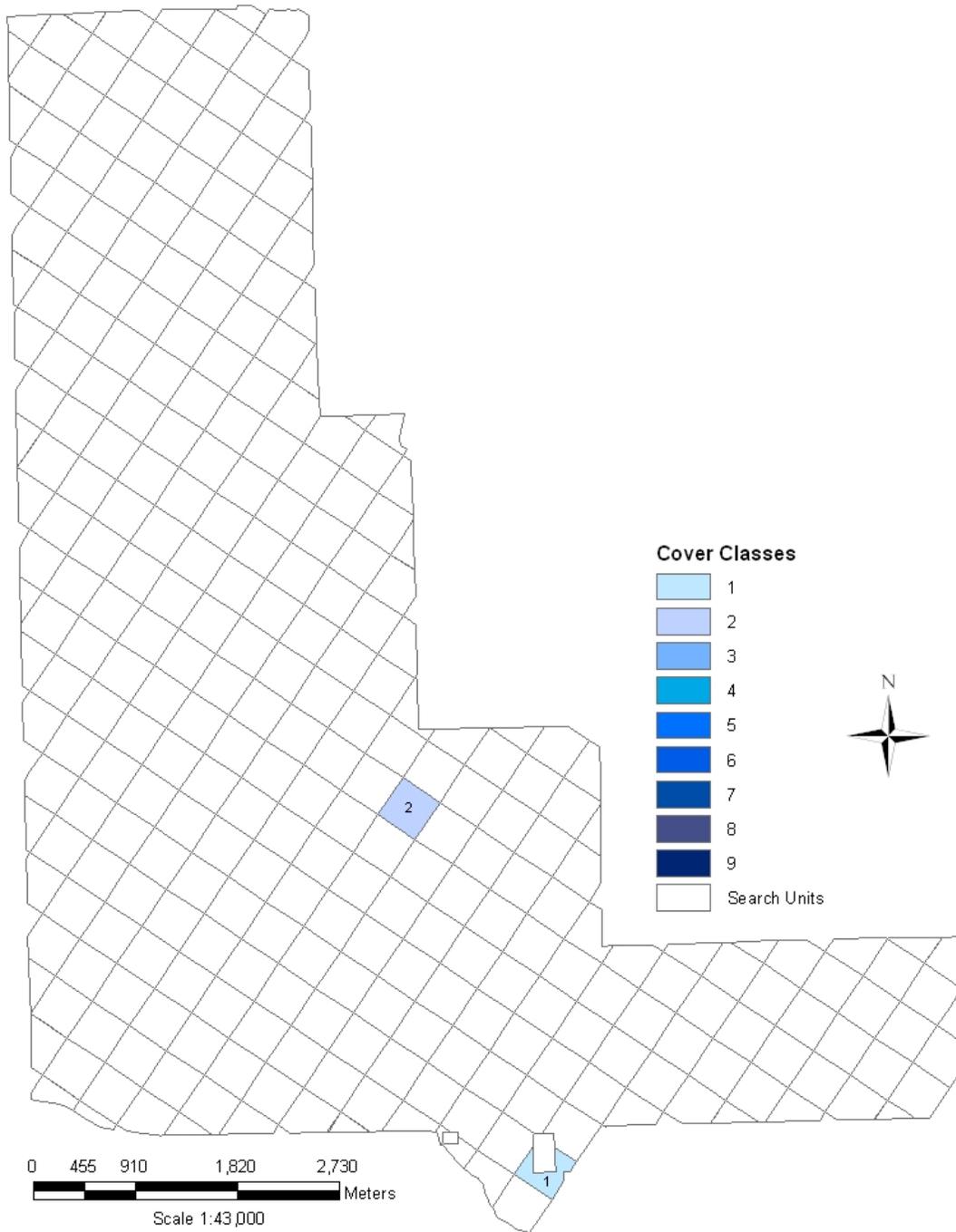
**Figure 8. Abundance and distribution of *Cirsium vulgare* (bull thistle) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## *Juniperus virginiana* - 2006



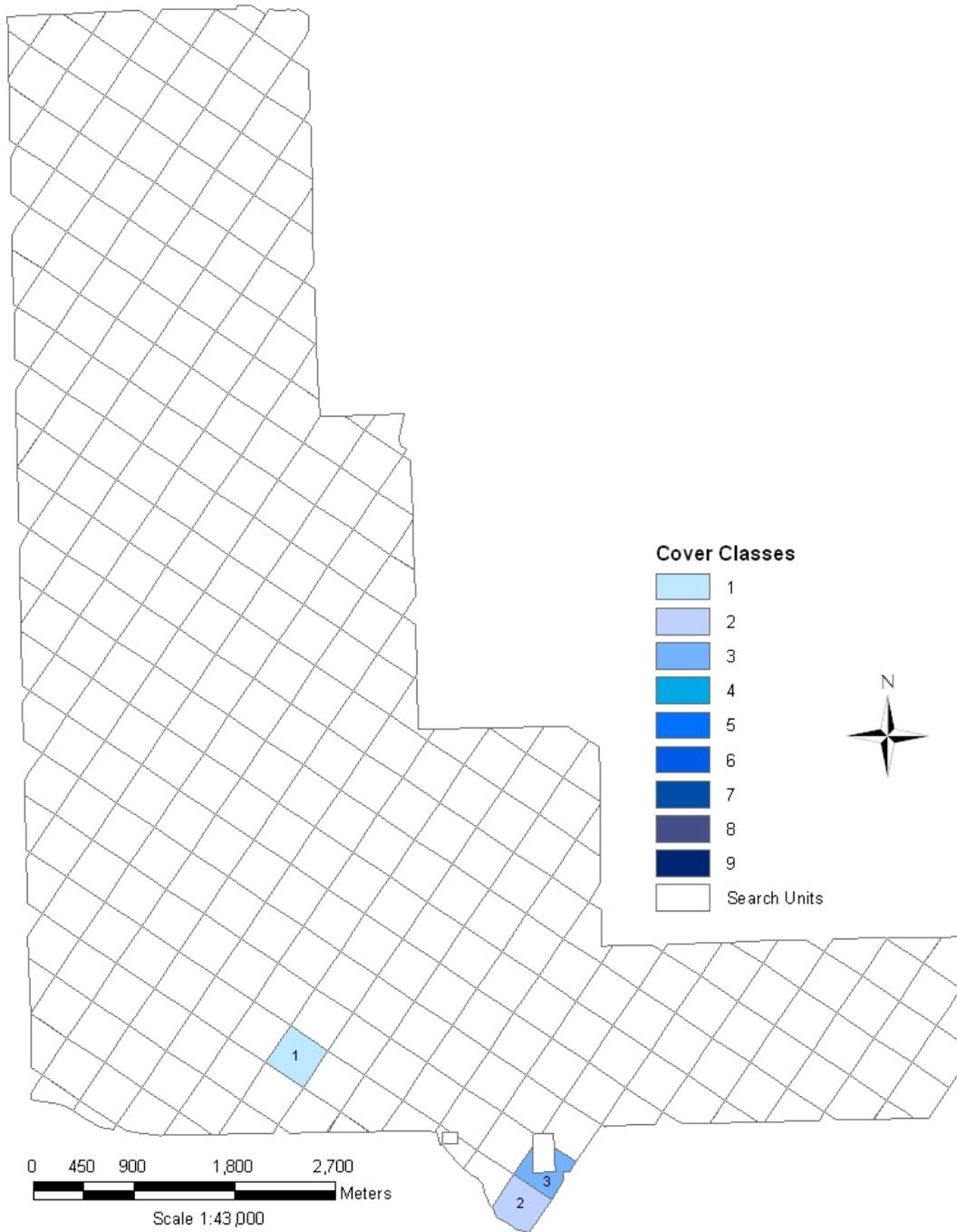
**Figure 9. Abundance and distribution of *Juniperus virginiana* (Eastern redcedar) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## Melilotus officinalis - 2006



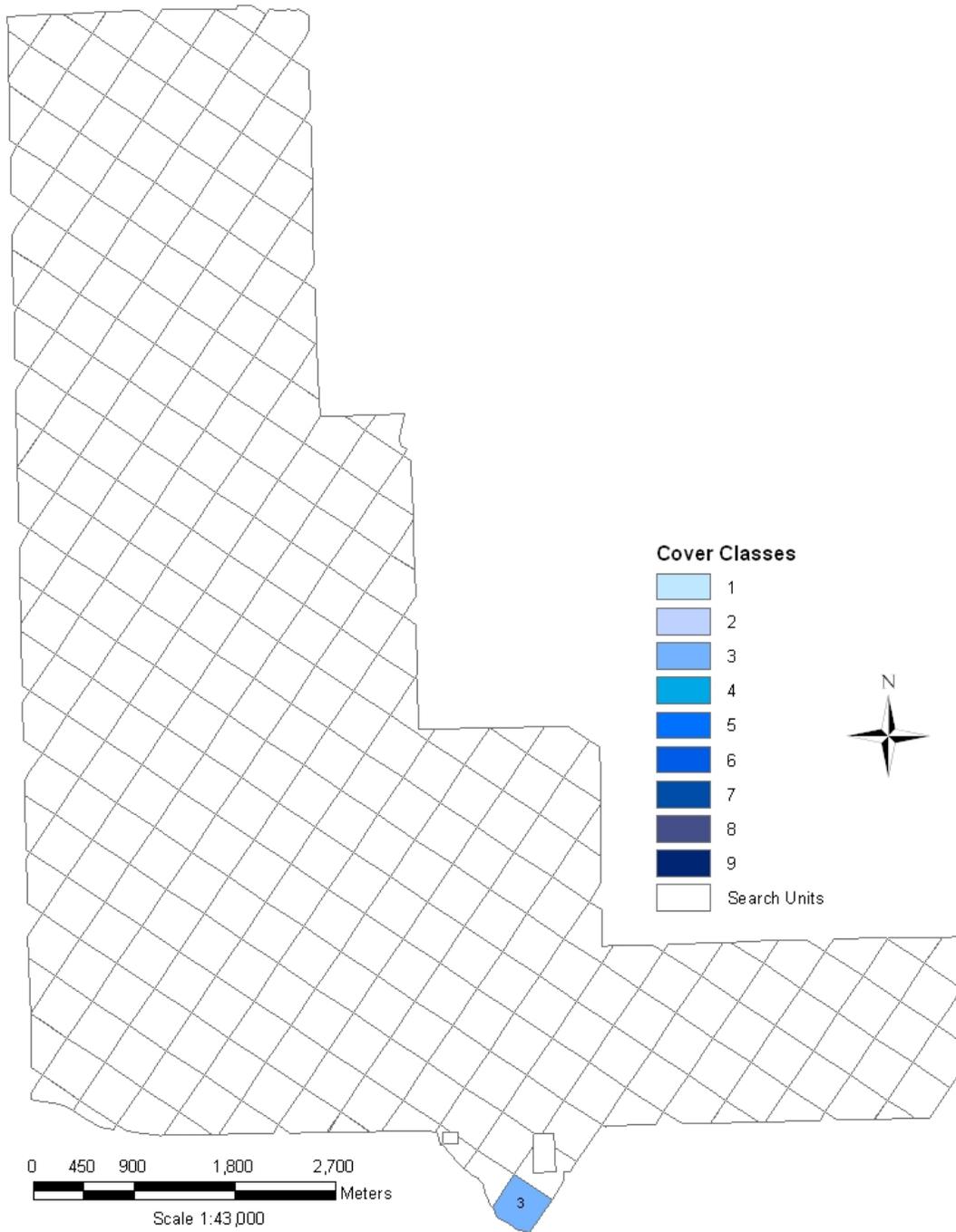
**Figure 10. Abundance and distribution of *Melilotus officinalis* (yellow sweet clover) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## *Morus alba* - 2006



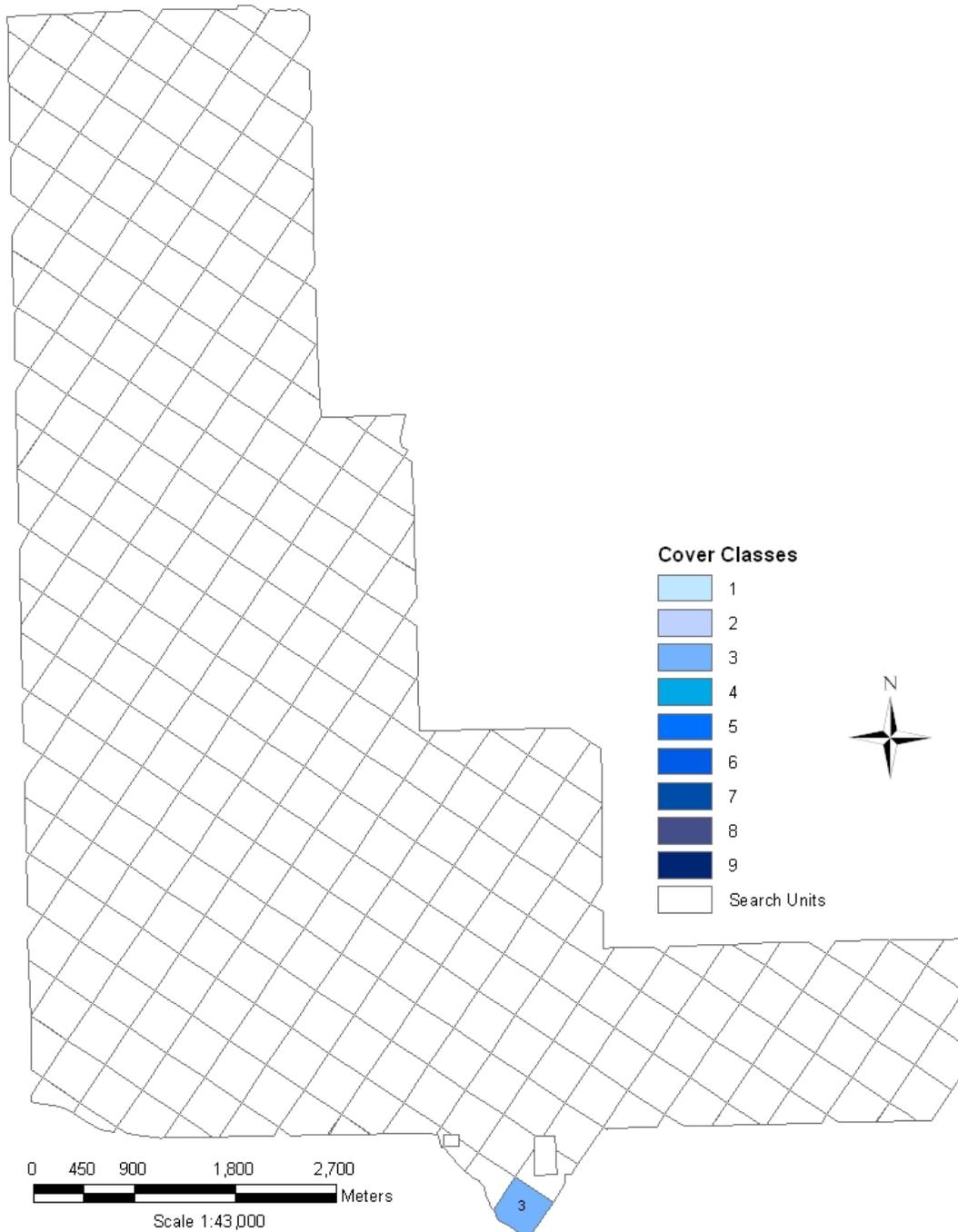
**Figure 11. Abundance and distribution of *Morus alba* (white mulberry) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## *Pyrus calleryana* - 2006



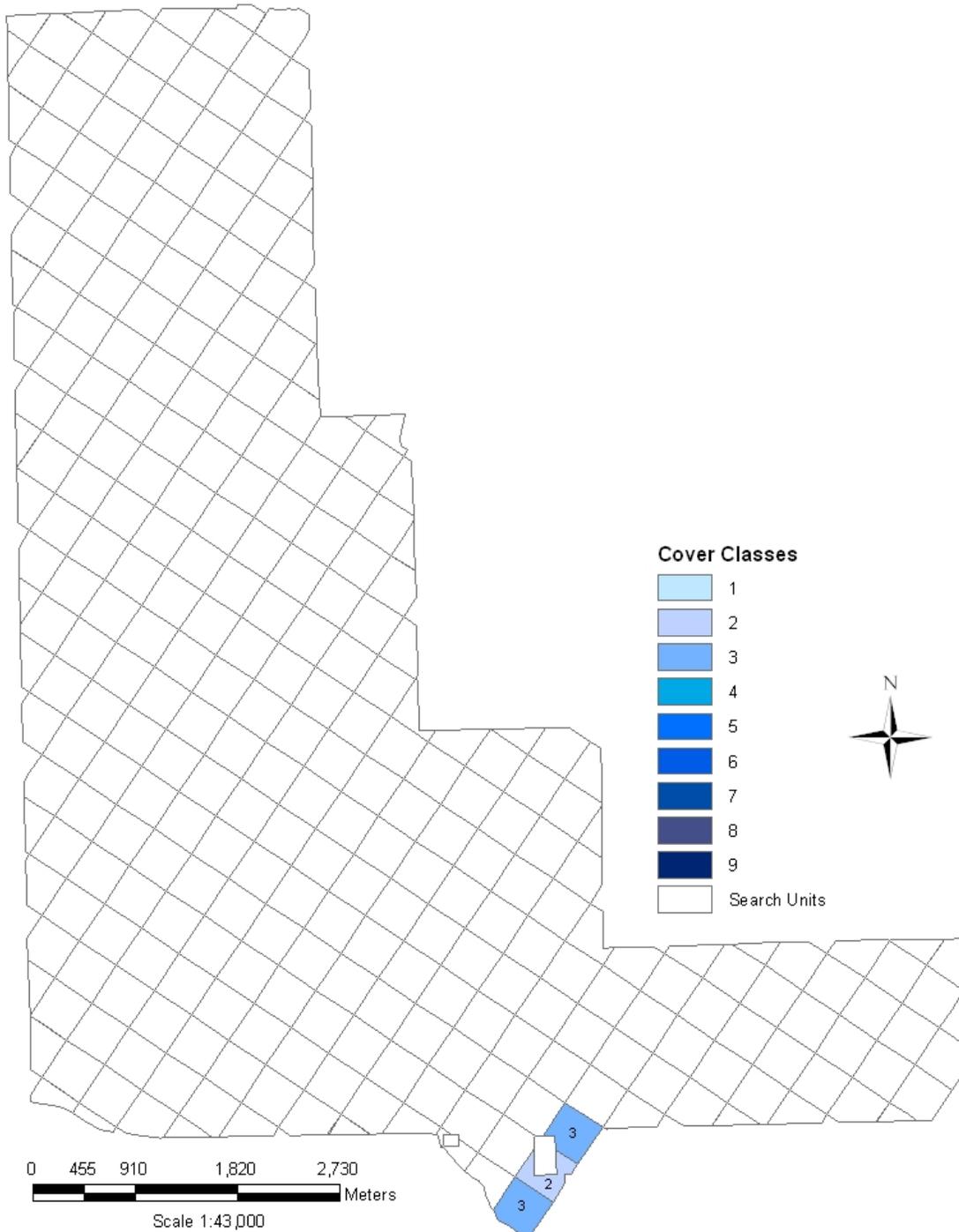
**Figure 12. Abundance and distribution of *Pyrus calleryana* (callery pear) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## *Robinia pseudoacacia* - 2006



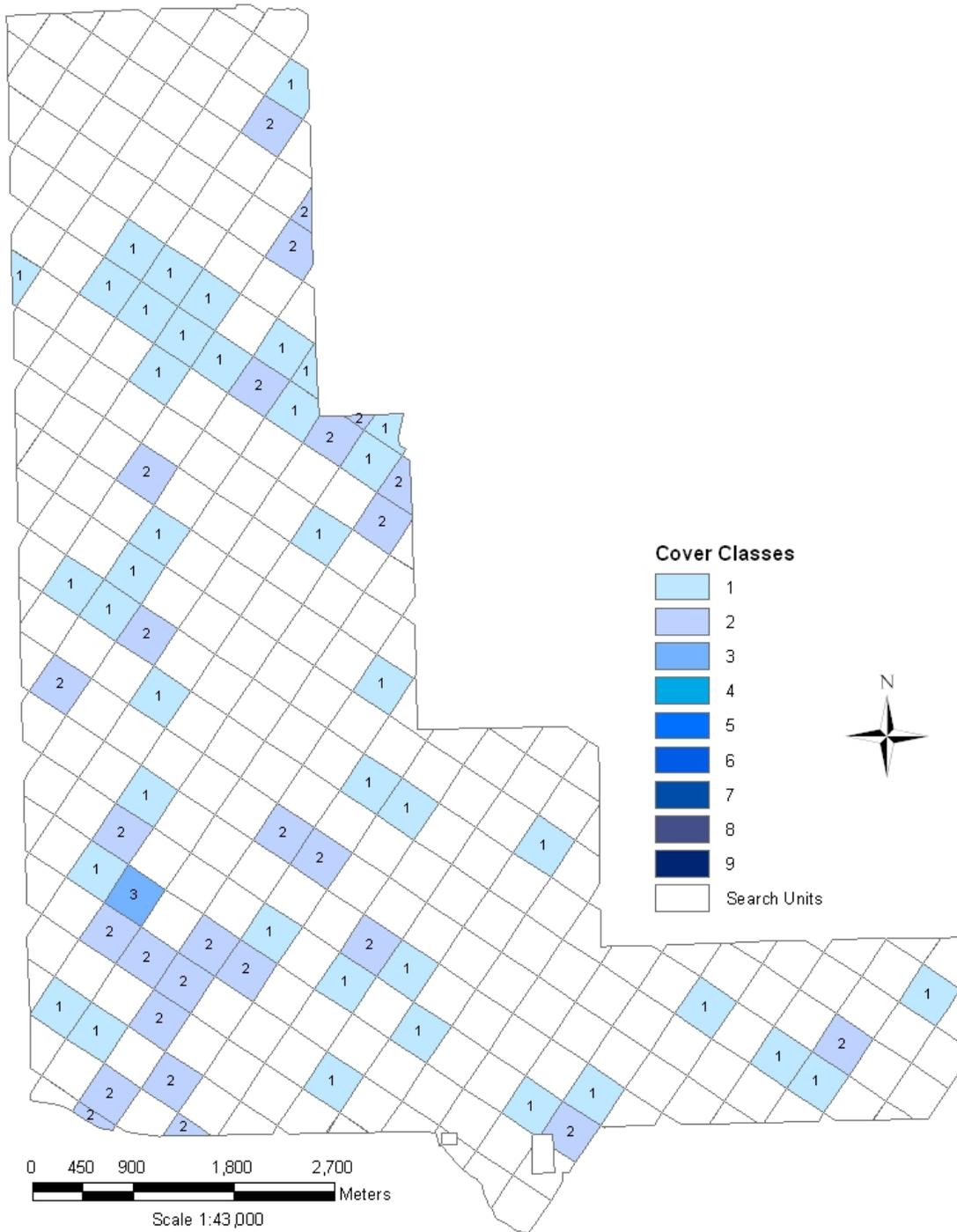
**Figure 13. Abundance and distribution of *Robinia pseudoacacia* (black locust) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## Schedonorus spp. - 2006



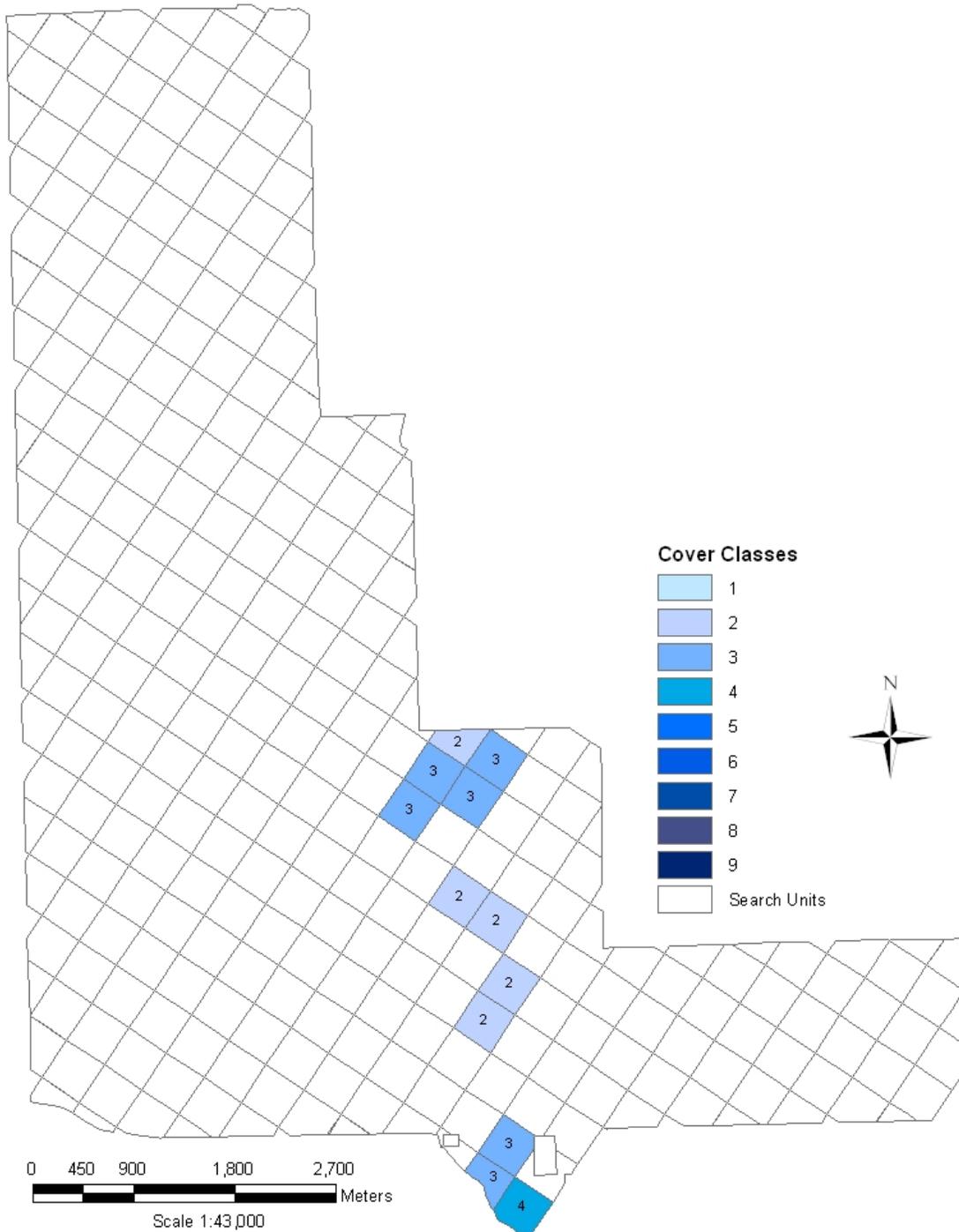
**Figure 14. Abundance and distribution of *Schedonorus* spp (fescue) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## *Solanum rostratum* - 2006



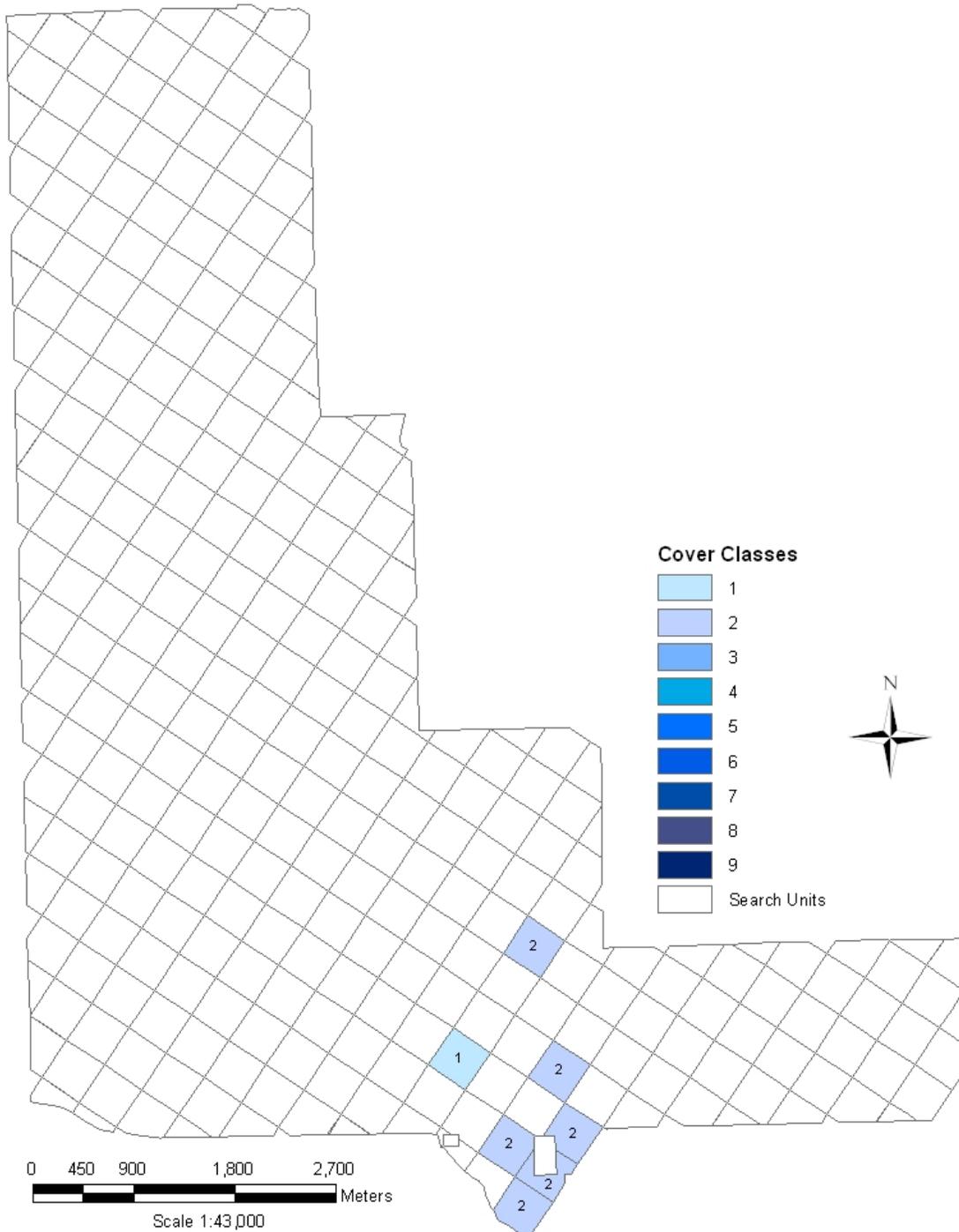
**Figure 15. Abundance and distribution of *Solanum rostratum* (buffalo-bur nightshade) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## Sorghum halepense - 2006



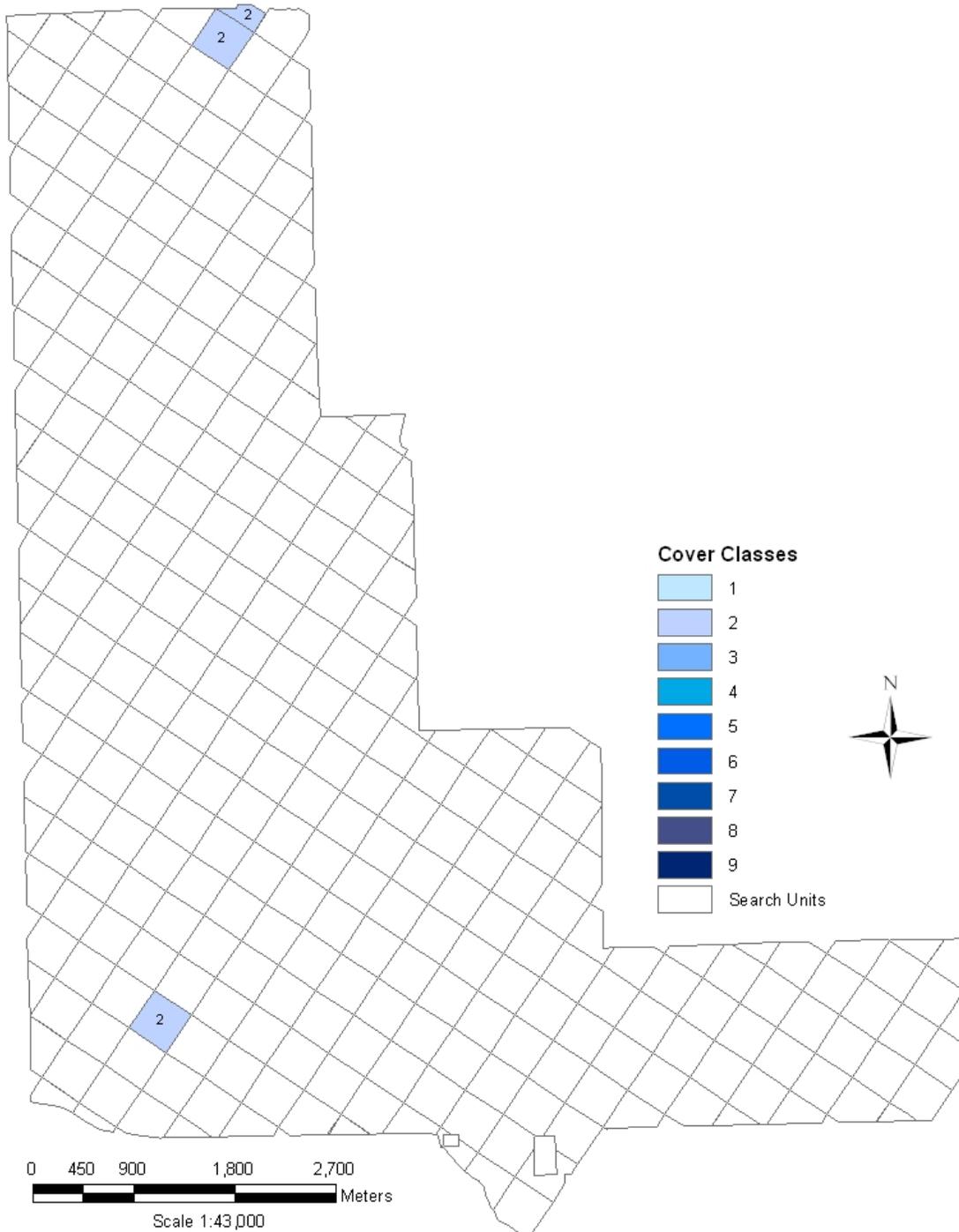
**Figure 16. Abundance and distribution of *Sorghum halepense* (Johnsongrass) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## *Torilis japonica* - 2006



**Figure 17. Abundance and distribution of *Torilis japonica* (Japanese hedge-parsley) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1,000-4,999.9 m<sup>2</sup>, 8=5,000-9,999.9 m<sup>2</sup>, and 9=10,000-14,999.9.**

## *Typha angustifolia* - 2006



**Figure 18. Abundance and distribution of *Typha angustifolia* (narrowleaf cattail) at Tallgrass Prairie National Preserve, 2006. Cover classes are as follows: 1=0.1-0.9 m<sup>2</sup>, 2=1-9.9 m<sup>2</sup>, 3=10-49.9 m<sup>2</sup>, 4= 50-99.9 m<sup>2</sup>, 5=100-499.9 m<sup>2</sup>, 6= 499.9-999.9 m<sup>2</sup>, 7=1000-4999.9 m<sup>2</sup>, 8=5000-9999.9 m<sup>2</sup>, and 9=10,000-14999.9.**

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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/](http://www.nature.nps.gov/im/units/htln/)



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.

NPS D-31, March 2007

**National Park Service**  
**U.S. Department of the Interior**



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