



Exotic Plant Monitoring in the Southern Plains Network

Project Report 2010

Natural Resource Technical Report Series NPS/SOPN/NRTR—2010/411



ON THE COVER

Sand Creek Massacre National Historic Site. David Zettner.

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Executive Summary

Globalization of commerce, transportation, human migration, and recreation in recent history has introduced invasive exotic species to new areas at an unprecedented rate. 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).

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 final selection of vital signs in 2006, invasive exotic-plant monitoring was recognized across all Southern Plains Network (SOPN) parks as the most important shared monitoring need. The strategy of early detection 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 one hectare), and (2) respond rapidly (i.e., implement appropriate management techniques to eliminate the invasive plant and all of its associated regenerative material). As a complement to this strategy, the SOPN has incorporated the following objectives into its monitoring plan for exotic plants: (1) to detect the initial occurrence for any of a subset of high-priority species in areas of high and low invasion probability, (2) to determine changes in the status and trend (density, abundance or extent) of a subset of high-priority species in areas of high and low invasion probability, and (3) to determine changes in species composition of a subset of high-priority species in areas of high and low invasion probability, taking into account any management treatments that occurred between sampling intervals.

In 2010, the SOPN conducted a second season of exotic-plant monitoring to continue to test the methods and results of the network's proposed Exotic Plant Monitoring Protocol. A total of 793 vector blocks (each 50 m long) were sampled along high-invasion-probability vectors (primary units) in SOPN parks. These vectors consisted of paved and unpaved roads, trails, and boundaries. As part of the SOPN grassland and fire monitoring effort, a total of 545 individual 4 x 1-meter plots on 109 transects in areas not considered high-invasion probability (secondary units) were also sampled. Overall, 72 species of exotic plants were observed in SOPN parks. Some species (e.g., *Kochia scoparia*) were widespread among parks, whereas others were found in only a few parks. Results of the 2010 study for each park sampled are presented in this report.

1 Introduction

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 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). The damage caused by these species to natural resources is often 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 Hawai'i 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.

Despite diligent efforts to curtail the problem, more NPS lands are infested daily. 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 will continue to be a management priority for the NPS well into the foreseeable future.

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 2004–2005, Southern Plains Network (SOPN) national parks recognized the need for exotic-plant monitoring (Perkins et al. 2006). All eleven network parks identified invasive exotic plants as among their most important management issues. SOPN parks include Alibates Flint Quarries National Monument (NM), Bent's Old Fort National Historic Site (NHS), Capulin Volcano NM, Chickasaw National Recreation Area (NRA), Fort Larned NHS, Fort Union NM, Lake Meredith NRA, Lyndon B. Johnson National Historical Park (NHP), Pecos NHP, Sand Creek Massacre NHS, and Washita Battlefield NHS. During final selection of vital signs in 2006, invasive exotic-plant monitoring was recognized across all network parks as the most important shared monitoring need.

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 high-impact species, eradication efforts are most successful for infestations of 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 U.S. 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 fa-

vor 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 one hectare), and (2) respond rapidly (i.e., implement appropriate management techniques to eliminate the invasive plant and all of its associated regenerative material). As a complement

to this strategy, the SOPN has incorporated the following objectives into its monitoring plan for exotic plants:

- (1) to detect the initial occurrence for any of a subset of high-priority species in areas of high and low invasion probability,
- (2) to determine changes in the status and trend (density, abundance or extent) of a subset of high-priority species in areas of high and low invasion probability, and
- (3) to determine changes in species composition of a subset of high-priority species in areas of high and low invasion probability, taking into account any management treatments that occurred between sampling intervals.

2 Methods

In 2010, the SOPN conducted a second season for exotic-plant monitoring to test the methods and results of the proposed protocol. Sampling was carried out from June to July. Due to time and budget constraints, two-and-one-half (2.5) days of exotic monitoring were conducted at each park.

2.1 Primary sampling methodology

The methodology employed in this monitoring is based on a generalized linear model. Fifty-meter sections (vector blocks) of both sides (right [R] and left [L]) of a vector were sampled (Figure 2-1). The transect ran parallel to the vector but was set into the roadside along the interior edge of the mow strip.

Distance classes from the vector were set as follows:

D1 = Roadside-transect (mowed area, approximately 2 m)

D2 = Transect-10 meters

D3 = 10-20 meters into the landscape

D4 = >20 meters into the landscape

Within each 50-meter length, the occurrence of an exotic species was noted only once, but its detectable presence in each distance class (D#) and its density (distribution within a given block) were recorded. This allowed for a rapid assessment; thus, we were able to cover more distance along the vector, as well as a greater sampling area. While a detailed location of a given population is lacking, the presence of any exotic within a 50-meter sample block, in conjunction with the distance class, can be reasonably relocated by management teams. Additionally, the presence of a major species of concern can trigger a more thorough search of the area for additional occurrences.

Density classes were used to describe exotic species populations. A population is distributed within a block in one of four ways: (1) less than five plants, (2) scattered throughout the block in a patchy or clumped manner, (3) scattered throughout in an even distribution, or (4) forming a matrix. This distribution equates to an initial introduction, establishment, spread and complete invasion of the habitat, and will allow for the future monitoring of gross changes to exotic populations.

Detection of some exotic species, particularly low-growing and rosette-stage species, decreases with distance, while other large-mass or tall growing species can easily be seen at a great

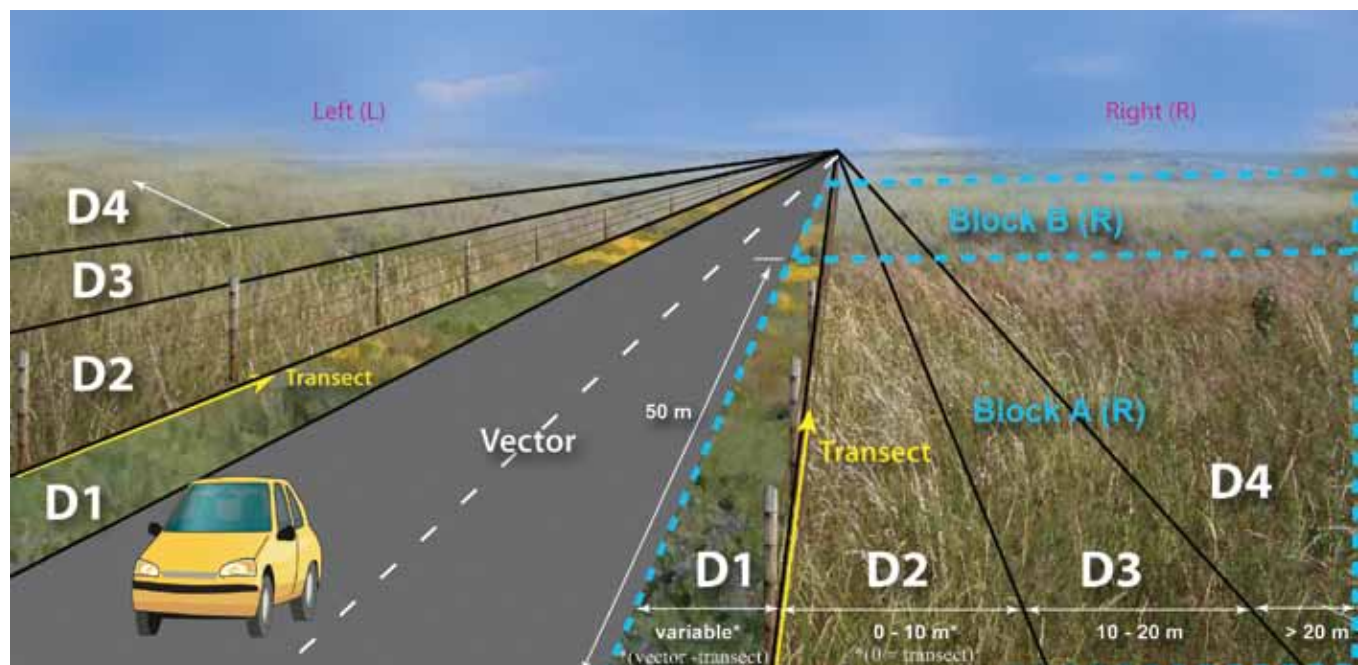


Figure 2-1. Fifty meter blocks are sampled on each side of a vector (e.g., roads and trails) in each of four distance classes from the vector.

distance. This limitation should always be taken into consideration when management actions are planned. The presence of a species of concern in any given area should trigger a more thorough search prior to eradication efforts. At times, topographic features, such as rises and depressions, will screen the visual field. These disruptions are noted in each sample block in the appropriate distance class as “no data available,” to distinguish from areas where no plants were detected.

2.2 Secondary sampling methodology

Secondary exotic-plant monitoring was accomplished for lower priority (interior landscape) areas in conjunction with the Grassland Monitoring efforts. This monitoring consists of collecting plant occurrence and cover data from five 4 x 1-m nested quadrats along a 50-meter permanent transect. This was the second year for establishing permanent transects and not all transects were established across the network. Secondary data was collected at each park.

3 Results

During 2010, we sampled a total of 793 vector blocks along high-invasion-probability vectors (primary units) in SOPN parks (Table 3-1). These vectors consisted of paved and unpaved roads, trails, and boundaries. As part of our grassland and fire monitoring effort, we also sampled a total of 545 individual plots on 109 transects in areas not considered high-invasion probability (secondary units).

Overall, 72 species of exotic plants were observed in SOPN parks (Table 3-2). Some species, for instance Russian thistle (*Salsola tragus*, see photos) were widespread among parks, whereas others were found in only a few parks. Results of the 2010 study for each park sampled are presented below.



Prairie restoration site at Bent's Old Fort NHS.

Table 3-1. Number of primary (high invasion probability) and secondary (low invasion probability) units sampled during 2010

Park unit	Primary sample units					Secondary sample units
	Total vector blocks	Roads		Trails		Total transects ¹
		Paved	Unpaved	Paved	Unpaved	
Bent's Old Fort NHS	106	—	—	—	106	13
Capulin Volcano NM	54	—	—	26	28	6
Chickasaw NRA	100	—	—	—	100	13
Fort Larned NHS	45	32	13	—	—	12
Fort Union NM	96	—	96	—	—	6
Lake Meredith NRA/ Alibates Flint Quarries NM	88	88	—	—	—	27
Lyndon B. Johnson NHP	32	—	—	—	32	2
Pecos NHP	80	—	80	—	—	8
Sand Creek Massacre NHS	122	—	122	—	—	12
Washita Battlefield NHS	70	—	34	—	36	10

¹ For each secondary sampling unit (transect), five individual plots were sampled.

Table 3-2. Exotic plant species observed in specific parks during 2010 SOPN exotic plant monitoring.

Scientific name	Common name	Park unit									
		BEOL	CAVO	CHIC	FOLS	FOUN	LAMR/ ALFL	LYJO	PECO	SAND	WABA
<i>Agropyron cristatum</i>	Crested wheatgrass		•								
<i>Albizia julibrissin</i>	Mimosa			•							•
<i>Amaranthus retroflexus</i>	Red-root pigweed	•		•	•						
<i>Arenaria serpyllifolia</i>	Thymeleaf sandwort			•							
<i>Asparagus officinalis</i>	Garden asparagus	•							•		
<i>Bothriochloa ischaemum</i> var. <i>songarica</i>	KR bluestem			•				•			
<i>Bromus arvensis</i>	Field brome	•									
<i>Bromus catharticus</i>	Rescue brome					•					
<i>Bromus inermis</i>	Smooth brome		•		•						
<i>Bromus japonicus</i>	Japanese brome		•	•	•		•	•	•		•
<i>Bromus lanceolatus</i>	Mediterranean brome								•		
<i>Bromus tectorum</i>	Cheatgrass	•	•	•	•		•	•	•	•	•
<i>Camelina microcarpa</i>	Smallseed false flax								•		
<i>Carduus nutans</i>	Musk thistle					•				•	
<i>Centaurea melitensis</i>	Malta starthistle							•			
<i>Chenopodium album</i>	Common lambsquarters	•	•		•				•	•	•
<i>Cirsium arvense</i>	Canada thistle	•			•				•		
<i>Cirsium vulgare</i>	Bull thistle				•				•		•
<i>Convolvulus arvensis</i>	Field bindweed	•	•		•	•	•		•	•	•
<i>Conium maculatum</i>	Poison hemlock				•						
<i>Cynodon dactylon</i>	Bermuda grass			•	•		•	•			•
<i>Dactylis glomerata</i>	Orchardgrass								•		
<i>Descurainia sophia</i>	Flixweed		•		•						
<i>Dichanthium annulatum</i>	Kleberg bluestem							•			
<i>Digitaria sanguinalis</i>	Hairy crabgrass				•		•				
<i>Eragrostis cilianensis</i>	Stinkgrass			•							
<i>Erodium cicutarium</i>	Red stork's-bill			•			•				
<i>Euphorbia davidii</i>	Davids spurge		•			•					
<i>Euphorbia dentata</i>	Toothed spurge	•		•	•		•	•			•
<i>Galium divaricatum</i>	Lamarck's bedstraw							•			
<i>Kochia scoparia</i>	Kochia	•	•		•	•	•		•	•	•
<i>Lactuca serriola</i>	Prickly lettuce	•	•						•	•	•
<i>Lamium amplexicaule</i>	Henbit				•						
<i>Lathyrus hirsutus</i>	Singletary pea			•							
<i>Lespedeza cuneata</i>	Sericea lespedeza			•							
<i>Lolium arundinaceum</i>	Tall fescue			•				•			
<i>Lolium perenne</i>	Perennial ryegrass			•	•			•			•
<i>Lolium pratense</i>	Meadow fescue			•							
<i>Lonicera japonicus</i>	Japanese honeysuckle							•			
<i>Marrubium vulgare</i>	Horehound		•			•			•		
<i>Medicago lupulina</i>	Black medic clover		•	•	•			•			•

Table 3-2. Exotic plant species observed in specific parks during 2010 SOPN exotic plant monitoring, cont.

Scientific name	Common name	Park unit									
		BEOL	CAVO	CHIC	FOLS	FOUN	LAMR/ ALFL	LYJO	PECO	SAND	WABA
<i>Medicago minima</i>	Burr medic clover			•			•	•			•
<i>Medicago sativa</i>	Alfalfa								•		
<i>Melilotus alba</i>	White sweetclover	•	•	•		•	•		•	•	
<i>Melia azedarach</i>	Chinaberry			•							
<i>Melilotus indicus</i>	Annual sweet clover								•		
<i>Melilotus officinalis</i>	Yellow sweetclover	•	•	•	•	•			•	•	•
<i>Paspalum urvillei</i>	Vaseygrass							•			
<i>Poa compressa</i>	Canada bluegrass								•		
<i>Poa pratensis</i>	Kentucky bluegrass				•		•				
<i>Polypogon monspeliensis</i>	Annual rabbitsfoot grass						•				
<i>Rumex crispus</i>	Curly dock	•			•						
<i>Rumex patientia</i>	Patience dock				•						
<i>Salsola collina</i>	Spineless Russian thistle						•				
<i>Salsola tragus</i>	Prickly Russian thistle	•	•	•	•	•	•		•	•	•
<i>Scorzonera laciniata</i>	Cutleaf vipergrass						•		•		
<i>Setaria viridis</i>	Green bristlegrass		•								
<i>Sonchus asper</i>	Spiny sowthistle			•	•						•
<i>Sorghum halepense</i>	Johnsongrass			•	•		•	•			•
<i>Tamarix chinensis</i>	Tamarisk						•				•
<i>Taraxacum officinale</i>	Dandelion			•	•		•	•			•
<i>Thinopyrum ponticum</i>	Rush wheatgrass	•							•		
<i>Torilis arvensis</i>	Spreading hedgeparsley			•				•			
<i>Tragopogon dubius</i>	Western salsify	•	•	•	•	•	•		•	•	•
<i>Tragopogon pratensis</i>	Meadow salsify								•		
<i>Trifolium dubium</i>	Small hop clover			•							
<i>Trifolium repens</i>	White clover				•						
<i>Trifolium species **</i>	Agricultural clover			•							
<i>Tribulus terrestris</i>	Puncturevine	•			•						
<i>Ulmus pumila</i>	Siberian elm					•			•		•
<i>Verbascum thapsus</i>	Mullein		•						•		
<i>Vicia sativa</i>	Garden vetch							•			

** = Agricultural species appearing in restoration

3.1 Bent's Old Fort NHS

Overall sampling at Bent's Old Fort includes most of the roadways and some trails within the park over a three-year rotation (Figure 3.1-3). During 2010, exotic-plant monitoring occurred at Bent's Old Fort for 2.5 days in July. The 2010 vectors sampled included the unpaved maintenance roads on the south side of the Arkansas River and a portion of the unpaved maintenance road/loop trail in the north bank riparian area (Figure 3.1-1). One hundred and six vector blocks were monitored, for a total linear effort of 2,650 meters (sampled on both sides of the road). These vectors are scheduled for monitoring again in 2013. Thirteen permanent transects within the landscape were also sampled, for a total of 65 4 x 1 meter plots.

Field bindweed (*Convolvulus arvensis*) was the most commonly found exotic species this field season, followed closely by prickly Russian thistle (*Salsola tragus*). Field bindweed was found most heavily in and around the prairie dog towns and in areas that underwent historic disturbance on the south side of the Arkansas River. It was not seen at all in the north bank monitoring vector. When field bindweed was found in the five secondary transects (38%), it was found in most plots and at cover rates up to 30%. Prickly Russian thistle was found in scattered patches throughout the south

section vector blocks, becoming evenly distributed patches into the landscape at the north end of the East Road. The SE Oxbow Road (north bank) had very limited prickly Russian thistle in only four vector blocks. Although it was found in seven secondary transects (54%), three of these transects had very limited amounts (<1%) in a single plot. Of the remaining transects, prickly Russian thistle was found in most plots at low covers (5% or less). One transect in the cottonwood did contain 15% Russian thistle, but was found in only one of the five plots.

Western salsify (*Tragopogon dubius*) was present in 35% of the vector blocks sampled in scattered patches on all vectors. It is consistently found in Distance Class 2, up to 12 meters into the landscape, and less so in Distance Class 1 where mowing or vehicular trampling may occur. This plant seems to be slowly spreading out from its initial invasion points, indicated by a few plants appearing in vector blocks adjacent to patches. Salsify appears on only one transect of the secondary plots, in only one plot at a cover of 1%. White sweet clover (*Melilotus alba*) appeared in 28% of the vector blocks. While only two vector blocks were infested on the Tamarisk Road, there were several large patches of white sweet clover on the East Road. Densities within these areas were generally scattered patches that appear to emanate

Table 3.1-1. Number and percentage of primary and secondary sample units where each species was detected, Bent's Old Fort, 2010

Scientific name	Common name	Primary vector blocks (n=106)		Secondary transects (n=13)	
		Total	% blocks	Total ¹	% transects
<i>Convolvulus arvensis</i>	Field bindweed	66	62	5	38
<i>Salsola tragus</i>	Prickly Russian thistle	57	54	7	54
<i>Tragopogon dubius</i>	Western salsify	37	35	1	8
<i>Melilotus alba</i>	White sweetclover	30	28	2	15
<i>Kochia scoparia</i>	Kochia	27	25	11	85
<i>Bromus tectorum</i>	Cheatgrass	22	21	0	0
<i>Asparagus officinalis</i>	Garden asparagus	19	18	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	14	13	0	0
<i>Bromus arvensis</i>	Field brome	11	10	0	0
<i>Euphorbia dentata</i>	Toothed spurge	10	9	2	15
<i>Amaranthus retroflexus</i>	Red-root pigweed	8	8	0	0
<i>Chenopodium alba</i>	Common lambsquarters	8	8	0	0
<i>Thinopyrum ponticum</i>	Rush wheatgrass	8	8	0	0
<i>Cirsium arvense</i>	Canada thistle	2	2	0	0
<i>Lactuca serriola</i>	Prickly lettuce	0	0	6	46
<i>Rumex crispus</i>	Curly dock	0	0	4	31

¹ The number of individual plots on secondary transects is shown in Figure 3.1-2.

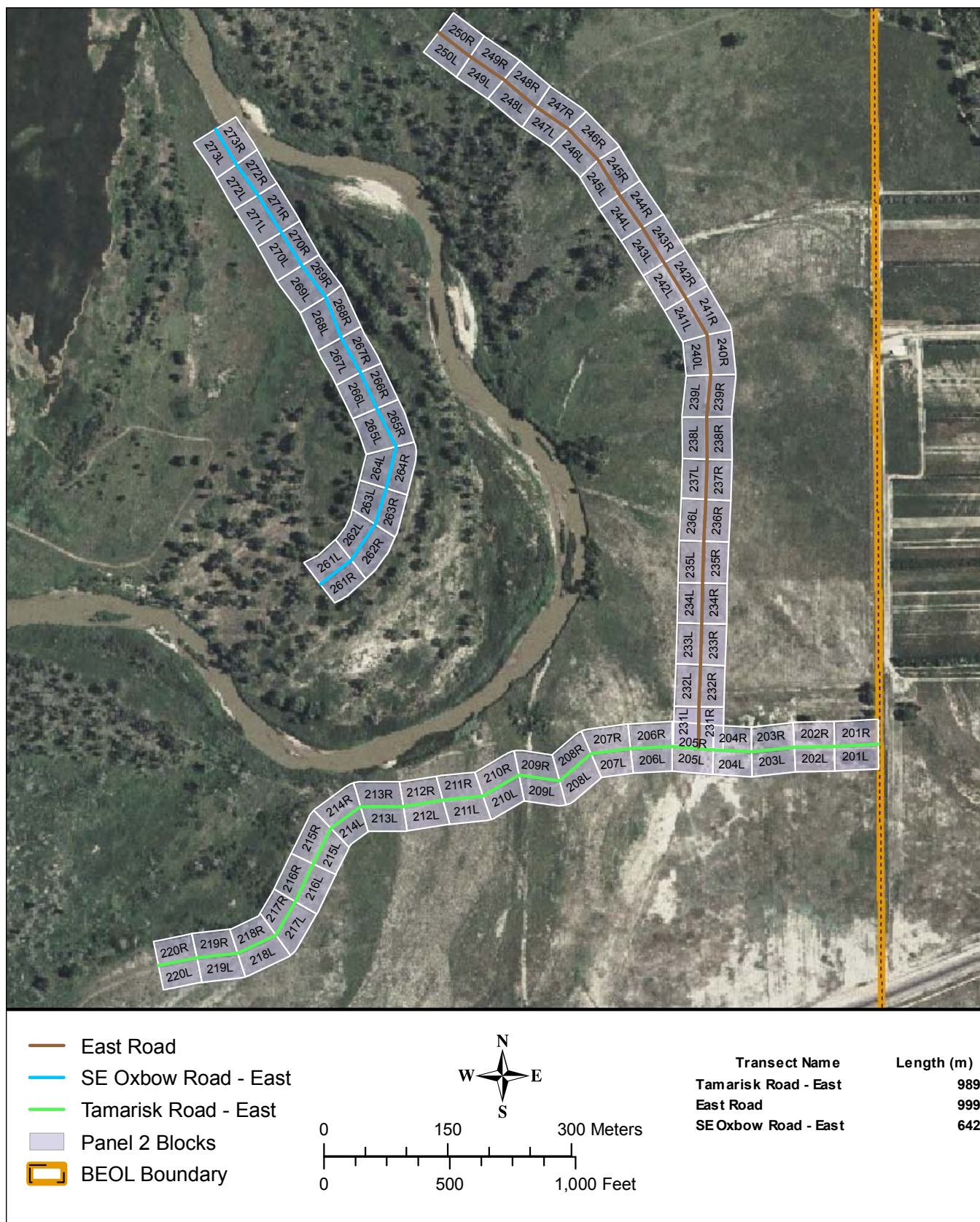
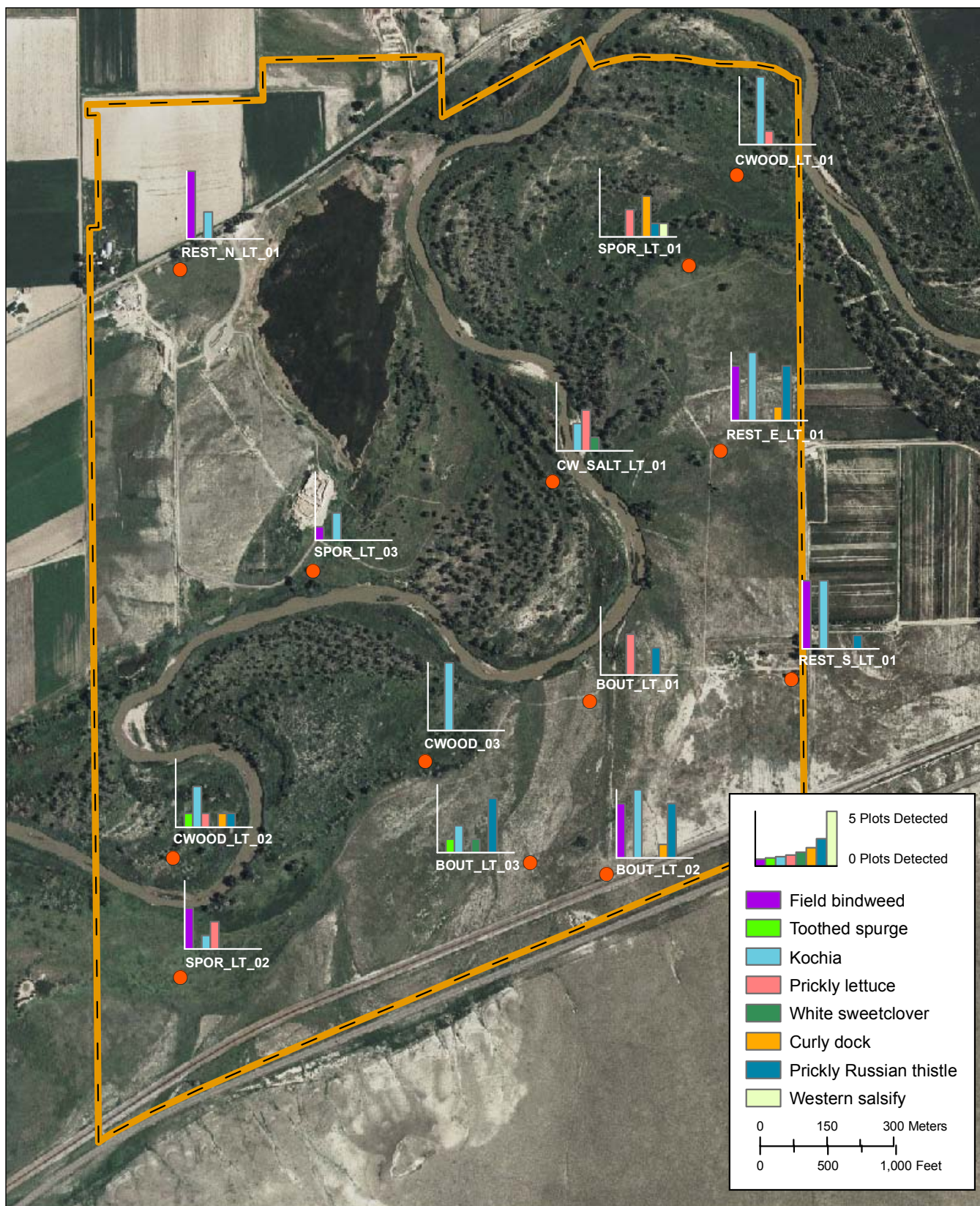


Figure 3.1-1. Individual vector blocks sampled, Panel 2, Bent's Old Fort NHS, 2010.



from denser evenly distributed patches deep into the landscape. This same species was common along the SE Oxbow Road in scattered patches, becoming more evenly distributed on the northern end of this vector. White sweetclover was found in only two secondary transects at limited covers of less than 1%. A sister species, yellow sweetclover (*Melilotus officinalis*) was present in 13% of the vector blocks, almost exclusively on the East Road in scattered patches that show signs of expanding. Two vector blocks on the SE Oxbow Road also contained yellow sweetclover in scattered to evenly distributed patches. This species was not detected in any of the secondary transects.

Kochia (*Kochia scoparia*) was found in 27% of the vector blocks sampled and 11 secondary transects (85%). Most prevalent along the East Road, kochia was present generally in scattered patches moving into the landscape. A few vector blocks contained this plant along the Tamarisk Road, also in scattered patches. It was present on the Oxbow Road in only three vector blocks as a few plants. Kochia's presence within the landscape, as evidenced by the secondary transect data, may be of some concern. Approximately half of the transects contained kochia in all five plots and these showed the greatest coverage—generally from 25% up to 60%. When found in only a couple of plots in a transect, kochia coverage was usually below 5%. Cheatgrass (*Bromus tectorum*) was detected in 21% of the vector blocks almost always in scattered patches. Only a few vector blocks on the south side of the river contained cheatgrass, indicating an opportunity for pre-emptive control. Vector blocks on the SE Oxbow Road were almost all impacted by cheatgrass in scattered patches. A related field brome (*Bromus arvensis*) was detected along the East Road only (10% of the vector blocks), but when found patches often reached an even distribution and ran over 20 meters into the landscape. It should be noted that no bromes of any kind were detected in the secondary transects.

The prairie dog towns on the south side of the Arkansas River were the sole locations for two exotics, toothed spurge (*Euphorbia dentata*) and puncturevine (*Tribulus terrestris*). Both appeared in scattered patches, but the toothed spurge tended to run deeper into the landscape, while the puncturevine was associated with the roadside.



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Field bindweed (*Convolvulus arvensis*) was the most commonly found exotic species in 2010 at Bent's Old Fort NHS.

Toothed spurge appeared in single plots on two secondary transects, but only with less than 1% cover. Rush wheatgrass (*Thinopyrum ponticum*; 8%) and Canada thistle (*Cirsium arvense*; 2%) were also detected only in vector blocks south of the river. A few scattered patches of rush wheatgrass exhibited expansion into the landscape. Canada thistle appeared as a limited number of plants in one vector block each on the Tamarisk and East Roads, allowing for rapid extermination of a problem plant. Neither of these species appeared in secondary transects.

Asparagus (*Asparagus officinalis*) was found only along both sides and all along the SE Oxbow Road in scattered patches into the landscape. Red-root pigweed (*Amaranthus retroflexus*) and what is believed to be common lambsquarters (*Chenopodium album*) were found in 8% of the vector blocks in low densities, all along the East Road except for a few plants on the Oxbow Road.

Prickly lettuce (*Lactuca serriola*) and curly dock (*Rumex crispus*) were not found along the monitored vectors but did appear in secondary transects. Prickly lettuce was found generally in two plots each of six transects at 1% cover or less, except for one transect in the cottonwoods containing 7% cover. Curly dock was found on four transects at 3% cover or less. Three transects contained only one plot of curly dock; however one transect contained three plots.

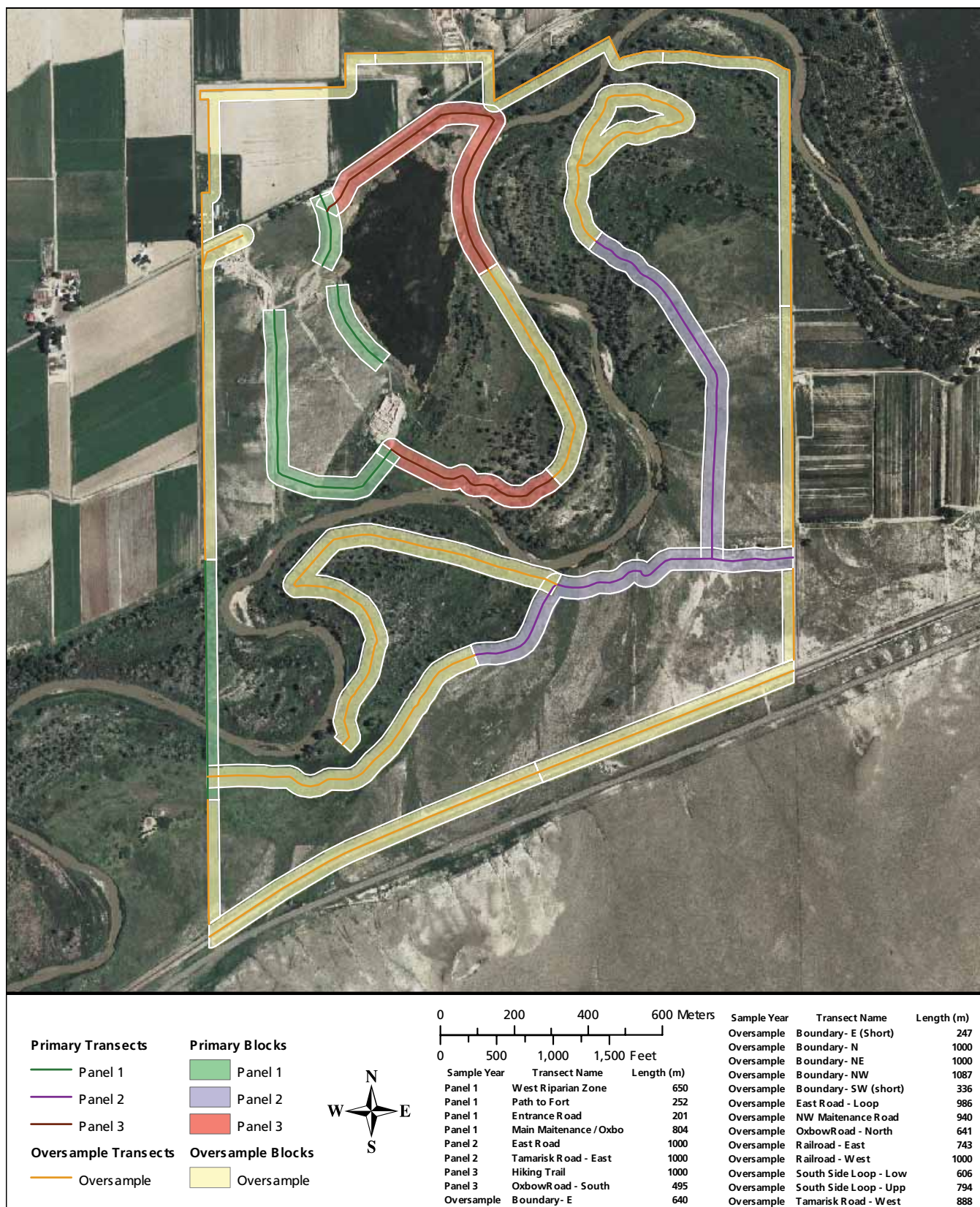


Figure 3.1-3. Overall planned sampling scheme for panels (annual samples) at Bent's Old Fort NHS for a full three-year rotation.

Table 3.1-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Bent's Old Fort NHS, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Amaranthus retroflexus</i>	Red-root pigweed	L	237	0	1	0	0
		R	237	1	1-2	0	0
		L	238	0	1	0	0
		R	238	2	1	0	0
		L	247	0	1	0	0
		R	249	0	0	1	0
		R	250	0	1	0	0
		R	272	0	1	–	–
<i>Asparagus officinalis</i>	Garden asparagus	L	261	0	1	1	0
		R	261	0	2	1	0
		L	262	0	1	1	0
		R	262	1	2	0	0
		L	263	0	1	1	0
		R	263	0	2	0	0
		L	264	0	0	2	0
		R	264	1	2	0	0
		L	265	0	1	1	0
		R	265	0	1	0	0
		L	266	0	1	2	2
		R	266	0	2	0	0
		L	267	0	1	0	0
		R	267	0	1	0	0
		L	268	0	1	0	0
		R	268	0	1	–	–
		R	269	0	1	–	–
		R	270	0	1	0	–
		L	273	0	1	0	0
<i>Bromus arvensis</i>	Field brome	L	237	0	2	3	3
		R	237	2	2	0	0
		L	238	0	2	3	3
		R	238	2	2	2	0
		L	239	0	2	3	3
		R	239	0	2	0	0
		L	241	0	1	0	0
		R	244	0	1	0	0
		L	245	0	2	0	0
		R	245	0	2	2	0
		L	246	0	2	0	0
<i>Bromus tectorum</i>	Cheatgrass	L	205	0	1	0	0
		L	209	0	2	2	0
		R	237	2	2	2	0
		R	238	0	2	2	0
		L	246	0	2	0	0
		R	248	1	0	0	0

Table 3.1-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Bent's Old Fort NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus tectorum</i> (cont.)		L	261	0	2	2	0
		R	261	2	2	2	2
		R	262	2	2	2	2
		L	263	0	2	0	0
		R	263	0	2	2	2
		L	264	0	1	0	0
		R	264	2	2	2	0
		R	265	2	2	0	0
		L	266	2	2	0	0
		R	266	2	2	1-2	0
		L	267	0	2	2	0
		R	267	2	2	0	0
		R	268	2	2	-	-
		R	269	2	0	-	-
		L	271	2	2	0	0
		R	271	2	1-2	-	-
<i>Chenopodium album</i>	Common lambsquarters	R	239	1	0	0	0
		L	241	0	1	0	0
		L	242	0	1	0	0
		L	248	0	1	0	0
		R	248	0	1	0	0
		R	249	0	1	1	0
		L	264	0	1	0	0
		R	273	0	1-2	-	-
<i>Cirsium arvense</i>	Canada thistle	R	214	0	1-2	0	0
		R	238	0	1	0	0
<i>Convolvulus arvensis</i>	Field bindweed	L	201	3	3	3	3
		R	201	3-4	3-4	3-4	3-4
		L	202	2	3	3	3
		R	202	3	3	3	3
		L	203	3	3	3	3
		R	203	3	3	3	3
		L	204	3	3	3	3
		R	204	3	3	3	3
		L	205	3	3	3	3
		R	205	3	3	3	3
		L	206	3	3	3	3
		R	206	2	2-3	2	2
		L	207	2	3	3	3
		R	207	2	2	0	0
		L	208	3	3	3	3
		R	208	2	2	2	0
		L	209	2	0	3	3
		R	209	2	2	0	0

Table 3.1-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Bent's Old Fort NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Convolvulus arvensis</i> (cont.)		L	213	2	2	2	0
		R	213	2	2	2	0
		L	214	2	2	2	0
		R	214	2	2	0	0
		L	215	0	2	2	0
		R	215	0	1-2	0	0
		L	216	2	2	2	0
		R	216	2	2	0	0
		L	217	2	2	2	0
		R	217	2	2	-	-
		L	218	2	2	0	0
		R	218	1-2	0	0	-
		L	219	2	2	2	0
		R	219	2	1	-	-
		R	220	1	0	0	0
		L	231	2	2	2	0
		R	231	3	3	3-4	3
		L	232	2	2	2	0
		R	232	3	3	3	3
		L	233	2	2	0	0
		R	233	3	3	3	3
		L	234	2	2	2	0
		R	234	3	3	3	3
		L	235	2	2	2	0
		R	235	3	3	3	3
		L	236	2	2	2	0
		R	236	3	3	3	3
		L	237	2	2	0	0
		R	237	3	2-3	2	3
		L	238	2	2	2	0
		R	238	2	2	2	0
		L	239	2	2	0	0
		R	239	2	2	2	2
		L	240	2	2	0	0
		R	240	3	2	2	2
		L	241	2	0	0	0
		R	241	2	2-3	3	3
		R	242	0	0	2	0
		L	243	0	1	0	0
		L	245	2	2	0	0
		R	245	1	2	0	0
		L	246	1	2	0	0
		R	246	1	0	0	0
		R	247	1	1	0	0

Table 3.1-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Bent's Old Fort NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Convolvulus arvensis</i> (cont.)		L	249	2	1	0	0
		R	249	0	1-2	0	0
		L	250	1	2	0	0
		R	250	1-2	1	0	0
<i>Euphorbia dentata</i>	Toothed spurge	L	201	0	1	0	0
		R	201	1	1-2	0	0
		L	205	0	2	2	0
		R	205	1	0	0	0
		L	206	2	2	2	0
		R	206	1	1	0	0
		L	207	0	1	1	0
		L	208	0	2	2	0
		L	209	0	1	0	0
		L	210	0	1	0	0
<i>Kochia scoparia</i>	Kochia	L	214	0	1	0	0
		R	214	0	1	0	0
		L	216	0	1	0	0
		L	219	0	2	0	0
		R	219	1	2	–	–
		L	220	0	2	2	0
		R	220	0	2	0	0
		L	237	0	2	0	0
		R	237	1	2	1	0
		R	241	0	1	1	0
		L	242	0	0	1	0
		L	243	0	1	1	0
		R	243	1-2	2	2	0
		L	244	0	2	0	–
		R	244	2	2-3	2	0
		R	245	0	2	0	0
		L	246	0	2	0	0
		R	246	0	2	0	0
		L	247	0	1	0	0
		R	247	0	1-2	0	0
		R	248	0	1	1-2	0
		R	249	1	2	0	0
		L	250	0	1	0	0
		R	250	1-2	2	0	0
		R	261	1	1	0	0
		R	262	1	1	0	0
		R	267	1	0	0	0
<i>Melilotus alba</i>	White sweetclover	R	208	0	1	0	0
		R	211	1	2	0	0

Table 3.1-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Bent's Old Fort NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Melilotus alba</i> (cont.)		L	237	0	2	3	0
		R	237	1-2	1	1	0
		L	238	0	3	3	3
		R	238	0	2	2	1
		L	239	0	2	2	0
		R	239	2	2	2	1
		L	242	0	0	2	0
		L	243	0	2	3	3
		R	243	0	1	0	0
		L	244	0	2	2	–
		R	244	1	1	2	0
		L	245	0	2	2	0
		R	245	0	2	2	2
		R	246	0	2	2	0
		L	250	0	1	0	0
		L	261	0	1	0	0
		R	261	0	2	0	0
		L	262	0	2	0	0
		R	262	0	2	0	2
		L	263	0	2	0	0
		R	263	0	0	0	2
		L	265	0	0	1	0
		R	266	0	0	1	0
		L	269	0	1	0	0
		L	270	0	2	3	3
		L	271	0	2	3	3
		L	272	0	2	2	0
		L	273	0	2	3	3
<i>Melilotus officinalis</i>	Yellow sweetclover	L	237	0	2	2	0
		R	237	0	1	0	0
		L	238	0	2	2	0
		R	238	1	0	0	0
		L	239	0	2	2	0
		R	239	1	1	0	0
		L	242	0	0	2	0
		L	243	1	0	0	0
		R	243	1	0	0	0
		L	245	0	0	1	0
		L	246	0	1	0	0
		R	246	0	1	0	0
		L	272	0	2	3	3
		L	273	0	2	2	0
<i>Salsola tragus</i>	Prickly Russian thistle	R	202	1	0	0	0
		L	204	1	1	0	0

Table 3.1-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Bent's Old Fort NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Salsola tragus</i> (cont.)		R	204	1	0	0	0
		L	206	1	1	0	0
		R	206	2	2	1	0
		L	207	1	1	0	0
		R	207	1	0	0	0
		L	208	1	1	0	0
		R	208	1	0	0	0
		L	209	1	1	0	0
		R	209	2	1	0	0
		L	210	1	1	0	0
		R	210	2	1	0	0
		L	211	1	1	0	0
		R	211	2	1	0	0
		L	212	2	2	0	0
		R	212	2	0	0	0
		L	213	2	2	0	0
		R	213	2	0	0	0
		L	214	2	2	0	0
		R	214	1-2	0	0	0
		L	215	2	2	0	0
		R	215	2	1	0	0
		R	217	1	0	–	–
		L	218	2	2	0	0
		R	218	1	0	0	–
		R	219	1	0	–	–
		L	220	2	2	0	0
		R	220	1-2	0	0	0
		L	235	0	2	0	0
		R	235	0	1	0	0
		L	236	0	2	2	0
		R	236	1	1	0	0
		L	237	0	2	0	0
		R	237	0	1-2	0	0
		R	238	0	2	2	0
		R	239	0	1	0	0
		L	240	1	1	0	0
		R	240	1-2	1	0	0
		L	241	2	2	0	0
		R	241	2-3	2	0	0
		L	242	2	2	0	0
		R	242	2	2	0	0
		L	243	2	2	0	0
		R	245	0	1	0	0
		R	246	1	0	0	0

Table 3.1-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Bent's Old Fort NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Salsola tragus</i> (cont.)		L	247	2	2	2	0
		R	247	0	1	0	0
		L	248	0	2	3	3
		R	248	0	1	0	0
		L	249	0	2	3	3
		R	249	0	1	0	0
		L	250	0	2	3	3
		L	261	1	1	0	0
		L	262	0	1	0	0
		R	264	1	0	0	0
		R	270	0	1	0	–
<i>Thinopyrum ponticum</i>	Rush wheatgrass	L	213	0	2	2	0
		R	213	1	1	0	0
		L	214	0	1	1	0
		L	216	0	0	1	0
		L	239	0	0	1	1
		R	239	1	2	2	1
		R	243	0	1	0	0
		R	246	0	1	0	0
<i>Tragopogon dubius</i>	Western salsify	L	211	0	1	1	0
		L	212	0	1	0	0
		R	212	0	1	0	0
		R	213	0	1	0	0
		L	214	0	1	0	0
		R	214	0	1	0	0
		L	215	0	1	0	0
		L	216	0	1	0	0
		L	217	0	1	1	0
		L	219	0	1	1	0
		L	220	0	1	0	0
		L	237	0	1	0	0
		L	238	0	1	0	0
		R	238	1	1	0	0
		L	239	0	1	0	0
		R	239	1–2	0	0	0
		L	242	0	1	0	0
		R	242	0	1	0	0
		L	243	0	1	0	0
		R	243	1	1	0	0
		L	244	0	2	0	–
		R	244	2	2	2	0
		L	245	0	2	0	0
		R	245	1	2	1	0
		L	246	0	2	0	0

Table 3.1-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Bent's Old Fort NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Tragopogon dubius</i> (cont.)		R	246	1	1	0	0
		L	247	0	2	1	0
		R	262	0	1	0	0
		R	263	0	1	0	0
		L	268	0	1	0	0
		R	268	1	0	–	–
		L	270	0	2	2	0
		L	271	0	2	2	0
		R	271	0	1	–	–
		L	272	1	0	0	0
		L	273	0	1	1	0
		R	273	0	1	–	–
<i>Tribulus terrestris</i>	Puncturevine	L	201	2	0	0	0
		R	201	2	0	0	0
		R	202	1	0	0	0
		L	204	1	0	0	0
		R	204	1	0	0	0

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

3.2 Capulin Volcano NM

Overall sampling at Capulin Volcano occurs on paved and unpaved roads and trails over its full three-year rotation (Figure 3.2-3). In 2010, exotic-plant monitoring occurred at Capulin Volcano for two days in July. The vectors sampled were the paved entrance road to the visitor center and paved trails at the top of the volcano leading both into the crater and around the rim. Fifty-four vector blocks were monitored, for a total of 1.35 linear kilometers sampled on both sides (Figure 3.2-1). In addition, six permanent transects within the landscape were sampled for a total of 30 4 x 1 meter plots.

Cheatgrass (*Bromus tectorum*) was the most commonly found exotic species this field season, followed by Japanese brome (*Bromus japonicus*). Cheatgrass was found in 54% of vector blocks sampled (29), primarily in scattered patches up to 12 meters into the landscape but at times over 20 meters deep. Cheatgrass was found along all vectors sampled. Japanese brome was found in 46% of vector blocks sampled (25), generally in scattered patches within 20 meters into the landscape, though it was seen a few times beyond that measure. Japanese brome was found only at the

beginning of the rim trail but scattered all along the entrance road. Neither of these bromes was detected in the secondary transects.

Western salsify (*Tragopogon dubius*) was present in 39% of vector blocks sampled (21) and 67% of secondary transects (4). Salsify was detected as a few individual plants along the rim trail and the entrance road and with a cover of less than 1% in a few plots each of the four secondary transects. Mullein (*Verbascum thapsus*) was present in 30% of vector blocks sampled (16) and 33% (2) of secondary transects as a few plants to occasional scattered patches within the first 12 meters of the vector primarily along the rim trail. It was found on one to two plots each of the two secondary transects in a cover of 1% or less. Smooth brome (*Bromus inermis*) was present in 28% of vector blocks sampled (15), generally as scattered patches up to 12 meters from the vector and primarily on the trails at the top of the cone. Smooth brome was not detected in the secondary transects.

Green bristlegrass (*Setaria viridis*) was present in 28% of vector blocks sampled (15) as individual plants to scattered patches only along the entrance road and primarily in the mowed zone.

Table 3.2-1. Number and percentage of primary and secondary sample units where each species was detected, Capulin Volcano NM, 2010

Scientific name	Common name	Primary vector blocks (n=54)		Secondary transects (n=6)	
		Total	% blocks	Total ¹	% transects
<i>Bromus tectorum</i>	Cheatgrass	29	54	0	0
<i>Bromus japonicus</i>	Japanese brome	25	46	0	0
<i>Tragopogon dubius</i>	Western salsify	21	39	4	67
<i>Verbascum thapsus</i>	Mullein	16	30	2	33
<i>Bromus inermis</i>	Smooth brome	15	28	0	0
<i>Setaria viridis</i>	Green bristlegrass	15	28	0	0
<i>Marrubium vulgare</i>	Horehound	14	26	1	17
<i>Descurainia sophia</i>	Flixweed	13	24	0	0
<i>Agropyron cristatum</i>	Crested wheatgrass	10	19	0	0
<i>Medicago lupulina</i>	Black medic clover	9	17	0	0
<i>Euphorbia davidii</i>	Davids spurge	4	7	2	33
<i>Salsola tragus</i>	Prickly Russian thistle	4	7	3	50
<i>Melilotus officinalis</i>	Yellow sweetclover	2	4	0	0
<i>Chenopodium album</i>	Common lambsquarters	1	2	0	0
<i>Convolvulus arvensis</i>	Field bindweed	1	2	0	0
<i>Kochia scoparia</i>	Kochia	1	2	0	0
<i>Melilotus alba</i>	White sweetclover	0	0	1	17
<i>Lactuca serriola</i>	Prickly lettuce	0	0	5	83

¹ The number of individual plots on secondary transects is shown in Figure 3.2-2.

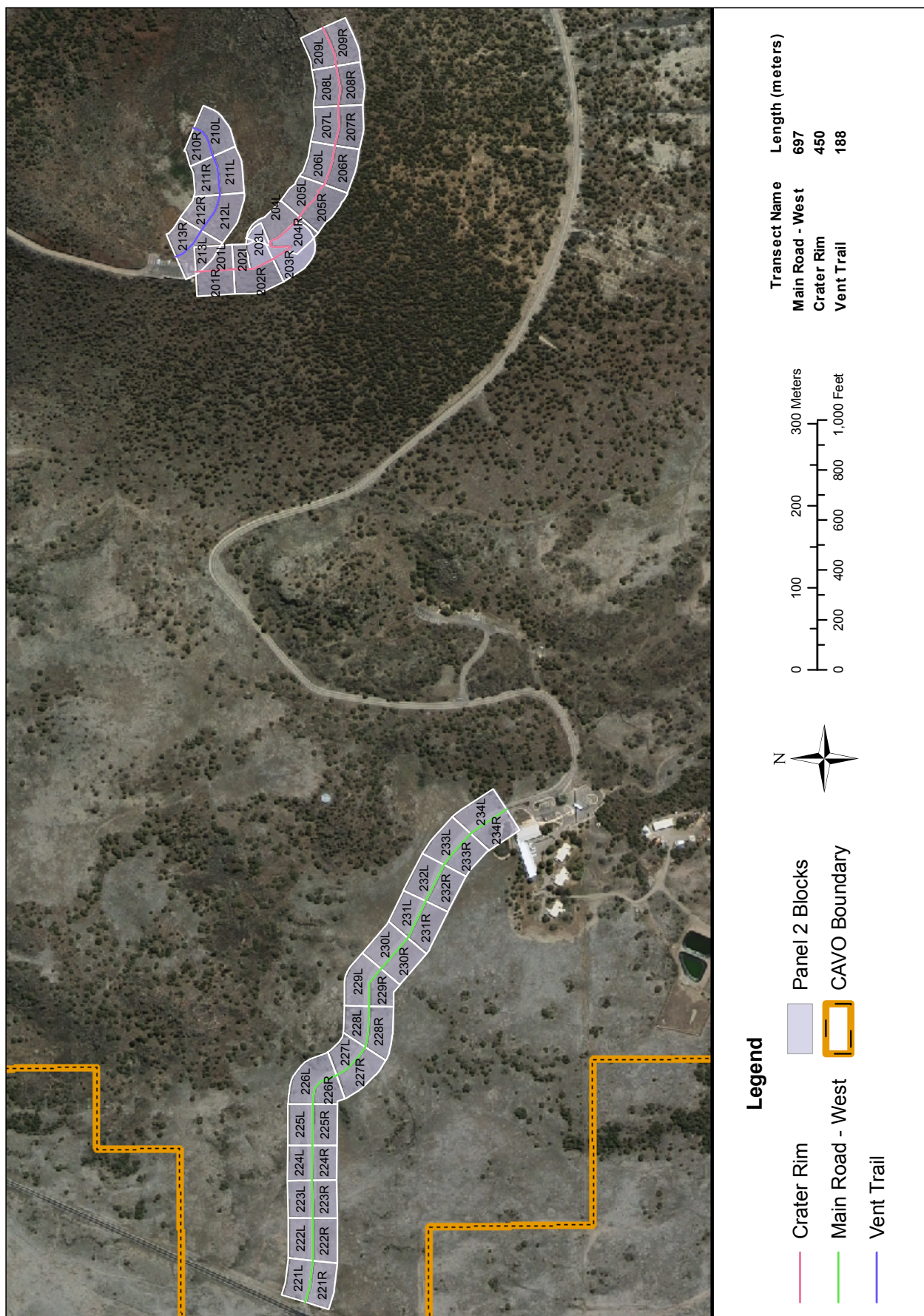


Figure 3.2-1. Individual vector blocks sampled, Panel 2, Capulin Volcano NM, 2010.

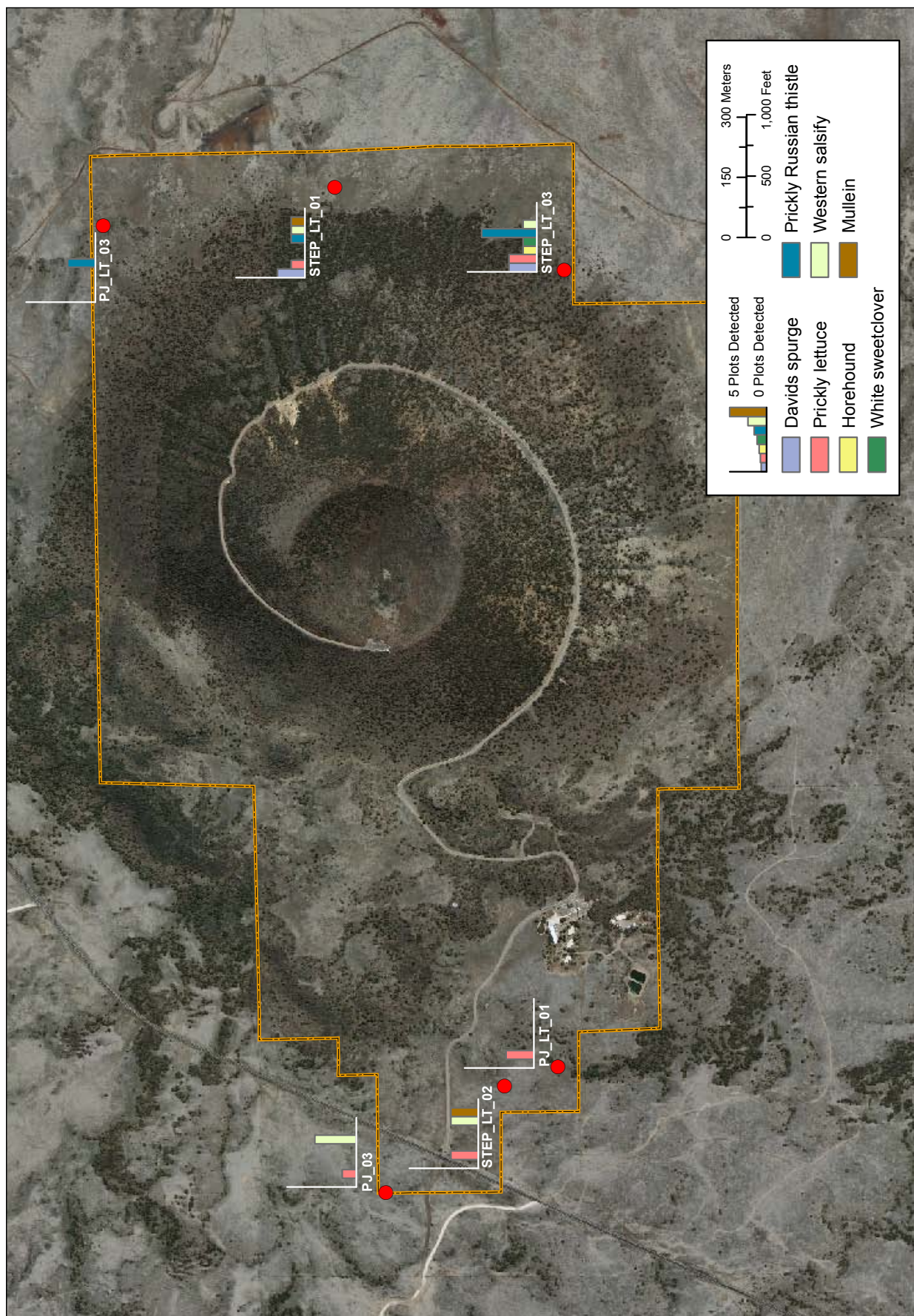


Figure 3.2-2. Secondary sample locations, Capulin Volcano NM, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

Horehound (*Marrubium vulgare*) was found in 26% of vector blocks sampled (14) and 17% (1) of secondary transects. It was found as individual plants to scattered patches along both trails at the top of the cone, and in one plot of one transect at 1% cover. Flixweed (*Descurainia sophia*) was found in 24% of vector blocks sampled (13) as individual plants up to 10 meters into the landscape along the trails. Crested wheatgrass (*Agropyron cristatum*) was found in 19% of vector blocks sampled (10) in scattered patches up to 10 meters into the landscape along the trails. Black medic clover (*Medicago lupulina*) was found in 17% of vector blocks sampled (9) as scattered patches generally within the first 10 meters of the vector on both the crater trail and the entrance road. Flixweed, crested wheatgrass, and black medic clover were not detected in any secondary transects.

Several species of exotics were found in limited numbers along the primary vectors but in large quantities within the landscape in the secondary transects. Prickly lettuce (*Lactuca serriola*) was not detected along vectors but was the most prevalent exotic found in the secondary monitoring, found in 83% (5) of the transects. When found it was present in only one to two plots per transect, generally with a cover of 1% or less. White sweetclover was also not present along vectors but found in one plot of one secondary transect at cover of less than 1%. Salsola (*Salsola tragus*) was found in only 17% (4) vector blocks in scattered patches on the left side of the entrance road, and in 50% (3) of the secondary transects at a cover of 3% or less. David's spurge (*Euphorbia davidii*) was also found in 17% (4) of the vector blocks, as individual plants found at the beginning of the trails. It was present in two plots each of two secondary transects at a cover density of less than 1%. None of the following species were



Cheatgrass (*Bromus tectorum*) was the most commonly found exotic species in 2010 at Capulin Volcano NM.

found in secondary transects. Yellow sweetclover (*Melilotus officinalis*) was found as a few plants in two vector blocks along the entrance road. A few plants of what is thought to be common goosefoot (*Chenopodium album*) were found in one vector block of the rim trail. A few plants of field bindweed (*Convolvulus arvensis*) and scattered patches of kochia (*Kochia scoparia*) were found in one vector block each along the entrance road.

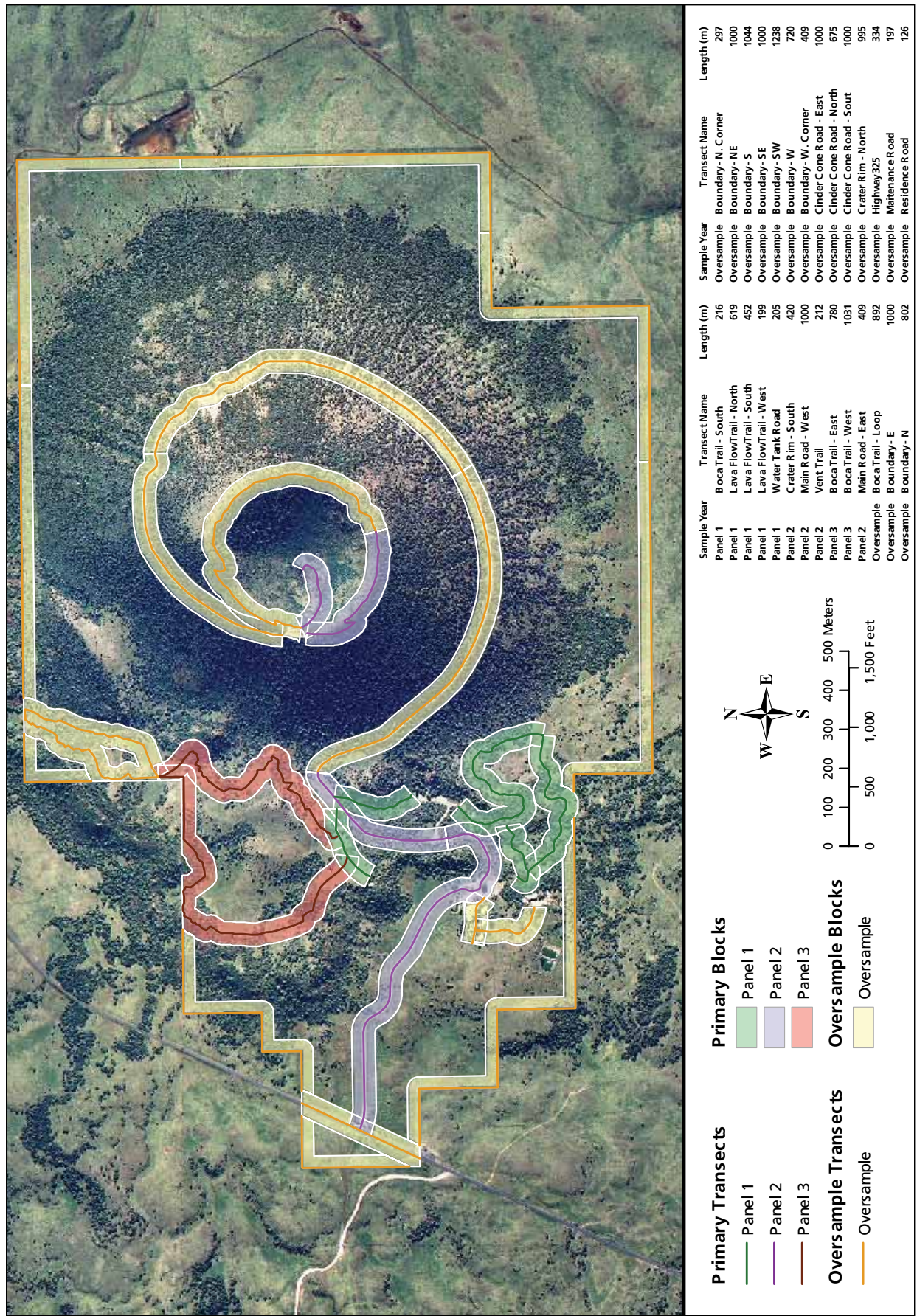


Figure 3.2-3. Overall planned sampling scheme for panels (annual samples) at Capulin Volcano NM for a full three-year rotation.

Table 3.2-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Capulin Volcano NM, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Agropyron cristatum</i>	Crested wheatgrass	R	202	1	0	–	–
		R	206	0	1–2	–	–
		R	208	1	0	–	–
		L	201	0	2	–	–
		L	202	0	2	–	–
		L	207	0	1	–	–
		R	213	1	0	0	0
		L	210	0	2	–	–
		L	211	0	2	–	–
		L	212	0	2	–	–
<i>Bromus inermis</i>	Smooth brome	R	201	0	2	–	–
		R	202	1–2	0	–	–
		R	203	1	2	–	–
		R	205	0	2	–	–
		L	201	0	2	–	–
		L	202	0	2	–	–
		L	203	0	2	–	–
		R	210	1–2	2	0	0
		R	211	0	1	0	0
		R	212	1	–	–	–
		R	213	1	1	0	0
		L	210	0	1	–	–
		L	211	0	2	–	–
		L	212	0	2	–	–
		L	227	0	2	0	0
<i>Bromus japonicus</i>	Japanese brome	R	201	1	2	–	–
		L	201	0	2	–	–
		R	221	2	2	0	0
		R	222	2	2	2	0
		R	223	2	2	2	0
		R	224	1	2	2	2
		R	225	1	2	2	2
		R	226	1–2	2	2	1–2
		R	227	0	2	2	0
		R	228	0	2	2	0
		R	230	0	2	2	0
		R	231	1	0	0	0
		R	232	0	2	0	0
		L	221	2	2	0	0
		L	223	1	2	0	0
		L	224	0	2	2	0
		L	225	0	2	0	0
		L	226	0	2	2	–
		L	227	0	2	2	0

Table 3.2-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Capulin Volcano NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus japonicus</i> (cont.)		L	229	0	2	2	0
		L	230	0	0	2	2
		L	231	0	2	2	2
		L	232	0	2	2	0
		L	233	0	2	2	2
		L	234	0	2	2	2
<i>Bromus tectorum</i>	Cheatgrass	R	201	1-2	0	-	-
		R	202	0	2	-	-
		R	206	1	1-2	-	-
		R	207	0	2	-	-
		R	208	0	1	-	-
		R	211	1	0	0	0
		R	212	1	-	-	-
		R	221	0	2	2	0
		R	222	2	2	0	0
		R	223	1	2	2	0
		R	224	1	2	2	0
		R	225	-	2	2	2
		R	226	0	2	0	0
		R	227	0	0	2	0
		R	228	0	2	0	0
		R	230	0	2	2	0
		R	231	0	2	2	0
		R	232	0	0	2	0
		R	233	0	0	2	0
		R	234	0	2	0	0
		L	223	1	2	0	0
		L	225	0	2	0	0
		L	228	2	2	0	0
		L	229	0	2	2	0
		L	230	0	0	2	2
		L	231	0	2	2	0
		L	232	0	2	2	0
		L	233	0	2	2	2
		L	234	2	2	2	2
<i>Chenopodium album</i>	Common lambsquarters	L	203	0	1	-	-
<i>Convolvulus arvensis</i>	Field bindweed	L	229	1	0	0	0
<i>Descurainia sophia</i>	Flixweed	R	206	0	1	-	-
		R	207	0	1	-	-
		R	208	1	0	-	-
		R	209	0	1	-	-
		L	204	0	1	-	-
		L	205	0	1	-	-
		L	206	0	1	-	-

Table 3.2-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Capulin Volcano NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Descurainia sophia</i> (cont.)		L	207	0	2	–	–
		L	208	0	1	–	–
		L	209	0	1	–	–
		R	210	0	1	0	0
		R	211	0	1	0	0
		L	224	0	1	0	0
<i>Euphorbia davidii</i>	Davids spurge	R	201	1	0	–	–
		R	202	2	0	–	–
		L	212	0	1	–	–
		L	213	0	1	–	–
<i>Kochia scoparia</i>	Kochia	L	222	0	2	2	0
<i>Marrubium vulgare</i>	Horehound	R	202	0	1–2	–	–
		R	203	1	0	–	–
		R	204	0	1	–	–
		R	207	0	2	–	–
		R	208	1	0	–	–
		L	203	0	1	–	–
		L	204	0	1	–	–
		L	206	0	1	–	–
		L	209	0	1	–	–
		R	212	1	–	–	–
		L	210	0	1	–	–
		L	211	0	1	–	–
		L	212	0	2	–	–
		L	225	0	2	0	0
<i>Medicago lupulina</i>	Black medic clover	R	212	1–2	–	–	–
		R	213	2	0	0	0
		L	212	2	0	–	–
		L	213	2	1	–	–
		R	222	2	0	0	0
		R	223	2	0	0	0
		R	225	2	0	0	0
		R	226	2	0	0	0
		R	234	2	0	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	R	230	1	0	0	0
		L	229	0	1	0	0
<i>Salsola tragus</i>	Prickly Russian thistle	L	222	0	2	2	0
		L	226	0	2	0	–
		L	230	0	2	2	0
		L	234	2	2	0	0
<i>Setaria viridis</i>	Green bristlegrass	R	224	1	0	0	0
		R	225	2	0	0	0
		R	226	2	0	0	0
		R	227	1	0	0	0

Table 3.2-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Capulin Volcano NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Setaria viridis</i> (cont.)		R	228	1	0	0	0
		R	229	1	0	–	–
		R	230	1	0	0	0
		R	231	2	1	0	0
		R	232	2	0	0	0
		R	233	2	0	0	0
		R	234	2	0	0	0
		L	223	0	1	0	0
		L	224	0	1	0	0
		L	225	1	2	0	0
		L	233	1	0	0	0
<i>Tragopogon dubius</i>	Western salsify	R	201	1	0	–	–
		R	202	1	0	–	–
		R	203	1	1	–	–
		R	205	1	0	–	–
		L	201	0	1	–	–
		L	202	0	1	–	–
		L	213	0	1	–	–
		R	222	1	0	0	0
		R	225	1	1	0	0
		R	227	1	0	0	0
		R	229	1	1	–	–
		R	231	1	0	0	0
		R	232	1	0	0	0
		R	233	0	1	1	0
		R	234	1	1	0	0
		L	227	0	1	0	0
		L	228	0	1	0	0
		L	229	0	1	0	0
		L	230	1	1	0	0
		L	231	0	1	0	0
		L	232	0	1	0	0
<i>Verbascum thapsus</i>	Mullein	R	201	0	1–2	–	–
		R	202	1	0	–	–
		R	203	1	1	–	–
		R	204	0	1	–	–
		R	205	1	2	–	–
		R	206	1	2	–	–
		L	201	0	1	–	–
		L	202	0	2	–	–
		L	203	0	2	–	–
		L	205	0	1	–	–
		L	207	0	1	–	–
		L	208	0	1	–	–

Table 3.2-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Capulin Volcano NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Verbascum thapsus</i> (cont.)		L	212	0	1	–	–
		L	213	0	1	–	–
		L	229	0	1	0	0
		L	234	0	1	0	0

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

3.3 Chickasaw NRA

Overall sampling at Chickasaw occurs on paved and unpaved roads and trails over its full three-year rotation (Figure 3.3-4, -5, -6). In 2010, exotic-plant monitoring occurred at Chickasaw 2.5 days in June. One hundred vector blocks were monitored, for a total of 2.5 linear kilometers sampled on both sides (Figure 3.3-1). In addition, 13 permanent transects within the landscape were sampled for a total of 65 4 x 1 meter plots.

Japanese brome (*Bromus japonicus*) was the most commonly found exotic species this field season,

found in 97% of vector blocks sampled (97) and alive in 23% of secondary transects (3). It was found on all vectors in scattered to evenly distributed patches, always within 12 meters of the vector and often over 20 meters into the landscape. One area at the far end of Trail 1 was nearing a matrix of Japanese brome. This species was found alive on three secondary transects at 3% cover or less, though it should be noted that dead Japanese brome was frequently observed in other transects and counted as litter. Spreading hedgeparsley (*Torilis arvensis*) was the second most commonly encountered exotic, found in 73% of the vector

Table 3.3-1. Number and percentage of primary and secondary sample units where each species was detected, Chickasaw NRA, 2010

Scientific name	Common name	Primary vector blocks (n=100)		Secondary transects (n=13)	
		Total	% blocks	Total ¹	% transects
<i>Bromus japonicus</i>	Japanese brome	97	97	3	23
<i>Torilis arvensis</i>	Spreading hedgeparsley	73	73	5	38
<i>Eragrostis cilianensis</i>	Stinkgrass	57	57	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	50	50	1	8
<i>Lolium perenne</i>	Perennial ryegrass	42	42	1	8
<i>Albizia julibrissin</i>	Mimosa	39	39	0	0
<i>Lespedeza cuneata</i>	Sericea lespedeza	33	33	5	38
<i>Sorghum halepense</i>	Johnsongrass	33	33	8	62
<i>Melia azedarach</i>	Chinaberry	23	23	0	0
<i>Medicago minima</i>	Burr medic clover	21	21	0	0
<i>Medicago lupulina</i>	Black medic clover	20	20	1	8
<i>Tragopogon dubius</i>	Western salsify	11	11	0	0
<i>Cynodon dactylon</i>	Bermuda grass	8	8	1	8
<i>Lathyrus hirsutus</i>	Singletary pea	7	7	2	15
<i>Amaranthus retroflexus</i>	Red-root pigweed	4	4	0	0
<i>Euphorbia dentata</i>	Toothed spurge	4	4	1	8
<i>Bromus tectorum</i>	Cheatgrass	3	3	0	0
<i>Lolium pratense</i>	Meadow fescue	2	2	0	0
<i>Taraxacum officinale</i>	Dandelion	2	2	0	0
<i>Lolium arundinaceum</i>	Tall fescue	1	1	0	0
<i>Bothriochloa ischaemum</i> var. <i>songarica</i>	KR bluestem	0	0	1	8
<i>Erodium cicutarium</i>	Red stork's-bill	0	0	2	15
<i>Melilotus alba</i>	White sweetclover	0	0	1	8
<i>Salsola tragus</i>	Prickly Russian thistle	0	0	1	8
<i>Arenaria serpyllifolia</i>	Thymeleaf sandwort	0	0	1	8
<i>Sonchus asper</i>	Spiny sowthistle	0	0	2	15
<i>Trifolium dubium</i>	Small hop clover	0	0	3	23
<i>Trifolium species</i>	Agricultural clover	0	0	2	15
<i>Trifolium species</i>	Agricultural clover	0	0	2	15

¹ The number of individual plots on secondary transects is shown in Figure 3.3-2.

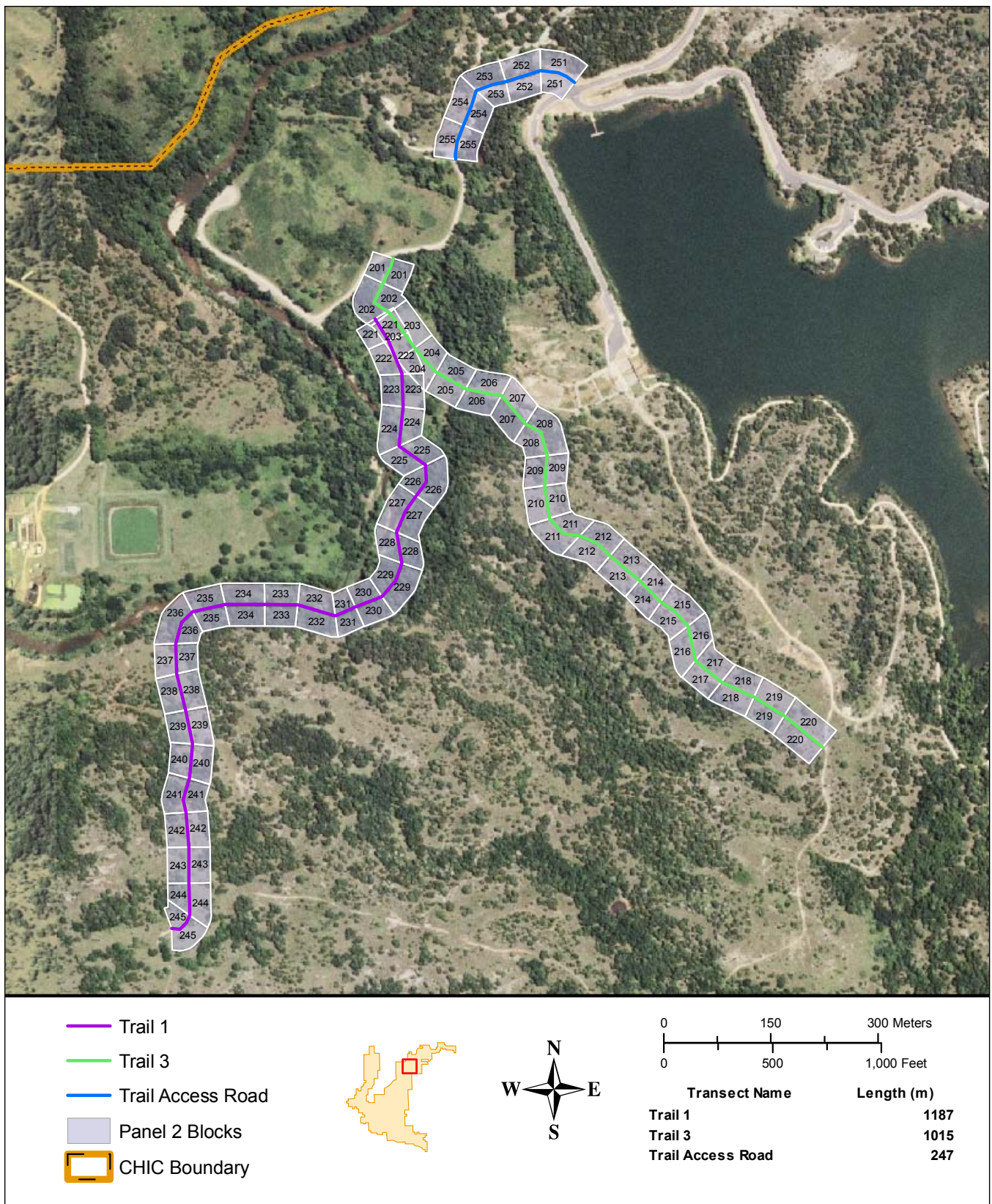


Figure 3.3-1. Individual vector blocks sampled, Panel 2, Chickasaw NRA, 2010.

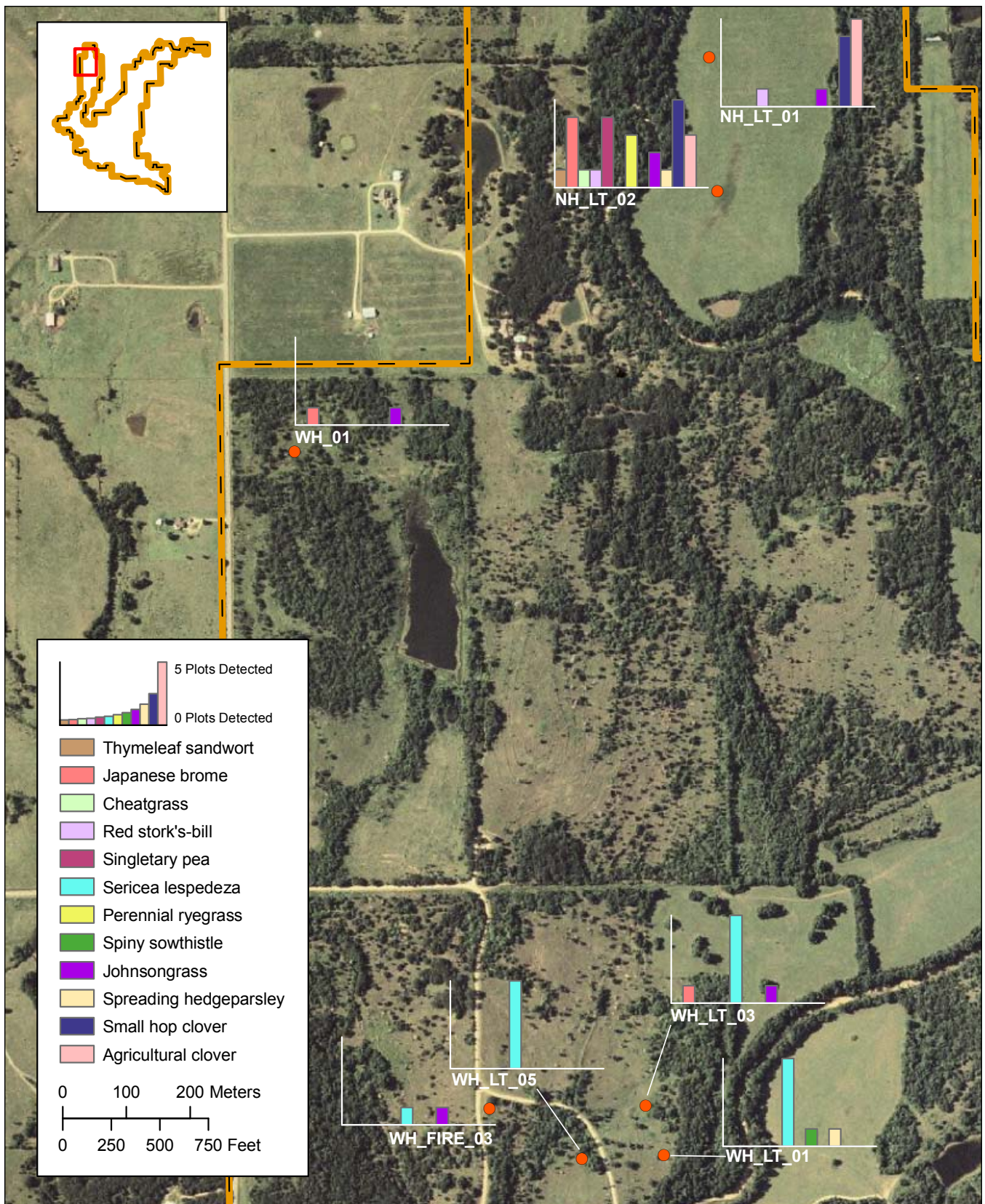


Figure 3.3-2. Secondary sample locations, Chickasaw NRA, West Hunting Area, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

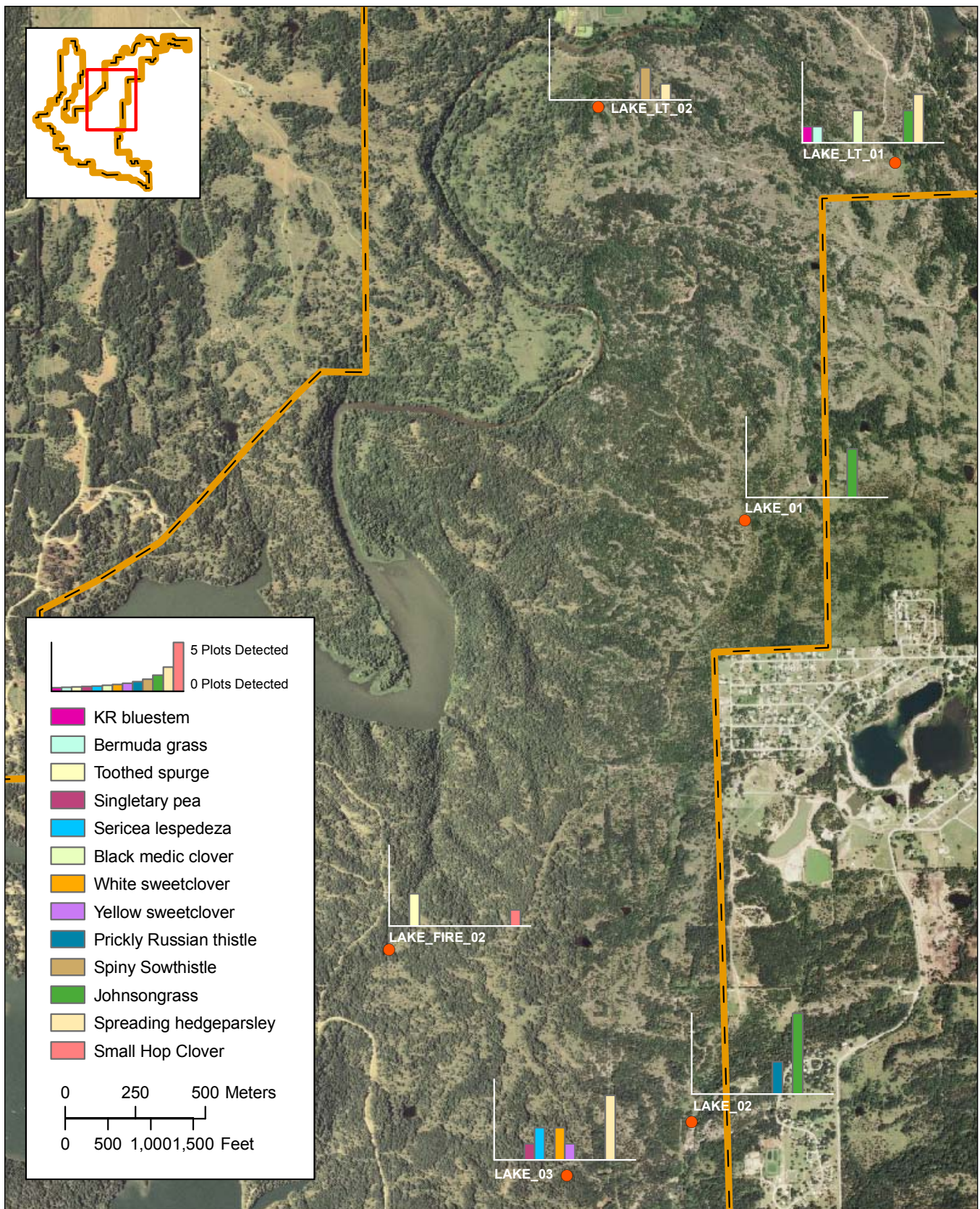


Figure 3.3-3. Secondary sample locations, Chickasaw NRA, Five Lakes Area, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

blocks (73) monitored and on 38% of the secondary transects (5). Hedgeparsley was generally found as individual plants or scattered patches, but a multi-block area at the beginning of Trail 3 exhibited evenly distributed patches. While always found in the first 12 meters of the vector, it was occasionally seen over 20 meters into the landscape. Hedgeparsley was found in one to four plots of the five secondary transects with a cover of 1% or less (one plot had 7% cover).

Stinkgrass (*Eragrostis cilianensis*) was found in 57% of the vector blocks (57) but no secondary transects. It was found predominately on Trails 1 and 3, contained in only one vector block at the end of the Trail Access Road. Stinkgrass was detected as individual plants to scattered patches in the first 12 meters off of Trail 3, but occasionally running deeper into the landscape on Trail 1 and in greater densities. Yellow sweetclover (*Melilotus officinalis*) was found in half of the vector blocks monitored (50) and one secondary transect. It was found on all vectors and varied from a few individual plants to evenly distributed patches, always in the first 12 meters of the vector but occasionally running 20 meters or deeper into the landscape. It was detected in one plot of one secondary transect at less than 1% cover. Perennial ryegrass (*Lolium perenne*) was found in 42% of the vector blocks (42) and one secondary transect. While found on all vectors almost always in the first 12 meters, it occurred as individual plants only on the Trail Access road; Trails 1 and 3 had densities at or near evenly distributed patches. Perennial ryegrass was found in three plots of one transect in the restoration area with covers as high as 10%.

Mimosa tree (*Albizia julibrissin*) was found in 39% of the vector blocks (39) monitored. It was found generally as individual plants to scattered patches on all vectors within the first 12 meters of the vector. Sericea lespedeza (*Lespedeza cuneata*) was detected on 33% of the vector blocks (33) and in 38% (5) of the secondary transects. It was found on all vectors, but primarily the first half of Trail 1, as scattered to evenly distributed patches up to 20 meters into the landscape and occasionally deeper. Lespedeza was most often found on the transects of the Guy Sandy area and when found was usually in all plots, but cover values ranged widely, from 1% to 75%. Johnsongrass (*Sorghum halepense*) appeared in one-third of all vector blocks (33) and was the most common exotic found in the secondary transects (62% or 8 transects). It was found in the first half of both



Spreading hedgeparsley (*Torilis arvensis*) was the second most commonly encountered exotic in 2010 at Chickasaw NRA.

Trails 1 and 3, and most of the Trail Access road, in scattered to evenly distributed patches running over 22 meters into the landscape. On the secondary transects, Johnsongrass appeared in variable amounts and in variable plot numbers, ranging in cover from less than 1% up to 23%, as would be expected in a patch-forming exotic.

Chinaberry (*Melia azedarach*) was found in 23% of the vector blocks (23) but no secondary transects. It was found off and on along both Trails 1 and 3, generally in scattered patches from 2 to over 20 meters into the landscape. One area of Trail 3 had increased densities running deep into the woods. Burr medic clover (*Medicago minima*) was detected in 21% of the vector blocks (21) in scattered patches up to 12 meters from the vector. One area along the Trail Access road exhibited evenly distributed patches. A similar species, black medic clover (*Medicago lupulina*) was found in 20% of the vector blocks (20) and one secondary transect. It was seen as scattered patches in

the first 12 meters of all vectors. Two plots of one transect contained black medic clover at less than 1% cover. Western salsify (*Tragopogon dubius*) was found in 11% of the vector blocks (11) generally as individual plants growing within 12 meters near the beginning of the trail, although one area of Trail 1 showed increasing densities.

Several species of exotics appeared minimally along vectors and in secondary transects. Bermuda grass (*Cynodon dactylon*) appeared in eight vector blocks and one transect. It was detected as evenly distributed along the Trail Access road in the first 12 meters of the vector, and in one plot of a transect at less than 1% cover. Singletary pea (*Lathyrus hirsutus*) was found in seven vector blocks and two transects. It appeared as scattered patches in the first 12 meters from the vector, in one area of Trail 3 and two disjunct areas on Trail 1. It occupied 1% or less cover in one plot of the lake area and four plots of a secondary transect in the restoration area. Toothed spurge (*Euphorbia dentata*) was found in the first two meters of four vector blocks as individual plants, and in one secondary transect at less than 1% cover. Redroot pigweed (*Amaranthus retroflexus*), cheatgrass (*Bromus tectorum*), meadow fescue (*Lolium prentense*), dandelion (*Taraxacum officinale*), and tall fescue (*Lolium arundinaceum*) all appeared in limited vector blocks and in no secondary transects. Redroot pigweed was found in four vector blocks as scattered patches in the first 12 meters from the vector on both trails. Cheatgrass appeared in three vector blocks as scattered patches

up to 20 meters into the landscape on both trails. Meadow fescue was found as individual plants in two vector blocks of the Trail Access road between 2 and 12 meters from the vector. Dandelion appeared in two vector blocks of the Trail Access road as individual plants or scattered patches in the first two meters from the vector. Tall fescue was found in one vector block of Trail 3 as a few individual plants 2–12 meters off the vector.

Eight exotic species were not found along primary vectors but did appear in secondary transects. Small hop clover (*Trifolium dubium*) was detected in three transects; two which held the greatest quantities were in the restoration area with cover values of less than 1% to as much as 20%. A species of agricultural clover (*Trifolium species*) was found in the two transects of the restoration area with cover as high as 90% or more in some plots. Spiny sowthistle (*Sonchus asper*) was detected in limited quantities in two transects at less than 1% cover. Redstem stork's-bill (*Erodium cicutarium*) was found in both transects of the restoration area with a 1% cover or less. KR bluestem (*Bothriochloa ischaemum*) was found in one plot of one transect, but the cover was 15%. White sweetclover (*Melilotus alba*), salsola (*Salsola tragus*) and thymeleaf sandwort (*Arenaria serpyllifolia*) were all found in single transects. Salsola and thymeleaf sandwort had covers of less than 1%, while white sweetclover had a cover of up to 15%.

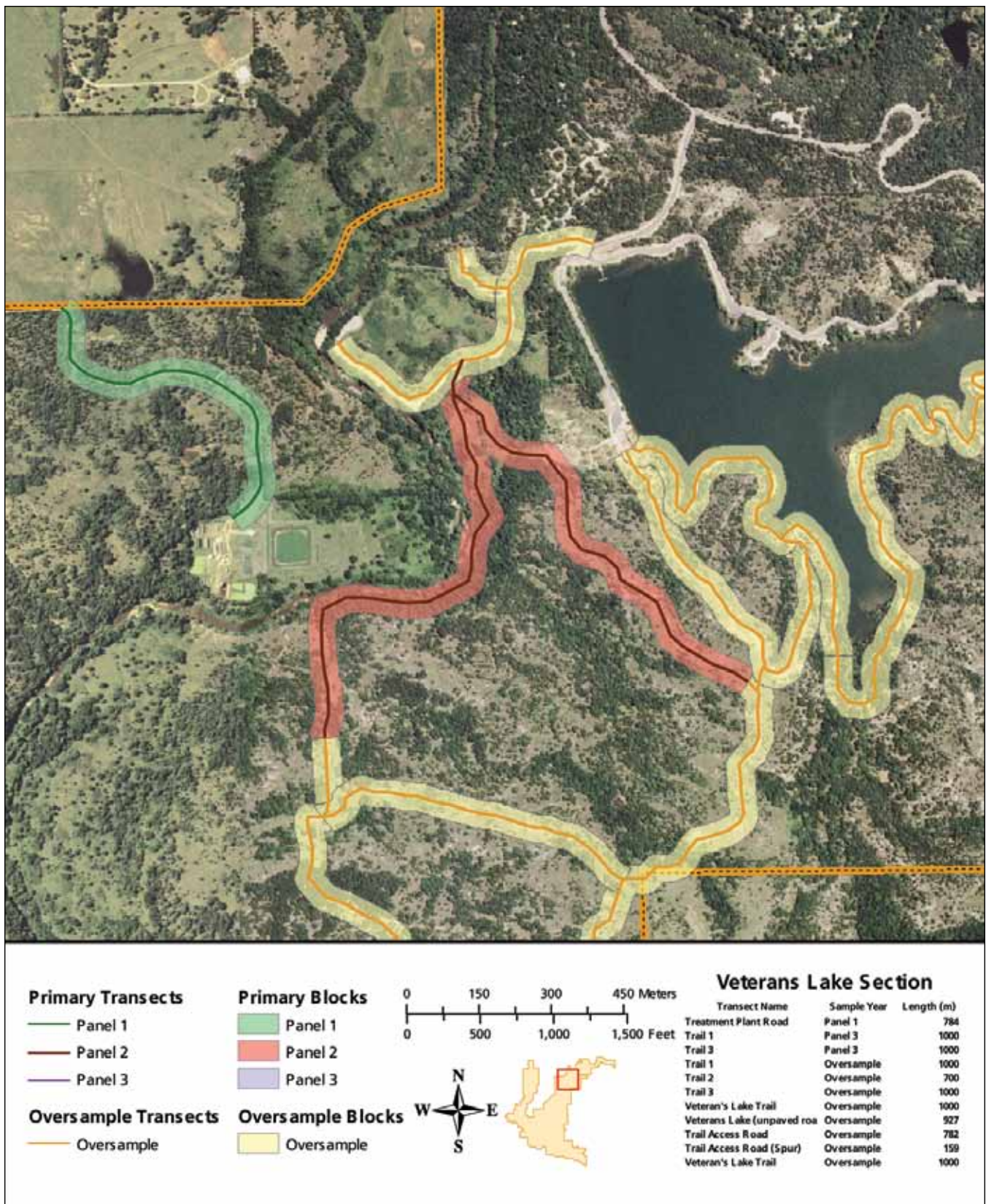


Figure 3.3-4. Overall planned sampling scheme for panels (annual samples) in the Veterans Lake vicinity of Chickasaw NRA for a full three-year rotation.

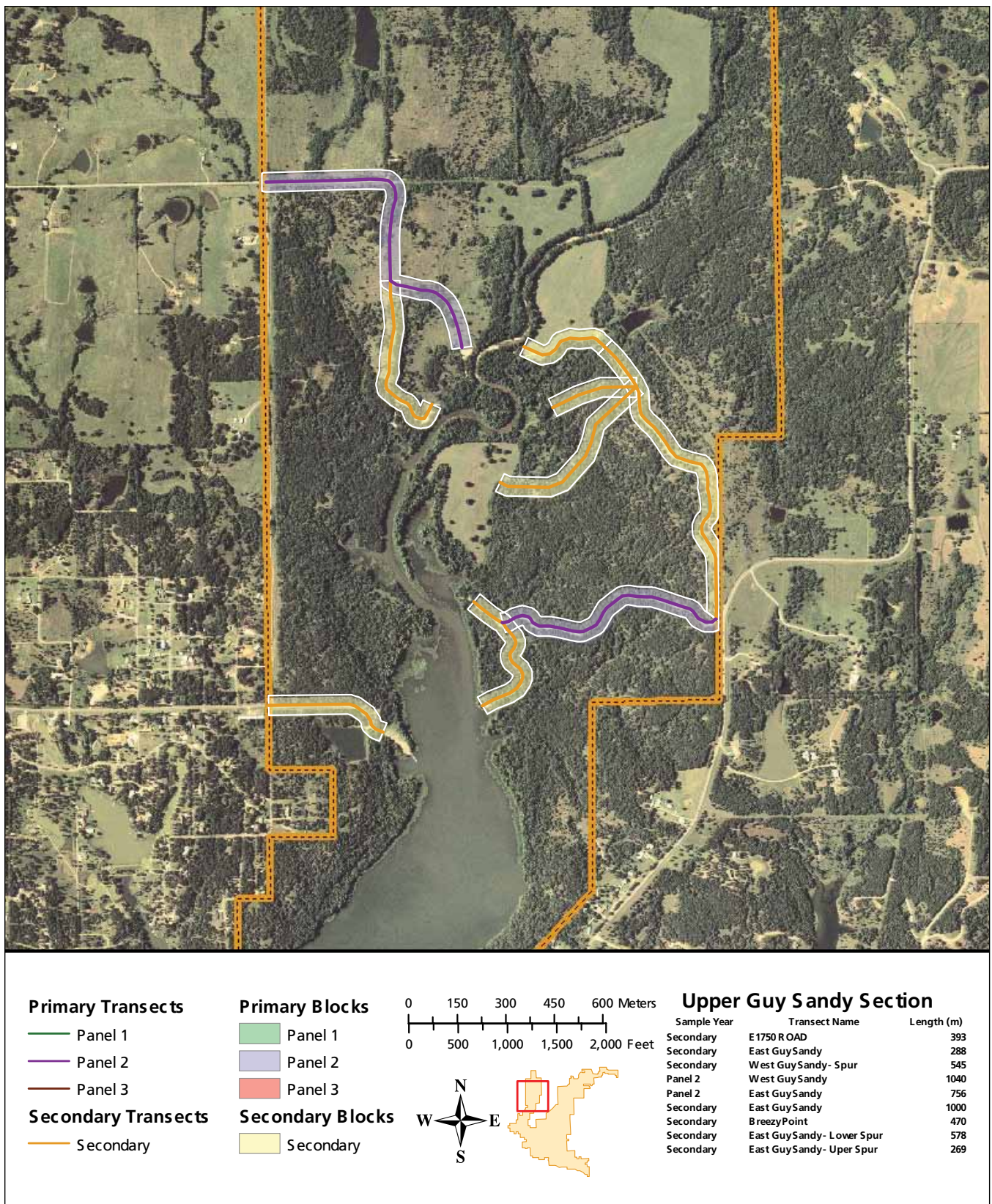


Figure 3.3-5. Overall planned sampling scheme for panels (annual samples) in the Upper Guy Sandy vicinity of Chickasaw NRA for a full three-year rotation.

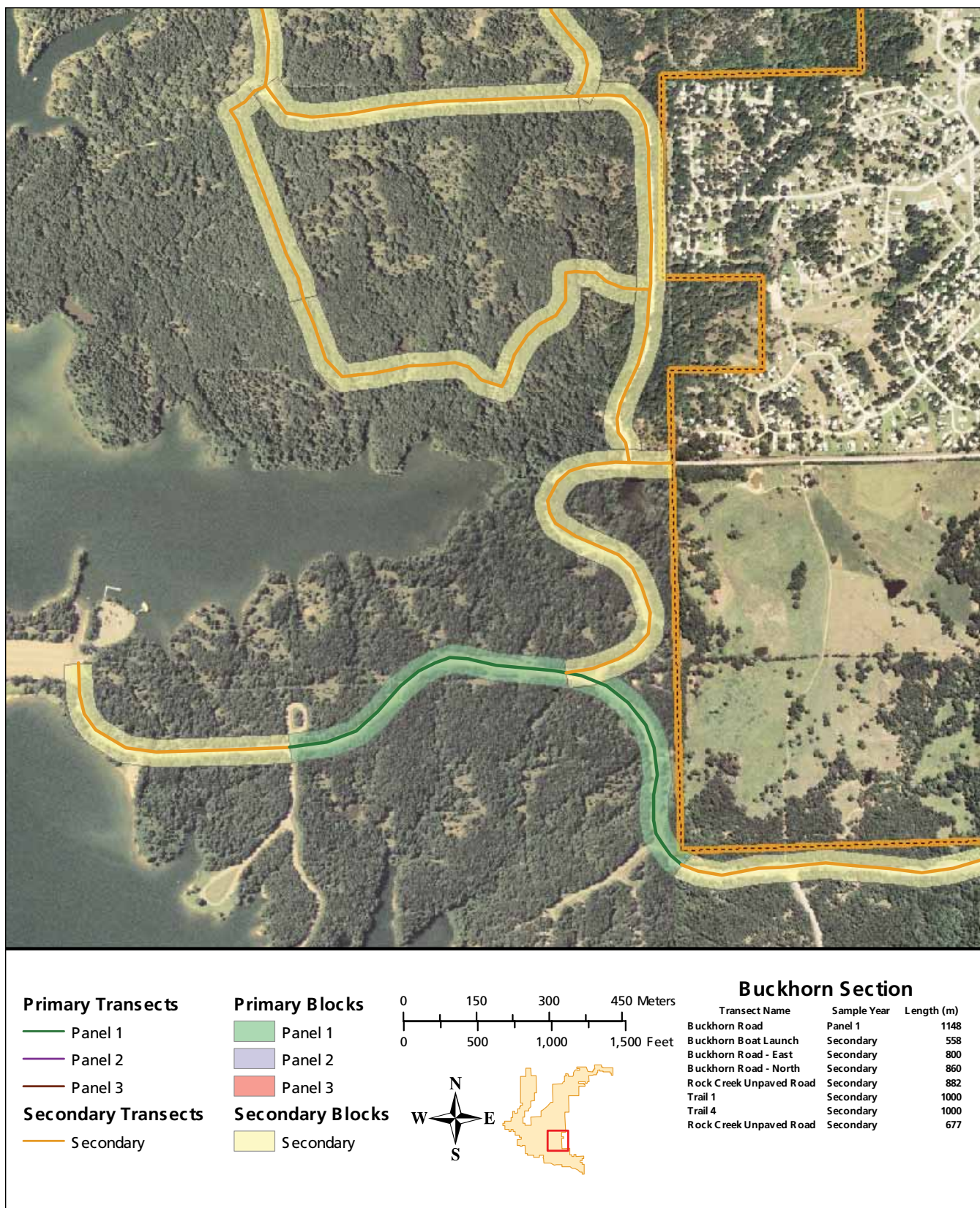


Figure 3.3-6. Overall planned sampling scheme for panels (annual samples) in the Buckhorn vicinity of Chickasaw NRA for a full three-year rotation.

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Albizia julibrissin</i>	Mimosa	R	206	2	2	–	–
		R	207	1	2	–	–
		R	208	0	1	–	–
		R	209	0	1	–	–
		R	212	0	2	0	–
		R	213	1	2	–	–
		R	216	1	0	0	–
		R	218	1–2	2	–	–
		L	207	1	1	0	0
		L	208	0	2	0	0
		L	209	0	2	0	0
		L	210	1	2	0	0
		L	211	2	3	0	0
		L	212	1	2	0	0
		L	213	2	2	0	0
		L	214	1	2	0	0
		L	216	0	2	0	–
		L	218	1	2	0	0
		L	220	1	2	0	0
		R	221	0	2	0	–
		R	224	1	0	0	–
		R	225	0	2	–	–
		R	236	1–2	0	–	–
		R	239	1	1	0	–
		R	240	2	2	1	–
		R	241	0	2	0	–
		R	245	0	1	–	–
		L	221	0	1	0	0
		L	222	1	0	0	0
		L	225	1	1	–	–
		L	239	1	2	2	0
		L	240	2	1	0	0
		L	241	2	2	–	–
		L	242	2	2	0	0
		R	251	1	0	–	–
		R	253	1	0	–	–
		R	254	2	2	–	–
		R	255	1	2	–	–
		L	251	0	1	–	–
		L	252	0	1	–	–

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Amaranthus retroflexus</i>	Red-root pigweed	R	205	0	1	–	–
		R	223	1	2	–	–
		L	223	2	2	0	0
		L	224	2	2	0	0
<i>Bromus japonicus</i>	Japanese brome	R	201	2	2	–	–
		R	202	0	2	2	2
		R	203	3	3	2	0
		R	204	3	3	3	0
		R	205	3	3	–	–
		R	205	0	1	–	–
		R	206	2	2	–	–
		R	207	2	0	–	–
		R	208	2	0	–	–
		R	209	2	0	–	–
		R	210	2	2	0	0
		R	211	2	0	–	–
		R	212	1	1	0	–
		R	213	1	0	–	–
		R	214	2	0	–	–
		R	215	1	0	0	–
		R	216	1–2	0	0	–
		R	217	2	2	0	–
		R	218	2	2	–	–
		R	219	3	3	–	–
		R	220	2	2–3	1	–
		L	201	2	2	–	–
		L	202	1	2	–	–
		L	203	3	3	0	0
		L	204	3	3	0	0
		L	205	2	3	3	0
		L	206	2	3	3	0
		L	207	2	3	3	0
		L	208	2	2	0	0
		L	209	2	2	0	0
		L	210	0	2	0	0
		L	211	1	1	0	0
		L	212	1	0	0	0
		L	214	0	1	0	0
		L	215	1	0	0	–
		L	216	1	0	0	–
		L	217	2	0	0	0
		L	218	2	0	0	0

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus japonicus</i> (cont.)		L	219	2	3	3	3
		L	220	2	2	0	0
		R	221	2-3	3	0	-
		R	222	3	3	2	-
		R	223	2-3	2-3	-	-
		R	224	3	3	2	-
		R	225	2-3	3	-	-
		R	226	2	2-3	-	-
		R	227	2	1	-	-
		R	228	2	2	-	-
		R	229	2	2	-	-
		R	230	1	2	-	-
		R	231	2	2	-	-
		R	232	2	2	-	-
		R	233	1	2	-	-
		R	234	1	2	-	-
		R	235	1	2	-	-
		R	236	2	3	-	-
		R	237	2	3	3	-
		R	238	2	3	2	-
		R	239	2	2	0	-
		R	240	2	2	1	-
		R	241	1	1	0	-
		R	242	2	2	0	-
		R	243	3	2	0	-
		R	244	3-4	3-4	-	-
		R	245	3-4	3-4	-	-
		L	221	2	3	3	0
		L	222	3	3	3	0
		L	223	3	3	0	0
		L	224	3	3	3	0
		L	225	3	3	-	-
		L	226	2	-	-	-
		L	227	1	-	-	-
		L	228	2	-	-	-
		L	229	2	2	2	-
		L	230	1	1	-	-
		L	231	1	0	-	-
		L	232	2	-	-	-
		L	233	1	0	0	0
		L	234	1	1	0	0
		L	235	1	2	-	-

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus japonicus</i> (cont.)		L	236	2	3	–	–
		L	237	2	3	0	0
		L	238	2	3	3	3
		L	239	2	3	3	3
		L	240	2	0	0	0
		L	241	2	0	–	–
		L	242	1	2	0	0
		L	243	2	2	–	–
		L	244	3	3	3	3
		L	245	3	3	0	0
		R	251	2	2	–	–
		R	253	2	2	–	–
		R	255	1	0	–	–
		L	251	2	3	–	–
		L	252	2	3	–	–
		L	253	3	–	–	–
		L	254	0	2	–	–
<i>Bromus tectorum</i>	Cheatgrass	L	201	1	2	–	–
		L	204	0	2	2	0
		L	244	0	1	0	0
<i>Cynodon dactylon</i>	Bermuda grass	R	251	3	1	–	–
		R	252	3	0	–	–
		R	253	1	0	–	–
		R	254	0	1	–	–
		L	251	3	0	–	–
		L	252	3	3	–	–
		L	253	3	–	–	–
		L	254	2	0	–	–
<i>Eragrostis cilianensis</i>	Stinkgrass	R	201	0	2	–	–
		R	202	0	2	0	0
		R	203	2	2	0	0
		R	204	2	2	0	0
		R	205	1	0	–	–
		R	208	0	2	–	–
		R	209	2	2	–	–
		R	210	0	2	0	0
		R	211	0	2	–	–
		R	213	1	1–2	–	–
		R	214	1	2	–	–
		R	215	2	2	0	–
		R	216	2	2	0	–
		R	217	1	2	0	–

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Eragrostis cilianensis</i> (cont.)		R	218	1	2	–	–
		R	219	2	1	–	–
		R	220	2	2	1	–
		L	202	1	0	–	–
		L	204	1	1	0	0
		L	208	0	1	0	0
		L	209	1	1	0	0
		L	210	0	1	0	0
		L	213	1	0	0	0
		L	214	1	1	0	0
		L	215	0	1	0	–
		L	216	1	0	0	–
		L	217	1	0	0	0
		L	219	0	1	0	0
		R	221	0	2	0	–
		R	222	0	2	0	–
		R	223	2	1	–	–
		R	224	2	2	0	–
		R	225	1–2	1–2	–	–
		R	226	2	2	–	–
		R	227	2	2	–	–
		R	228	1	1	–	–
		R	233	2	0	–	–
		R	235	1	1	–	–
		R	237	2	2	2	–
		R	238	2–3	3	2	–
		R	239	2	2	0	–
		R	241	1	1	0	–
		R	242	1	0	0	–
		R	243	2	1	0	–
		R	244	3	3	–	–
		R	245	2	2	–	–
		L	223	1	0	0	0
		L	226	2	–	–	–
		L	227	1	–	–	–
		L	228	2	–	–	–
		L	234	1	0	0	0
		L	237	2	0	0	0
		L	238	3	3	0	0
		L	239	2	2	0	0
		L	244	1	2	0	0
		L	245	3	3	0	0

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Eragrostis cilianensis</i> (cont.)		L	255	0	2	–	–
<i>Euphorbia dentata</i>	Toothed spurge	L	202	2	0	–	–
		L	207	1	0	0	0
		L	230	1	0	–	–
		L	254	1	0	–	–
<i>Lathyrus hirsutus</i>	Singletary pea	R	204	0	2	0	0
		L	203	0	2	0	0
		L	204	0	2	0	0
		R	238	1	1	0	–
		R	244	1	2	–	–
		R	245	0	1	–	–
		L	238	1	2	0	0
<i>Lespedeza cuneata</i>	Sericea lespedeza	R	201	2	2	–	–
		R	202	2	2	2	2
		R	203	0	0	2	0
		R	204	0	2	2	0
		R	205	2	2–3	–	–
		R	206	2	2	–	–
		R	207	0	2	–	–
		R	208	0	2	–	–
		L	201	1	1	–	–
		L	202	2	2	–	–
		L	205	2–3	3	3	0
		L	206	3	3	2	0
		R	221	1	2	1	–
		R	223	1	1	–	–
		R	224	2	2–3	0	–
		R	227	2	2	–	–
		R	228	2	2	–	–
		R	232	0	1	–	–
		R	233	0	1	–	–
		R	235	1	1	–	–
		R	237	0	0	2	–
		L	221	2	2	1	0
		L	222	1	2	3	3
		L	223	0	2	3	0
		L	224	0	2	0	0
		L	225	2	2	–	–
		L	226	2	–	–	–
		L	227	2	–	–	–
		L	228	2	–	–	–
		L	235	2	2	–	–

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Lespedeza cuneata</i> (cont.)		L	237	0	2	0	0
		L	251	0	1	–	–
		L	253	2	–	–	–
<i>Lolium arundinaceum</i>	Tall fescue	R	206	0	1	–	–
<i>Lolium perenne</i>	Perennial ryegrass	R	201	2	2	–	–
		R	202	1	2	0	0
		R	203	2	0	0	0
		R	204	2	2	0	0
		R	205	2	2	–	–
		R	206	2	0	–	–
		R	208	1–2	0	–	–
		R	209	2	0	–	–
		R	210	2	1	0	0
		R	211	1	0	–	–
		R	215	1	0	0	–
		R	216	1	1	0	–
		R	219	3	3	–	–
		R	220	1	1	0	–
		L	201	1	2	–	–
		L	203	0	1	0	0
		L	204	1	2	0	0
		L	205	2	0	0	0
		L	206	1	0	0	0
		L	207	0	1	0	0
		L	208	1	0	0	0
		L	209	1	0	0	0
		L	211	1	0	0	0
		L	214	0	1	0	0
		L	219	3	0	0	0
		R	223	2	2	–	–
		R	224	2	2–3	0	–
		R	225	1	0	–	–
		R	237	2	2	0	–
		R	238	2–3	2–3	0	–
		R	239	2	2	0	–
		R	240	2	2	1	–
		R	241	1	1	0	–
		R	242	1	2	0	–
		R	243	1	0	0	–
		L	223	1	1	0	0
		L	224	1	0	0	0
		L	237	1	0	0	0

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Lolium perenne</i> (cont.)		L	240	1	0	0	0
		R	251	1	0	–	–
		R	253	1	0	–	–
		L	251	1	1	–	–
<i>Lolium pratense</i>	Meadow fescue	R	252	0	1	–	–
		L	252	0	1	–	–
<i>Medicago lupulina</i>	Black medic clover	R	201	2	0	–	–
		R	204	2–3	2–3	0	0
		R	205	2–3	2–3	–	–
		R	206	2	2	–	–
		L	201	1	0	–	–
		L	203	1	0	0	0
		L	204	2	2	0	0
		L	205	2	2	0	0
		L	206	2	2	0	0
		L	207	1	0	0	0
		R	221	1	0	0	–
		R	222	2	2	0	–
		R	224	1	0	0	–
		R	238	2	2	0	–
		L	236	1	0	–	–
		L	237	2	0	0	0
		R	251	2	0	–	–
		R	252	2	0	–	–
		R	253	2	0	–	–
		R	254	2	0	–	–
<i>Medicago minima</i>	Burr medic clover	R	201	2	0	–	–
		R	202	1	0	0	0
		L	201	1	0	–	–
		L	202	2	2	–	–
		L	203	1	1	0	0
		R	222	2	1–2	0	–
		R	224	1	0	0	–
		R	237	1	0	0	–
		R	238	2	0	0	–
		L	221	2	0	0	0
		L	222	2	0	0	0
		L	224	2	2	0	0
		L	237	1	0	0	0
		L	238	2	0	0	0
		R	251	2–3	0	–	–
		R	252	3	0	–	–

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Medicago minima</i> (cont.)		R	254	2	0	–	–
		L	251	2	0	–	–
		L	252	3	0	–	–
		L	253	3	–	–	–
		L	255	2	0	–	–
<i>Melia azedarach</i>	Chinaberry	R	201	0	2	–	–
		R	202	0	2	0	0
		R	203	0	1	0	0
		R	204	0	2	0	0
		R	205	0	2	–	–
		R	211	0	2	–	–
		R	213	0	2	–	–
		R	216	0	0	1	–
		R	217	0	2	1	–
		L	201	0	2	–	–
		L	203	0	2	2	0
		L	204	0	2	3	3
		L	205	0	2	3	3
		L	207	0	1	0	0
		L	208	0	1	0	0
		L	220	0	1	0	0
		R	225	0	1	–	–
		R	226	0	2	–	–
		R	228	0	1	–	–
		L	226	2	–	–	–
		L	228	1	–	–	–
		L	229	1	0	0	–
		L	237	0	1	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	R	201	0	1	–	–
		R	202	1	2	0	0
		R	204	2	2	2	0
		R	205	2	2	–	–
		R	206	2	2	–	–
		R	207	1	2	–	–
		R	208	3	3	–	–
		R	220	1	1	0	–
		L	201	0	2	–	–
		L	202	1	2	–	–
		L	203	1	0	0	0
		L	204	2	0	0	0
		L	205	2	0	0	0
		L	206	1	2	2	0

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Melilotus officinalis</i> (cont.)		L	207	2	2	0	0
		L	208	2	3	3	0
		L	209	1	0	0	0
		R	221	0	1	1	–
		R	225	1–2	2	–	–
		R	226	2	2	–	–
		R	235	2	0	–	–
		R	237	2–3	2–3	2	–
		R	238	2	2–3	2	–
		R	239	2–3	2–3	3	–
		R	241	1	0	0	–
		R	242	0	2	0	–
		R	243	1	0	0	–
		R	244	1	0	–	–
		L	221	1	2	2	0
		L	222	0	2	2	2
		L	224	0	2	2	0
		L	225	2	2	–	–
		L	226	3	–	–	–
		L	228	2	–	–	–
		L	235	1	0	–	–
		L	237	1	2	0	0
		L	238	1	2	2	0
		L	239	2	3	0	0
		L	240	2	0	0	0
		L	241	1	2	–	–
		L	243	1	2	–	–
		L	244	2	2	0	0
		L	245	0	0	2	0
		R	252	0	2–3	–	–
		R	254	2	0	–	–
		L	251	0	2	–	–
		L	252	0	2	–	–
		L	253	2	–	–	–
		L	254	1	0	–	–
		L	255	0	1	–	–
<i>Sorghum halepense</i>	Johnsongrass	R	201	0	2	–	–
		R	202	2	2	2	0
		R	203	0	2	2	0
		R	204	0	0	2	0
		R	205	3	3	–	–
		R	206	2–3	2–3	–	–

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Sorghum halepense</i> (cont.)		R	207	0	1	–	–
		L	201	1	2	–	–
		L	202	2	1	–	–
		L	203	0	2	3	0
		L	204	0	2	2	0
		L	205	2	3	0	0
		L	206	2	3	0	0
		L	213	0	2	3	0
		L	216	0	0	2	–
		R	221	0	2	2	–
		R	222	0	2–3	2	–
		R	223	0	3	–	–
		R	224	0	3	3	–
		R	237	0	1	0	–
		L	221	0	0	2	2
		L	222	2	2	3	3
		L	223	1	2	3	3
		L	224	3	3	3	3
		R	251	1	1	–	–
		R	252	2–3	2	–	–
		R	253	3	3	–	–
		R	254	0	2	–	–
		R	255	1	0	–	–
		L	251	1	1	–	–
		L	252	2	2	–	–
		L	253	2	–	–	–
		L	255	0	1	–	–
<i>Taraxacum officinale</i>	Dandelion	R	251	2	0	–	–
		R	253	1	0	–	–
<i>Torilis arvensis</i>	Spreading hedgeparsley	R	201	2	2	–	–
		R	202	2	2	2	2
		R	203	3	3	2	3
		R	204	3	3	3	0
		R	205	3	3	–	–
		R	206	0	2	–	–
		R	207	1	0	–	–
		R	209	1	1	–	–
		R	210	1	0	0	1
		R	212	0	2	0	–
		R	213	0	2	–	–
		R	214	0	2	–	–
		R	216	1	2	0	–

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Torilis arvensis</i> (cont.)		R	219	2	2	–	–
		R	220	0	1	0	–
		L	201	2	2	–	–
		L	203	0	3	3	0
		L	204	3	3	0	0
		L	205	2	3	0	0
		L	206	2	3	0	0
		L	207	2	0	0	0
		L	208	1	1	0	0
		L	210	1	1	0	0
		L	212	0	1	0	0
		L	213	0	1	0	0
		L	214	0	1	0	0
		L	215	0	1	0	–
		L	216	0	1	1	–
		L	217	0	1	0	0
		L	218	1	1	0	0
		L	219	1	1	2	2
		L	220	0	2	0	0
		R	221	0	1–2	0	–
		R	222	0	2–3	2	–
		R	223	0	2	–	–
		R	224	2	2–3	0	–
		R	225	0	2	–	–
		R	226	2	2	–	–
		R	227	1	2	–	–
		R	228	1–2	1	–	–
		R	229	1	1	–	–
		R	234	1	0	–	–
		R	237	0	1	0	–
		R	238	2	2	0	–
		R	239	0	2	2	–
		R	240	0	1	0	–
		R	242	1	0	0	–
		R	243	1	1	0	–
		R	244	0	2	–	–
		R	245	0	1	–	–
		L	221	0	2	0	0
		L	222	0	0	3	0
		L	223	1	2	2	0
		L	224	0	2	2	2
		L	225	2	2	–	–

Table 3.3-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Chickasaw NRA, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Torilis arvensis</i> (cont.)		L	226	2	–	–	–
		L	227	1	–	–	–
		L	228	1	–	–	–
		L	237	0	1	0	0
		L	238	1	2	2	0
		L	239	1	2	2	2
		L	242	0	1	0	0
		L	244	2	2	0	0
		L	245	0	2	0	0
		R	251	0	2	–	–
		R	252	0	2–3	–	–
		R	253	2	2	–	–
		R	254	0	1	–	–
		L	251	1	2	–	–
		L	252	0	2	–	–
		L	253	2	–	–	–
		L	254	1	2	–	–
		L	255	1	1	–	–
<i>Tragopogon dubius</i>	Western salsify	R	203	1	1	0	0
		R	204	0	1	0	0
		R	205	0	1	–	–
		L	203	0	1	0	0
		L	204	0	1	0	0
		L	205	0	1	0	0
		L	218	0	1	0	0
		L	222	2	2	2	0
		L	224	1	0	0	0
		L	225	1	0	–	–
		L	255	0	1	–	–

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

3.4 Fort Larned NHS

Overall sampling at Fort Larned occurs on paved and unpaved roads, trails and boundaries of the main unit over its full three-year rotation (Figure 3.4-3). In 2010, exotic-plant monitoring occurred at Fort Larned for two days in June. A total of 45 vector blocks were monitored resulting in 440 linear meters surveyed on both sides of paved entrance road, 275 linear meters surveyed on one side of paved boundary road, and 1 linear kilometer surveyed on one side of unpaved boundary road (Figure 3.4-1). In addition, twelve permanent transects within the landscape were sampled for a total of 60 4 x 1 meter plots.

It is no surprise that smooth brome (*Bromus inermis*) was the most commonly found exotic in both primary and secondary monitoring. All but one vector block (98%) contained smooth brome as evenly distributed patches to matrices running from the vector edge deep into the landscape. Nine secondary transects contained smooth brome, generally in all plots, with cover as much as 80%. Smooth brome was not found in the two transects of Burn Unit 2A and in the Ruts Unit. Yellow sweetclover was found in 62% of the vector blocks (28) and 58% of the transects (7). It was found as scattered to evenly distributed patches deep into the landscape on all vectors, although less densely and deeply on the far southern boundary. In the secondary transects,

Table 3.4-1. Number and percentage of primary and secondary sample units where each species was detected, Fort Larned NHS, 2010

Scientific name	Common name	Primary vector blocks (n=45)		Secondary transects (n=12)	
		Total	% blocks	Total ¹	% transects
<i>Bromus inermis</i>	Smooth brome	44	98	9	75
<i>Melilotus officinalis</i>	Yellow sweetclover	28	62	7	58
<i>Kochia scoparia</i>	Kochia	19	42	2	17
<i>Convolvulus arvensis</i>	Field bindweed	17	38	9	75
<i>Euphorbia dentata</i>	Toothed spurge	16	36	1	8
<i>Medicago lupulina</i>	Black medic clover	16	36	0	0
<i>Taraxacum officinale</i>	Dandelion	16	36	0	0
<i>Tragopogon dubius</i>	Western salsify	14	31	1	8
<i>Amaranthus retroflexus</i>	Red-root pigweed	11	24	0	0
<i>Chenopodium album</i>	Common lambsquarters	11	24	2	17
<i>Cynodon dactylon</i>	Bermuda grass	11	24	0	0
<i>Bromus tectorum</i>	Cheatgrass	10	22	0	0
<i>Digitaria sanguinalis</i>	Hairy crabgrass	10	22	0	0
<i>Lamium amplexicaule</i>	Henbit	7	16	0	0
<i>Cirsium arvense</i>	Canada thistle	6	13	0	0
<i>Rumex patientia</i>	Patience dock	6	13	0	0
<i>Cirsium vulgare</i>	Bull thistle	5	11	0	0
<i>Sorghum halepense</i>	Johnsongrass	4	9	0	0
<i>Conium maculatum</i>	Poison hemlock	2	4	0	0
<i>Descurainia sophia</i>	Flixweed	2	4	0	0
<i>Salsola tragus</i>	Prickly Russian thistle	2	4	0	0
<i>Trifolium repens</i>	White clover	2	4	0	0
<i>Lolium perenne</i>	Perennial ryegrass	1	2	0	0
<i>Rumex crispus</i>	Curly dock	1	2	1	8
<i>Tribulus terrestris</i>	Puncturevine	1	2	0	0
<i>Bromus japonicus</i>	Japanese brome	1	2	1	8
<i>Poa pratensis</i>	Kentucky bluegrass	0	0	1	8
<i>Sonchus asper</i>	Spiny sowthistle	0	0	1	8

¹ The number of individual plots on secondary transects is shown in Figure 3.4-2.



Figure 3.4-1. Individual vector blocks sampled, Panel 2, Fort Larned NHS, 2010.



Figure 3.4-2. Secondary sample locations, Fort Larned NHS, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.



Smooth brome (*Bromus inermis*) was the most commonly found exotic in both primary and secondary monitoring in 2010 at Fort Larned NHS.

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yellow sweetclover appeared in varying amounts with cover of less than 1% to as high as 45%. Kochia (*Kochia scoparia*) was detected in 42% of the vector blocks (19) but only 2 secondary transects. It was found as individual plants in a few blocks along the entrance road, but more commonly and frequently as scattered patches in the southwestern and southern boundaries. In all instances, it ran at least 20 meters into the landscape. Kochia was found on one transect of the main unit at a cover of 3% or less, and in the Ruts transect at cover as high as 10%.

Field bindweed (*Convolvulus arvensis*) appeared in 38% of the vector blocks (17) and was the second most common exotic in the eight secondary transects (67%). Found on all vectors, bindweed appeared most often as scattered patches but displayed some areas of even distribution, always within the first 12 meters but often running up to and over 20 meters into the landscape. When found in a transect, bindweed almost always appeared in three to five plots generally at 20% cover or below, though occasionally reaching up to 50% cover. Toothed spurge (*Euphorbia dentata*) was found in 36% of the vector blocks (16) and one transect. It was observed along the western and southwestern boundaries as individual plants to scattered patches generally in the first 12 meters of the vector. Spurge was seen on two plots of one transect at 1% cover or less. Black medic clover (*Medicago lupulina*) and dandelion (*Taraxacum officinale*) were also found in 36% of the vector blocks (16) but not in any transects. Along the main entrance road, both species were found as scattered to evenly distributed patches from the vector to over 20 meters into the landscape,

but on the boundaries found only as individual plants to scattered patches up to 12 meters from the vector.

Western salsify (*Tragopogon dubius*) was observed in 31% vector blocks (14) and one secondary transect. It was found as individual plants to scattered patches, primarily along the boundaries up to 20 meters from the vector. Salsify was only found in one plot of one transect at less than 1% cover. Common lambsquarters (*Chenopodium album*) was detected in 24% vector blocks (11) and two transects. It was found only along the southern boundary primarily as scattered patches within the first 12 meters, but occasionally running deeper into the landscape. One transect contained one plot with a cover of 15% while the second transect contained two plots with 1% or less cover. Redroot pigweed (*Amaranthus retroflexus*) and Bermuda grass (*Cynodon dactylon*) also were found in 24% of the vector blocks (11). Pigweed was detected along the boundary as scattered patches up to 20 meters into the landscape, while Bermuda grass was along the Entrance road and the boundary as scattered patches up to 12 meters from the vector. Cheatgrass (*Bromus tectorum*) and hairy crabgrass (*Digitaria sanguinalis*) were seen in 22% of the vector blocks (10). A few individual plants of cheatgrass were within 12 meters of the side of the entrance road at the highway, but more frequently along the boundaries as scattered patches at the same distance. Crabgrass was found in scattered patches along all vectors within the first 2 meters of the vector, but running up to 12 meters deep at the southwestern boundary.

Several species of exotics were found in a minimal number of vector blocks and a few secondary transects. Henbit (*Lamium amplexicaule*) was detected in seven vector blocks along the southern boundary as scattered patches within the first two meters of the vector. Canada thistle (*Cirsium arvense*) appeared in six vector blocks. Primarily found along the southern boundary, it was seen as individual plants to scattered patches over 12 meters from the vector; one block at the entrance road and highway held a few individuals in the first two meters. Patience dock (*Rumex patientia*) was also in six vector blocks as individual plants to scattered patches on all vectors, but ran up to 22 meters into the landscape. Bull thistle (*Cirsium vulgare*) was tentatively identified in five vector blocks along the western boundary in scattered patches up to 20 meters into the landscape. Johnsongrass (*Sorghum halepense*) was found in

four vector blocks along the western boundary as scattered patches up to 20 meters or more into the landscape. Hemlock (*Conium maculatum*) was found in two vector blocks along the boundaries as individual plants from next to the vector up to 20 meters deep. Flixweed (*Descurainia sophia*) was observed in two vector blocks along the boundary as individual plants in mowed areas. A few individual plants of salsola (*Salsola tragus*) were found in the mowed areas of two vector blocks along the entrance road. White clover (*Trifolium repens*) was found in two vector blocks along the entrance road as scattered patches from 2 to 20 meters into the landscape. Perennial ryegrass (*Lolium perenne*) and puncturevine (*Tribulus terrestris*) were found in one vector block each on the southern boundary as individual plants. Ryegrass was seen from 2 to 12 meters from the

vector while puncturevine was in the first two meters. A few individual plants of curlydock (*Rumex crispus*) was found along one vector block on the south boundary and in one plot of one transect at 1% cover. Japanese brome (*Bromus japonicus*) was found as a few individual plants up to 12 meters into one vector block at the entrance road and highway. It was also found in three plots of the Ruts transect at 3% cover or less. Kentucky bluegrass (*Poa pratensis*) and spiny sowthistle (*Sonchus asper*) were not detected along the vectors but did appear in the Ruts transect. The bluegrass showed up to 10% cover, while the sowthistle was at 1% cover or less.

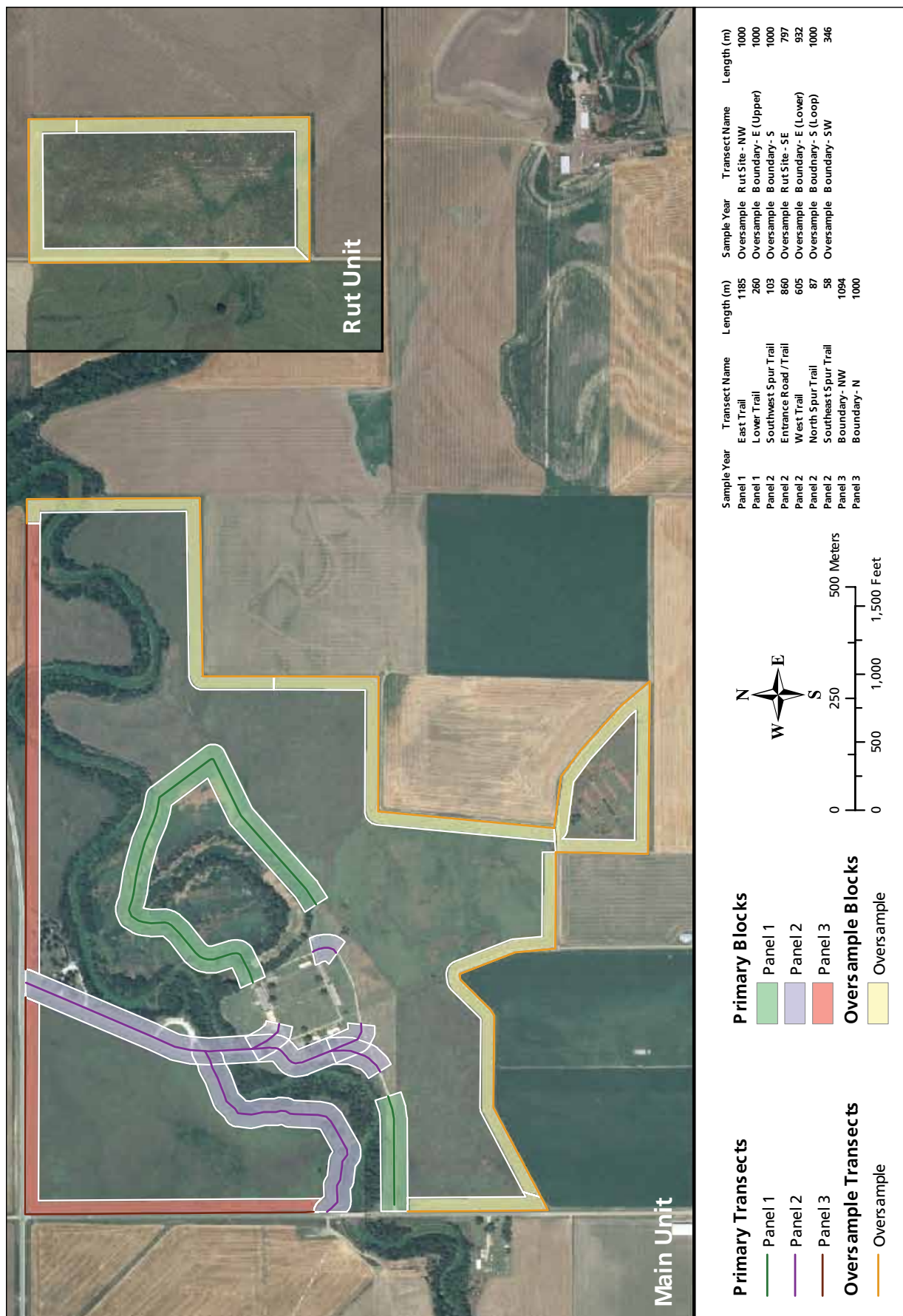


Figure 3.4-3. Overall planned sampling scheme for panels (annual samples) at Fort Larned NHS for a full three-year rotation.

Table 3.4-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Larned NHS, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Amaranthus retroflexus</i>	Red-root pigweed	L	216	1	0	0	0
		L	225	0	1	0	0
		L	227	0	2	0	0
		L	229	2	2	2	0
		L	231	1	0	0	0
		L	236	2	1	0	0
		L	238	1	1	0	0
		L	226	0	2	0	0
		L	228	0	2	3	0
		L	230	2	2	0	0
		L	239	1	2	2	0
<i>Bromus inermis</i>	Smooth brome	L	202	0	1	1	0
		L	203	0	0	2	2
		L	204	0	2	4	–
		L	205	0	1–2	4	–
		L	206	0	1	4	4
		L	207	0	0	2	3
		L	208	1	0	0	3
		L	209	1	2	2	3
		R	201	2	3–4	3–4	3–4
		R	202	2	3–4	3–4	3–4
		R	203	0	3–4	3–4	3–4
		R	204	0	3–4	3–4	3–4
		R	205	0	3–4	3–4	3–4
		R	206	0	3–4	3–4	3–4
		R	207	0	3–4	3–4	3–4
		R	208	0	3–4	3–4	3–4
		R	209	0	3–4	3–4	3–4
		L	211	3	3	3	3
		L	213	3	3	3	3
		L	215	3–4	3	3	3
		L	212	3	3	3	3
		L	214	3	3	3	3
		L	216	3	3	3	3
		L	221	3	3	3	4
		L	223	3	3	3	3
		L	225	3	3	3	3
		L	227	3	3	3	3
		L	229	3–4	4	4	4
		L	231	3	3	3	3
		L	233	3	3	3	3
		L	236	3	3	3	3
		L	238	3	3	3	3
		L	240	3	3	3	3

Table 3.4-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Larned NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus inermis</i> (cont.)		L	222	3	4	4	4
		L	224	3	3	3	3
		L	226	3	3	3	3
		L	228	3	3	3	3
		L	230	4	4	4	4
		L	232	3	3	3	3
		L	234	3	3	3	3
		L	235	3	3	3	3
		L	237	3	3	3	3
		L	239	3	3	3	3
		L	241	3	4	4	3
<i>Bromus japonicus</i>	Japanese brome	L	201	1–2	1	0	0
<i>Bromus tectorum</i>	Cheatgrass	L	201	0	1	0	0
		R	201	1	0	0	0
		L	212	2	0	0	0
		L	216	2	0	0	0
		L	236	0	2	0	0
		L	238	0	2	0	0
		L	240	0	2	0	0
		L	228	0	0	2	0
		L	235	2	2	0	0
		L	239	2	0	0	0
<i>Chenopodium album</i>	Common lambsquarters	L	229	2	2	2	0
		L	233	2	0	0	0
		L	236	2	0	0	0
		L	238	2	0	0	0
		L	240	1–2	0	0	0
		L	228	0	2	0	0
		L	230	1	0	0	0
		L	232	2	0	0	0
		L	234	1	1	0	0
		L	239	1	0	0	0
		L	241	1	0	0	0
<i>Cirsium arvense</i>	Canada thistle	R	201	2	0	0	0
		L	224	0	0	1	0
		L	235	1	0	0	0
		L	237	1	2	0	0
		L	239	1	2	0	0
		L	241	1	0	0	0
<i>Cirsium vulgare</i>	Bull thistle	L	215	0	2	2	0
		L	214	0	2	2	0
		L	216	0	0	2	0
		L	224	0	2	0	0
		L	230	1	0	0	0

Table 3.4-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Larned NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Convolvulus arvensis</i>	Field bindweed	L	201	0	1	2	2
		L	202	0	1	0	0
		L	203	0	1	0	0
		R	204	1	1	0	0
		R	205	0	3	2	0
		R	206	2	2	0	0
		R	207	2	0	0	0
		R	208	2	2	3	0
		R	209	2	3	2	0
		L	211	1	2	2	2
		L	213	1	1	0	0
		L	212	2	3	3	0
		L	223	2	1	0	0
		L	233	0	1	0	0
		L	236	2	0	0	0
		L	240	1	0	0	0
		L	230	3	3	3	0
<i>Conium maculatum</i>	Poison hemlock	L	216	1	0	0	0
		L	239	0	0	1	0
<i>Cynodon dactylon</i>	Bermuda grass	L	202	1	0	0	0
		R	204	2	0	0	0
		R	205	2	0	0	0
		R	206	2	0	0	0
		R	208	2	0	0	0
		R	209	2	0	0	0
		L	223	1	0	0	0
		L	227	1	0	0	0
		L	222	2	0	0	0
		L	226	2	2	0	0
		L	228	2	2	0	0
<i>Descurainia sophia</i>	Flixweed	L	213	0	1	0	0
		L	236	1	0	0	0
<i>Digitaria sanguinalis</i>	Hairy crabgrass	L	205	2	0	0	–
		L	206	2	0	0	0
		L	208	2	0	0	0
		R	206	2	0	0	0
		R	207	2	0	0	0
		R	208	2	0	0	0
		L	221	1	0	0	0
		L	222	2	0	0	0
		L	224	2	2	0	0
		L	226	2	2	0	0
<i>Euphorbia dentata</i>	Toothed spurge	L	211	1	1	0	0
		L	213	0	1	0	0
		L	212	1	1	0	0

Table 3.4-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Larned NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Euphorbia dentata</i> (cont.)		L	225	0	1	0	0
		L	227	0	1	0	0
		L	236	1	1	0	0
		L	238	1-2	1	0	0
		L	240	1	0	0	0
		L	222	0	1	0	0
		L	228	0	1	0	0
		L	230	1	0	0	0
		L	232	0	1	0	0
		L	234	2	2	2	0
		L	235	2	0	0	0
		L	239	1	2	0	0
		L	241	2	2	0	0
<i>Kochia scoparia</i>	Kochia	L	207	0	1	1	0
		R	202	0	1	1	0
		R	206	0	1	0	0
		L	212	0	1	0	0
		L	229	2	0	0	0
		L	231	2	0	0	0
		L	233	2	0	0	0
		L	236	2	0	0	0
		L	238	2	0	0	0
		L	240	2	1	0	0
		L	224	0	1	0	0
		L	228	0	0	1	0
		L	230	2	2	2	0
		L	232	2	2	0	0
		L	234	2	2	0	0
		L	235	2	2	0	0
		L	237	2	2	2	0
		L	239	2	2	0	0
		L	241	2	2	0	0
<i>Lamium amplexicaule</i>	Henbit	L	231	2	0	0	0
		L	233	2	0	0	0
		L	236	1	0	0	0
		L	230	2	0	0	0
		L	232	2	0	0	0
		L	234	2	0	0	0
		L	235	2	0	0	0
<i>Lolium perenne</i>	Perennial ryegrass	L	238	0	1	0	0
<i>Medicago lupulina</i>	Black medic clover	L	201	1-2	0	2	1
		L	202	0	2	2	2
		L	203	0	2	2	2
		L	204	0	2	2	–
		L	205	0	3	0	–

Table 3.4-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Larned NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Medicago lupulina</i> (cont.)		L	206	0	3	0	0
		L	207	0	2	0	0
		R	201	2	0	0	0
		R	202	2	0	0	0
		R	203	2	0	0	0
		R	204	2	0	0	0
		R	206	2	0	0	0
		R	207	2	0	0	0
		R	208	2	0	0	0
		L	237	2	2	0	0
		L	239	2	0	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	R	201	1	0	0	0
		R	202	0	2	2	3
		R	203	0	0	2	3
		R	204	0	0	3	3
		R	205	0	0	3	3
		R	206	0	0	3	3
		R	207	0	1	2	2
		R	208	0	0	2	0
		L	211	0	2	2	2
		L	213	0	2	2	2
		L	215	0	2	2	2
		L	212	0	2	2	3
		L	214	0	2	3	3
		L	223	0	2	2	0
		L	225	0	2	3	0
		L	227	0	2	0	0
		L	233	0	1	0	0
		L	236	1	2	0	0
		L	238	1	0	2	0
		L	240	2	0	1	0
		L	224	0	2	3	2
		L	226	0	2	2	2
		L	228	0	2	2	2
		L	230	2	2	0	0
		L	235	1	2	0	0
		L	237	0	1	2	0
		L	239	2	2	0	0
		L	241	1	0	0	0
<i>Rumex crispus</i>	Curly dock	L	241	1	0	0	0
<i>Rumex patientia</i>	Patience dock	R	201	0	2	2	0
		R	204	0	1	0	0
		L	211	1	1	1	0
		L	215	0	0	1	0
		L	238	1	0	0	0

Table 3.4-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Larned NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Rumex patientia</i> (cont.)		L	222	0	1	0	0
<i>Salsola tragus</i>	Prickly Russian thistle	R	203	1	1	0	0
		R	204	1	0	0	0
<i>Sorghum halepense</i>	Johnsongrass	L	211	2	2	2	2
		L	213	1	1	0	0
		L	212	2	2	2	0
		L	214	2	0	0	0
<i>Taraxacum officinale</i>	Dandelion	L	201	0	2	2	2
		L	202	0	2	3	3
		L	203	0	3	3	3
		L	204	0	2	2	–
		L	205	0	2	0	–
		L	206	0	2	0	0
		L	207	0	0	1	0
		R	201	2	1	0	0
		R	202	2	0	0	0
		R	206	1	0	0	0
		R	209	1	1	0	0
		L	216	1	0	0	0
		L	223	1	0	0	0
		L	227	2	0	0	0
		L	229	1	0	0	0
		L	238	1	1	0	0
<i>Tragopogon dubius</i>	Western salsify	R	203	0	1	0	0
		L	221	0	0	1	0
		L	229	0	1	0	0
		L	231	2	2	0	0
		L	236	1	1	0	0
		L	238	1	0	0	1
		L	240	1	1	0	0
		L	228	0	0	1	0
		L	230	0	0	1	0
		L	232	0	0	0	0
		L	234	0	2	0	0
		L	235	2	2	0	0
		L	237	0	2	2	0
		L	239	2	2	2	0
<i>Trifolium repens</i>	White clover	L	207	0	0	2	0
		L	208	0	2	2	0
<i>Tribulus terrestris</i>	Puncturevine	L	236	1	0	0	0

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

3.5 Fort Union NM

Overall sampling at Fort Union includes both paved and unpaved roads in both units over its full three-year rotation (Figure 3.5-3). In 2010, exotic-plant monitoring occurred at Fort Union for two days in July. The vectors sampled were unpaved maintenance roads around from the fort ruins to the water tower and down into the north-west corner of the main unit. The two-track road in the Old Fort unit was also surveyed leading to and in front of the ruins. Ninety-six vector blocks were monitored, for a total of 2.4 linear kilometers sampled on both sides (Figure 3.5-1). In addition, six permanent transects within the landscape were sampled for a total of 30 4 x 1 meter plots. No exotics were found in six vector blocks.

Prickly Russian thistle (*Salsola tragus*) was the most commonly found exotic species this field season, followed by kochia (*Kochia scoparia*). Prickly Russian thistle was found in 80% of the vector blocks sampled (77) and 50% of the secondary transects (3). While most frequently seen within the first 12 meters of the roadside in scattered patches, it was often observed running over 20 m into the landscape. The scattered patches appear to be expanding, as surrounding blocks contain occasional plants. An evenly distributed, fairly dense area of prickly Russian thistle occurs near the riparian area along the northwest boundary. Prickly Russian thistle was detected in three of the six permanent transects, usually with less than 1% cover, but once at 8% cover. Kochia appeared in 59% of vector blocks (57) and 33% of secondary transects (2). Its densities were from

a few plants to scattered patches and it occurred randomly in all distance classes. Kochia also appeared in only one plot each of two permanent transects at a cover of 3% or less

White sweetclover (*Melilotus alba*) was present in 15% of vector blocks sampled (14), and was absent from secondary transects. Only a few plants were detected in one area of the Old Fort unit, and single plants were scattered along the main unit transects up to 12 m into the landscape. Western salsify (*Tragopogon dubius*) was found in 13% of vector blocks sampled (12) and was absent from secondary transects. Within the main unit, only one vector block contained a few plants—this being the same riparian area at the northwest boundary where the prickly Russian thistle was so abundant. Western salsify was found here and there throughout the Old Fort unit as single plants within the first 12 meters from the vector. Field bindweed (*Convolvulus arvensis*) was found in 9% of vector blocks sampled (9) and was also absent from secondary transects. One vector block containing scattered patches of field bindweed was found in the Old Fort unit near the ruins and efforts towards its eradication would prevent further spread. Scattered patches were also found along the northwest boundary road (two vector blocks) and in several vector blocks along the road to the water tank. Often these patches were associated with trail ruts.

Musk thistle (*Carduus nutans*) was present in 3% of vector blocks sampled (3) as individual plants and was also absent from secondary transects. The vector block at the water tower, a vec-

Table 3.5-1. Number and percentage of primary and secondary sample units where each species was detected, Fort Union NM, 2010

Scientific name	Common name	Primary vector blocks (n=96)		Secondary transects (n=6)	
		Total	% blocks	Total ¹	% transects
<i>Salsola tragus</i>	Prickly Russian thistle	77	80	3	50
<i>Kochia scoparia</i>	Kochia	57	59	2	33
<i>Melilotus alba</i>	White sweetclover	14	15	0	0
<i>Tragopogon dubius</i>	Western salsify	12	13	0	0
<i>Convolvulus arvensis</i>	Field bindweed	9	9	0	0
<i>Carduus nutans</i>	Musk thistle	3	3	0	0
<i>Euphorbia davidii</i>	Davids spurge	2	2	3	50
<i>Bromus catharticus</i>	Rescue brome	1	1	0	0
<i>Marrubium vulgare</i>	Horehound	1	1	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	1	1	0	0
<i>Ulmus pumila</i>	Siberian elm	1	1	0	0

¹ The number of individual plots on secondary transects is shown in Figure 3.5-2.

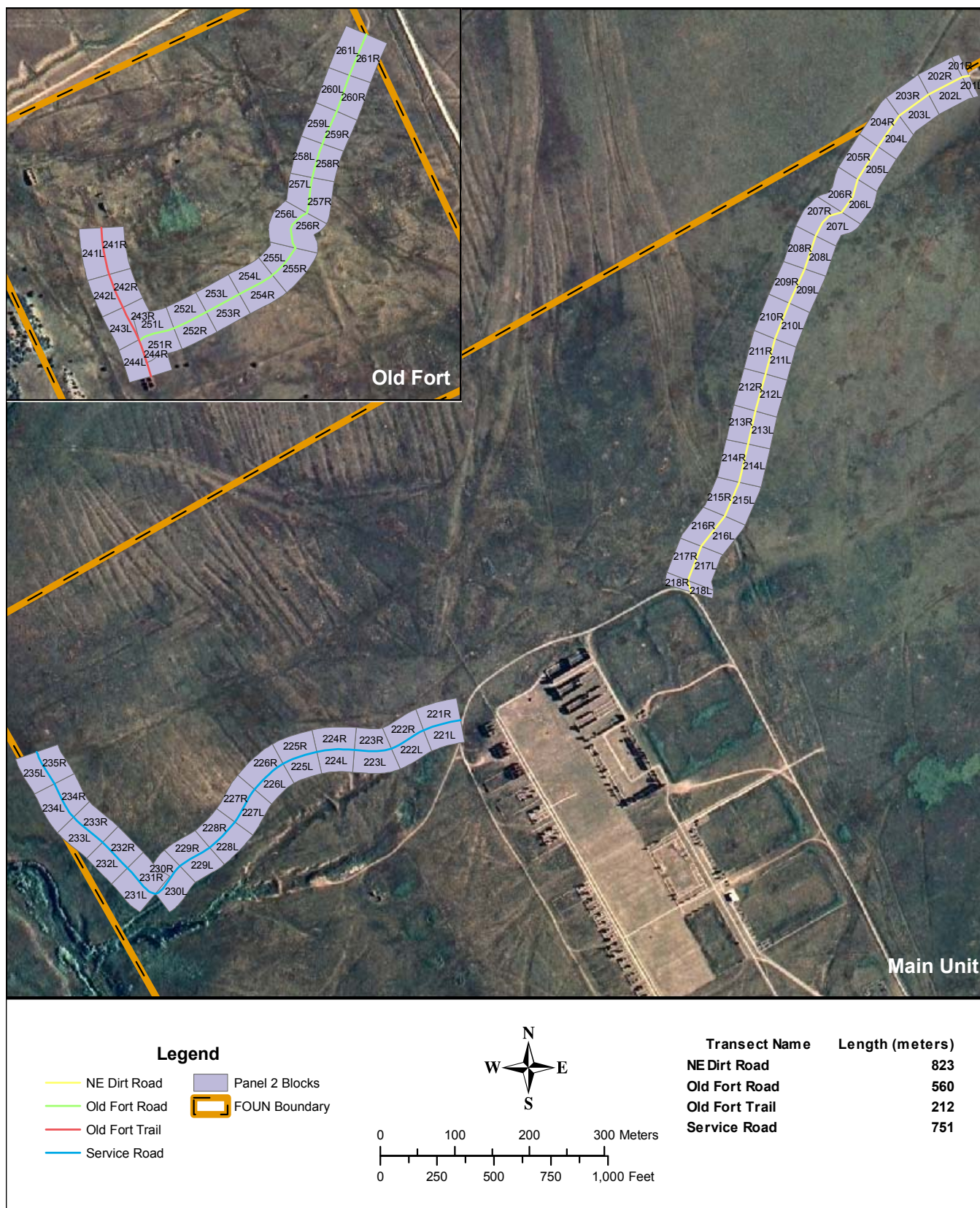


Figure 3.5-1. Individual vector blocks sampled, Panel 2, Fort Union NM, 2010.

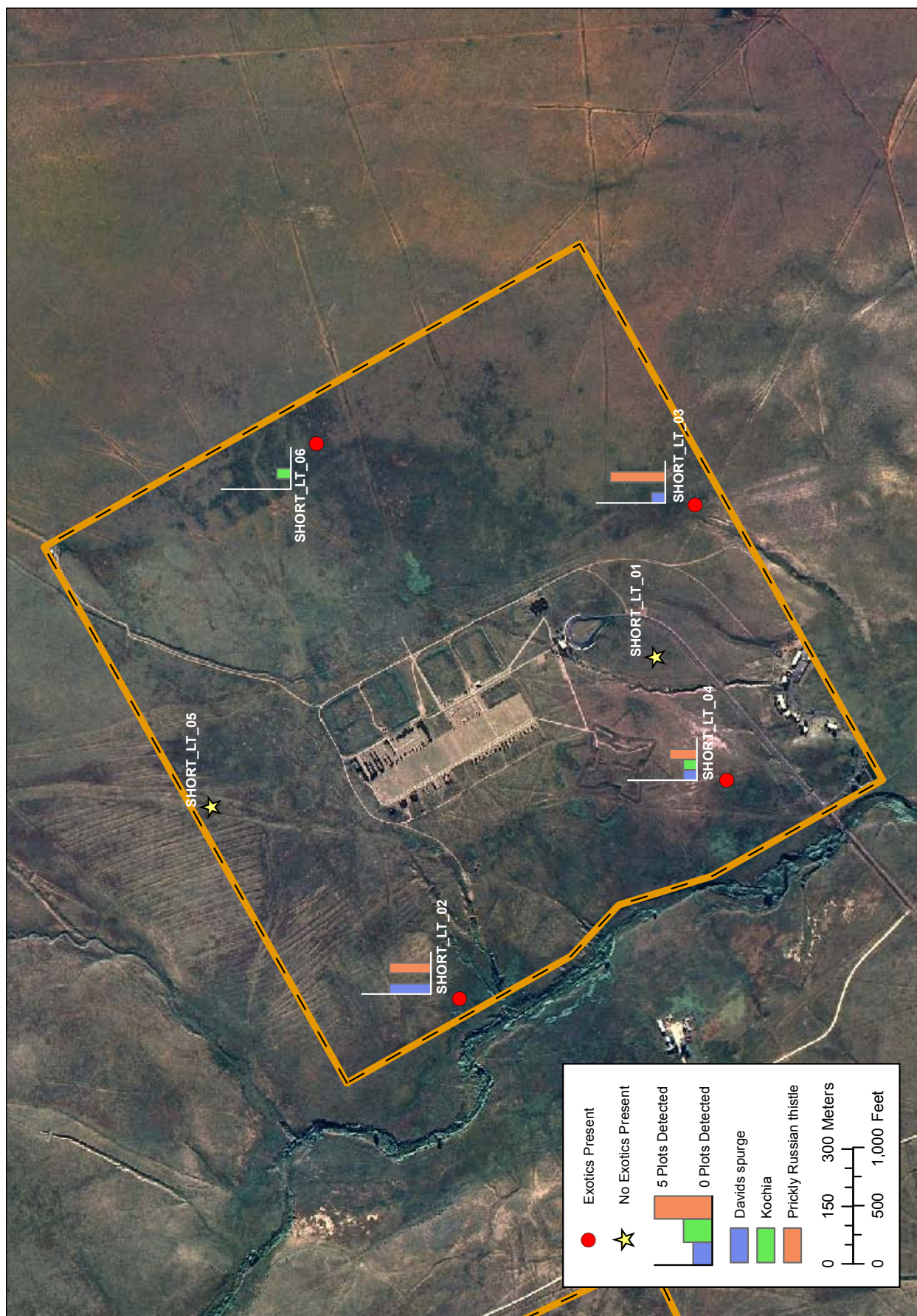


Figure 3.5-2. Secondary sample locations, Fort Union NM, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

tor block midway along the northwest boundary road, and a vector block near the ruins of the Old Fort unit each contained limited plants. Care should be taken prior to eradication efforts to verify the species identification, as native thistles can resemble this noxious plant. David's spurge (*Euphorbia davidii*) was present in 2% of vector blocks sampled (2) and 50% of secondary transects (3). Two vector blocks at the ruts just past the road junction contained a few plants and this should be watched for spread, as David's spurge appears to multiple easily at Fort Union. One permanent transect had three plots containing David's spurge up to 10% cover, while the two other transects contained single plots of up to 5% cover. Rescue brome (*Bromus catharticus*), horehound (*Marrubium vulgare*), yellow sweetclover (*Melilotus officinalis*), and Siberian elm (*Ulmus pumila*) were each present in 1% of vector blocks sampled (1) and none of the permanent transects. Rescue brome was present in scattered patches near the Old Fort unit ruins. Horehound was found in scattered patches of an area along the northwest boundary road that may be associated with an historic cultural resource. Yellow sweetclover was found in a few patches along the road to the water tank, mixed in with the white sweetclover. A few Siberian elms were found at the juncture of the northwest boundary road near the ruins.



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Prickly Russian thistle (*Salsola tragus*) was the most commonly found exotic species in 2010 at Fort Union NM.

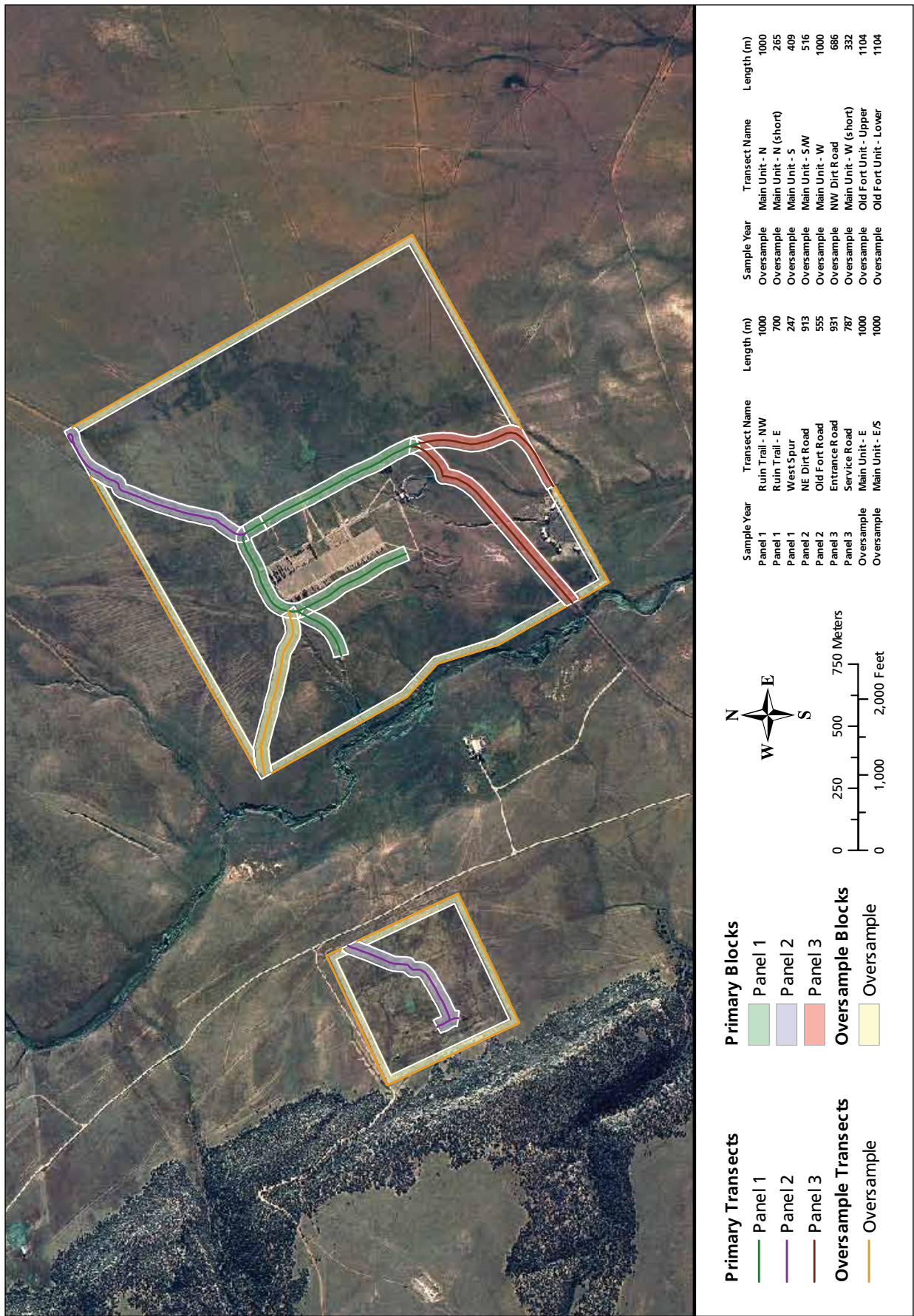


Figure 3.5-3. Overall planned sampling scheme for panels (annual samples) at Fort Union NM for a full three-year rotation.

Table 3.5-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Union NM, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus catharticus</i>	Rescue brome	R	242	0	2	0	0
<i>Carduus nutans</i>	Musk thistle	R	202	0	1	0	0
		R	229	0	0	0	1
		R	242	1	0	0	0
<i>Convolvulus arvensis</i>	Field bindweed	R	215	2	0	0	0
		R	217	1-2	0	0	0
		L	213	0	2	0	0
		L	214	0	2	0	0
		L	215	2	2	0	0
		L	217	2	2	0	0
		L	224	0	2	0	0
		L	228	0	1	0	0
		R	242	0	2	0	0
<i>Euphorbia davidii</i>	Davids spurge	R	215	1	0	0	0
		L	215	1	0	0	0
<i>Kochia scoparia</i>	Kochia	R	206	0	0	0	1
		R	207	0	0	1	0
		R	208	0	0	1	0
		R	210	0	0	0	1-2
		R	211	0	0	0	2
		R	212	0	0	0	1
		R	213	0	1	1	0
		R	216	0	0	1	1
		R	217	0	2	0	0
		R	218	3	3	2	0
		L	215	0	1	0	0
		L	218	2	2	2	0
		R	221	2	2	2	2
		R	222	0	0	1	0
		R	223	1	1	1	0
		R	224	0	1	0	0
		R	225	0	1	0	0
		R	226	0	2	1	0
		R	227	0	2	0	0
		R	228	1-2	2	2	1
		R	229	1	1-2	0	0
		R	230	2	2	0	0
		L	221	2	2	2	0
		L	222	0	2	2	0
		L	223	0	2	2	2
		L	228	0	2	2	0
		L	229	0	2	2	0
		L	230	0	2	2	0

Table 3.5-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Union NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Kochia scoparia</i> (cont.)		L	232	0	2	2	0
		L	235	1	0	0	0
		R	241	0	1-2	0	0
		R	242	2	2	2	1
		R	243	2	2	2	2
		R	244	0	2	2	2
		L	241		2	2	2
		L	242	0	2	2	0
		L	243	0	2	2	0
		L	244	2	2	2	2
		R	251	2	2	2	2
		R	252	0	2	2	2
		R	253	1	2	2	2
		R	254	1	1	0	0
		R	256	0	2	2	0
		R	258	0	2	2	1
		R	259	0	2	2	2
		R	260	2	2	2	2
		R	261	0	1-2	1-2	2
		L	251	0	2	2	0
		L	252	0	2	2	0
		L	253	0	2	2	2
		L	255	0	2	2	0
		L	256	0	2	2	0
		L	257	0	2	2	0
		L	258	0	2	2	0
		L	259	0	2	2	0
		L	260	0	2	2	0
		L	261	1	0	0	0
<i>Marrubium vulgare</i>	Horehound	L	224	0	2	0	0
<i>Melilotus alba</i>	White sweetclover	R	203	1	0	0	0
		R	205	1	1	0	0
		R	216	1	1	1	0
		L	214	1	0	0	0
		L	217	0	1	0	0
		R	224	0	1-2	0	0
		R	227	1	0	0	0
		R	229	1	1	0	0
		R	233	0	1	0	0
		R	234	0	1	0	0
		R	235	0	1	0	0
		L	224	0	2	0	0
		L	227	0	1	0	0
		R	258	1	0	0	0

Table 3.5-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Union NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Melilotus officinalis</i>	Yellow sweetclover	R	216	0	1	0	0
No exotics found		R	201	0	0	–	–
		R	209	0	0	0	0
		L	201	0	0	0	0
		L	203	0	0	0	0
		L	204	0	0	0	0
		L	234	0	0	0	0
<i>Salsola tragus</i>	Prickly Russian thistle	R	204	0	2	0	0
		R	205	0	1	0	0
		R	206	1–2	1	0	0
		R	207	1	1	0	0
		R	208	1	0	0	0
		R	214	2	2	0	0
		R	215	2	1	2	0
		R	216	2	0	0	0
		R	217	1–2	2	0	0
		R	218	1	0	0	0
		L	202	0	0	1	0
		L	205	0	1	0	0
		L	206	0	2	0	0
		L	207	2	2	0	0
		L	208	0	2	0	0
		L	209	0	1	0	0
		L	210	0	2	0	0
		L	211	0	2	0	0
		L	212	0	2	0	0
		L	213	2	2	0	0
		L	214	0	2	0	0
		L	215	2	2–3	0	0
		L	216	2	2	0	0
		L	218	1	0	0	0
		R	221	0	0	1	0
		R	222	1	1	1	0
		R	223	0	1	0	0
		R	224	1	1	0	1
		R	225	1	1–2	0	0
		R	226	0	1–2	2	0
		R	227	0	1–2	0	0
		R	228	2	2	0	0
		R	229	0	0	1	1
		R	230	2	2	2	2
		R	231	3–4	3	3	2
		R	232	3	3	2	2
		R	233	2	2	2	1

Table 3.5-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Union NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Salsola tragus</i> (cont.)		R	235	0	0	0	1
		L	221	0	1	2	0
		L	222	0	2	2	0
		L	223	0	2	2	0
		L	224	2	2	2	0
		L	225	0	2	2	0
		L	226	0	2	2	0
		L	227	0	2	2	0
		L	228	0	2	2	0
		L	229	0	1	0	0
		L	230	2	2	0	0
		L	231	3	3	3	3
		L	232	3	3	3	3
		L	233	3	3	3	0
		R	241	1	1-2	0	0
		R	242	1	2	0	0
		R	243	1-2	1	0	0
		R	244	1	2	0	0
		L	242	0	0	2	0
		L	243	0	0	2	0
		L	244	0	1	0	0
		R	251	1	0	0	0
		R	252	1	1	1	0
		R	253	1-2	0	0	0
		R	254	2	0	0	0
		R	255	1	0	0	0
		R	256	2	0	0	0
		R	257	1	0	0	0
		R	258	2	1	0	0
		R	259	1	0	0	0
		R	260	1-2	0	0	0
		R	261	2	2	0	0
		L	251	1	0	0	0
		L	252	0	2	0	0
		L	253	1	2	2	0
		L	254	2	2	0	0
		L	255	2	2	0	0
		L	256	2	0	0	0
		L	258	1	0	0	0
		L	260	2	1	0	0
<i>Tragopogon dubius</i>	Western salsify	L	230	0	1	0	0
		R	242	0	1	0	0
		L	241	0	1	0	0
		R	253	0	1	0	0

Table 3.5-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Fort Union NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Tragopogon dubius</i> (cont.)		R	255	1	0	0	0
		R	257	1	0	0	0
		R	258	1	0	0	0
		R	259	0	1	0	0
		R	260	1	1	0	0
		R	261	0	1	0	0
		L	255	0	1	0	0
		L	256	0	1	0	0
<i>Ulmus pumila</i>	Siberian elm	L	231	0	0	0	1

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

3.6 Lake Meredith NRA/Alibates Flint Quarries NM

Overall sampling at Lake Meredith/Alibates Flint Quarries occurs on paved roads over its full three-year rotation (Figure 3.6-4, -5, -6). In 2010, exotic-plant monitoring occurred at LAMR for 2.5 days in June. Bugbee, Cedar Canyon, Sanford Yake roads were sampled. Eighty-eight vector blocks were monitored, for a total of 2.2 linear kilometers sampled on both sides (Figure 3.6-1). In addition, 27 permanent transects within the landscape were sampled for a total of 135 4 x 1 meter plots. There were no exotics found in only one vector block sampled.

Prickly Russian thistle (*Salsola tragus*) was the most commonly found exotic species this field season, found in 61% of vector blocks sampled (54) and 81% of secondary transects (22). Prickly Russian thistle was found in scattered to evenly distributed patches along all vectors, over 20 meters into the landscape on the Sanford Yakes and Cedar Creek roads and only 12 meters into the landscape on the Bugbee road. Prickly Russian thistle is widespread within the landscape at Lake

Meredith, found in numerous plots in numerous transects in cover densities of up to 50% per plot, but more generally of 20% or less. Japanese brome (*Bromus japonicus*), found in 59% of vector blocks sampled (52) in similar locations and densities along all vectors. Senesced (dead) plants of Japanese brome were observed in various secondary transects and were treated as litter, so no cover information is available.

Hairy crabgrass (*Digitaria sanguinalis*) was present in 56% of vector blocks sampled (49) in scattered patches commonly 12 meters and occasionally up to 20 meters into the landscape on all vectors. White sweetclover (*Melilotus alba*) was present in 43% of vector blocks sampled (38) in scattered patches up to 20 meters into the landscape on all vectors. There are some areas along the Bugbee road with densities increasing to evenly distributed patches. Bermuda grass (*Cynodon dactylon*) was present in 28% of vector blocks sampled (25) in scattered patches within the first 12 meters of the vectors. It was most common along the Sanford Yake road spreading deeper into the landscape, but present only at the beginning of the Bugbee road. None of these three spe-

Table 3.6-1. Number and percentage of primary and secondary sample units where each species was detected, Lake Meredith NRA/Alibates Flint Quarries NM, 2010

Scientific name	Common name	Primary vector blocks (n=88)		Secondary transects (n=27)	
		Total	% blocks	Total ¹	% transects
<i>Salsola tragus</i>	Prickly Russian thistle	54	61	22	81
<i>Bromus japonicus</i>	Japanese brome	52	59	0	0
<i>Digitaria sanguinalis</i>	Hairy crabgrass	49	56	0	0
<i>Melilotus alba</i>	White sweetclover	38	43	0	0
<i>Cynodon dactylon</i>	Bermuda grass	25	28	0	0
<i>Kochia scoparia</i>	Kochia	23	26	11	41
<i>Tragopogon dubius</i>	Western salsify	14	16	0	0
<i>Euphorbia dentata</i>	Toothed spurge	10	11	0	0
<i>Convolvulus arvensis</i>	Field bindweed	4	5	0	0
<i>Taraxacum officinale</i>	Dandelion	4	5	0	0
<i>Erodium cicutarium</i>	Red stork's-bill	3	3	0	0
<i>Poa pratensis</i>	Kentucky bluegrass	3	3	0	0
<i>Tamarix chinensis</i>	Tamarisk	3	3	0	0
<i>Salsola collina</i>	Spineless Russian thistle	2	2	0	0
<i>Sorghum halepense</i>	Johnsongrass	2	2	2	7
<i>Bromus tectorum</i>	Cheatgrass	1	1	0	0
<i>Medicago minima</i>	Burr medic clover	1	1	0	0
<i>Polypogon monspeliensis</i>	Annual rabbitsfoot grass	1	1	0	0
<i>Scorzonera laciniata</i>	Cutleaf vipergrass	1	1	0	0

¹ The number of individual plots on secondary transects is shown in Figure 3.6-2.

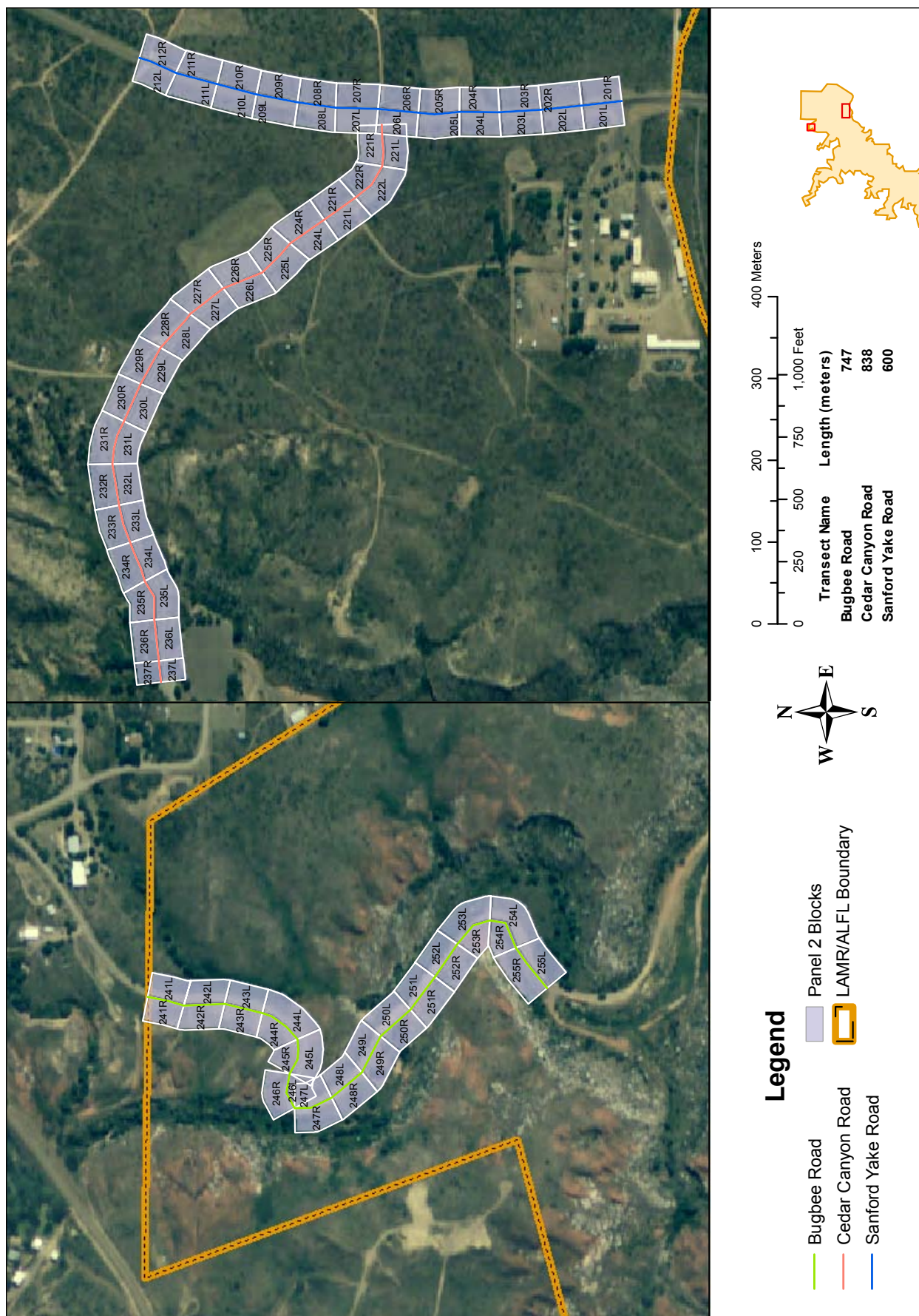


Figure 3.6-1. Individual vector blocks sampled, Panel 2, Lake Meredith NRA and Alibates Flint Quarries NM, 2010.

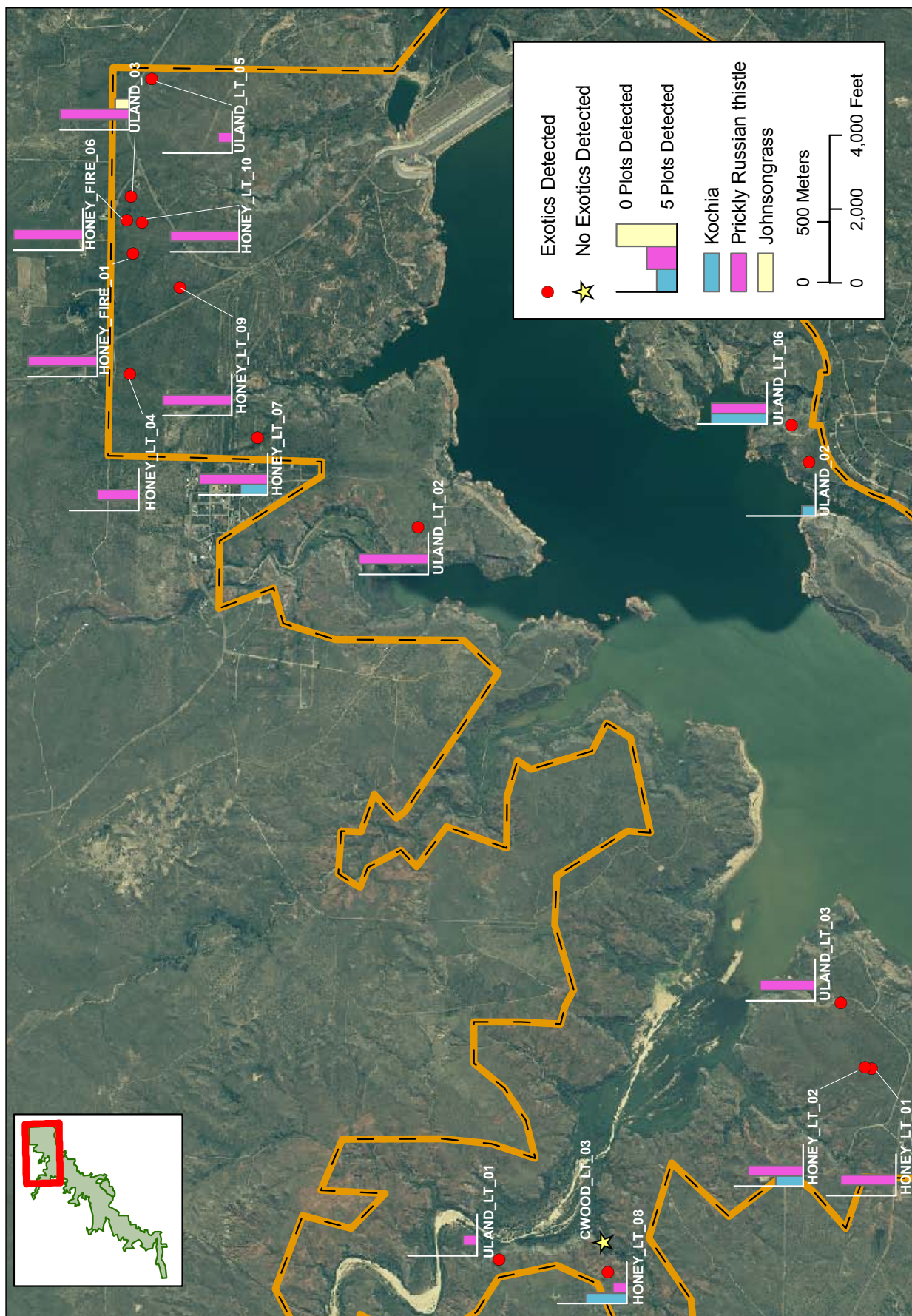


Figure 3.6-2. Secondary sample locations, Lake Meredith NRA, Upper Region, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

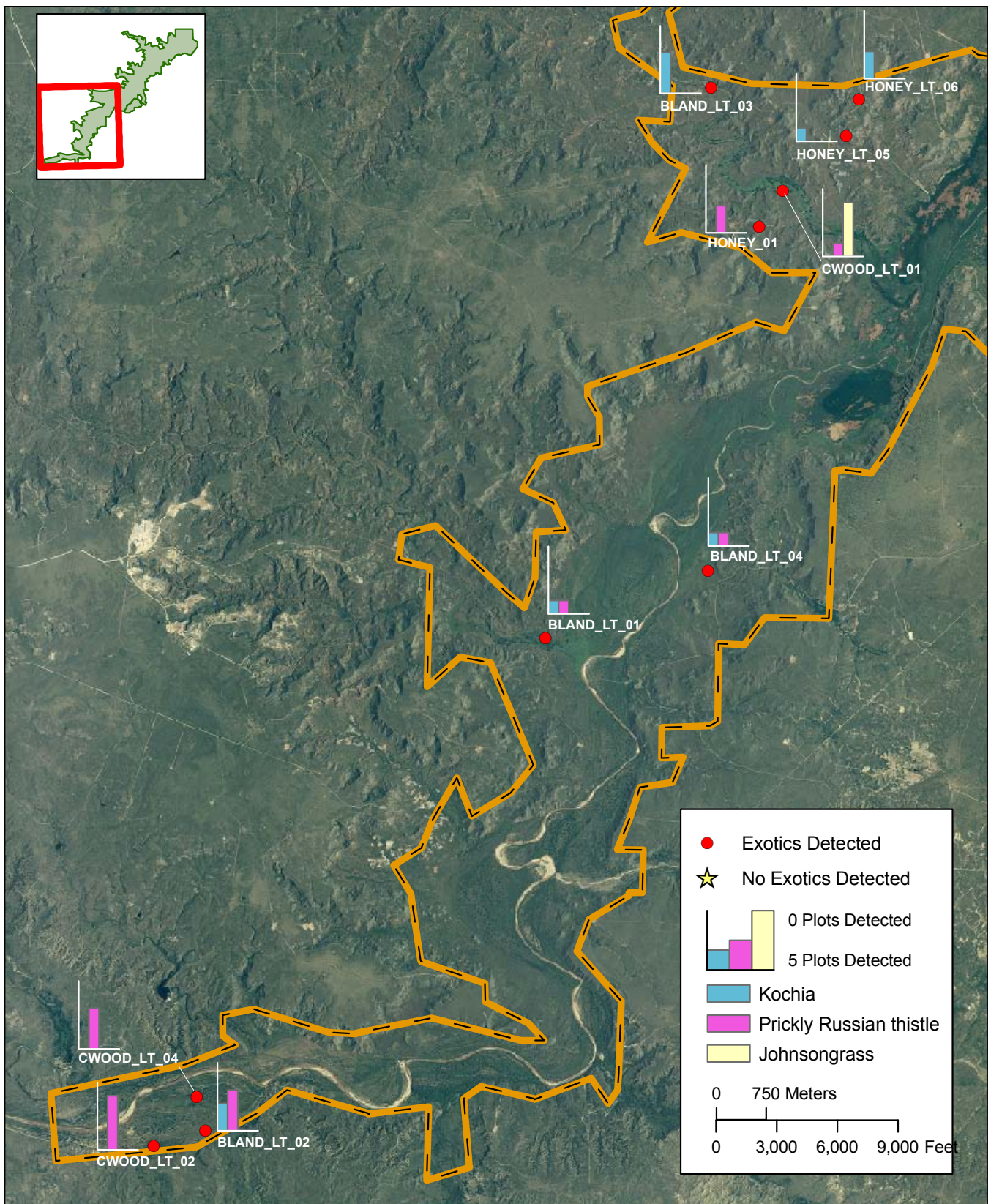


Figure 3.6-3. Secondary sample locations, Lake Meredith NRA, Lower Region, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

cies were detected in secondary transects.

Kochia (*Kochia scoparia*) was found in 26% of vector blocks sampled (23) and 41% of secondary transects (11). *Kochia* was found in scattered patches along the Sanford Yake and Cedar Canyon roads up to 20 meters into the landscape, but only as a few plants at the beginning of the Bugbee road only in the first two meters from the vector edge. *Kochia* was found in multiple plots of 11 secondary transects in covers of 3% or less. Western salsify (*Tragopogon dubius*) was found in 16% of vector blocks sampled (14) as a few plants within the first 10 meters of all vectors, but primarily along the Sanford Yake road. Toothed spurge (*Euphorbia dentata*) was found in 11% of vector blocks sampled (10), as scattered patches up to 20 meters along the Cedar Creek road and as a few individual plants up to 10 meters into the landscape along the Bugbee road. Neither salsify or toothed spurge were found in secondary transects.

Many species of exotics were detected in minor amounts along primary vectors, but only one—Johnsongrass (*Sorghum halepense*)—was found in the secondary transects. Scattered patches of Johnsongrass were detected deep into the landscape in two vector blocks located at the maintenance yard on Sanford Yake road and was found in two secondary transects; one transect contained Johnsongrass in one plot at 1% cover, but the second transect had it in four plots at up to 28% cover. Field bindweed (*Convolvulus arvensis*) and dandelion (*Taraxacum officinale*) were found in four vector blocks each as a few plants to scattered patches in the first 12 meters of both Sanford Yake and Cedar Canyon roads. Red-stem storks-bill was found in three vector blocks as scattered plants in the mow strip on the right side of Sanford Yake road. Kentucky bluegrass (*Poa pratensis*) was found as scattered patches between 2 and 12 meters of the vector in three vector blocks along Sanford Yake road. Tamarisk (*Tamarix chinensis*) was found as individual plants in three vector blocks at the end of the Bugbee vector. Spineless Russian thistle (*Salsola collina*) was found as individual plants in two vector blocks along the mowstrip of Cedar Canyon road. A few plants of burr medic clover (*Medicago minima*) were found in the mowstrip of one



Hairy crabgrass (*Digitaria sanguinalis*) commonly found in 2010 at Lake Meredith NRA.

vector block near the end of Bugbee road. Cutleaf vipergrass (*Scorzonera laciniata*) was found as individual plants up to 12 meters into the landscape in one vector block near the end of Cedar Canyon road. Cheatgrass (*Bromus tectorum*) was found over 10 meters into the landscape in one vector block at the maintenance yard on Sanford Yake road. In the same area, scattered patches of annual rabbitsfoot grass (*Polypogon monspeliensis*) was found up to 10 meters into the landscape in one vector block.

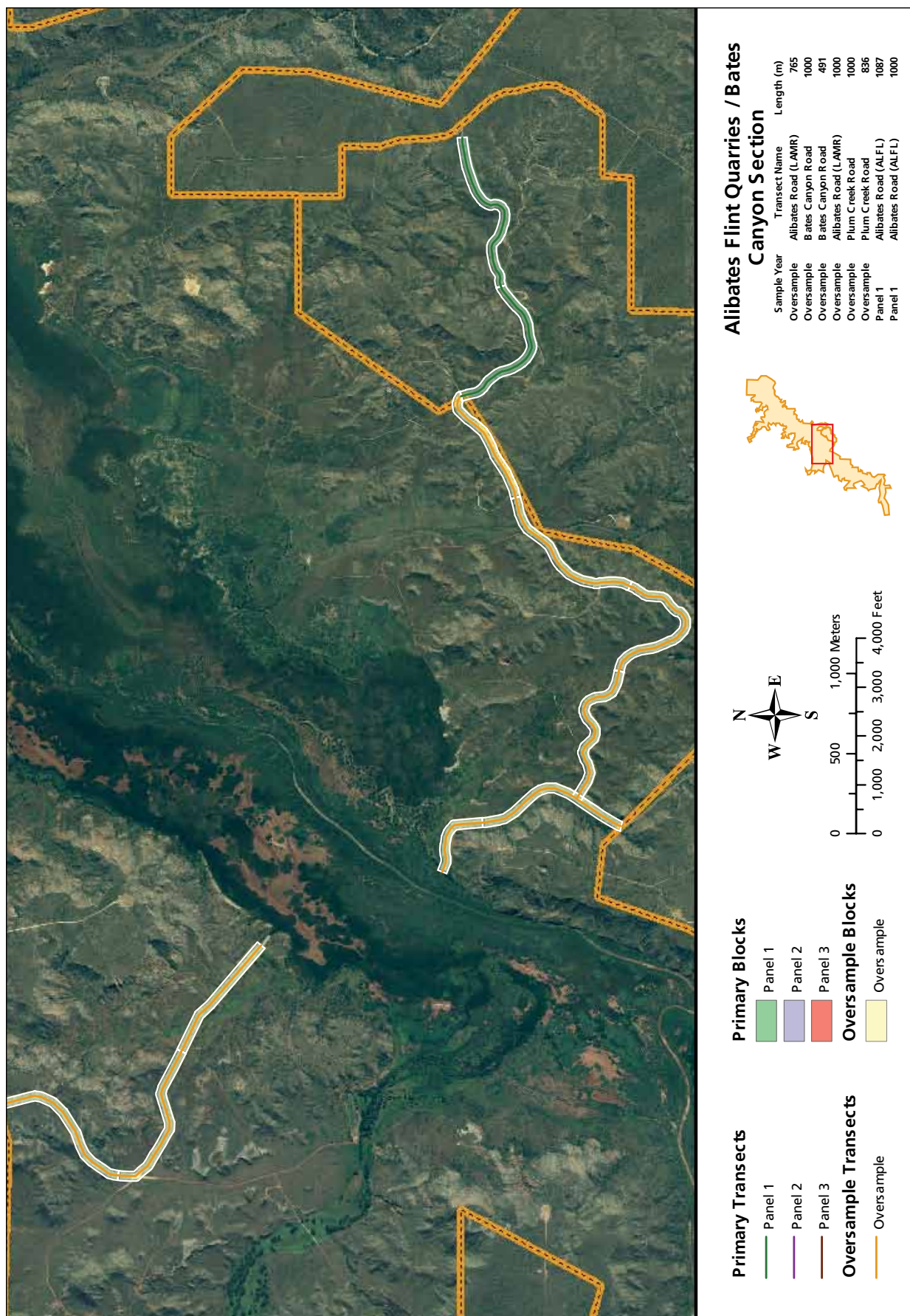


Figure 3.6-4. Overall planned sampling scheme for panels (annual samples) in the Alibates Flint Quarries NM vicinity for a full three-year rotation.

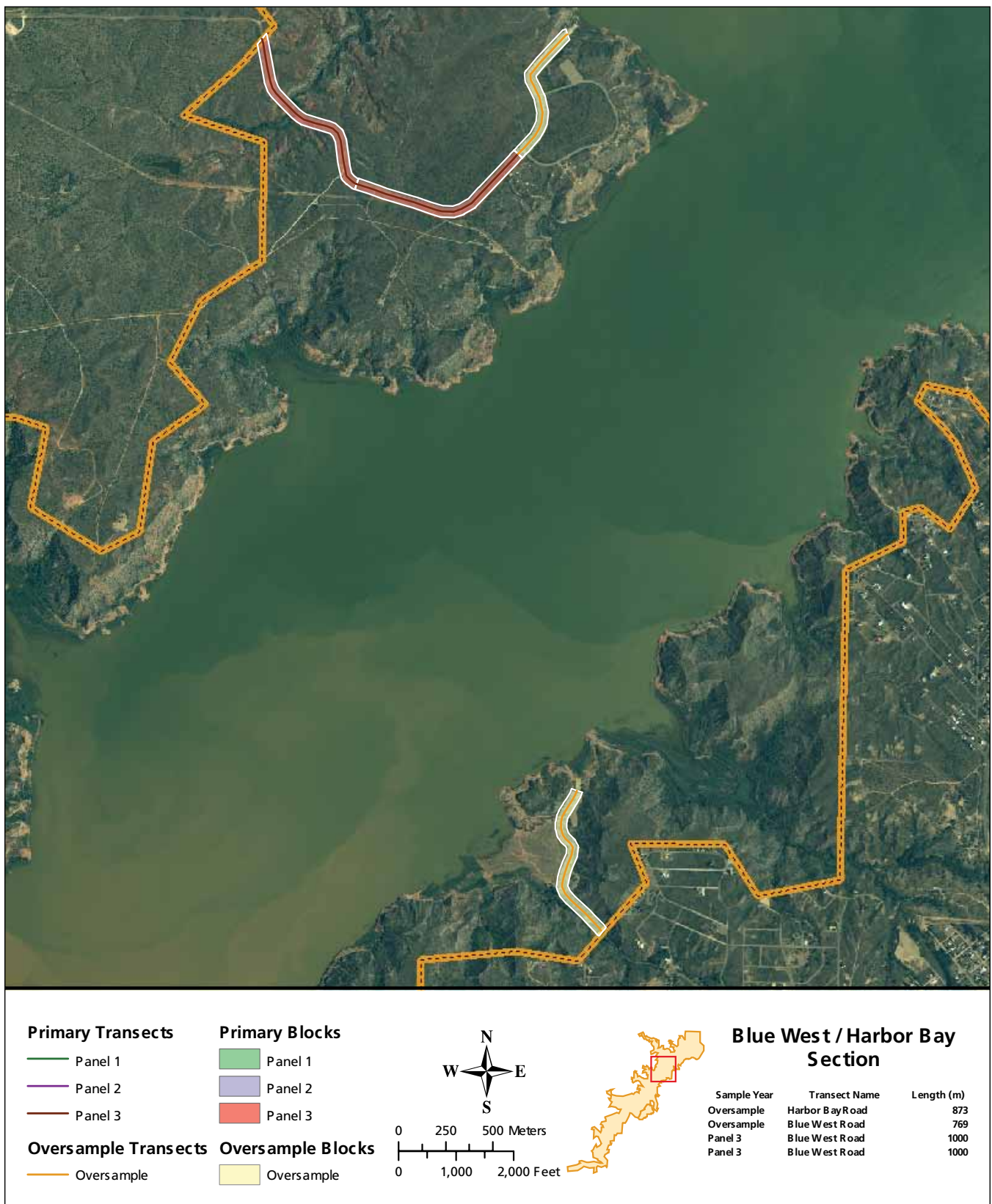


Figure 3.6-5. Overall planned sampling scheme for panels (annual samples) in the Blue West/Harbor Bay vicinity of Lake Meredith NRA for a full three-year rotation.

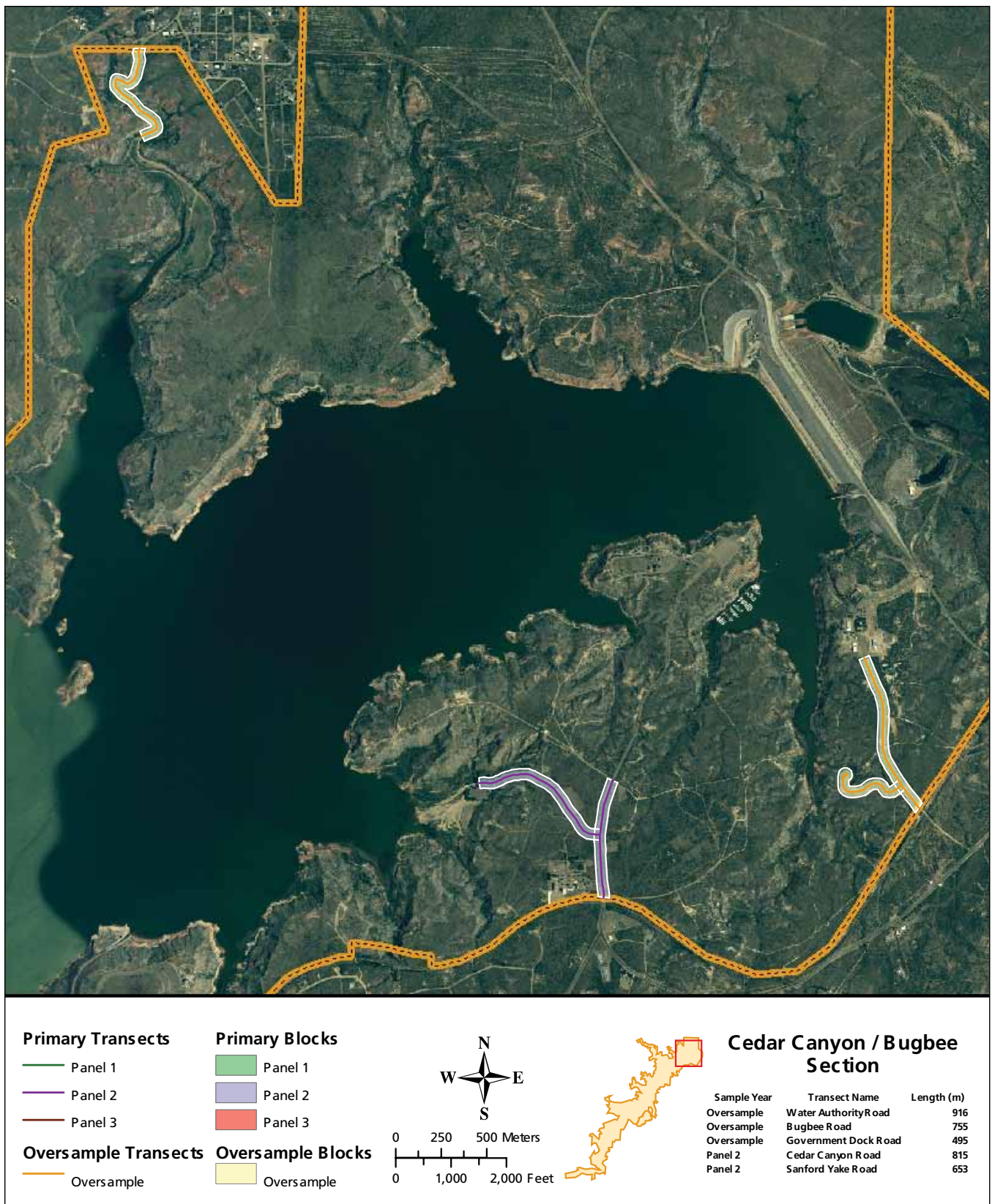


Figure 3.6-6. Overall planned sampling scheme for panels (annual samples) in the Cedar Canyon/Bugbee vicinity of Lake Meredith NRA for a full three-year rotation.

Table 3.6-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lake Meredith NRA and Alibates Flint Quarries NM, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus japonicus</i>	Japanese brome	L	201	0	0	2	0
		L	202	0	0	0	0
		L	203	0	0	3	0
		L	204	0	0	2	–
		L	206	0	2	3	–
		L	207	0	0	2	3
		L	208	0	2	2	2
		L	209	0	0	2	2
		L	211	0	0	2	2
		L	212	0	2	2	2
		R	202	0	2	0	2
		R	203	0	0	2	0
		R	204	0	2	2	0
		R	205	0	2	0	0
		R	206	0	2	2	0
		R	207	0	3	3	3
		R	208	0	3	3	0
		R	209	0	2	2	0
		R	210	0	2	2	0
		R	211	0	2	0	–
		L	221	0	3	3	3
		L	222	0	2	2	2
		L	223	0	2	2	2
		L	224	0	2	2	0
		L	225	0	2	2	0
		L	227	0	2	2	0
		L	228	0	2	3	0
		L	229	2	3	3	–
		L	230	2	2	–	–
		L	232	2	2	0	–
		L	234	1	2	0	–
		L	235	2	0	–	–
		L	236	2	3	–	–
		R	222	0	2	2	0
		R	223	0	2	2	0
		R	228	0	2	2	2
		R	229	2	2	–	–
		R	230	2	2	–	–
		R	231	1	0	–	–
		R	232	2	0	–	–
		R	233	0	1–2	–	–
		R	237	2	2	0	0
		L	241	1	0	–	–

Table 3.6-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lake Meredith NRA and Alibates Flint Quarries NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus japonicus</i> (cont.)		L	242	0	2	0	0
		L	250	2	0	–	–
		L	254	0	2	2	0
		R	241	0	1	0	0
		R	242	0	1–2	–	–
		R	243	0	1	–	–
		R	244	1	0	–	–
		R	247	2	2	–	–
		R	255	0	2–3	0	0
<i>Bromus tectorum</i>	Cheatgrass	L	203	0	0	3	0
<i>Convolvulus arvensis</i>	Field bindweed	R	204	0	2	0	0
		L	227	0	1	0	0
		R	223	1	0	0	0
		R	229	1	1	–	–
<i>Cynodon dactylon</i>	Bermuda grass	L	201	2	2	2	0
		L	202	2	2	0	0
		L	203	2	2	0	0
		L	204	2	2	0	–
		L	205	2	2	0	–
		L	206	2	2	0	–
		L	207	2	2	2	0
		L	208	2	2	0	0
		L	209	2	2	0	0
		L	210	1	0	0	0
		L	211	2	0	0	0
		L	212	2	0	0	0
		R	201	2–3	2	0	0
		R	202	3–4	3	0	0
		R	203	2	2	0	0
		R	204	0	2	0	0
		L	221	2	2	0	0
		L	222	2	0	0	0
		L	223	2	0	0	0
		L	224	2	0	0	0
		L	225	2	0	0	0
		L	226	2	0	0	0
		L	242	2	0	0	0
		L	244	2	0	0	0
		R	241	0	2	0	0
<i>Digitaria sanguinalis</i>	Hairy crabgrass	L	201	2	2	0	0
		L	202	2	2	0	0
		L	203	2	2	0	0
		L	204	2	2	0	–
		L	205	2	2	0	–

Table 3.6-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lake Meredith NRA and Alibates Flint Quarries NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Digitaria sanguinalis</i> (cont.)		L	206	2	2	0	–
		L	207	2	2	2	0
		L	209	2	0	0	0
		L	210	2	0	0	0
		L	211	2	0	0	0
		L	212	2	0	0	0
		R	201	2	1	0	0
		R	202	2	0	0	0
		R	203	2	2	0	0
		R	204	2	0	0	0
		R	205	2	2	0	0
		R	206	2	2	0	0
		R	207	2	2	0	0
		R	208	2–3	2	0	0
		R	209	2	2	0	0
		R	210	2	2	0	0
		R	211	2	2	0	–
		R	212	2	0	0	–
		L	221	1	2	0	0
		L	224	2	0	0	0
		L	226	2	0	0	0
		L	227	2	0	0	0
		L	228	2	0	0	0
		R	221	2	2	2	0
		R	222	2	2	0	0
		R	224	2–3	2	0	0
		R	225	2	2	0	0
		R	226	1	1	0	0
		R	227	0	1	0	0
		L	241	2	0	–	–
		L	243	2	0	0	0
		L	244	2	0	0	0
		L	254	2	0	0	0
		L	255	2	2	0	0
		R	241	2	2	0	0
		R	242	1	0	–	–
		R	243	1	0	–	–
		R	245	1	0	–	–
		R	247	1	0	–	–
		R	248	2	0	0	0
		R	249	1	0	0	0
		R	252	1	0	0	–
		R	254	1	2	0	0
		R	255	1	0	0	0

Table 3.6-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lake Meredith NRA and Alibates Flint Quarries NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Erodium cicutarium</i>	Red stork's-bill	R	208	1	0	0	0
		R	211	2	0	0	–
		R	212	1	0	0	–
<i>Euphorbia dentata</i>	Toothed spurge	L	221	0	1	0	0
		L	222	0	2	0	0
		L	223	1	2	2	0
		L	226	0	2	0	0
		R	231	1	1	–	–
		L	245	1	0	–	–
		L	247	1	0	–	–
		L	252	1	0	–	–
		R	241	1	0	0	0
		R	242	0	1	–	–
<i>Kochia scoparia</i>	Kochia	L	205	0	0	2	–
		R	202	0	1	0	0
		R	203	0	2	0	0
		R	204	0	2	0	0
		R	205	2	0	0	0
		R	210	0	1	0	0
		R	211	0	1	0	–
		L	221	0	2	2	0
		L	222	0	2	2	0
		L	223	2	2	0	0
		L	225	0	1	0	0
		L	226	0	1	0	0
		L	227	1	2	0	0
		L	228	1	2	0	0
		L	229	0	2	0	–
		L	236	1	0	–	–
		R	226	0	1	0	0
		R	227	1	0	0	0
		R	228	0	1	0	0
		R	229	0	1–2	–	–
		L	241	1	0	–	–
		R	241	1	0	0	0
		R	242	1	0	–	–
<i>Medicago minima</i>	Burr medic clover	R	252	1	0	0	–
<i>Melilotus alba</i>	White sweetclover	L	201	0	0	2	0
		L	211	0	1	0	0
		L	212	0	2	2	0
		R	212	0	1–2	0	–
		L	224	0	2	2	0
		L	225	0	2	2	0
		L	229	0	2	0	–

Table 3.6-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lake Meredith NRA and Alibates Flint Quarries NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Melilotus alba</i> (cont.)		L	231	2	0	–	–
		L	232	2	1	0	–
		L	233	2	2	2	–
		L	234	0	2	0	–
		L	235	0	1	–	–
		R	232	0	1	–	–
		R	233	1–2	1–2	–	–
		R	234	1–2	1–2	–	–
		R	235	0	2	0	–
		R	236	1	2	2	–
		L	241	0	1	–	–
		L	244	0	2	2	0
		L	245	2	2	–	–
		L	246	2	2	–	–
		L	247	2	0	–	–
		L	248	2	2	–	–
		L	249	0	2	–	–
		L	253	0	2	–	–
		L	255	2	0	0	0
		R	242	0	2	–	–
		R	243	2–3	2–3	–	–
		R	244	3	2–3	–	–
		R	245	2	3	–	–
		R	246	1	2	1	0
		R	249	0	1	0	0
		R	250	2	2	1	0
		R	251	1	2	1	–
		R	252	1	2	1	–
		R	253	2	3	2	–
		R	254	1	1	0	0
		R	255	0	2	0	0
No exotics found		L	237	0	0	0	0
<i>Poa pratensis</i>	Kentucky bluegrass	L	208	0	2	0	0
		L	209	0	2	0	0
		R	207	0	2	0	0
<i>Polypogon monspeliensis</i>	Annual rabbitsfoot grass	R	201	0	2	0	0
<i>Salsola collina</i>	Spineless Russian thistle	L	227	1	0	0	0
		R	223	1–2	0	0	0
<i>Salsola tragus</i>	Prickly Russian thistle	L	202	2	2	2	2
		L	203	0	0	2	0
		L	204	0	0	3	–
		L	206	0	2	3	–
		L	207	0	0	3	3

Table 3.6-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lake Meredith NRA and Alibates Flint Quarries NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Salsola tragus</i> (cont.)		L	208	0	0	2	2
		L	210	0	2	0	0
		L	212	0	2	2	0
		R	201	0	2	2	0
		R	202	0	2	1	0
		R	203	0	2	2	0
		R	204	1	2	2	0
		R	205	0	2	0	0
		R	210	0	2	0	0
		R	211	0	2	0	–
		R	212	0	2	0	–
		L	221	2	2	3	3
		L	222	1	3	3	2
		L	223	1	2	3	3
		L	224	1	2	3	2
		L	225	0	3	3	3
		L	226	0	2	2	2
		L	227	0	3	3	3
		L	228	0	2	2	0
		L	236	2	2	–	–
		R	222	2	2	0	0
		R	223	1	2	2	0
		R	224	1	2	2	0
		R	225	1	1	1	0
		R	226	1	0	0	0
		R	227	2	0	0	0
		R	228	2	2	0	0
		R	229	1	2	–	–
		R	230	1	1	–	–
		R	231	2	2	–	–
		R	235	1	1	0	–
		R	236	2	1	0	–
		R	237	1	2	0	0
		L	242	2	2	0	0
		L	243	2	2	0	0
		L	247	2	2	–	–
		L	248	2	2	–	–
		L	249	0	2	–	–
		R	241	2	2	0	0
		R	242	1–2	0	–	–
		R	243	1	0	–	–
		R	245	0	1	–	–
		R	246	1–2	0	0	0
		R	247	2	2	–	–

Table 3.6-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lake Meredith NRA and Alibates Flint Quarries NM, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Salsola tragus</i> (cont.)		R	248	2	1	0	0
		R	249	0	1	0	0
		R	253	0	2	0	–
		R	254	0	2	0	0
		R	255	1	2	0	0
<i>Scorzonera laciniata</i>	Cutleaf vipergrass	R	246	1	1	0	0
<i>Sorghum halepense</i>	Johnsongrass	L	202	0	0	0	2
		L	203	0	0	0	2
<i>Tamarix chinensis</i>	Tamarisk	L	250	1	0	–	–
		L	251	1	0	–	–
		L	252	1	1	–	–
<i>Taraxacum officinale</i>	Dandelion	L	207	2	2	0	0
		R	204	1	0	0	0
		R	221	0	1	0	0
		R	225	0	1	0	0
<i>Tragopogon dubius</i>	Western salsify	L	205	0	0	0	–
		L	206	1	0	0	–
		L	208	0	1	0	0
		R	201	0	1	0	0
		R	203	1	0	0	0
		R	206	0	1	0	0
		R	207	0	1	0	0
		R	208	1	1	0	0
		L	226	0	1	0	0
		L	228	0	1	0	0
		L	229	1	0	0	–
		L	231	1	0	–	–
		L	248	1	0	–	–
		R	255	1	1	0	0

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

3.7 Lyndon B. Johnson NHP

Overall sampling at Lyndon B. Johnson occurs on the unpaved Settlement Trail over its full three-year rotation (Figure 3.7-2). In 2010, exotic-plant monitoring occurred at Lyndon B. Johnson for one day in May. Thirty-two vector blocks were monitored, for a total of 0.8 linear kilometers sampled on both sides (Figure 3.7-1). In addition, two permanent transects within the landscape were sampled for a total of 10 4 x 1 meter plots.

Black medic clover (*Medicago lupulina*) was the most commonly found exotic species this field season and was found in 94% of vector blocks sampled (30), but not in the secondary transects. Black medic clover was found in scattered patches primarily up to 10 meters into the landscape, though occasionally found deeper. Johnsongrass (*Sorghum halepense*) was found in 81% of vector blocks sampled (26) and both of secondary transects (2). Densities varied from just a few plants to areas of evenly distributed patches and it was found from trailside to over 20 meters into the landscape. In the secondary transects, Johnson-

grass was found in one to two plots per transect, but one plot had 30% cover.

Dandelion (*Taraxacum officinale*) and spreading hedgeparsley (*Torilis arvensis*) were found in 69% of vector blocks sampled (22) but no secondary transects. Dandelion was usually individual plants with a few scattered patches within the first 12 meters of the vector, but occasionally up to 20 meters. Spreading hedgeparsley was found in scattered patches within 20 meters of the vector, with one area of evenly distributed patches along the north side of the trail. Japanese brome (*Bromus japonicus*) and perennial ryegrass (*Lolium perenne*) were found in 53% of vector blocks sampled (17). Japanese brome was found in scattered patches up to 12 meters into the landscape, with two patches of evenly distributed patches. Perennial ryegrass was also found in scattered patches up to 20 meters into the landscape, and even farther in the northwest corner of the loop.

KR bluestem (*Bothriochloa ischaemum* var. *songarica*) was present in 44% of vector blocks sampled (14) and both of secondary transects (2).

Table 3.7-1. Number and percentage of primary and secondary sample units where each species was detected, Lyndon B. Johnson NHP, 2010

Scientific name	Common name	Primary sample units (n=32)		Secondary sample units (n=2)	
		Total	% blocks	Total ¹	% transects
<i>Medicago lupulina</i>	Black medic clover	30	94	0	0
<i>Sorghum halepense</i>	Johnsongrass	26	81	2	100
<i>Taraxacum officinale</i>	Dandelion	22	69	0	0
<i>Torilis arvensis</i>	Spreading hedgeparsley	22	69	0	0
<i>Bromus japonicus</i>	Japanese brome	17	53	0	0
<i>Lolium perenne</i>	Perennial ryegrass	17	53	0	0
<i>Bothriochloa ischaemum</i> var. <i>songarica</i>	KR bluestem	14	44	2	100
<i>Dichanthium annulatum</i>	Kleberg bluestem	11	34	0	0
<i>Galium divaricatum</i>	Lamarck's bedstraw	9	28	0	0
<i>Lolium arundinaceum</i>	Tall fescue	9	28	0	0
<i>Medicago minima</i>	Burr medic clover	8	25	0	0
<i>Bromus tectorum</i>	Cheatgrass	5	16	0	0
<i>Centaurea melitensis</i>	Malta starthistle	5	16	0	0
<i>Lonicera japonicus</i>	Japanese honeysuckle	5	16	0	0
<i>Paspalum urvillei</i>	Vaseygrass	5	16	0	0
<i>Vicia sativa</i>	Garden vetch	5	16	0	0
<i>Euphorbia dentata</i>	Toothed spurge	0	0	2	100
<i>Cynodon dactylon</i>	Bermuda grass	0	0	1	50

¹ The number of individual plots on secondary transects is shown in Figure 3.7-2.

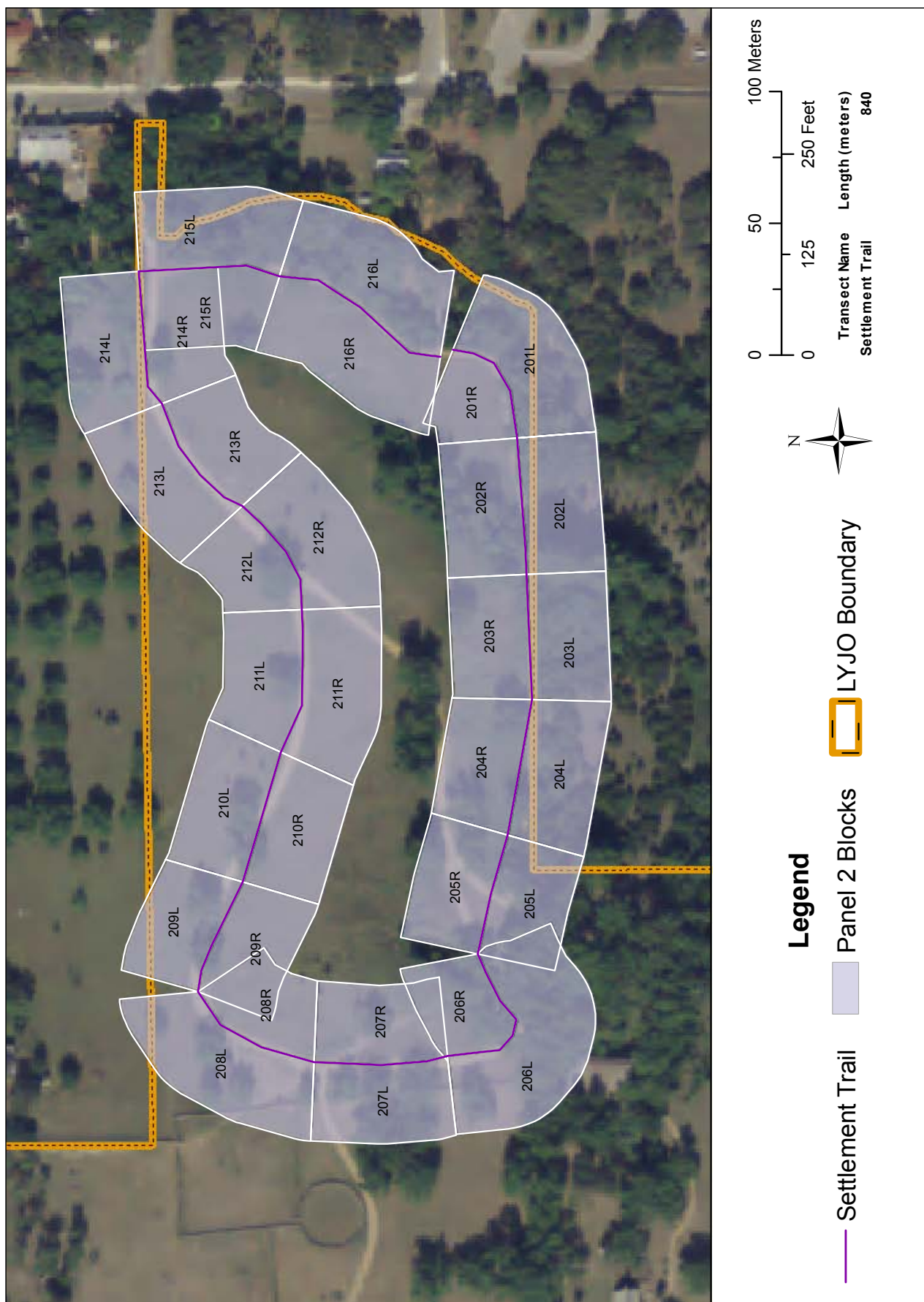


Figure 3.7-1. Individual vector blocks sampled, Panel 2, Lyndon B. Johnson NHP, 2010.

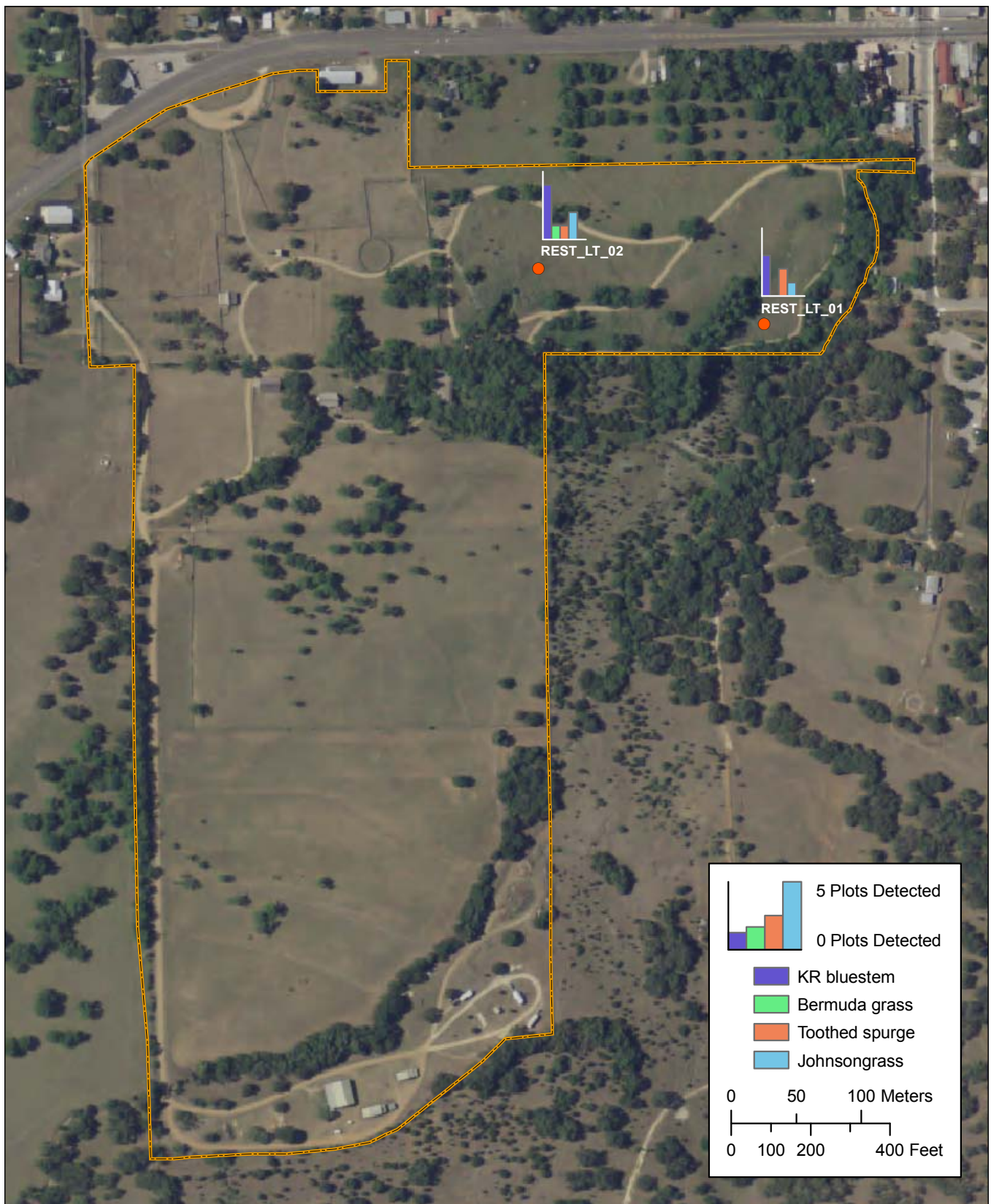


Figure 3.7-2. Secondary sample locations, Lyndon B. Johnson NHP, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

KR bluestem was found as scattered patches up to 20 meters into the landscape. It was found on three and four plots of each transect with covers of 30% and up to 60%, becoming a major dominant grass. Kleberg bluestem (*Dichanthium annulatum*) was present in 34% of vector blocks sampled (11). It was found in scattered to evenly distributed patches on the north side of the loop up to and beyond 22 meters. Lamarck's bedstraw (*Galium divaricatum*) and tall fescue (*Lolium arundinaceum*) were present in 28% of vector blocks sampled (9). The bedstraw was found as individual plants up to 20 meters into the landscape, while tall fescue was found in scattered patches (with one area of even distribution) over 20 meters deep. Burr medic clover (*Medicago minima*) was present in 25% of vector blocks sampled (8). Burr medic clover was found in scattered patches up to 12 meters into the landscape, primarily on the north and east sides of the loop.

A number of exotic species were found only along the vector. Cheatgrass (*Bromus tectorum*), Maltese starthistle (*Centaurea melitensis*), Japanese honeysuckle (*Lonicera japonica*), Vaseygrass (*Paspalum urvillei*), and garden vetch (*Vicia sativa*) were all found in 16% (5) of the vector blocks monitored. Cheatgrass, Vaseygrass and garden vetch were found as individual plants within the first 12 meters of the landscape. Maltese starthistle was found as evenly distributed patches over 20 meters into the landscape. Japanese honey-



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Field bindweed (*Convolvulus arvensis*) was the most commonly found exotic species in 2010 at Bent's Old Fort NHS.

suckle was found usually as individual plants along fencelines and up to 20 meters into the landscape. Two exotic species not detected along the vectors were found in the secondary transect. Toothed spurge (*Euphorbia dentata*) was found minimally on both transects with a cover of less than 1%, while Bermuda grass (*Cynodon dactylon*) was found in one plot of one transect at a cover of 5%.

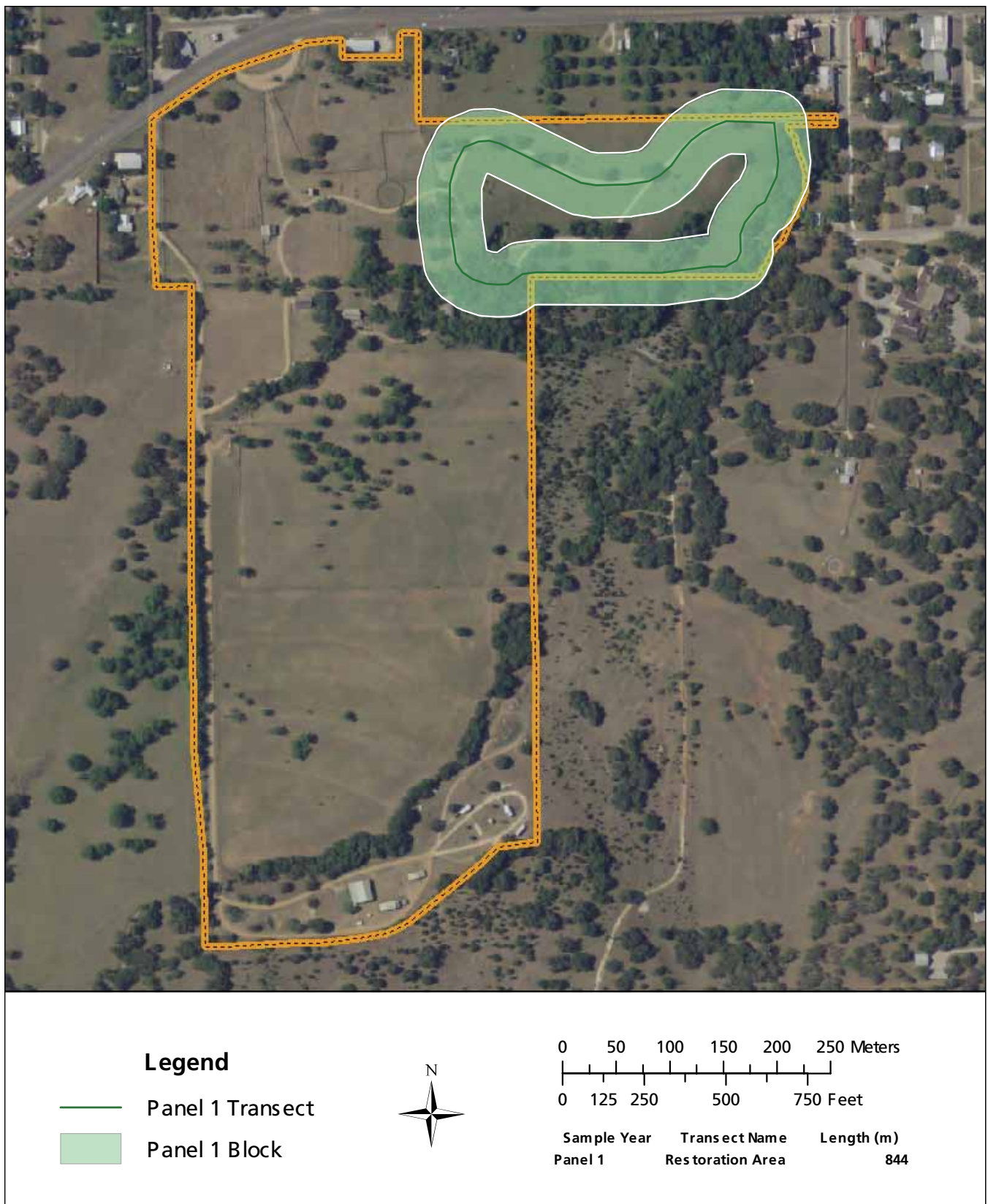


Figure 3.7-3. Overall planned sampling scheme for panels (annual samples) at Lyndon B. Johnson NHP for a full three-year rotation.

Table 3.7-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lyndon B. Johnson NHP, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bothriochloa ischaemum</i> var. <i>songarica</i>	KR bluestem	L	201	2	–	–	–
		R	201	1	1	1	0
		L	202	1	0	–	–
		R	202	2	2	1	0
		L	203	1	1	–	–
		R	203	1	1	0	0
		L	204	1	1	–	–
		R	204	3	1	0	0
		R	205	2	0	0	0
		R	206	–	1	0	0
		R	207	2	0	0	0
		R	208	2	2	0	0
		L	216	1	–	–	–
		R	216	2	0	0	0
<i>Bromus japonicus</i>	Japanese brome	L	201	1	–	–	–
		L	202	1	0	–	–
		R	202	1	2	0	0
		R	203	0	3	0	0
		L	204	1	1	–	–
		R	204	0	2	0	0
		L	205	0	2	0	0
		R	205	0	2	0	0
		L	206	0	1	0	0
		R	206	–	3	0	0
		L	207	2	0	0	0
		L	208	1	2	0	0
		L	209	2	0	0	0
		L	210	2	2	0	0
		L	215	1	0	–	–
		R	215	0	2	0	0
		R	216	0	1	0	0
<i>Bromus tectorum</i>	Cheatgrass	L	202	1	0	–	–
		L	203	1	1	–	–
		L	204	2	1	–	–
		L	208	0	1	0	0
		L	209	1	0	0	0
<i>Centaurea melitensis</i>	Malta starthistle	L	205	1	0	0	0
		L	207	0	1	0	0
		L	208	1	3	3	2
		L	209	2	3	0	0
		L	211	1	2	0	0
<i>Dichanthium annulatum</i>	Kleberg bluestem	L	208	0	2	2	0
		R	208	0	1	0	0

Table 3.7-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lyndon B. Johnson NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Dichanthium annulatum</i> (cont.)		L	209	1	3	3	3
		R	209	0	1	0	0
		L	210	1	0	0	0
		R	210	2	0	0	0
		R	212	0	2	0	0
		L	213	0	2	3	2
		L	214	2	2	0	0
		R	214	2	2	0	0
		R	215	1	2	0	0
<i>Galium divaricatum</i>	Lamarck's bedstraw	L	202	1	0	–	–
		R	202	0	1	1	0
		R	203	0	1	1	0
		R	204	0	1	0	0
		R	205	0	1	1	0
		R	207	0	2	0	0
		R	208	0	1	1	0
		R	210	0	1	0	0
		R	213	0	1	0	0
<i>Lolium arundinaceum</i>	Tall fescue	R	202	1	0	0	0
		R	203	2	2	0	0
		R	204	0	2	0	2
		R	205	0	1	0	0
		L	206	0	1	0	0
		R	206	0	2	0	0
		L	210	2	2	0	0
		L	212	2	3	3	2
		L	214	0	2	0	0
<i>Lolium perenne</i>	Perennial ryegrass	R	202	1	2	0	0
		L	203	1	0	–	–
		R	203	1	1	0	0
		R	204	0	2	0	0
		L	205	1	2	0	0
		R	205	0	3	1	0
		L	206	1	2	1	0
		R	206	2	0	0	0
		R	207	0	2	2	0
		L	208	1	1	0	0
		R	208	0	2	2	2
		R	209	0	2	0	2
		R	210	0	2	0	0
		L	213	0	2	2	0
		R	213	1	0	0	0
		R	214	0	1	0	0
		L	215	2	1	1	0

Table 3.7-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lyndon B. Johnson NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Lonicera japonicus</i>	Japanese honeysuckle	L	203	2	1	–	–
		L	204	1	1	–	–
		L	206	0	1	0	0
		L	209	0	0	1	0
		L	214	0	1	1	0
<i>Medicago lupulina</i>	Black medic clover	L	201	2	–	–	–
		L	201	2	–	–	–
		R	201	3	2	0	0
		L	202	3	0	–	–
		R	202	3	2	0	0
		L	203	2	2	–	–
		R	203	2	0	0	0
		L	204	2	0	–	–
		R	204	2	0	0	0
		L	205	2	0	2	0
		L	206	2	2	2	0
		R	206	1	0	0	0
		L	207	2	2	0	0
		R	207	1	0	0	0
		R	208	1	0	0	0
		L	209	1	0	0	0
		R	209	2	1	0	0
		L	210	2	2	0	0
		R	210	2	0	0	0
		L	211	2	0	0	0
		R	211	1	0	0	0
		L	212	–	–	0	0
		R	212	2	0	0	0
		L	213	1	0	0	0
		R	213	1	0	0	0
		R	214	1	0	0	0
		L	215	2	0	–	–
		R	215	2	0	0	0
		L	216	3	–	–	–
		R	216	2	0	0	0
<i>Medicago minima</i>	Burr medic clover	R	212	2	0	0	0
		R	213	2	2	0	0
		L	214	1	0	0	0
		R	214	2	2	0	0
		L	215	2	2	0	0
		R	215	2	0	0	0
		L	216	3	–	–	–
		R	216	2	2	0	0

Table 3.7-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lyndon B. Johnson NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Paspalum urvillei</i>	Vaseygrass	L	202	1	0	–	–
		L	203	1	1	–	–
		L	207	1	0	0	0
		L	209	1	0	0	0
		L	216	1	–	–	–
<i>Sorghum halepense</i>	Johnsongrass	R	201	0	1	1	2
		R	202	0	1	1	2
		R	203	0	1	1	0
		L	204	1	0	–	–
		R	204	0	3	2	1
		L	205	0	2	3	0
		R	205	2	3	2	0
		L	206	1	1	0	0
		R	206	–	2	2	0
		L	207	0	0	1	0
		R	207	0	2	2	0
		L	208	0	1	2	0
		R	208	0	2	1	0
		L	209	1	2	2	2
		L	210	1	1	2	2
		R	210	0	1	0	0
		L	211	1	2	3	2
		R	211	0	0	0	2
		L	212	2	3	3	2
		R	212	0	1	0	2
		L	213	0	0	2	2
		R	213	0	2	0	0
		L	214	0	2	3	3
		L	215	2	3	–	–
		L	216	1	–	–	–
		R	216	0	2	0	2
<i>Taraxacum officinale</i>	Dandelion	L	201	1	–	–	–
		L	202	1	0	–	–
		L	203	1	0	–	–
		L	204	1	0	–	–
		L	205	1	0	1	0
		R	205	1	0	0	0
		L	206	0	1	1	0
		L	207	1	0	1	0
		R	207	0	1	0	0
		L	208	1	1	0	0
		R	208	0	1	0	0
		L	209	1	0	0	0
		R	209	0	1	0	0

Table 3.7-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Lyndon B. Johnson NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Taraxacum officinale</i> (cont.)		L	210	0	1	1	0
		R	210	1	2	1	0
		L	211	1	1	0	0
		R	211	0	2	0	0
		R	212	0	1	0	0
		L	213	0	1	1	0
		R	213	0	1	0	0
		R	215	0	1	0	0
		R	216	0	1	0	0
<i>Torilis arvensis</i>	Spreading hedgeparsley	L	201	1	–	–	–
		R	202	1	1	0	0
		L	203	1	0	–	–
		R	203	1	2	0	0
		L	204	1	0	–	–
		R	204	0	2	0	0
		L	205	1	1	0	0
		R	205	0	1	0	0
		R	206	0	1	0	0
		R	207	0	2	0	0
		L	208	1	2	0	0
		R	208	0	1	1	0
		R	209	0	1	1	0
		L	210	1	2	2	0
		R	210	0	1	1	0
		L	212	–	–	0	0
		R	212	0	1	0	0
		L	213	2	3	3	0
		R	213	1	2	0	0
		L	214	1	2	0	0
		L	215	2	2	2	0
		R	215	0	1	0	0
<i>Vicia sativa</i>	Garden vetch	L	201	1	–	–	–
		L	202	1	0	–	–
		L	203	1	0	–	–
		L	206	1	1	0	0
		L	208	1	0	0	0

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

3.8 Pecos NHP

Overall sampling at Pecos occurs on paved and unpaved roads and trails over its full three-year rotation (Figure 3.8-3). In 2010, exotic-plant monitoring occurred at Pecos for two days in July. The vector sampled was the unpaved Well Road through the Forked Lightning Ranch. Eighty vector blocks were monitored, for a total of 1 linear kilometer sampled on both sides (Figure 3.8-1). In addition, eight permanent transects within the landscape were sampled for a total of 40 4 x 1 meter plots.

Western salsify (*Tragopogon dubius*) was the most common exotic found in both primary and secondary monitoring, occurring in 91% of the vector blocks (73) and 88% of the transects (7). It was seen as individual plants to scattered patches at least 20 meters into the landscape and

occasionally deeper. Salsify was found in varying numbers of plots in the transects at 3% cover or less. Salsola (*Salsola tragus*) appeared in 69% vector blocks (55) and one transect. It was observed as individual plants to scattered patches at least 12 meters from the vector and occasionally up to 20 meters into the landscape. Salsola was found in two plots of one transect at less than 1% cover. A species tentatively identified as smallseed false flax (*Camelina microcarpa*) was detected in 66% of the vector blocks (53). Further identification verification is needed. It was seen as individual plants to scattered patches from the vector side to over 20 meters into the landscape. Yellow sweet-clover (*Melilotus officinalis*) was found in 53% of the vector blocks (42) as individual plants to scattered patches at least 20 meters into the landscape, occasionally deeper.

Table 3.8-1. Number and percentage of primary and secondary sample units where each species was detected, Pecos NHP, 2010

Scientific name	Common name	Primary sample units (n=80)		Secondary sample units (n=8)	
		Total	% blocks	Total ¹	% transects
<i>Tragopogon dubius</i>	Western salsify	73	91	7	88
<i>Salsola tragus</i>	Prickly Russian thistle	55	69	1	13
<i>Camelina microcarpa</i>	Smallseed false flax	53	66	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	42	53	0	0
<i>Marrubium vulgare</i>	Horehound	36	45	0	0
<i>Chenopodium album</i>	Common lambsquarters	24	30	0	0
<i>Kochia scoparia</i>	Kochia	21	26	0	0
<i>Bromus japonicus</i>	Japanese brome	20	25	0	0
<i>Cirsium arvense</i>	Canada thistle	15	19	0	0
<i>Tragopogon pratensis</i>	Meadow salisify	14	18	0	0
<i>Bromus lanceolatus</i>	Mediterranean brome	11	14	0	0
<i>Verbascum thapsus</i>	Mullein	11	14	1	13
<i>Asparagus officinalis</i>	Garden asparagus	8	10	0	0
<i>Thinopyrum ponticum</i>	Rush wheatgrass	7	9	0	0
<i>Dactylis glomerata</i>	Orchardgrass	4	5	0	0
<i>Medicago sativa</i>	Alfalfa	4	5	0	0
<i>Convolvulus arvensis</i>	Field bindweed	3	4	0	0
<i>Poa compressa</i>	Canada bluegrass	3	4	0	0
<i>Scorzonera laciniata</i>	Cutleaf vipergrass	3	4	0	0
<i>Cirsium vulgare</i>	Bull thistle	2	3	0	0
<i>Melilotus indicus</i>	Annual sweet clover	2	3	0	0
<i>Bromus tectorum</i>	Cheatgrass	1	1	0	0
<i>Melilotus alba</i>	White sweetclover	1	1	0	0
<i>Ulmus pumila</i>	Siberian elm	1	1	0	0
<i>Lactuca serriola</i>	Prickly lettuce	0	0	4	50

¹ The number of individual plots on secondary transects is shown in Figure 3.8-2.

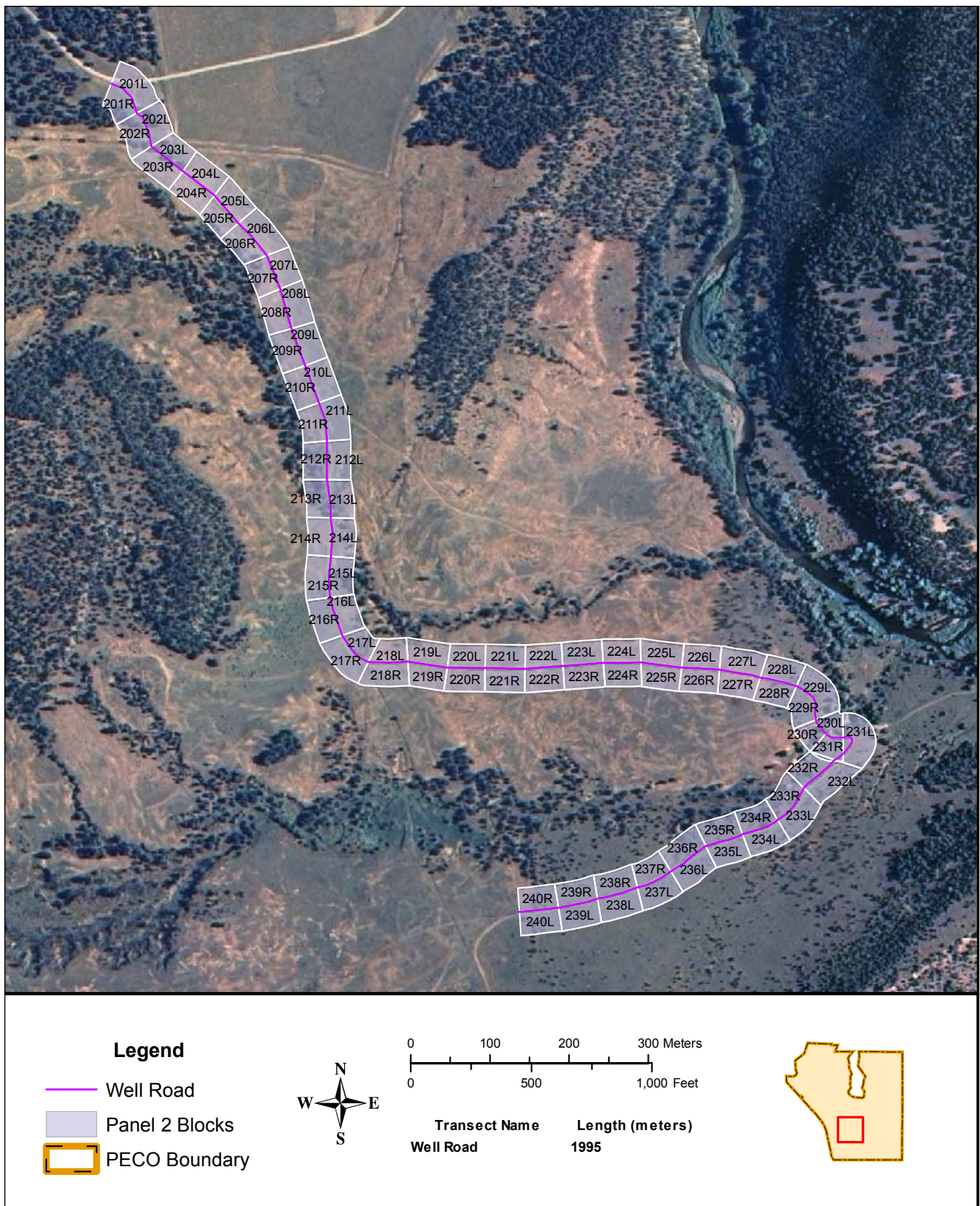


Figure 3.8-1. Individual vector blocks sampled, Panel 2, Pecos NHP, 2010.

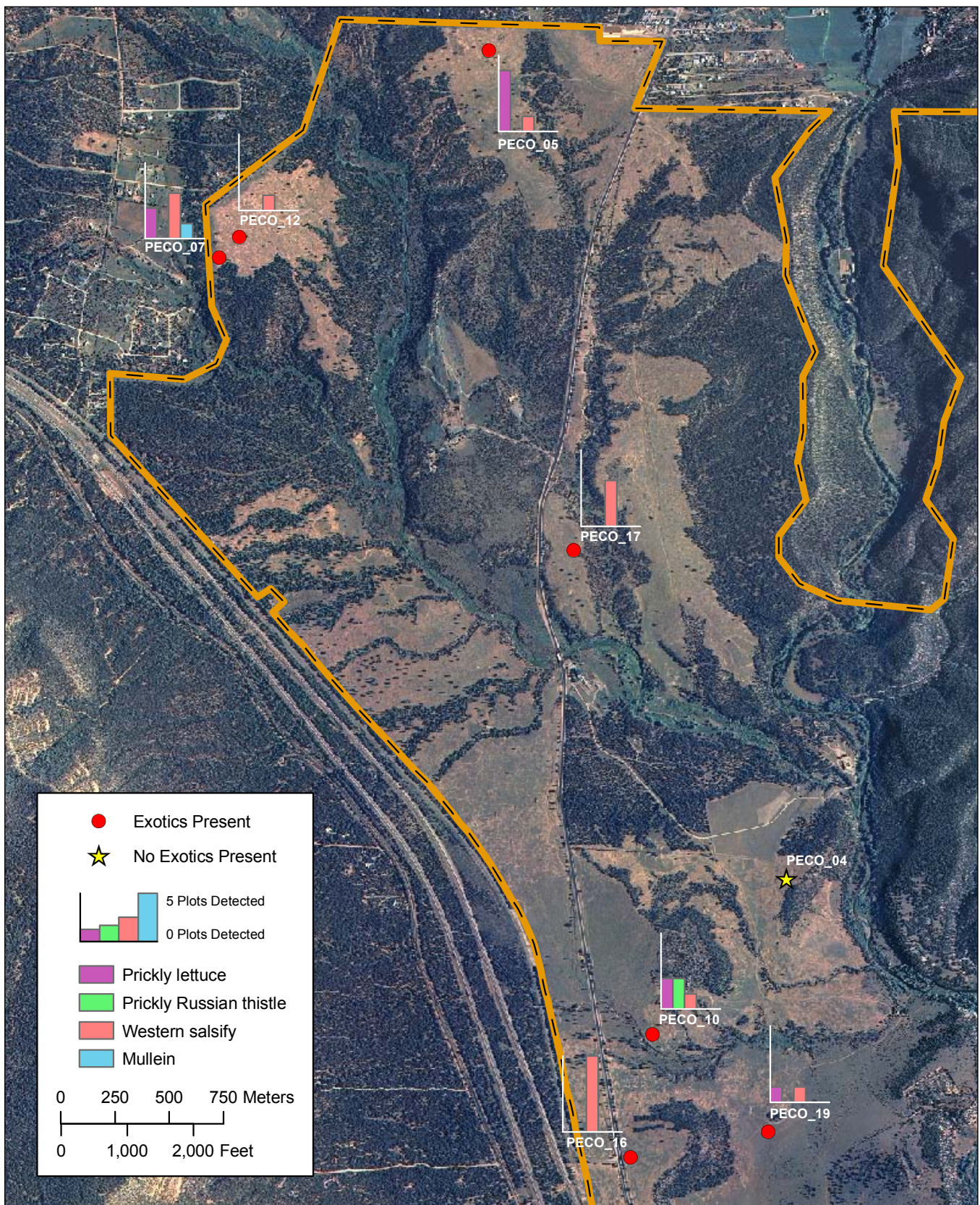


Figure 3.8-2. Secondary sample locations, Pecos NHP, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

Horehound (*Marrubium vulgare*) appeared in 45% of the vector blocks (36) all located in the lower half of the vector. It was seen as scattered to evenly distributed patches to over 22 meters deep in the landscape. A species of lambsquarters, possibly *Chenopodium album*, was found in 30% of the vector blocks (24), appearing generally as individual plants to scattered patches up to 12 meters from the vector. Identification verification is needed for this species. Kochia (*Kochia scoparia*) was seen in 26% of the vector blocks (21), primarily as individual plants within the first 12 meters of the vector. Japanese brome (*Bromus japonicus*) appeared in 25% of the vector blocks (20), throughout the lower two-thirds of the vector. It was observed generally in scattered patches up to 12 meters from the vector and occasionally further. Canada thistle (*Cirsium arvense*) was noted in 19% of the vector blocks (15)—all located in the northern half of the vector. It appeared as individual plants to scattered patches up to 20 meters deep into the landscape. Meadow salsify (*Tragopogon pratense*) was found in 18% of the vector blocks (14) as individual plants to scattered patches usually up to 12 meters from the vector. Mediterranean brome (*Bromus lanceolatus*) and mullein (*Verbascum thapsus*) were both found in 14% of the vector blocks (11). The brome was found in scattered patches within 12 meters of the vector, while mullein was seen as individual plants to scattered patches from the vector-side to over 20 meters into the landscape. Mullein was also found in one plot of one transect at 1% cover. Garden asparagus (*Asparagus officinalis*) was seen in 10% of the vector blocks (8) in the center section of the vector as individual plants to scattered patches occasionally up to 20 meters or deeper. Rush wheatgrass (*Thinopyrum ponticum*) appeared in 9% of the vector blocks (7) in the first third of the vector as scattered patches up to 20 meters from the vector.

Several exotic species appeared in a minimal number of vector blocks. Orchardgrass (*Dactylis glomerata*) and alfalfa (*Medicago sativa*) were found in four vector blocks each. A few individual plants of orchardgrass were seen at the beginning of the vector from 2 to 12 meters into the landscape, while alfalfa appeared as individual plants to scattered patches up to 12 meters from the vector. Field bindweed (*Convolvulus arvensis*),



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Western salsify (*Tragopogon dubius*) was the most common exotic found in both primary and secondary monitoring in 2010 at Pecos NHP.

Canadian bluegrass (*Poa compressa*) and cutleaf vipergrass (*Scorzonera laciniata*) were found in three vector blocks each. Two separate patches of bindweed were found with even distributions of patches, generally up to 12 meters from the vector but also deeper into the landscape. Canadian bluegrass was seen as scattered patches at the beginning of the vector up to 20 meters from the vector-side. Vipergrass was detected as individual plants to scattered patches from 2 to 12 meters into the landscape. Bull thistle (*Cirsium vulgare*) and annual sweetclover (*Melilotus indicus*) were found in two vector blocks each. A few individual plants of bull thistle were seen from 2 to 20 meters from the vector, while annual sweetclover was found in one area of a few individual plants up to 12 meters from the vector. Cheatgrass (*Bromus tectorum*), white sweetclover (*Melilotus alba*) and Siberian elm (*Ulmus pumila*) were found in one vector block each. A scattered patch of cheatgrass was seen mid-vector from 2 to 12 meters in the landscape. A few individuals of white sweetclover appeared along the vector-side. A few individuals of Siberian elm was seen near the end of the vector up to 12 meters into the landscape.

It should be noted that prickly lettuce (*Lactuca serriola*) was not found along the vectors, but did appear in 50% of the secondary transects (4). It was found in varying numbers of plots, but at never more than 3% cover.

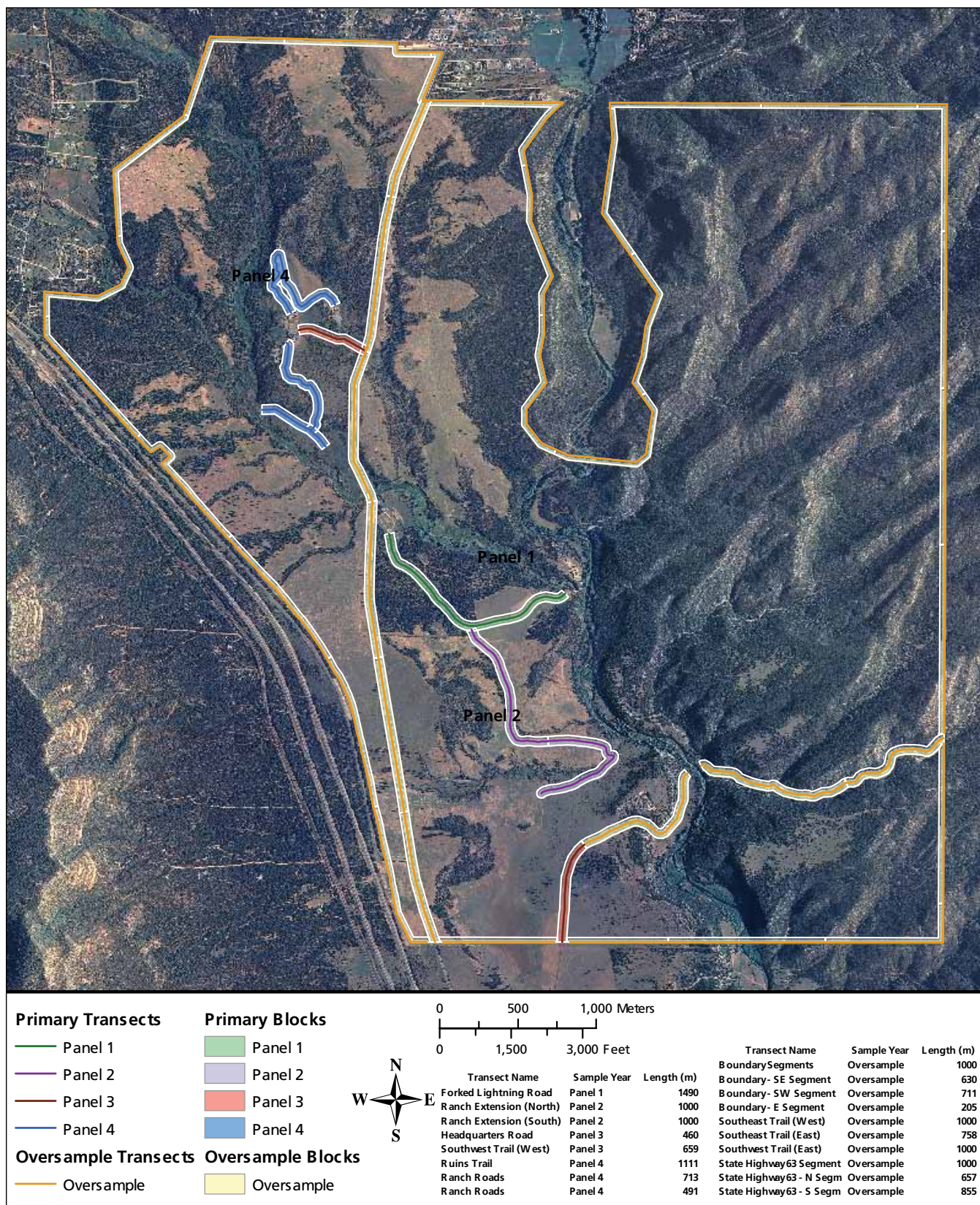


Figure 3.8-3. Overall planned sampling scheme for panels (annual samples) at Pecos NHP for a full three-year rotation.

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Asparagus officinalis</i>	Garden asparagus	R	212	1	0	–	–
		R	213	1	0	–	–
		L	212	0	1	0	0
		L	213	0	2	–	–
		L	215	0	1	–	–
		L	216	0	1	–	–
		L	219	0	1	2	–
		L	221	0	0	2	2
<i>Bromus japonicus</i>	Japanese brome	R	213	1–2	0	–	–
		R	214	2	0	0	0
		R	215	1	0	0	0
		R	217	2	1–2	0	0
		R	219	1	0	0	0
		R	230	2	2	0	0
		R	231	2	0	0	0
		R	232	0	2	1	0
		R	233	1–2	0	0	0
		R	234	0	1	0	–
		R	236	2	2	2	–
		R	237	2	0	0	0
		L	214	0	2	–	–
		L	229	0	2	0	–
		L	230	1	2	–	–
		L	231	2	0	0	0
		L	233	2	2	0	0
		L	237	2	2	0	0
		L	238	2	2	0	0
		L	239	2	0	0	0
<i>Bromus lanceolatus</i>	Mediterranean brome	R	201	2	0	0	–
		R	218	1–2	0	0	0
		R	222	1	0	0	0
		R	230	1	0	0	0
		R	231	1	0	0	0
		L	201	0	2	0	0
		L	202	0	2	0	0
		L	206	0	2	0	0
		L	209	2	2	0	0
		L	213	0	2	–	–
		L	231	0	2	0	0
<i>Bromus tectorum</i>	Cheatgrass	L	217	0	2	0	0
<i>Camelina microcarpa</i>	Smallseed false flax	R	201	0	0	1	–
		R	202	0	0	2	2
		R	203	0	2	2	2
		R	204	1	2	2	–

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Camelina microcarpa</i> (cont.)		R	205	0	2	2	–
		R	206	0	1	–	–
		R	207	1	2	–	–
		R	208	0	1	2	–
		R	209	2	2	–	–
		R	210	0	2	–	–
		R	211	1	2	–	–
		R	212	0	1–2	–	–
		R	213	1–2	1	–	–
		R	214	1	2	2	2
		R	215	0	2	2	2
		R	216	0	1	0	1
		R	217	0	1	1	0
		R	218	1	1	1	0
		R	219	1	2	1	0
		R	220	2	2	1	1
		R	221	1	1–2	1	0
		R	222	0	1	1	0
		R	223	0	0	1	1
		R	230	1	1	0	0
		R	231	1	2	1	0
		R	233	0	1	0	0
		R	240	0	0	1	0
		L	202	0	2	0	0
		L	203	0	2	2	0
		L	204	0	2	2	0
		L	205	0	2	2	0
		L	206	0	2	2	0
		L	207	0	2	2	0
		L	208	0	2	2	0
		L	209	0	2	2	0
		L	210	0	2	2	2
		L	211	0	2	2	2
		L	212	0	1	0	0
		L	213	0	2	–	–
		L	214	0	2	–	–
		L	215	0	1	–	–
		L	216	0	1	–	–
		L	218	0	2	2	–
		L	219	1	2	2	–
		L	220	0	2	2	0
		L	221	0	2	2	0
		L	222	0	2	2	–
		L	223	0	1	2	–

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Camelina microcarpa</i> (cont.)		L	224	0	2	3	–
		L	225	0	2	2	–
		L	226	0	1	1	–
		L	230	0	1	–	–
		L	231	0	2	0	0
<i>Chenopodium album</i>	Common lambsquarters	R	201	2	2	0	–
		R	222	1	0	0	0
		R	223	1	0	0	0
		R	231	1	0	0	0
		R	232	0	1	0	0
		R	236	2	0	0	–
		R	237	2	2	0	0
		L	201	0	2	0	0
		L	202	0	2	0	0
		L	210	0	1	0	0
		L	215	0	2	–	–
		L	220	1	0	0	0
		L	221	1	1	0	0
		L	222	1	2	0	–
		L	223	1	0	0	–
		L	226	1	1	0	–
		L	227	1	1	0	–
		L	229	0	1	0	–
		L	230	0	2	–	–
		L	231	1	0	0	0
		L	232	0	1	0	0
		L	233	1	0	0	0
		L	236	1	0	0	0
		L	237	0	2	2	0
<i>Cirsium arvense</i>	Canada thistle	R	202	1	0	0	0
		R	204	0	1	1	–
		R	205	0	1	0	–
		R	207	0	2	–	–
		R	208	0	1	0	–
		L	204	0	1	0	0
		L	205	1	1	1	0
		L	206	0	2	0	0
		L	207	0	1	1	0
		L	209	0	2	0	0
		L	210	0	0	2	0
		L	211	0	2	0	0
		L	217	0	2	0	0
		L	220	0	0	1	0
		L	225	0	2	0	–

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Cirsium vulgare</i>	Bull thistle	R	203	0	0	1	0
		R	210	0	1	–	–
<i>Convolvulus arvensis</i>	Field bindweed	R	206	3	3	–	–
		L	206	3	3	0	0
		L	211	0	2	2	0
<i>Dactylis glomerata</i>	Orchardgrass	R	201	0	0	2	–
		R	204	0	1	0	–
		R	205	0	1	0	–
		L	205	0	1	0	0
<i>Kochia scoparia</i>	Kochia	R	201	1–2	1	0	–
		R	204	1	0	0	–
		R	205	1	1	0	–
		R	206	1	0	–	–
		R	207	0	1	–	–
		R	213	0	1	–	–
		R	214	1	0	0	0
		R	215	1	0	0	0
		R	216	0	1	0	0
		R	218	1–2	0	0	0
		R	219	1	0	0	0
		R	221	1–2	0	0	0
		R	226	1	0	0	0
		R	229	1	0	0	0
		L	211	0	1	0	0
		L	218	2	2	0	–
		L	219	2	0	0	–
		L	221	2	0	0	0
		L	229	0	1	0	–
		L	230	1	0	–	–
		L	231	0	1	0	0
<i>Marrubium vulgare</i>	Horehound	R	220	0	2	0	0
		R	221	0	2	2	2
		R	222	3	3	2	2
		R	223	2–3	2–3	2	2
		R	224	2	2	2	2
		R	225	1–2	3	3	2–3
		R	226	2	2	2–3	2
		R	227	–	–	–	–
		R	228	2–3	2–3	2–3	2–3
		R	229	2	2	2	2
		R	230	0	2	2	2
		R	231	1–2	2	2	0
		R	232	0	2	2	1–2
		R	235	1	1	0	–

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Marrubium vulgare</i> (cont.)		R	236	1-2	2	2	–
		R	237	2	2	2	2
		R	238	2	2	2	2
		R	239	0	2	2	2
		R	240	0	2	2	0
		L	221	0	2	3	0
		L	222	0	2	3	–
		L	223	0	2	2	–
		L	225	0	2	2	–
		L	226	0	2	3	–
		L	227	0	2	3	–
		L	228	0	2	3	–
		L	229	0	2	2	–
		L	231	0	2	2	0
		L	233	0	2	2	0
		L	234	0	2	2	2
		L	235	0	2	3	3
		L	236	0	2	3	3
		L	237	1	2	3	3
		L	238	1	2	3	3
		L	239	0	2	2	2
		L	240	0	2	3	3
<i>Medicago sativa</i>	Alfalfa	R	201	2	1	0	–
		L	201	0	2	0	0
		L	212	0	1	0	0
		L	222	1	1	0	–
<i>Melilotus alba</i>	White sweetclover	L	235	1	0	0	0
<i>Melilotus indicus</i>	Annual sweet clover	R	213	1	1	–	–
		L	213	1	0	–	–
<i>Melilotus officinalis</i>	Yellow sweetclover	R	201	2	1	0	–
		R	202	0	2	2	2
		R	203	2	2	0	0
		R	204	0	2	2	–
		R	205	0	2	2	–
		R	206	0	2	–	–
		R	207	2	2	–	–
		R	208	0	2	2	–
		R	209	0	2	–	–
		R	210	0	1	–	–
		R	211	0	1	–	–
		R	212	0	1	–	–
		R	213	1	0	–	–
		R	214	1	1	0	0
		R	215	1-2	0	0	0

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Melilotus officinalis</i> (cont.)		R	216	1	0	0	0
		R	217	2	1	0	1
		R	218	0	1	0	0
		R	219	0	0	1	0
		R	226	1	0	0	0
		R	227	–	–	–	–
		R	230	1	1	0	0
		R	231	1	0	1	0
		R	233	2	0	0	0
		R	234	2	0	0	–
		R	235	3	2	0	–
		R	238	1	0	0	0
		L	201	2	0	0	0
		L	211	1	0	0	0
		L	213	1	1	–	–
		L	214	1	0	–	–
		L	216	1	2	–	–
		L	217	0	2	0	0
		L	218	0	2	2	–
		L	219	0	2	0	–
		L	224	0	2	0	–
		L	230	1	0	–	–
		L	231	1	1	0	0
		L	232	1	1	1	0
		L	234	2	2	0	0
		L	235	2	2	0	0
		L	239	1	0	0	0
<i>Poa compressa</i>	Canada bluegrass	R	201	0	0	2	–
		R	202	0	2	2	0
		R	203	2	2	0	0
<i>Salsola tragus</i>	Prickly Russian thistle	R	201	1	1	1	–
		R	202	0	0	1	0
		R	203	0	1	1	0
		R	204	1	2	2	–
		R	205	2	2	1	–
		R	206	0	2	–	–
		R	207	2	2	–	–
		R	208	0	1	0	–
		R	214	0	1	0	0
		R	217	1	0	0	0
		R	218	2	0	0	0
		R	219	1	0	0	0
		R	220	2	0	0	0
		R	221	2	0	0	0

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Salsola tragus</i> (cont.)		R	222	1-2	1	0	0
		R	224	2	0	0	0
		R	225	2	2	0	0
		R	226	2	1	0	0
		R	227	–	–	–	–
		R	228	1	0	0	0
		R	229	1-2	2	0	0
		R	231	2	0	0	0
		R	232	1	0	0	0
		R	233	1-2	1	0	0
		R	234	1	0	0	–
		R	235	1	2	0	–
		R	236	2	2	1	–
		R	237	2	2	0	0
		R	238	1	0	0	0
		R	239	1	0	0	0
		R	240	2	0	0	0
		L	201	0	1	0	0
		L	203	0	1	0	0
		L	207	0	1	0	0
		L	212	0	1	0	0
		L	213	0	2	–	–
		L	214	0	1	–	–
		L	216	0	1	–	–
		L	218	1	0	0	–
		L	219	2	0	0	–
		L	220	2	2	0	0
		L	221	2	2	0	0
		L	223	1	1	0	–
		L	224	1	2	0	–
		L	225	1	1	0	–
		L	226	1	1	0	–
		L	227	1	1	0	–
		L	228	1	0	0	–
		L	231	0	2	0	0
		L	232	2	2	0	0
		L	233	2	2	0	0
		L	236	1	0	0	0
		L	238	1	0	0	0
		L	239	1	1	0	0
		L	240	2	2	0	0
<i>Scorzonera laciniata</i>	Cutleaf vipergrass	L	212	0	1	0	0
		L	213	0	1	–	–
		L	215	0	2	–	–

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Thinopyrum ponticum</i>	Rush wheatgrass	R	203	0	1	0	0
		R	207	1-2	0	–	–
		R	211	0	2	–	–
		R	212	1	1	–	–
		L	210	0	2	2	0
		L	211	0	2	2	0
		L	212	0	2	0	0
<i>Tragopogon dubius</i>	Western salsify	R	201	1	1	0	–
		R	203	0	0	1	0
		R	204	1	2	1	–
		R	205	1	2	0	–
		R	207	2	2	–	–
		R	208	2	2	1	–
		R	209	2	1	–	–
		R	210	2	2	–	–
		R	211	1	1-2	–	–
		R	212	1	1-2	–	–
		R	214	2	2	2	0
		R	215	0	2	2	0
		R	217	1	1	0	1
		R	218	1	1-2	1	0
		R	219	1	2	1	0
		R	220	2	2	0	0
		R	221	1-2	2	0	1
		R	222	1	2	0	0
		R	223	0	2	1	0
		R	224	1	2	0	0
		R	225	1	2	0	0
		R	226	1	1-2	1	1
		R	227	–	–	–	–
		R	228	1-2	1-2	1	2
		R	229	1	2	1	0
		R	230	0	1-2	1	1
		R	231	1	0	2	0
		R	232	1-2	2	1	0
		R	233	2	2	0	0
		R	234	1-2	1	0	–
		R	235	0	1	0	–
		R	236	1	2	0	–
		R	237	1	2	0	0
		R	238	1	1	0	0
		R	239	1	2	1	0
		R	240	0	1	0	0
		L	201	0	1	0	0

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Tragopogon dubius</i> (cont.)		L	204	0	2	2	0
		L	205	1	2	2	0
		L	206	2	2	2	0
		L	207	1	2	2	0
		L	208	1	2	2	0
		L	209	0	2	2	0
		L	210	1	2	2	2
		L	211	1	2	2	2
		L	212	0	2	2	0
		L	214	0	2	–	–
		L	215	0	2	–	–
		L	216	0	2	–	–
		L	217	1	1	0	0
		L	218	0	1	0	–
		L	219	0	2	0	–
		L	220	2	2	0	0
		L	221	0	2	2	0
		L	222	0	2	2	–
		L	223	0	2	0	–
		L	224	0	1	0	–
		L	225	1	1	2	–
		L	226	0	1	1	–
		L	227	0	2	2	–
		L	228	0	2	2	–
		L	229	0	1	2	–
		L	230	0	1	–	–
		L	231	0	1	2	2
		L	232	1	2	0	0
		L	233	1	2	2	0
		L	234	0	2	2	0
		L	235	0	1	2	2
		L	236	0	2	2	0
		L	237	0	2	2	0
		L	238	1	2	2	0
		L	239	1	2	2	0
		L	240	0	2	2	0
<i>Tragopogon pratensis</i>	Meadow salisify	R	212	0	1	–	–
		R	214	0	1	0	0
		R	215	0	1–2	0	0
		R	216	0	1	0	0
		R	217	1	1	0	0
		R	220	1	0	0	0
		R	224	1	0	0	0
		L	212	0	1	0	0

Table 3.8-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Pecos NHP, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Tragopogon pratensis</i> (cont.)		L	217	0	2	2	0
		L	218	0	2	0	–
		L	221	2	0	0	0
		L	224	0	1	0	–
		L	236	1	0	0	0
		L	237	1	1	0	0
<i>Ulmus pumila</i>	Siberian elm	L	235	1	1	0	0
<i>Verbascum thapsus</i>	Mullein	R	202	0	0	1	0
		R	205	0	1	0	–
		R	206	0	2	–	–
		R	207	0	1	–	–
		R	209	1	0	–	–
		R	238	0	0	0	1
		L	209	0	2	2	0
		L	210	0	0	2	0
		L	217	0	2	0	0
		L	229	0	1	1	–
		L	232	0	1	0	0

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

3.9 Sand Creek Massacre NHS

Overall sampling at Sand Creek Massacre occurs on unpaved roads over its full three-year rotation (Figure 3.9-3). In 2010, exotic-plant monitoring occurred at Sand Creek Massacre for 2.5 days in early July. The vectors sampled were the ceremony road, county road, cutoff road, and Lower Monument Road, North. A total of 122 vector blocks were monitored, for a total of 3.05 linear kilometers sampled on both sides (Figure 3.9-1). In addition, 12 permanent transects within the landscape were sampled for a total of 60 4 x 1 meter plots. No exotics were observed in two vector blocks.

Kochia (*Kochia scoparia*) was the most commonly found exotic species this field season and was found in 78% of vector blocks sampled (95) and 67% of secondary transects (8). *Kochia* was most frequently found as single plants to scattered patches up to 12 meters into the landscape, with the exception of the ceremony and cutoff roads where it was frequently found up to 22 meters. The secondary permanent transect monitoring showed *kochia* to be the most prevalent forb encountered with mean transect cover of 25% or more in the transects near the Chivington ditch. Prickly Russian thistle (*Salsola tragus*) was present in 51% of vector blocks sampled (62) and 50% of secondary transects (6). This species was consistently found as single plants to scattered patches up to 12 meters into the landscape. The densest areas are found near the overlook and an area along the county road. Western salsify (*Tragopogon dubius*) was found in 50% (61) of the vector blocks, most frequently as individual plants ranging deep into the landscape. No salsify

was found in secondary transects but plants were observed in the surrounding areas.

Yellow sweetclover (*Melilotus officinalis*) was present in 11% of vector blocks sampled (14) and 17% of secondary transects (2). Yellow sweetclover was consistently found as individual plants up to 12 meters into the landscape along the riparian area and over 20 meters off of the county road. The secondary transects where it was found were both in the cottonwoods at the riparian area in 1% or less cover. A close relative, white sweetclover (*Melilotus alba*) was found in similar riparian areas and densities and could possibly be a white or faded version of the yellow sweetclover. Cheatgrass (*Bromus tectorum*) was found as scattered individual plants in 2% of the vector blocks (2) and no secondary transects. When found it was within 2 meters of the vector and is likely spread by tires.

Three exotic species were found in secondary transects within the landscape, but not along monitored vectors. Common goosefoot (*Chenopodium album*) is suspected in two transects but encountered only in one plot each of the transects and with less than 1% cover. Of greater concern are field bindweed (*Convolvulus arvensis*) and prickly lettuce (*Lactuca serriola*), found in one transect each. Field bindweed was present the southeastern prairie dog town with cover up to 20%, while prickly lettuce was found in one plot of a cottonwood transect at less than 1% cover.

Table 3.9-1. Number and percentage of primary and secondary sample units where each species was detected, Sand Creek Massacre NHS, 2010

Scientific name	Common name	Primary sample units (n=122)		Secondary sample units (n=12)	
		Total	% blocks	Total ¹	% transects
<i>Kochia scoparia</i>	Kochia	95	78	8	67
<i>Salsola tragus</i>	Prickly Russian thistle	62	51	6	50
<i>Tragopogon dubius</i>	Western salsify	61	50	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	14	11	2	17
<i>Melilotus alba</i>	White sweetclover	8	7	1	8
<i>Bromus tectorum</i>	Cheatgrass	2	2	0	0
<i>Chenopodium album</i>	Common lambsquarters	0	0	2	17
<i>Convolvulus arvensis</i>	Field bindweed	0	0	1	8
<i>Lactuca serriola</i>	Prickly lettuce	0	0	1	8

¹ The number of individual plots on secondary transects is shown in Figure 3.9-2.

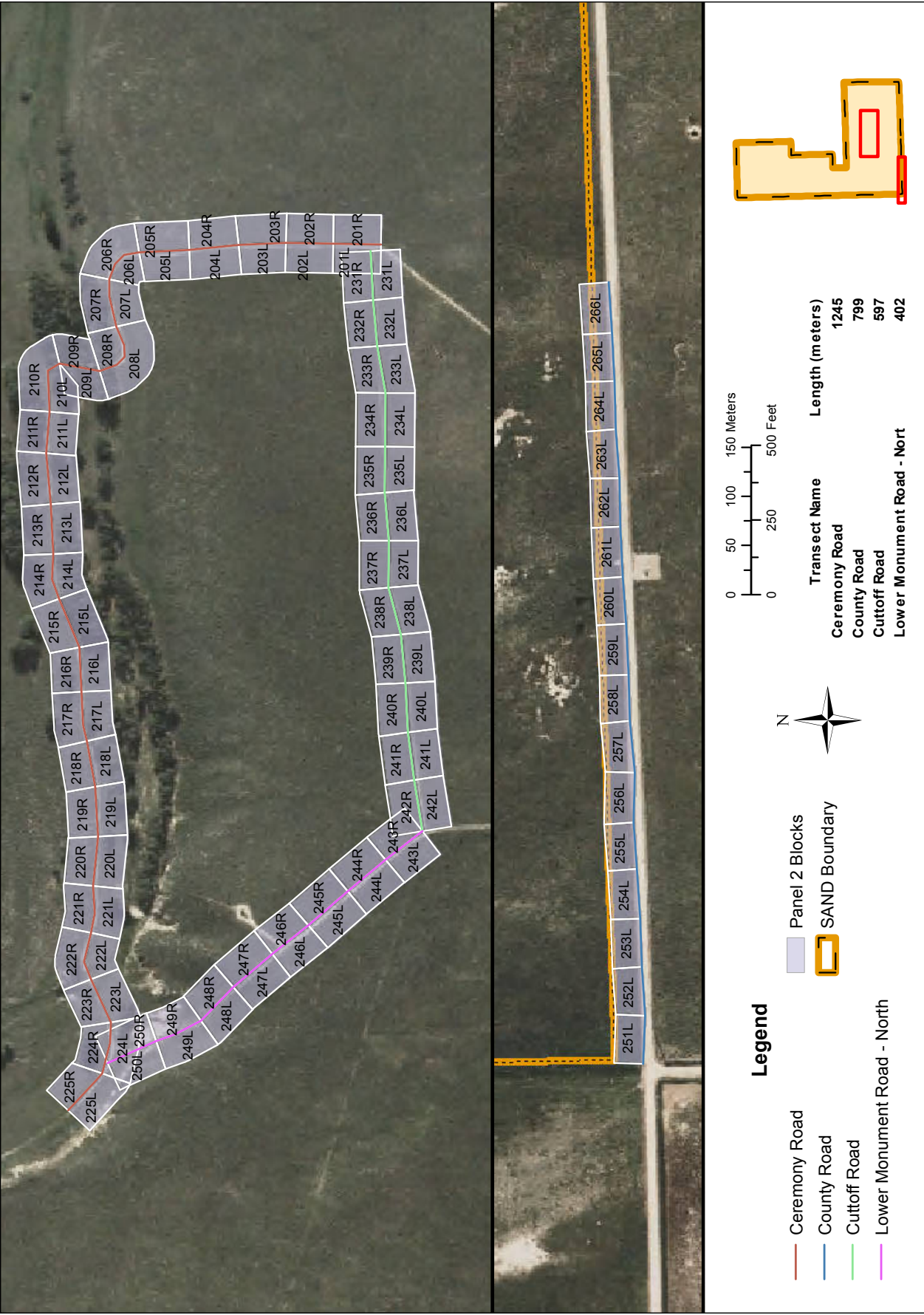


Figure 3.9-1. Individual vector blocks sampled, Panel 2, Sand Creek Massacre NHS, 2010.

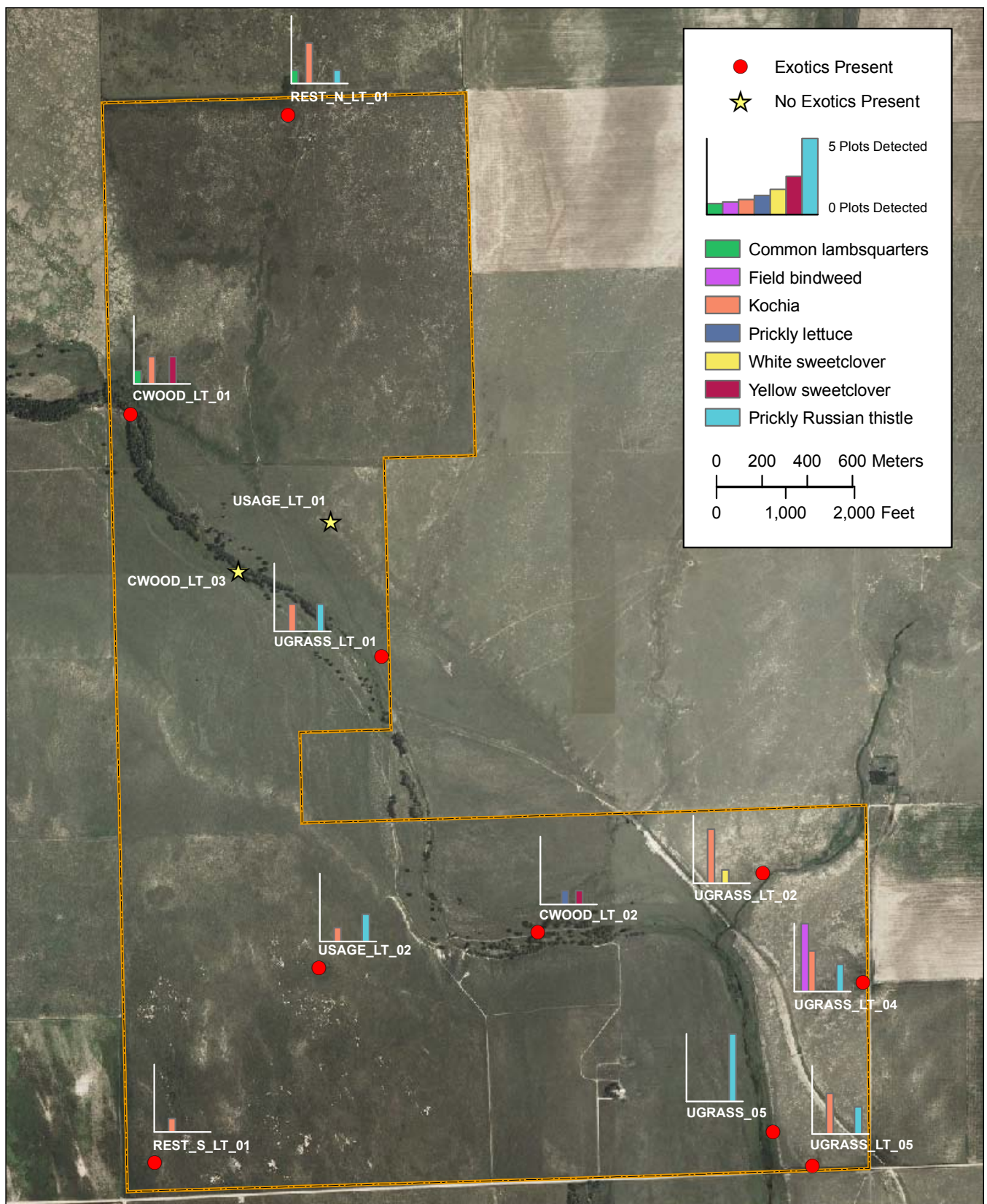


Figure 3.9-2. Secondary sample locations, Sand Creek Massacre NHS, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

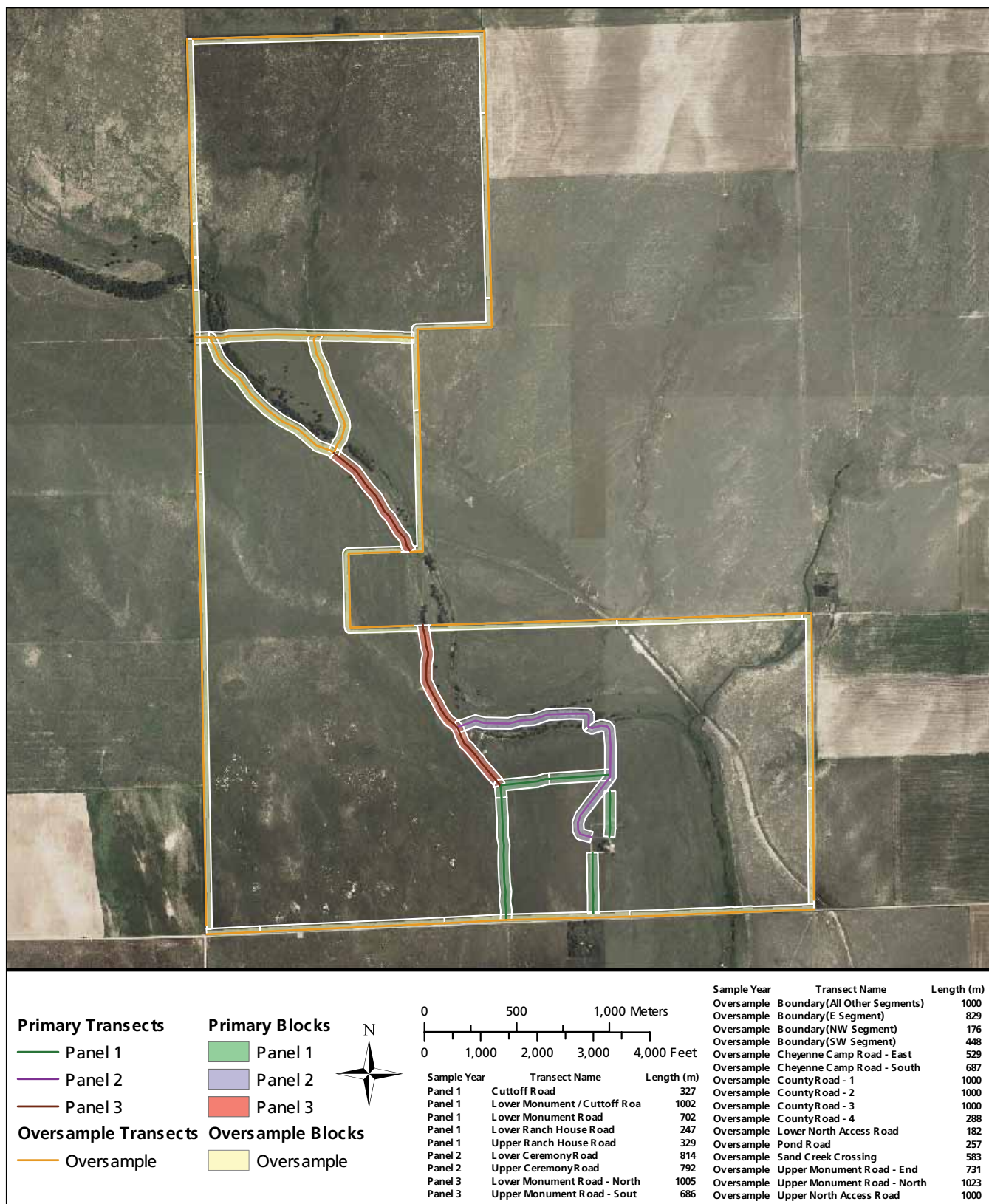


Figure 3.9-3. Overall planned sampling scheme for panels (annual samples) at Sand Creek Massacre NHS for a full three-year rotation.

Table 3.9-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Sand Creek Massacre NHS, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus tectorum</i>	Cheatgrass	R	205	1	0	0	0
		L	259	1	0	0	0
<i>Kochia scoparia</i>	Kochia	L	201	0	2	0	0
		R	201	2	2	2	2
		L	202	2	2	2	0
		R	202	2	2	2	0
		L	203	2	2	2	0
		R	203	2	2	2	0
		L	204	0	2	2	0
		R	204	2	2	2	0
		L	205	2	2	2	0
		R	205	0	2	2	0
		L	206	0	2	2	0
		R	206	0	2	0	0
		L	207	2	2	2	–
		R	207	0	1	0	0
		L	208	0	2	2	0
		R	208	1	0	0	0
		R	210	1	0	0	0
		L	211	0	1	0	0
		L	212	1	1	0	0
		R	212	1	0	0	0
		L	213	0	1	0	0
		R	214	0	1	0	0
		L	215	0	2	0	0
		R	215	2	2	0	0
		L	216	0	2	2	0
		R	216	2	2	1–2	0
		L	217	0	2	2	0
		R	217	0	1–2	0	0
		L	218	0	2	2	0
		R	218	2	2	0	0
		L	219	0	1	0	0
		R	219	2	2	1	0
		L	220	2	2	2	0
		R	220	2	2	2	0
		L	221	2	2	2	0
		R	221	2	2	0	0
		L	222	0	2	2	0
		R	222	2	2	0	0
		L	223	0	2	2	2
		R	223	2	2	0	0
		L	224	0	2	2	2
		R	224	2	2	2	0

Table 3.9-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Sand Creek Massacre NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Kochia scoparia</i> (cont.)		L	225	2	2	2	–
		R	225	2	2	2	0
		L	231	2	2	2	0
		R	231	2	2	0	0
		L	232	2	2	2	0
		R	232	2	2	0	0
		L	233	2	2	2	0
		R	233	2	2	1	0
		L	234	2	2	2	0
		R	234	2	2	0	0
		L	235	0	2	2	0
		R	235	2	2	0	0
		L	236	2	2	2	0
		R	236	2	2	0	0
		L	237	2	2	2	0
		R	237	2	2	2	0
		L	238	2	2	2	0
		R	238	2	2	1	0
		L	239	2	2	2	0
		R	239	2	2	0	0
		L	240	2	3	2	0
		R	240	2	2–3	0	0
		L	241	0	2	2	0
		R	241	2	2	0	0
		L	242	0	2	1	0
		R	242	1–2	2	0	0
		L	243	0	2	2	0
		R	243	2	2	2	0
		L	244	0	2	2	0
		R	244	2	2	0	0
		R	245	0	1	0	0
		L	248	2	2	0	0
		R	248	2	2	0	0
		L	249	0	2	2	–
		R	249	1	2	2	0
		L	250	2	2	2	–
		R	250	2	2	2	0
		L	251	2	2	2	2
		L	252	0	2	2	0
		L	253	2	2	0	0
		L	254	2	2	0	0
		L	255	0	2	2	0
		L	256	0	2	2	0
		L	257	2	2	0	0

Table 3.9-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Sand Creek Massacre NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Kochia scoparia</i> (cont.)		L	258	2	2	0	0
		L	259	2	2	2	0
		L	260	2	2	2	0
		L	261	2	2	2	0
		L	262	2	2	0	0
		L	263	2	2	2	0
		L	264	2	2	2	0
		L	265	2	2	0	0
		L	266	1	2	0	0
<i>Melilotus alba</i>	White sweetclover	L	209	0	1	0	0
		R	209	1	1	0	0
		R	217	0	1	0	0
		R	218	1	1	1	0
		L	219	0	1	1	0
		R	220	0	1	0	0
		R	222	0	1	0	0
		R	223	1	1	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	L	209	0	1	0	0
		R	209	1	0	0	0
		L	218	0	1	0	0
		L	220	0	1	0	0
		L	221	1	1	0	0
		L	234	1	0	0	0
		L	250	0	1	0	–
		L	253	0	1	0	0
		L	254	0	1	0	0
		L	260	0	1	0	0
		L	261	0	2	2	2
		L	262	0	1	0	0
		L	263	0	1	2	0
		L	264	0	1	0	0
No exotics found		L	245	0	0	0	0
		R	246	0	0	0	0
<i>Salsola tragus</i>	Prickly Russian thistle	L	201	0	1	0	0
		R	201	1	0	0	0
		L	202	1	1	0	0
		L	203	1	0	0	0
		R	203	1	0	0	0
		L	204	0	1	0	0
		R	204	1	0	0	0
		R	206	0	1	0	0
		L	207	1	2	0	–
		R	207	2	0	0	0
		L	208	2	2	0	0

Table 3.9-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Sand Creek Massacre NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Salsola tragus</i> (cont.)		R	208	2	2	0	0
		L	209	2	2	0	0
		R	209	2	0	0	0
		L	210	1	1	0	0
		L	211	1	0	0	0
		R	211	1	0	0	0
		L	212	2	0	0	0
		R	212	1	0	0	0
		R	213	1	0	0	0
		L	214	1	0	0	0
		R	215	1	1	0	0
		L	216	2	0	0	0
		R	216	2	1-2	0	0
		L	217	2	0	0	0
		R	217	1	1	0	0
		R	218	0	1	0	0
		R	219	1	0	0	0
		L	220	0	2	0	0
		R	220	1	0	0	0
		R	221	1	0	0	0
		L	224	1	0	0	0
		R	224	2	1-2	0	0
		R	225	1	1	0	0
		L	238	2	0	0	0
		R	238	1	0	0	0
		L	239	2	2	0	0
		R	239	2	1	0	0
		L	240	2	2	0	0
		R	240	1	1	0	0
		L	241	3	2	0	0
		R	241	3	1	0	0
		L	242	3	2	0	0
		R	242	3	3	1	0
		L	243	2	0	0	0
		R	243	2	1	0	0
		L	251	1	2	0	0
		L	252	2	0	0	0
		L	253	2-3	2	0	0
		L	254	2-3	2	0	0
		L	255	2	0	0	0
		L	256	2	2	0	0
		L	257	1	0	0	0
		L	258	1	1	0	0
		L	259	2	0	0	0

Table 3.9-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Sand Creek Massacre NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Salsola tragus</i> (cont.)		L	260	2	2	0	0
		L	261	2	1	0	0
		L	262	2	1	0	0
		L	263	2	2	0	0
		L	264	2	2	0	0
		L	265	3	1	0	0
		L	266	2-3	1	0	0
<i>Tragopogon dubius</i>	Western salsify	L	201	0	0	1	0
		R	201	0	0	0	1
		R	202	0	1	1	0
		L	203	0	1	1	0
		R	203	0	1	0	0
		L	204	0	1	0	0
		R	204	0	1	1	0
		R	205	0	0	0	1
		R	206	0	1	0	0
		R	207	1	0	0	0
		L	208	0	1	0	0
		R	209	0	1	0	0
		L	210	–	1	0	0
		R	210	1	0	0	0
		L	211	0	1	0	0
		R	211	0	1	0	0
		L	212	0	1	0	0
		R	212	0	1	0	0
		L	213	0	0	0	1
		R	213	1	1	0	0
		L	214	0	1	1	0
		R	214	1	0	0	0
		L	215	0	1	0	0
		R	216	1	0	0	0
		L	217	0	1	0	0
		R	218	0	2	2	0
		L	218	1	0	0	0
		R	219	0	2	2	0
		L	219	0	1	0	0
		R	220	0	2	0	0
		L	222	0	1	0	0
		R	223	0	1	0	0
		L	223	0	1	0	0
		R	224	0	1	0	0
		L	225	1	0	0	0
		R	232	0	0	0	1
		L	234	0	1	0	0

Table 3.9-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Sand Creek Massacre NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Tragopogon dubius</i> (cont.)		R	235	0	1	1	0
		L	236	0	1	1	0
		R	236	0	1	1	0
		L	237	0	0	1	0
		R	237	0	1	0	0
		R	238	0	1	0	0
		L	239	0	1	1	0
		R	239	1	1	0	1
		L	240	0	0	0	1
		L	241	0	1	1	0
		L	242	0	1	0	0
		L	246	0	1	0	0
		L	248	0	1	0	0
		R	248	0	1	0	0
		R	250	0	1	0	0
		L	253	0	0	1	0
		L	254	0	1	0	0
		L	256	0	0	1	0
		L	259	0	1	1	0
		L	260	0	1	0	0
		L	261	1	0	0	0
		L	262	0	1	0	0
		L	263	1	2	2	0
		L	264	0	2	1	0

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

3.10 Washita Battlefield NHS

Overall sampling at Washita Battlefield includes both unpaved roads and trails over its full three-year rotation (Figure 3.10-3). In 2010, exotic-plant monitoring occurred at Washita Battlefield for 2.5 days in June. The vectors sampled were an unpaved maintenance road and two trails: a new trail and the South Loop Trail in the southwestern corner of the park. Seventy vector blocks were monitored, for a total of 1.75 linear kilometers sampled on both sides (Figure 3.10-1). In addition, 10 permanent transects within the landscape were sampled for a total of 50 4 x 1 meter plots.

Japanese brome (*Bromus japonicus*) was the most commonly found exotic species this field season, followed by Johnsongrass (*Sorghum halepense*) and cheatgrass (*Bromus tectorum*). While most commonly found in scattered patches, all three species had areas where the distribution became evenly scattered. Japanese brome was found in 97% of the vector blocks sampled (68) and 50%

of the secondary transects (5). Of the secondary transects, the cover was only 3% of two transects and less than 1% for the others. Johnsongrass was found in 89% of the vector blocks sampled (62) and 50% of the secondary transects (5), with transect cover densities generally over 10% and as high as 55%. Both species were most frequently seen within 22 meters of the vector, and often observed running deeper into the landscape. Cheatgrass was present in 83% of vector blocks sampled (58). It was also most frequently seen within up to 22 meters into the landscape, and was occasionally observed running over 22 meters into the landscape. Cheatgrass was not identified in any of the secondary transects. These three species of exotic grasses pose a major threat to the grasslands at Washita Battlefield, with the bromes filling the interstices between the native bunchgrasses.

Kochia (*Kochia scoparia*) was found in 67% of the vector blocks sampled (47) and one secondary transect. It was consistently seen up to 12

Table 3.10-1. Number and percentage of primary and secondary sample units where each species was detected, Washita Battlefield NHS, 2010

Scientific name	Common name	Primary sample units (n=70)		Secondary sample units (n=10)	
		Total	% blocks	Total ¹	% transects
<i>Bromus japonicus</i>	Japanese brome	68	97	5	50
<i>Sorghum halepense</i>	Johnsongrass	62	89	5	50
<i>Bromus tectorum</i>	Cheatgrass	58	83	0	0
<i>Kochia scoparia</i>	Kochia	47	67	1	10
<i>Melilotus officinalis</i>	Yellow sweetclover	38	54	0	0
<i>Tragopogon dubius</i>	Western salsify	34	49	0	0
<i>Cirsium vulgare</i>	Bull thistle	33	47	0	0
<i>Ulmus pumila</i>	Siberian elm	26	37	7	70
<i>Euphorbia dentata</i>	Toothed spurge	11	16	1	10
<i>Albizia julibrissin</i>	Mimosa	9	13	0	0
<i>Medicago minima</i>	Burr medic clover	6	9	0	0
<i>Chenopodium album</i>	Common lambsquarters	4	6	0	0
<i>Lactuca serriola</i>	Prickly lettuce	3	4	0	0
<i>Tamarix chinensis</i>	Tamarisk	3	4	0	0
<i>Cynodon dactylon</i>	Bermuda grass	2	3	1	10
<i>Lolium perenne</i>	Perennial ryegrass	1	1	0	0
<i>Medicago lupulina</i>	Black medic clover	1	1	0	0
<i>Taraxacum officinale</i>	Dandelion	1	1	0	0
<i>Convolvulus arvensis</i>	Field bindweed	0	0	2	20
<i>Salsola tragus</i>	Prickly Russian thistle	0	0	1	10
<i>Sonchus asper</i>	Spiny sowthistle	0	0	2	20

¹ The number of individual plots on secondary transects is shown in Figure 3.10-2.

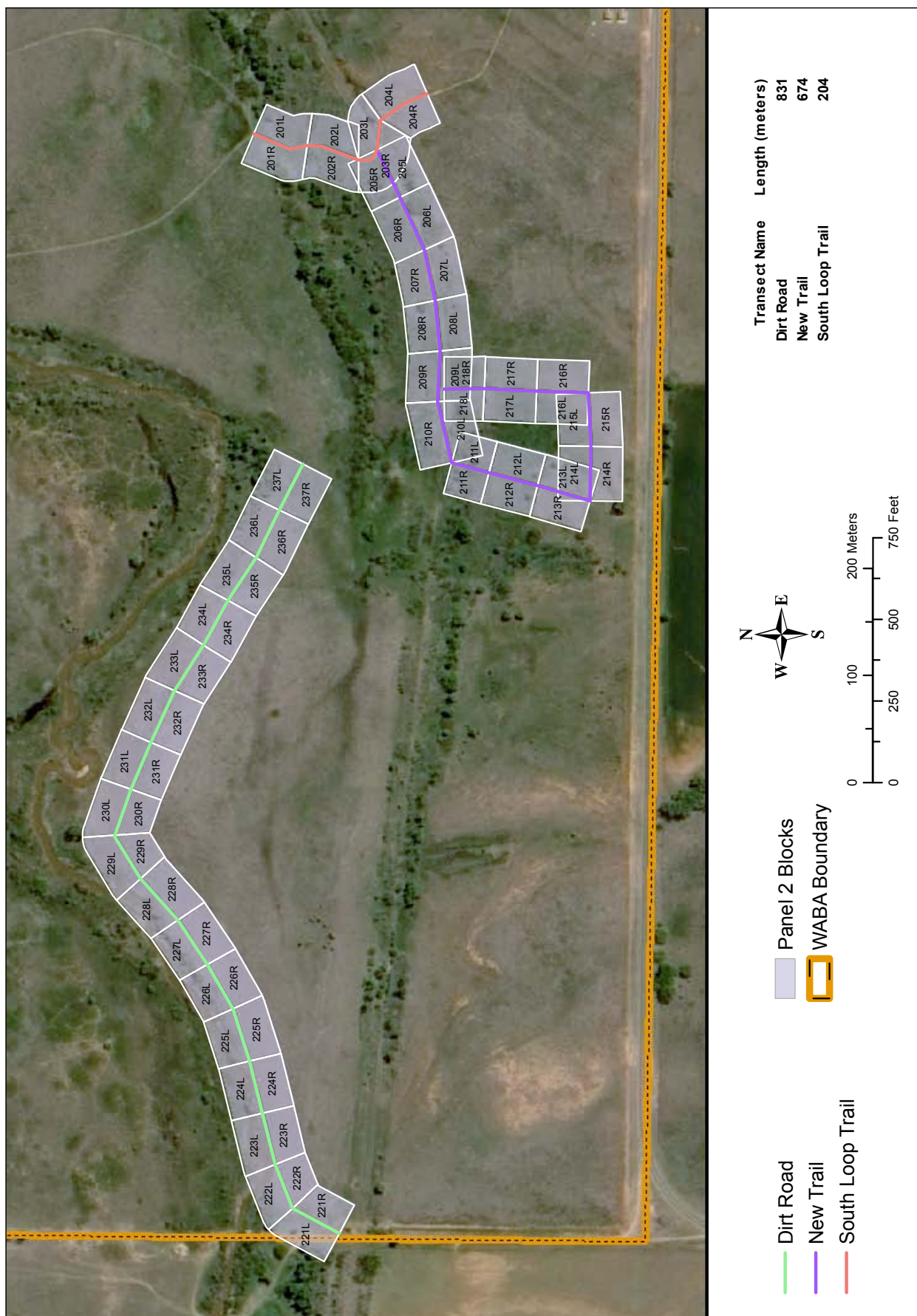


Figure 3.10-1. Individual vector blocks sampled, Panel 2, Washita Battlefield NHS, 2010.

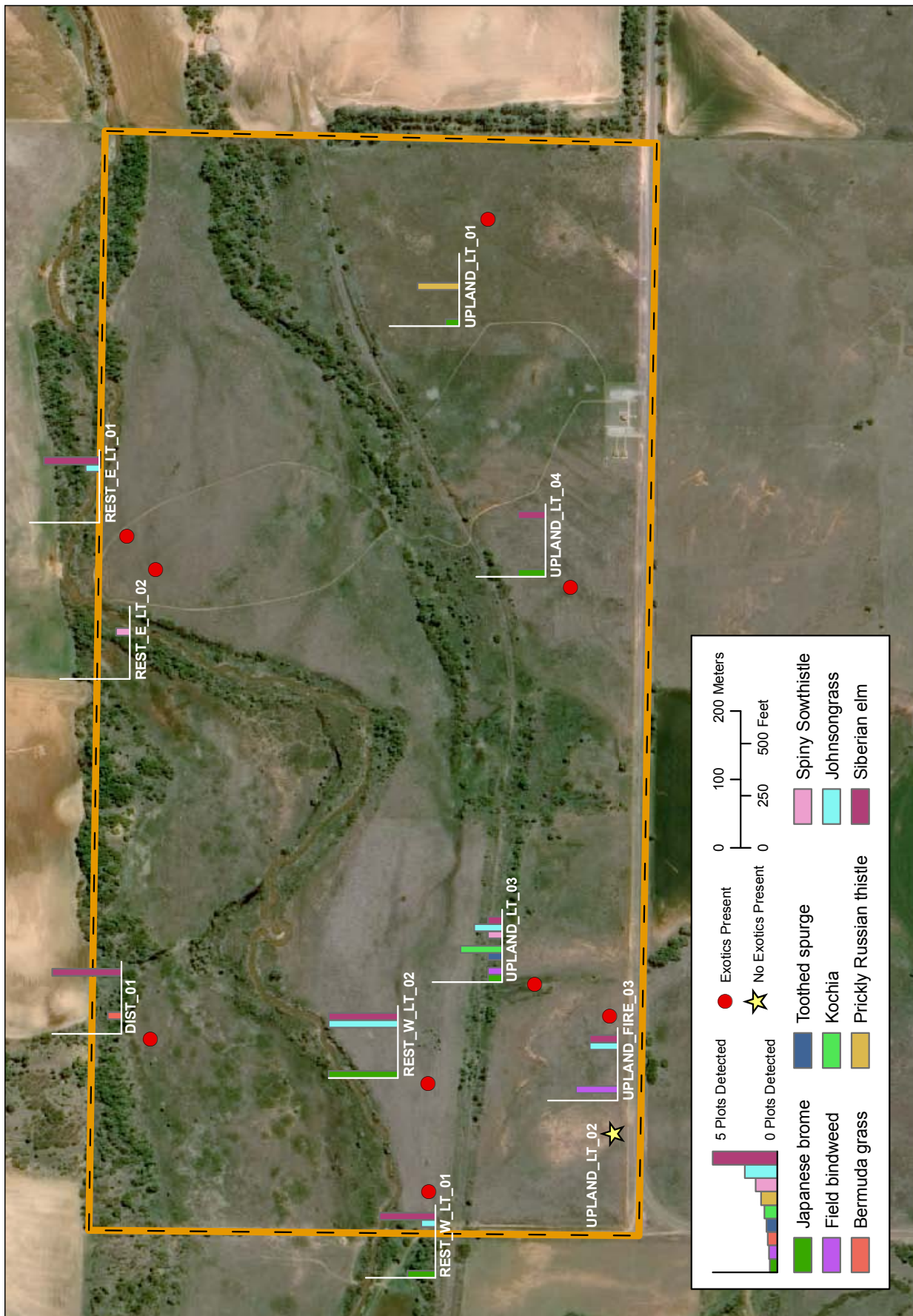


Figure 3.10-2. Secondary sample locations, Washita Battlefield NHS, 2010. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.



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Johnsongrass (*Sorghum halepense*) was one of the most commonly found exotic species in 2010 at Washita Battlefield NHS.

meters into the landscape, and occasionally more than 22 meters into the landscape. While observed throughout the vector blocks in scattered patches, the area of the old homestead exhibited areas where kochia had become a matrix in the landscape. Kochia was present at 25% cover in one plot of the single transect. Yellow sweetclover (*Melilotus officinalis*) was found in 54% of the vector blocks sampled (38). Yellow sweetclover was primarily seen up to 22 meters into the landscape and occasionally at farther distances. Sweetclover densities were generally scattered patches, with evidence of spread into surrounding areas. A few evenly distributed patches were observed primarily around the old homestead and the swale near the railroad bed.

Western salsify (*Tragopogon dubius*) was present in 49% of the vector blocks sampled (34), appearing on both vectors as a few plants to scattered patches. It was consistently seen up to 12 meters into the landscape and a few times further than 22 meters. A thistle, identified by the team as bull thistle (*Cirsium vulgare*), was present in 47% of the vector blocks sampled (33) and was primarily found as a few plants to scattered patches up to 12 meters into the landscape. However, chances are very good that this species was misidentified, as personal observation throughout this year showed no evidence of bull thistle being present. Several native thistles are present at Washita Battlefield and additional reconnaissance should be made to verify the species. Siberian elm (*Ulmus pumila*) was found in 37% of the vector blocks sampled (26) and 70% of the secondary transects (7). Siberian elm was primarily found up

to 22 meters into the landscape, but was noted a few times at farther distances. While observed at the old homestead, Siberian elm was most frequently found in scattered patches throughout the western restoration area. Secondary transect monitoring resulted in the highest cover densities (generally 3% up to 10%) observed in the same locations within the landscape.

Toothed spurge (*Euphorbia dentata*) was present in 16% of the vector blocks sampled (11) and 10% of secondary transects (1). This species was found primarily up to 12 meters into the landscape and sometimes up to 22 meters as a few plants to scattered patches. It was present at less than 1% cover in the secondary transect near the old homestead. Mimosa (*Albizia julibrissin*) was present in 13% of the vector blocks sampled (9) and was primarily found 1.5–2 meters into the landscape and occasionally up to 12 meters. This was found only on the trail vector in scattered patches and its identity was verified because it was in bloom. All plants were relatively low-growing with no mature trees present.

Burr medic clover (*Medicago minima*) was found in 9% (6) of the vector blocks in scattered patches along the trail, in all cases save one in the first 12 meters of the vector. It was not present in any of the secondary transects. Prickly lettuce (*Lactuca serriola*) showed up in 6% (4) of the vector blocks as occasional plants within the first 12 meters of the trail vector in one area along the railroad bed. This species has shown a creeping spread in other SOPN parks, so quick eradication of these plants should be considered. Tamarisk (*Tamarix chinensis*) was seen in 3 vector blocks in scattered patches over 12 m into the landscape. The largest patch was near the railroad bed with an occasional plant found along the Washita River. Bermuda grass (*Cynodon dactylon*) was found in two vector blocks and one secondary transect. It is just becoming established at the beginning of the trail in the mowed area and was found in the northwest corner of the park at less than 1% cover. Perennial ryegrass (*Lolium perenne*), black medic clover (*Medicago lupulina*), and dandelion (*Taraxacum officinale*) were each found in single vector blocks and no secondary transects. Scattered patches of perennial ryegrass and a few plants of both black medic clover and dandelion were found at the beginning of the trail and are prime candidates for eradication.

Three exotic species were found in the secondary transects but not along this year's monitored vectors. Field bindweed (*Convolvulus arvensis*) was found in two transects, both located near the old homestead site, at less than 1% cover. Spiny sowthistle (*Sonchus asper*) was found on two secondary transects, one in the eastern restoration area and the other near the old homestead, at less than 1% cover. Prickly Russian thistle (*Salsola tragus*) was detected in the southeastern transect at less than 1% cover.

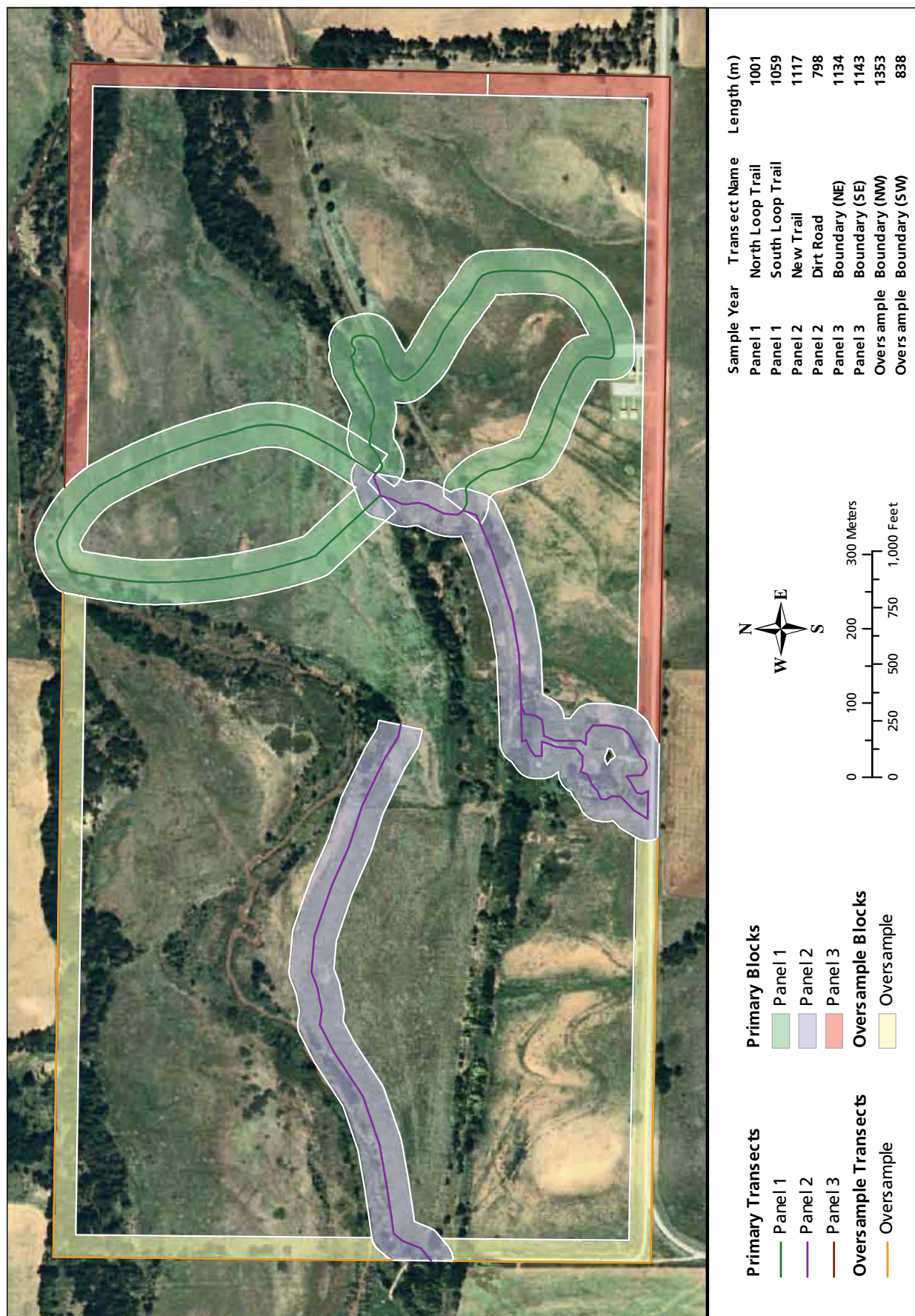


Figure 3.10-3. Overall planned sampling scheme for panels (annual samples) at Washita Battlefield NHS for a full three-year rotation.

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Albizia julibrissin</i>	Mimosa	R	201	0	2	2	0
		R	202	0	2	1	0
		R	203	1	0	0	0
		R	206	1-2	0	0	–
		R	207	1-2	0	0	0
		R	208	1	0	0	0
		R	209	1	0	0	0
		R	214	1	0	0	–
		R	217	2	1	2	0
<i>Bromus japonicus</i>	Japanese brome	R	201	2	2	2	0
		R	202	2	2	0	0
		R	203	2	2	0	0
		R	204	2	2	0	0
		L	201	2	2	0	0
		L	202	2	2	0	0
		L	203	2	2	0	0
		L	204	2	2	0	0
		R	205	2	2	0	–
		R	206	2	2	0	–
		R	207	2	2	2	0
		R	208	2	2	2	0
		R	209	2	2	1-2	0
		R	210	2	2	2	2
		R	211	2	2	2	0
		R	213	2	2	2	2
		R	214	2-3	2-3	2-3	–
		R	215	3	3	3	–
		R	216	3	3	3	3
		R	217	3	3	3	3
		R	218	2	2	2	1
		L	205	2	0	0	0
		L	206	2	2	–	–
		L	207	2	2	0	0
		L	208	2	2	2	0
		L	209	2	2	2	0
		L	210	2	2	0	–
		L	211	3	3	3	3
		L	212	0	0	3	3
		L	213	3	3	3	3
		L	214	3	3	3	0
		L	215	3	3	3	3
		L	216	2	3	3	3
		L	217	3	3	3	3
		L	218	3	3	–	–

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus japonicus</i> (cont.)		R	221	3	3	2	2
		R	222	2	2	2	2
		R	223	2	2	2	0
		R	224	2	2	2	0
		R	225	2-3	2-3	2	0
		R	226	2	2	2	0
		R	227	2	2	2	0
		R	228	2	2	2	2
		R	229	2	2	2	2
		R	230	2	2	2	2
		R	231	2	2	2	2
		R	232	2	2	2	2
		R	233	2	2	2	2
		R	234	1-2	1-2	0	0
		R	235	2	2	2	0
		R	236	2	2	0	0
		R	237	2	2	0	0
		L	221	3	3	3	0
		L	222	3	3	3	0
		L	223	2	2	2	2
		L	224	2	3	3	0
		L	225	2	2	0	0
		L	226	2	2	2	0
		L	227	2	2	0	0
		L	228	2	2	0	0
		L	229	2	2	0	0
		L	230	2	2	2	0
		L	232	2	2	0	0
		L	233	2	2	0	0
		L	234	2	2	0	0
		L	235	2	2	2	0
		L	236	2	2	2	0
		L	237	2	2	2	0
<i>Bromus tectorum</i>	Cheatgrass	R	202	1	2	2	0
		R	203	2	2	2	2
		R	204	2	2	0	0
		L	202	2	2	0	0
		L	203	2	2	0	0
		L	204	2	2	0	0
		R	205	0	2	2	-
		R	207	0	0	2	2
		R	208	0	2	0	2
		R	209	0	2	0	0
		R	210	2-3	2-3	3	3

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus tectorum</i> (cont.)		R	211	2	2-3	2-3	0
		R	213	2	2	3	2
		R	214	2-3	2-3	2-3	–
		R	215	2	2	2	–
		R	216	2-3	2-3	2-3	2-3
		R	217	2-3	2-3	2-3	2-3
		R	218	2	2	2	2
		L	205	2	2	0	0
		L	206	2	2	–	–
		L	207	0	0	2	0
		L	208	0	3	3	0
		L	209	1	2	3	3
		L	210	2	3	3	–
		L	211	3	3	3	3
		L	212	0	0	3	3
		L	213	3	3	3	3
		L	214	0	2	3	0
		L	215	3	3	2	2
		L	216	0	0	3	2
		L	217	2	3	3	2
		L	218	3	3	–	–
		R	221	3	3	2	2
		R	222	2	2	2	2
		R	223	0	2	0	0
		R	224	2	0	0	0
		R	225	0	1-2	2	0
		R	226	0	2	0	0
		R	230	2	2	2	0
		R	231	1-2	1-2	0	0
		R	232	2	2	0	0
		R	233	2	2	0	0
		R	235	2	2	0	0
		R	236	1-2	2	0	0
		R	237	2	2	2	2
		L	221	3	3	3	3
		L	222	3	3	3	3
		L	223	2	2	0	0
		L	224	2	3	3	0
		L	225	2	2	0	0
		L	226	2	2	0	0
		L	228	2	2	0	0
		L	229	0	2	2	0
		L	230	1	2	2	0
		L	232	2	2	0	0

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Bromus tectorum</i> (cont.)		L	235	2	2	3	0
		L	236	2	2	2	0
		L	237	2	3	3	0
<i>Chenopodium album</i>	Common lambsquarters	R	201	2	2	2	0
		L	201	0	1	1	0
		R	211	0	2	0	0
		R	237	1	2	0	0
<i>Cirsium vulgare</i>	Bull thistle	L	204	0	2	0	2
		R	207	1	0	0	0
		R	208	1-2	0	0	0
		R	209	1	0	0	0
		R	210	1	0	–	–
		R	213	1	1	0	0
		R	214	0	1	0	–
		R	215	1	2	0	–
		L	205	2	0	0	0
		L	207	1	2	0	0
		L	208	1	1	0	0
		L	209	2	0	0	0
		L	213	0	2	2	0
		L	214	2	2	2	0
		L	215	1	2	2	0
		L	216	2	2	0	0
		R	222	0	1	0	0
		R	223	0	0	2	0
		R	224	0	2	0	0
		R	225	1	2	0	0
		R	226	0	0	1	0
		R	227	0	1	0	0
		R	228	1	1	0	0
		R	232	0	1	0	0
		R	233	1	2	0	0
		L	222	1	1	0	0
		L	225	1	2	0	0
		L	226	1	1	0	0
		L	227	1	1	0	0
		L	228	1	2	0	0
		L	233	2	2	0	0
		L	234	1	2	0	0
		L	236	0	1	0	0
<i>Cynodon dactylon</i>	Bermuda grass	R	201	1	0	0	0
		L	201	1	0	0	0
<i>Euphorbia dentata</i>	Toothed spurge	R	202	1	0	0	0
		L	202	0	1	0	0

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Euphorbia dentata</i> (cont.)		L	203	1	1	0	0
		R	205	1	0	0	–
		R	209	1	0	0	0
		R	215	0	2	0	–
		L	206	1	0	–	–
		L	211	0	1	0	0
		L	215	2	2	2	0
		L	223	1	2	0	0
		L	224	0	2	0	0
<i>Kochia scoparia</i>	Kochia	R	201	2	1	0	0
		R	202	2	0	0	0
		R	203	2	2	0	0
		R	204	1	0	0	0
		L	201	2	0	2	2
		L	202	1	2	0	0
		L	203	2	0	0	0
		R	205	1	0	0	–
		R	206	2	0	0	–
		R	207	0	1–2	0	0
		R	208	2	2–3	0	0
		R	209	1	2–3	0	0
		R	211	3–4	3–4	3–4	3–4
		R	212	4	4	4	4
		R	213	1–2	1–2	1–2	1–2
		R	214	0	0	2	–
		L	205	0	2	0	0
		L	207	2	0	0	0
		L	208	1	1	0	0
		L	209	1	2	3	3
		L	210	0	2	2	–
		L	211	2	4	4	4
		L	212	4	4	4	3
		L	213	0	2	3	0
		L	214	0	2	0	3
		L	216	2	2	3	4
		L	217	0	2	3	4
		L	218	1	2	–	–
		R	221	2	2	2	0
		R	223	2	2	0	0
		R	224	2	2	0	0
		R	225	1	2	0	0
		R	226	2	2	1–2	1–2
		R	228	1	0	1	0
		R	232	2	2	0	0

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Kochia scoparia</i> (cont.)		R	233	2	2	0	0
		R	236	2	2	0	0
		R	237	0	1	0	0
		L	221	2	3	0	0
		L	222	2	3	3	0
		L	223	2	2	0	0
		L	224	1	2	0	0
		L	225	2	0	0	0
		L	226	1	0	0	0
		L	232	1	2	0	0
		L	233	1	1	0	0
		L	236	2	0	0	0
<i>Lactuca serriola</i>	Prickly lettuce	R	208	0	1-2	0	0
		L	207	0	1	0	0
		L	208	0	1	0	0
<i>Lolium perenne</i>	Perennial ryegrass	L	202	0	2	0	0
<i>Medicago lupulina</i>	Black medic clover	R	201	1	0	0	0
<i>Medicago minima</i>	Burr medic clover	R	208	1-2	0	0	0
		R	213	2-3	2-3	2-3	0
		R	214	2	2	0	–
		L	208	2	0	0	0
		L	209	2	0	0	0
		L	213	3	2	0	0
<i>Melilotus officinalis</i>	Yellow sweetclover	R	202	0	0	1	0
		R	203	2	2	2-3	2
		R	204	2-3	3	3	2-3
		L	201	0	1	1	0
		L	203	0	2	0	0
		L	204	2	3	2	2
		R	205	2	2	0	–
		R	207	1	0	0	0
		R	208	2	0	0	0
		R	209	2	2	2	1-2
		R	213	0	2	2-3	2
		R	215	0	2	2	–
		R	216	1	2	2	1
		R	217	2	2	2	2
		R	218	1	2	1	1
		L	205	2	2	3	0
		L	207	2	2	0	0
		L	208	2	2	0	0
		L	209	2	2	3	2
		L	213	0	1	1	0
		L	214	1	1	0	0

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Melilotus officinalis</i> (cont.)		L	215	1	2	2	0
		L	216	1	2	2	0
		L	217	3	3	3	0
		R	221	0	1	0	0
		R	224	0	1	0	0
		R	229	0	1	0	0
		R	230	0	2	2	0
		R	231	2	2	2	2
		R	232	0	1	1	0
		R	233	0	2	0	0
		R	234	2	2	2	2
		L	231	1	2	2	0
		L	232	0	1	0	0
		L	233	1	1	0	0
		L	234	2	2	0	0
		L	235	0	1	1	0
		L	236	0	2	0	0
<i>Sorghum halepense</i>	Johnsongrass	R	201	0	2	2	2
		R	203	2	2	2	2
		L	201	0	2	2	0
		L	203	0	2	0	0
		R	205	2	2	0	–
		R	206	2	2	1–2	–
		R	207	2	2	0	0
		R	208	2	2	0	0
		R	209	2	2	1–2	1–2
		R	210	2	2	–	–
		R	211	0	2	0	0
		R	213	2	2	0	0
		R	214	2	2	2	–
		R	215	2	2	2	–
		R	216	2	2	2	2
		R	217	2	2	2	2
		R	218	1	2	2	2
		L	205	2	2	2	0
		L	206	2	3	–	–
		L	207	2	2	2	2
		L	208	3	3	3	3
		L	209	3	3	3	3
		L	210	3	3	0	–
		L	213	0	2	2	2
		L	214	2	3	3	3
		L	215	2	3	3	3
		L	216	0	3	3	3

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Sorghum halepense</i> (cont.)		L	217	3	3	3	3
		L	218	2	3	–	–
		R	221	1	2	2	2
		R	222	2	2	2	2
		R	223	2	2	2	2
		R	224	1	2	2	2
		R	225	2	2	2	2
		R	226	2	2	2	2
		R	227	0	2	2	0
		R	228	2	2	2	0
		R	229	2	2	2	2
		R	231	2	2	0	0
		R	232	2	2–3	2	0
		R	233	2	2	0	0
		R	234	2	2	0	2
		R	235	2	2	2	2
		R	236	1	2	2	2
		R	237	0	2	2	2
		L	221	2	2	3	3
		L	222	2	3	3	0
		L	223	0	3	3	0
		L	224	0	3	3	0
		L	225	2	3	3	3
		L	226	2	3	3	3
		L	227	0	2	3	3
		L	228	0	3	3	0
		L	229	2	3	3	2
		L	230	0	0	3	3
		L	231	2	2	3	3
		L	232	1	2	3	3
		L	233	2	2	3	3
		L	234	0	0	3	3
		L	235	2	2	2	0
		L	236	0	3	3	0
		L	237	2	3	3	3
<i>Tamarix chinensis</i>	Tamarisk	L	207	0	0	0	2
		L	208	0	0	2	2
		L	231	0	0	0	1
<i>Taraxacum officinale</i>	Dandelion	L	201	1	0	0	0
<i>Tragopogon dubius</i>	Western salsify	R	201	0	1	0	0
		R	202	0	1	0	0
		L	201	0	2	1	0
		L	202	1	1	0	0
		R	208	1	1	0	0

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Tragopogon dubius</i> (cont.)		R	209	1	0	0	0
		R	213	0	2	0	0
		R	214	0	1	0	–
		L	205	1	1	0	0
		L	206	1	0	–	–
		L	207	1	2	0	0
		L	208	2	2	0	0
		L	209	1	2	0	0
		L	210	1	0	0	–
		L	213	2	2	2	0
		L	214	1	2	0	0
		R	221	0	2	0	0
		R	222	1	1	0	0
		R	224	1	0	0	0
		R	229	0	1	0	0
		R	231	0	1	1	0
		R	232	0	1	1	1
		R	233	1	1	0	0
		R	234	1	2	0	0
		R	235	1	1	1	0
		R	237	0	1	0	0
		L	222	0	1	0	0
		L	224	1	1	0	0
		L	230	0	1	0	0
		L	232	0	1	0	0
		L	233	1	1	0	0
		L	234	1	1	0	0
		L	235	1	0	0	0
		L	237	0	1	0	0
<i>Ulmus pumila</i>	Siberian elm	R	216	2	2	2	2
		R	217	2	2	2	2
		R	218	1–2	1–2	1–2	1–2
		R	223	0	0	0	1
		R	224	1	1	0	1
		R	225	0	2	0	0
		R	226	1	2	2	2
		R	227	0	2	0	1
		R	228	1	1	0	0
		R	229	0	1	0	0
		R	230	0	1	0	0
		R	233	1	1	2	1
		R	234	0	0	1	0
		L	222	0	1	1	0
		L	223	0	2	0	0

Table 3.10-2. Sample locations (vector blocks) of exotic plant species observations with density class observed at each distance class, Washita Battlefield NHS, 2010, cont.

Scientific name	Common name	Vector side	Vector block	Distance class ^{a, b}			
				1	2	3	4
<i>Ulmus pumila</i> (cont.)		L	224	0	1	1	0
		L	225	0	2	2	0
		L	226	2	2	2	0
		L	227	2	2	2	0
		L	228	2	2	2	0
		L	229	0	2	2	0
		L	230	0	2	2	0
		L	231	0	2	2	2
		L	232	0	2	3	0
		L	234	1	2	2	0
		L	237	2	2	2	0

^aDistance class: 1 = from edge of vector to 1.5 or 2 meters in; 2 = from transect (at 1.5–2 meters in) to 10 meters; 3 = 10–20 meters ; 4 = over 20 meters into the landscape.

^bDensity class: 1 = 1–5 plants; 2 = scattered patches; 3 = evenly distributed patches; 4 = matrix; 0 = species not seen in distance class; – = no data.

4 Discussion

The monitoring objectives found in the introduction indicate that all SOPN parks will be stratified into high- and low-probability areas for sampling, roughly corresponding to roads, trails, streams, and boundaries (high-probability) and interior areas (low-probability). Exotic species present in the low invasion probability areas have been measured in conjunction with grassland monitoring. This report encompasses both high- and low-probability invasion areas, although not all low-probability areas were sampled this season.

Specific exotic species differ among the parks as environmental conditions change along the north-south and east-west gradients. While Johnsongrass (*Sorghum halepense*) is a major problem at Chickasaw (easternmost park), it becomes non-existent in the far western reach of the network. Each state produces a noxious weed list, but any particular species may not be considered noxious in all states where it is found. Therefore, a noxious designation is just one of many components to be considered when determining the level of threat posed by a species. Of greater importance is the displacement of native

species through the rate of spread and extent of an exotic. Both prickly Russian thistle (*Salsola tragus*) and mullein (*Verbascum thapsus*) are listed as noxious weeds only in Colorado, but they are major invasive components at Capulin Volcano, Fort Union, and Lake Meredith, requiring management consideration.

Each park within the SOPN has its problematic exotic plants, with field bindweed (*Convolvulus arvensis*), Johnsongrass, K.R. bluestem (*Bothriochloa ischaemum*), green bristlegrass (*Setaria viridis*), and prickly Russian thistle found in several parks. Both the greatest variety of exotics and the most established populations occur most frequently within and adjacent to the mowstrips along paved vectors.

The SOPN will continue to monitor the introduction, distribution, and spread of exotics in network parks, and develop a system to rapidly communicate results to parks and the appropriate Exotic Plant Management Teams. In return, it will be important for the SOPN to receive information about management activities relative to specific exotic species, which will help inform future monitoring results.

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