National Park Service
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Natural Resource Program Center

Exotic Plant Monitoring in the Southern Plains Network

Project Report 2009

Natural Resource Technical Report Series NPS/SOPN/NRTR—2010/357

ON THE COVER

Kochia (*Kochia scoparia*) at Pecos National Historical Park. NPS/Heidi Sosinski.

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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 2009, the SOPN conducted a pilot season for exotic-plant monitoring to test the methods and results of the network's proposed Exotic Plant Monitoring Protocol. A total of 540 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 and trails. As part of the SOPN grassland and fire monitoring effort, a total of 360 individual 1-m^2 plots on 72 transects in areas not considered high-invasion probability (secondary units) were also sampled. Overall, 60 species of exotic plants were observed in SOPN parks. Some species (e.g., *Salsola tragus*) were widespread among parks, whereas others were found in only a few parks. Results of the 2009 pilot 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, non-native 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). Non-native 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. SPON parks include Alibates Flint Quarries National Monument (ALFL), Bent's Old Fort National Historic Site (BEOL), Capulin Volcano National Monument (CAVO), Chickasaw National Recreation Area (CHIC), Fort Larned National Historic Site (FOLA), Fort Union National Monument (FOUN), Lake Meredith National Recreation Area (LAMR), Lyndon B. Johnson National Historical Park (LYJO), Pecos National Historical Park (PECO), Sand Creek Massacre National Historic Site (SAND), and Washita Battlefield National Historic Site (WABA). 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 non-native 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 favor of being proactive. Although preventing the introduction of invasive exotic plants is the most successful and preferred strategy for resource managers, the realities of globalization, tight fiscal constraints, and limited staff time guarantee that invaders will get through park borders. Fortunately, invasive exotic plants quite often undergo a lag period between introduction and subsequent colonization of new areas. Managers, then, can take advantage of early detection monitoring to make certain invasive exotic species are found and successfully eradicated before populations become well established.

This strategy requires resource managers to: (1) detect invasive exotic species early (i.e., find a new species or an incipient population of an existing species while the infestation is small—less than 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 2009, the SOPN conducted a pilot season for exotic-plant monitoring to test the methods and results of the proposed protocol. Sampling was carried out from June to September, in conjunction with a grassland-monitoring pilot study. Due to time and budget constraints, two 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

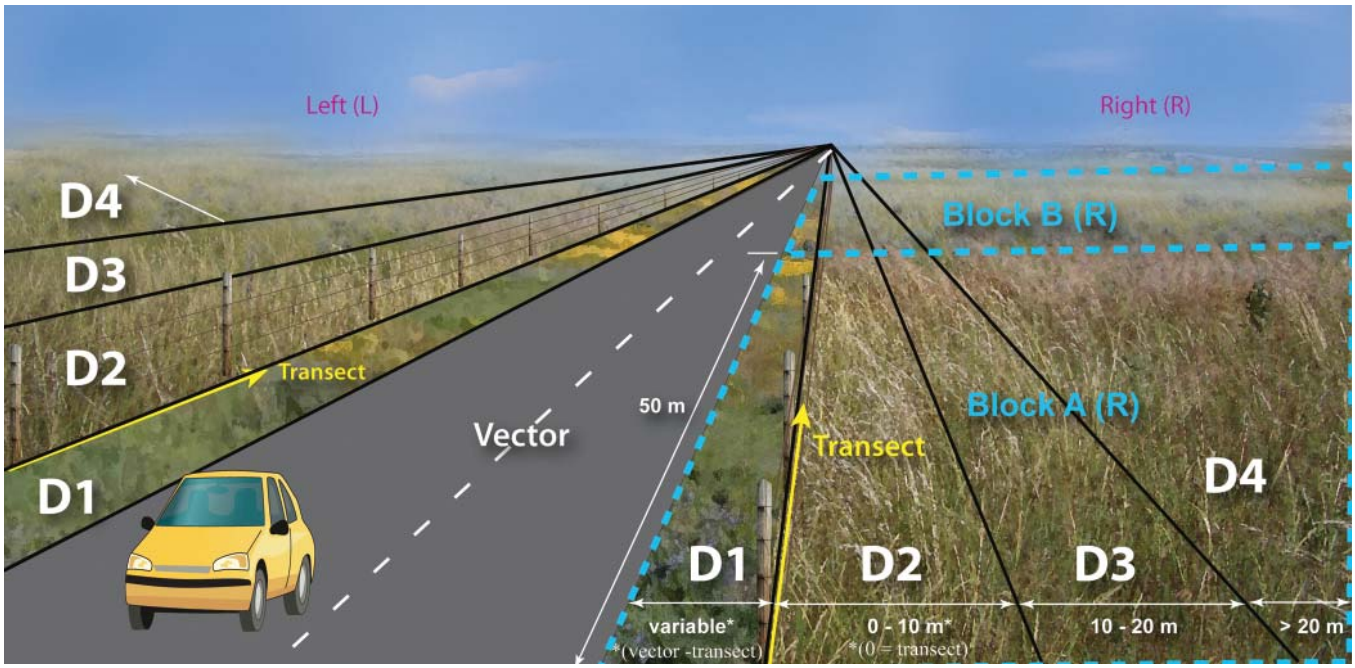

Figure 2-1. Fifty meter blocks are sampled on each side of a vector (e.g., roads and trails) in each of four distance classes from the vector.

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 1m2 nested quadrats along a 50-meter permanent transect. This was the first year for establishing permanent transects and not all transects were established across the network. No secondary data was collected at CHIC, FOUN, and PECO, and only limited data was collected at CAVO.

3 Results

During 2009, we sampled a total of 540 vector blocks along high-invasion-probability vectors (primary units) in SOPN parks (Table 3-1). These vectors consisted of paved and unpaved roads and trails. As part of our grassland and fire monitoring effort, we also sampled a total of 360 individual plots on 72 transects in areas not considered high-invasion probability (secondary units).

Overall, 60 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 2009 pilot study for each park sampled are presented below.

Table 3-1. Number of primary (high invasion probability) and secondary (low invasion probability) units sampled during 2009.

	Primary sample units					Secondary sample units
		Roads		Trails		
Park unit	Total vector blocks	Paved	Unpaved	Paved	Unpaved	Total transects[2]
Bent's Old Fort NHS	49	7	32	10	-	13
Capulin Volcano NM	52[1]	-	-	-	52	2
Chickasaw NRA	56	-	-	-	56	0
Fort Larned NHS	56	-	10	-	46	15
Fort Union NM	78	-	78	-	-	0
Lake Meredith NRA/Alibates Flint Quarries NM	62	62	-	-	-	14
Lyndon B. Johnson NHP	18[1]	-	18	-	-	2
Pecos NHP	60	-	60	-	-	0
Sand Creek Massacre NHS	52[1]	-	52	-	-	13
Washita Battlefield NHS	56[1]	-	-	-	56	13

[1] Effort curtailed due to weather conditions.
[2] For each secondary sampling unit (transect), five individual plots were sampled.

Russian thistle seedling, flowers, and leaves.

Table 3-2. Exotic plant species observed in specific parks during 2009 SOPN exotic plant monitoring.

Scientific name	Common name	Park unit									
		BEOL	CAVO	CHIC	FOLS	FOUN	LAMR/ ALFL	LYJO	PECO	SAND	WABA
Agropyron desertorum	clustered wheatgrass								●		
Agrostis gigantea	creeping bentgrass			●							
Albizia julibrissin	mimosa tree			●							
Alliaria petiolata	garlic mustard				●						
Amaranthus blitoides	prostrate pigweed				●						
Amaranthus retroflexus	redroot pigweed	●			●						
Bothriochloa ischaemum	K.R. bluestem							●			●
Brassicaceae species	mustard species								●	●	
Bromus arvensis	field brome	●								●	
Bromus inermis	smooth brome				●				●		
Bromus japonicus	Japanese brome			●				●			●
Bromus species	unidentified bromes								●		
Bromus tectorum	cheatgrass				●					●	
Buglossoides arvensis	corn gromwell									●	
Calystegia sepium ssp. *sepium*	hedge bindweed				●						
Cannabis sativa ssp. *indica*	hemp				●						
Capsella bursa-pastoris	shepard's purse				●						
Centaurea melitensis	Malta starthistle							●			
Chenopodium alba	common lambsquarters	●	●		●	●	●		●	●	
Chenopodium glaucum	oakleaf goosefoot						●				
Cirsium arvense	Canadian thistle									●	
Cirsium vulgare	bull thistle				●				●		
Convolvulus arvensis	field bindweed	●	●		●	●			●	●	●
Conium maculatum	poison hemlock				●						
Cynodon dactylon	Bermudagrass			●	●			●			
Cynoglossum officinale	houndstongue		●								
Cyperus esculentus	yellow nutgrass			?							
Descurainia sophia	herb sophia		●		●					●	
Digitaria sanguinalis	hairy crabgrass				●		●				
Echinochloa colona	jungle ricegrass			●							
Elaeagnus angustifolia	Russian olive				●						
Eragrostis barrelieri	Mediterranean lovegrass							●	●		
Eragrostis cilianensis	stinkgrass				●						
Erodium cicutarium	red-stem stork's-bill			●					●		
Eupatorium davidii	David's spurge					●			●		
Eupatorium dentata	toothed spurge	●		●							●
Kochia scoparia	kochia	●	●		●	●	●		●	●	●
Lactuca serriola	prickly lettuce	●	●	●					●		
Lamium amplexicaule	henbit				●						
Lespedeza cuneata	sericea lespedeza			●							
Lonicera japonicus	Japanese honeysuckle			●							
Marrubium vulgare	horehound		●			●		●			

Table 3-2. Exotic plant species observed in specific parks during 2009 SOPN exotic plant monitoring, cont.

Scientific name	Common name	Park unit									
		BEOL	CAVO	CHIC	FOLS	FOUN	LAMR/ ALFL	LYJO	PECO	SAND	WABA
Medicago lupulina	black medic clover				●						
Melilotus alba	white sweetclover	●				●			●		●
Melilotus officinalis	yellow sweetclover		●		●				●	●	●
Poa pratensis	Kentucky bluegrass									●	
Polygonum arenastrum	prostrate knotweed				●						
Polygonum convolvulus	climbing bindweed		●								
Rumex crispus	curly dock	●			●						●
Salsola tragus	prickly Russian thistle		●			●	●		●	●	●
Setaria viridis	green bristlegrass	●	●		●		●			●	
Sonchus asper	spiny sowthistle		●		●						●
Sorghum halepense	Johnsongrass							●			●
Tamarix ramosissima	saltcedar										●
Taraxacum officinale	dandelion		●	●	●		●			●	
Tragopogon dubius	western salsify	●	●	●	●	●	●		●	●	●
Tribulus terrestris	puncturevine				●				●		
Typha angustifolia	narrowleaf cattail	●									
Ulmus pumila	Siberian elm										●
Verbascum thapsus	mullein		●					●	●		

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 (Appendix A, Figure A1). During 2009, exotic-plant monitoring occurred at BEOL for two days in late July. The 2009 vectors sampled included the unpaved maintenance road from the administrative work yard to the back of the historic structure, the paved trail from the historic structure to the visitor parking lot, and the paved entrance road to the parking lot (Figure 3.1-1). Forty-nine vector blocks were monitored, for a total linear effort of 1,250 meters (sampled on both sides of the road). Future monitoring in this panel will contain a short section of the western park boundary that crosses an irrigation ditch and the Arkansas River—an area of high-risk exotic introduction from adjoining private land. These vectors are scheduled for monitoring again in 2012. Thirteen permanent transects within the landscape were also sampled, for a total of 65 1-m^2 plots.

Kochia (*Kochia scoparia*) was encountered in all vector blocks on both sides of the vector and in 8% of the secondary interior plots (Table 3.1, Figure 3.1-2; Appendix B, Table B1;). This exotic, often forming a matrix, is being actively managed by the park, along with often evenly distributed field bindweed (*Convolvulus arvensis*), found in 31 vector blocks and 38% of the interior plots. Field brome (*Bromus arvensis*) was also well established on all vector types and in 23% of the interior plots. Matrix-forming cattails were found in all wetlands encountered and have been tentatively identified as the exotic narrowleaf cattail (*Typha angustifolia*). This identification is not confirmed, and further investigation is warranted. Prickly Russian thistle (*Salsola tragus*) was noted along both the unpaved road and the paved trail, in patches up to 12 meters into the landscape from the vector. Prickly Russian thistle was also found throughout the interior landscape at BEOL, occurring in 46% of the plots sampled. Previous efforts to control Canadian thistle (*Cirsium arvense*) appear to be working slowly, although it was still present in all blocks along the Arch wetland. This thistle was evident in all unmowed areas between the transect and the wetland in scattered patches; only one block contained an even distribution. Prickly lettuce (*Lactuca serriola*) was observed in scattered patches around the Arch wetland. It was also noted in one vector block along the unpaved road, again in the wetland vicinity.

Several exotic plants species were found in numbers small enough that minimal control measures at this time may preclude major efforts in the future. Redroot pigweed (*Amaranthus retroflexus*),

Table 3.1. Number and percentage of primary and secondary sample units where each species was detected, Bent's Old Fort, 2009.

		Primary vector blocks (n=49)		Secondary transects (n=13)	
Scientific name	Common name	Total	Percent where IEP found	Total[1]	Percent where IEP found
Kochia scoparia	kochia	49	100%	1	8%
Convolvulus arvensis	field bindweed	31	63%	5	38%
Bromus arvensis	field brome	24	49%	3	23%
Salsola tragus	prickly Russian thistle	11	22%	6	46%
Typha angustifolia	narrowleaf cattail	10	20%	0	0
Cirsium arvense	Canadian thistle	7	14%	0	0
Lactuca serriola	prickly lettuce	5	10%	0	0
Eupatorium dentata	toothed spurge	4	8%	0	0
Tragopogon dubius	western salsify	3	6%	0	0
Amaranthus retroflexus	redroot pigweed	2	4%	0	0
Melilotus alba	white sweetclover	2	4%	0	0
Setaria viridis	green bristlegrass	2	4%	0	0
Rumex crispus	curly dock	1	2%	0	0
Chenopodium alba	common lambsquarters	0	0	2	15%

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

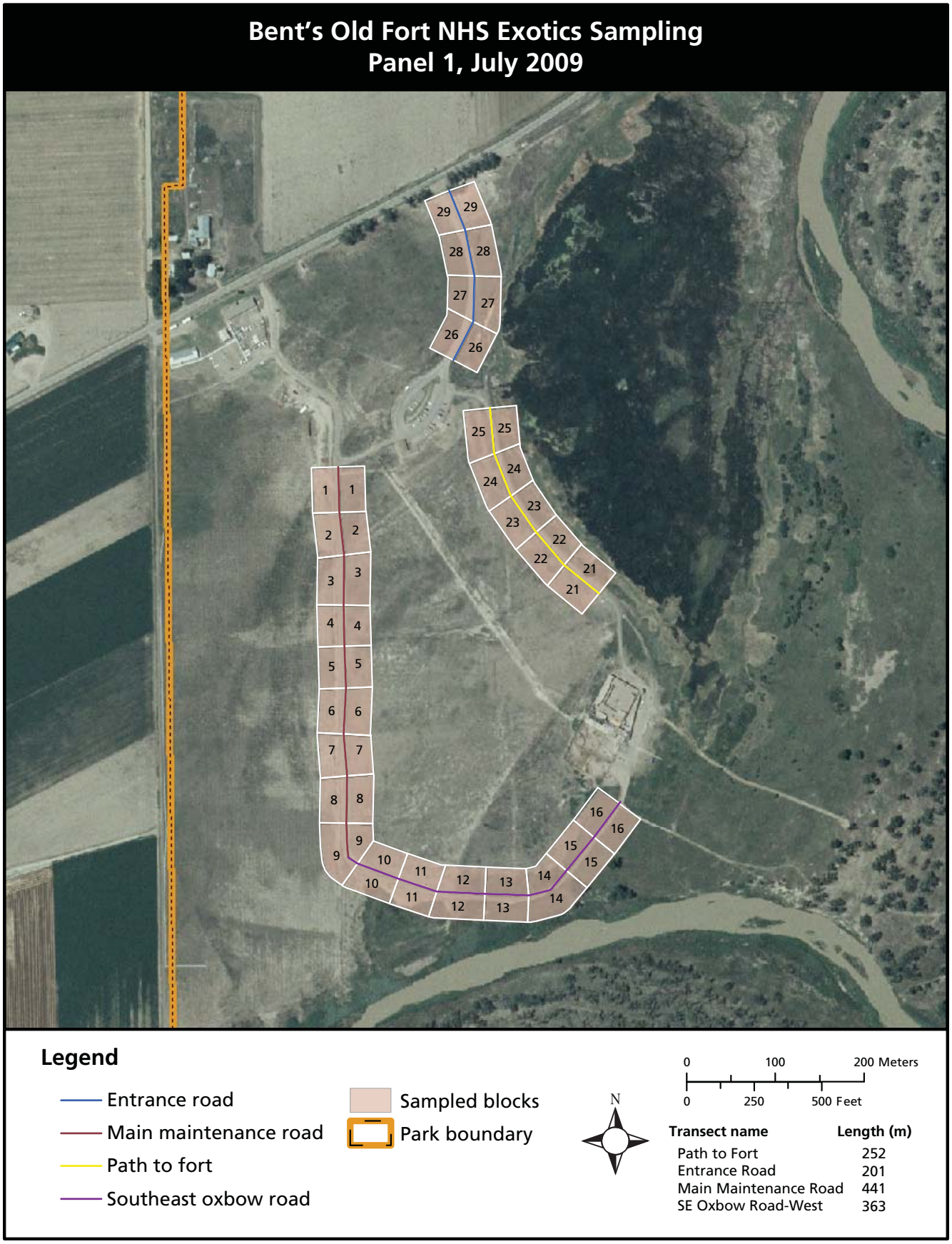

Figure 3.1-1. Individual vector blocks sampled, Bent's Old Fort NHS, 2009.

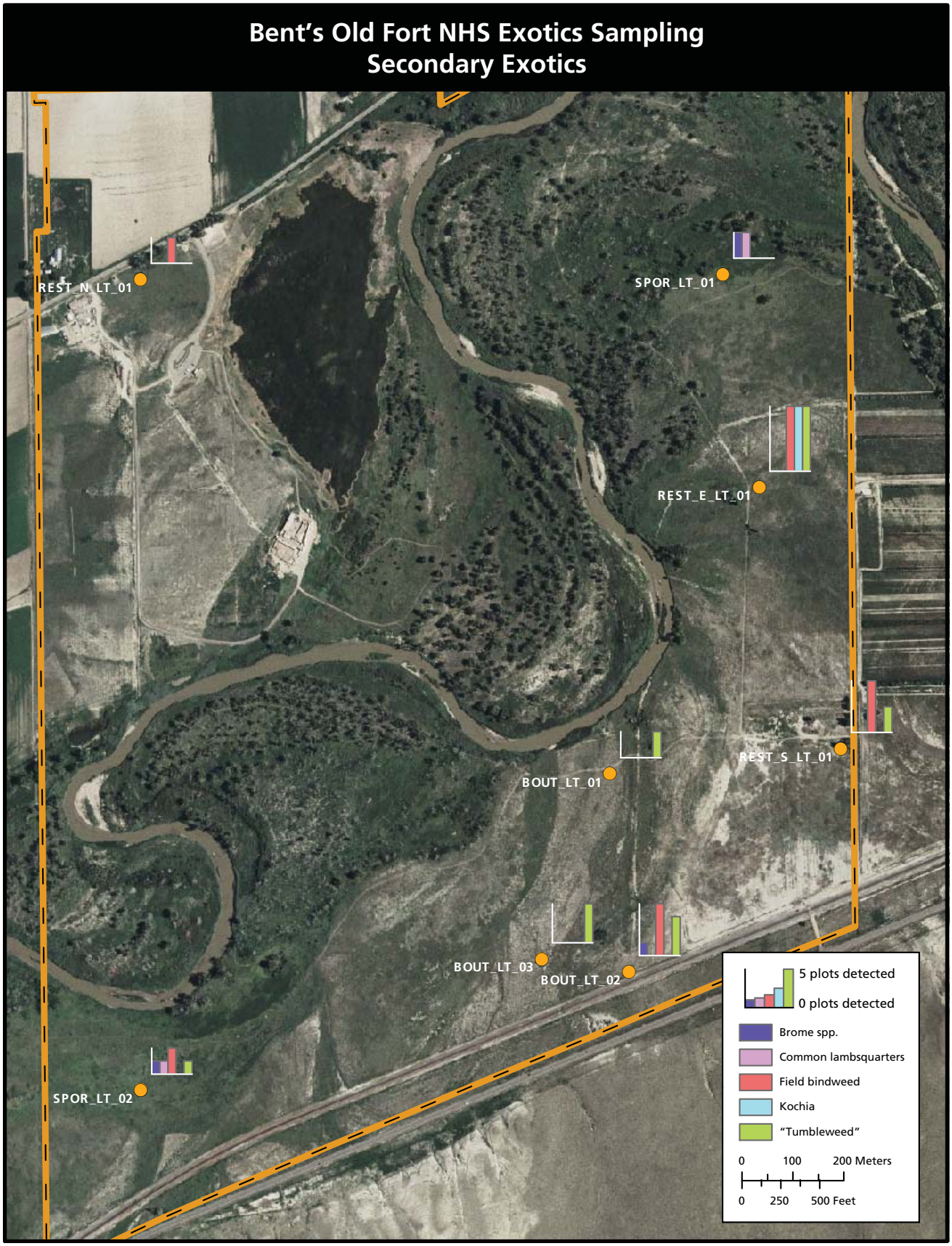

Figure 3.1-2. Secondary sample locations, Bent's Old Fort NHS, 2009. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

curly dock (*Rumex crispus*), white sweetclover (*Melilotus alba*), and green bristlegrass (*Setaria viridus*) were only found in one or two vector blocks, in scattered patches, from the vector to 10 meters into the landscape. The green bristlegrass is of particular concern, as it responds favorably to mowing and can eventually spread along vectors to form monocultures. Toothed spurge (*Eupatorium dentata*) and western salsify (*Tragopogon dubius*) were found in four or fewer vector blocks as just a few plants.

Common lambsquarters (*Chenopodium album*) was the only exotic species found within the landscape but not along the sampled vector. Lambsquarters was observed in 15% of the plots sampled at BEOL.

3.2 Capulin Volcano NM

Overall sampling at Capulin Volcano includes most trails and the paved entrance road to the point that it begins to climb the volcano over the three-year rotation (Appendix A, Figure A2). During 2009, exotic-plant monitoring occurred at CAVO for two days in late August. Vectors sampled were all unpaved trails, with one 4-block section that doubled as maintenance road (Figure 3.2-1). These trails included the entire stretch of the Nature Trail, the Boca Trail leading from the parking area to the water plant, and all but the bottom loop of the Lava Trail. Rains prevented the completion of the Lava Trail but this area will be included in the panel beginning in 2012. Twenty-six vector blocks were monitored, for a total of 1,300 linear meters. Additionally, two permanent transects were sampled within the landscape, for a total of 10 1-m^2 plots.

Two exotic plant species were found in every block sampled: mullein (*Verbascum thapsus*) and an unidentified species of brome (*Bromus* sp.) (Table 3.2; Appendix B, Table B2). A sample of the brome was taken for identification purposes because, of the four brome species found in the park, only Japanese brome (*Bromus japonicus*) is considered exotic. Brome was also observed in 20% of the secondary plots (Figure 3.2-2). Active control of mullein is underway at the park and was evident during our survey, although many of the plants observed were actively growing. Mullein was present in only one grassland plot, on one transect.

Horehound (*Marrubium vulgare*), common lambsquarters (*Chenopodium album*), herb sophia

Table 3.2. Number and percentage of primary and secondary sample units where each species was detected, Capulin Volcano NM, 2009.

		Primary vector blocks (n=52)		Secondary transects (n=2)	
Scientific name	Common name	Total	Percent where IEP found	Total[1]	Percent where IEP found
Verbascum thapsus	mullein	52	100%	1	50%
Bromus species	brome species	47	90%	2	100%
Chenopodium album	common lambsquarters	20	38%	1	50%
Marrubium vulgare	horehound	19	36%	0	0
Descurainia sophia	flixweed; herb sophia	19	36%	2	100%
Tragopogon dubius	western salsify	16	31%	0	0
Melilotus officinalis	yellow sweetclover	9	17%	0	0
Kochia scoparia	kochia	4	8%	0	0
Cynoglossum officinale	houndstongue	3	6%	0	0
Salsola tragus	prickly Russian thistle	3	6%	0	0
Taraxacum officinale	dandelion	2	4%	0	0
Polygonum convolvulus	climbing bindweed	2	4%	0	0
Convolvulus arvensis	field bindweed	1	2%	0	0
Lactuca serriola	prickly lettuce	1	2%	1	50%
Setaria viridis	green bristlegrass	1	2%	0	0
Sonchus asper	spiny sowthistle	1	2%	0	0

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

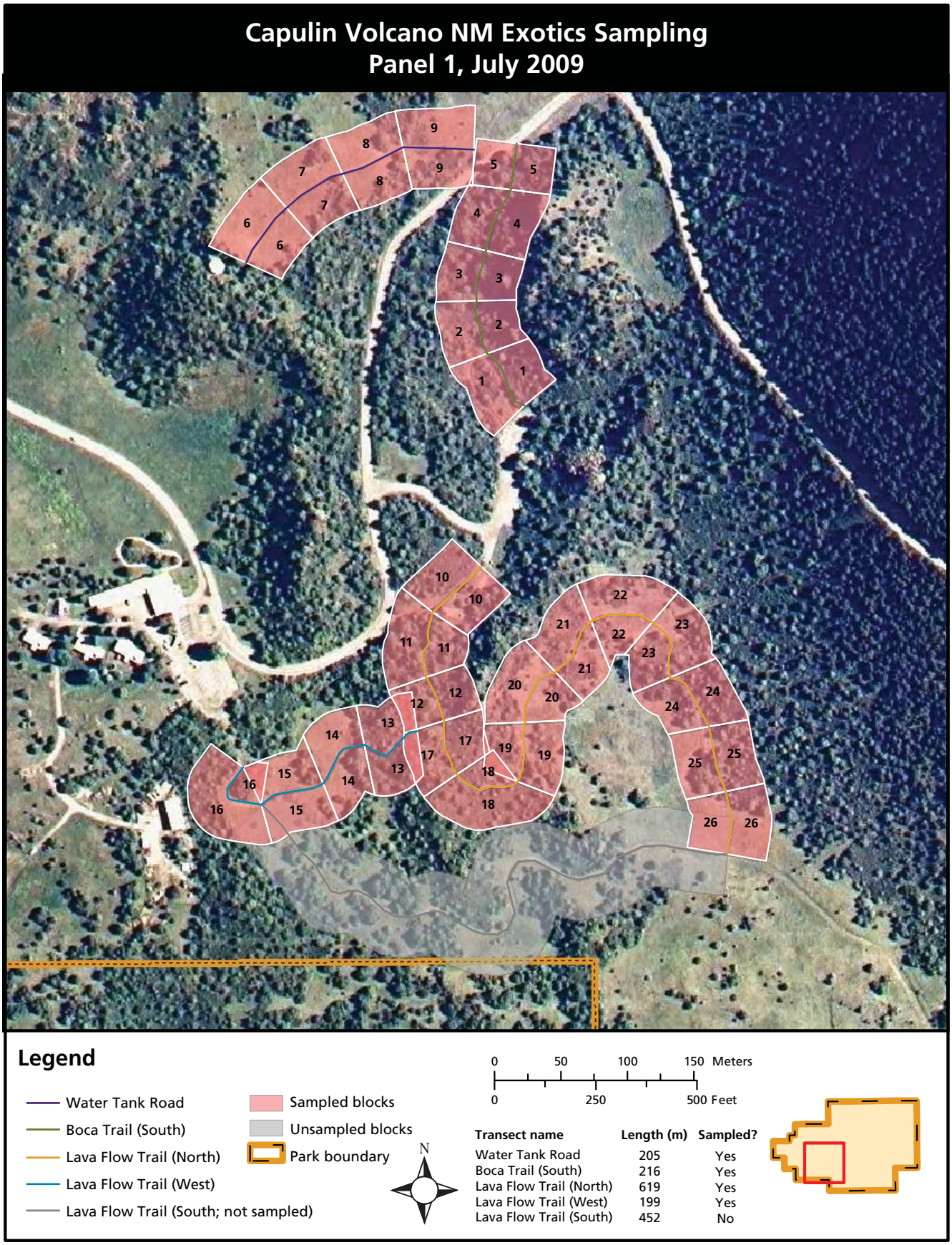

Figure 3.2-1. Individual vector blocks sampled, Capulin Volcano NM, 2009

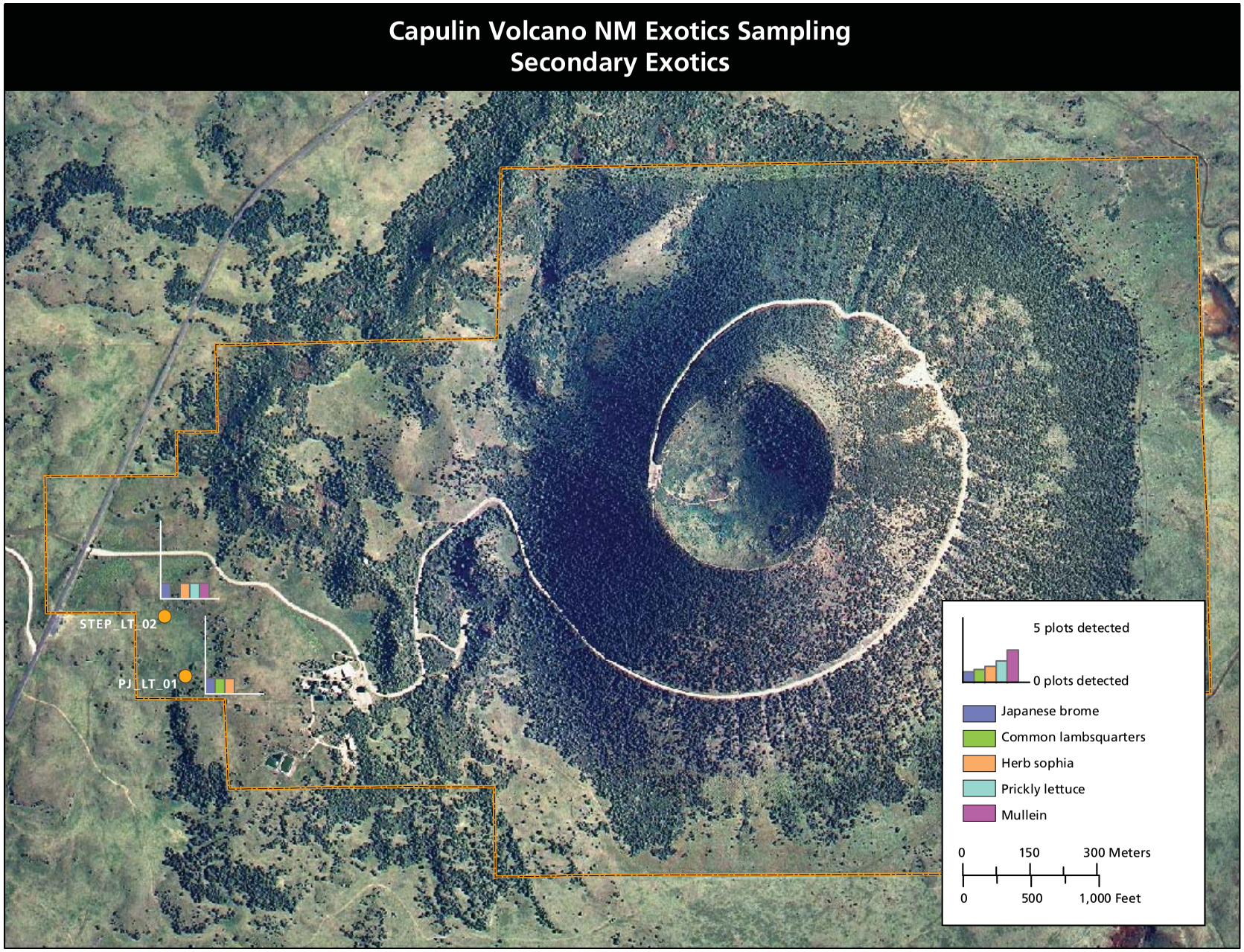

Figure 3.2-2. Secondary sample locations, Capulin Volcano NM, 2009. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

(*Descurainia sophia*), and western salsify (*Tragopogon dubius*) were all found in roughly half of the vector blocks sampled. Both common lambsquarters and western salsify were found throughout the areas, in scattered patches, up to 12 meters into the landscape. Lambsquarters was found in only one plot, on one transect, during grassland monitoring. Herb sophia and horehound were prevalent along the Boca Trail from the road crossing to the water plant, but found scattered in other areas. Horehound was seen up to 30 meters into the landscape and, in some places, had reached an even distribution. Herb sophia was found in scattered patches, generally within the first 10 meters into the landscape, and observed in one plot on each of the two transects. Yellow sweetclover (*Melilotus officinalis*) was spotted in scattered clumps, primarily on the Lava Trail within the first 10 meters, but one block found it moving well into the landscape.

More than half of the exotic species observed at CAVO were found in limited populations and should be considered for control before they spread. One section of particular concern was the area from the parking lot to the road along the Boca Trail (vector blocks 1–5). This area has been heavily disturbed and there are initial or remnant infestations of several quickly spreading exotics in this area: houndstongue (*Cynoglossum officinale*), kochia (*Kochia scoparia*), dandelion (*Taraxacum officinale*), field bindweed (*Convolvulus arvensis*), climbing bindweed (*Polygonum convolvulus*), prickly Russian thistle (*Salsola tragus*), green bristlegrass (*Setaria viridus*), and spiny sowthistle (*Sonchus asper*). Houndstongue was observed deep into the landscape in scattered patches, while dandelion, climbing bindweed, and spiny sowthistle were found closer to the trail, in limited numbers. Kochia, field bindweed, and green bristlegrass were found closer to the parking area, and kochia was evenly distributed in this area. Yellow sweetclover (*Melilotus officinalis*), prickly lettuce (*Lactuca serriola*), and prickly Russian thistle were found primarily along the Lava Trail and seemed to be initially associated with scars from earlier prescribed burns. There was also a stand of kochia observed along the Nature Trail. Prickly lettuce was observed in one plot on one transect in the interior landscape.

3.3 Chickasaw NRA

Overall sampling at Chickasaw NRA includes a selection of paved and unpaved roads and unpaved equestrian/hiking trails over a full three-year rotation (Appendix A, Figures A3-1, A3-2, and A3-3). During 2009, exotic-plant monitoring occurred at CHIC for one day in early August (Figure 3.3). Two monitoring teams worked simultaneously, providing similar man-hour efforts as in normal two-day efforts. The vector sampled was the Nature Trail behind the Nature Center, an unpaved trail improved with gravel. Twenty-eight vector blocks were monitored, for a total of 1,400 linear meters. This area has received active exotic management and reflects these ongoing efforts. The limited number of exotic plants has resulted in a decision to exclude this trail from future exotic-plant monitoring; it will be replaced with a section of equestrian trail that is of more serious concern. No secondary interior monitoring took place at CHIC in 2009.

Table 3.3. Number and percentage of primary sample units where each species was detected, Chickasaw NRA, 2009.

Scientific name	Common name	Primary vector blocks (n=56)	
		Total	Percent where IEP found
Cyperus (esculentus ?)	nutgrass sedge	54	96%
Eupatorium dentata	toothed spurge	12	21%
Lespedeza cuneata	sericea lespedeza	9	16%
Albizia julibrissin	mimosa tree	7	13%
Bromus japonicus	Japanese brome	5	9%
Erodium cicutarium	red-stem stork's-bill	4	7%
Lactuca serriola	prickly lettuce	3	5%
Agrostis gigantea	creeping bentgrass	2	4%
Cynodon dactylon	Bermudagrass	2	4%
Taraxacum officinale	dandelion	2	4%
Echinochloa colona	jungle ricegrass	1	2%
Lonicera japonicus	Japanese honeysuckle	1	2%
Tragopogon dubius	western salsify	1	2%

Only one species of sedge (*Cyperus*) was observed as scattered patches in all vector blocks (Table 3.3, Appendix B, Table B3). This sedge was not in bloom, which precluded species identification. One very invasive exotic sedge, yellow nutgrass (*Cyperus esculentus*), has been previously identified within CHIC. The sedge observed during monitoring was tracked in order to provide distribution density should this

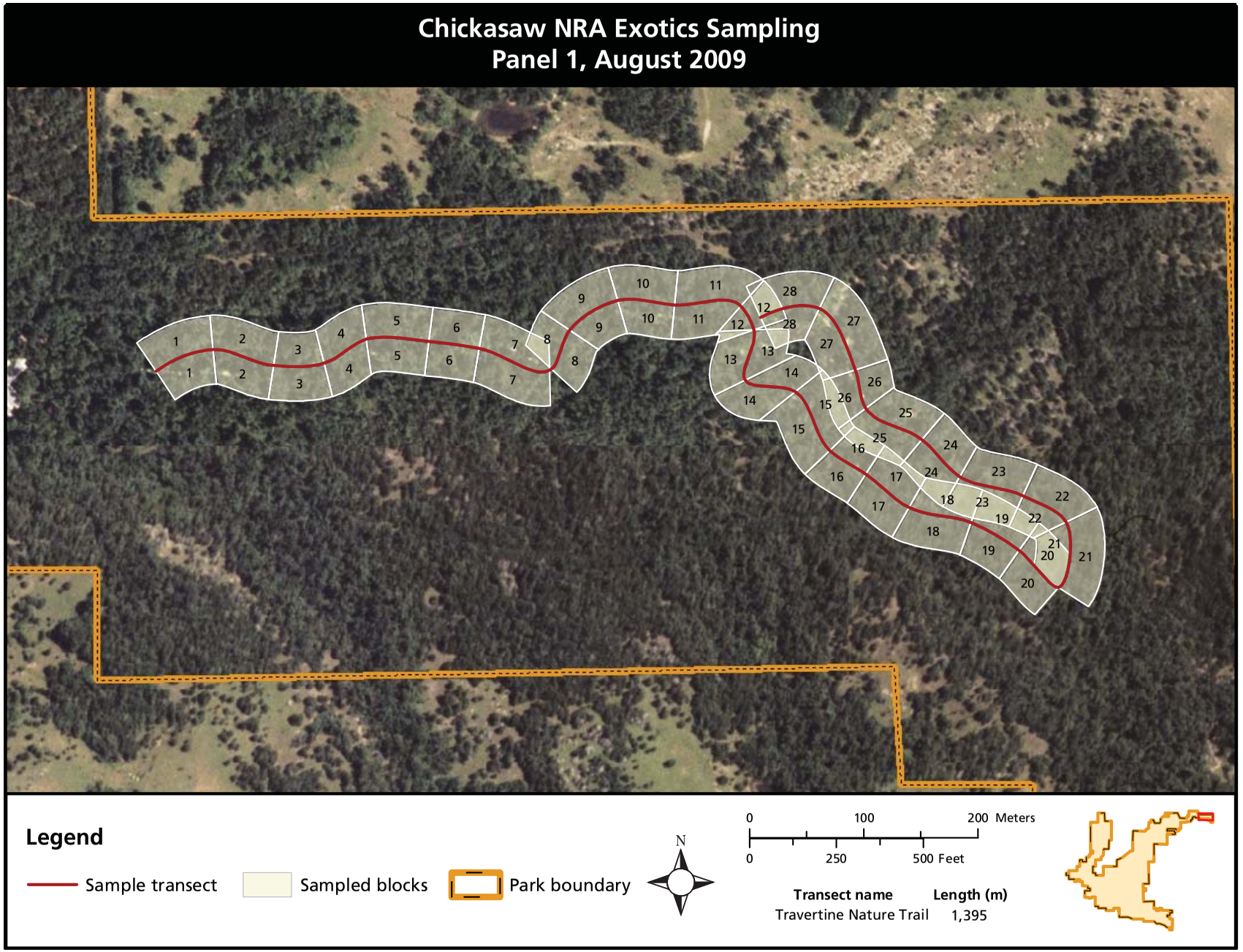

Figure 3.3. Individual vector blocks sampled, Chickasaw NRA, 2009.

species later prove to be yellow nutgrass. There are a number of native sedges at CHIC, so positive identification will be required before any control methods are implemented.

Sericea lespedeza (*Lespedeza cuneata*), toothed spurge (*Eupatorium dentatum*), and mimosa tree (*Albizia julibrissin*) were found in 25% or fewer vector blocks. Sericea lespedeza was found primarily in the first two meters from the trail, but was observed evenly distributed up to 10 meters into the landscape in one block located at the site of an abandoned road. Toothed spurge was found in scattered patches, generally in the first two meters of the vector. Several mature mimosa trees were found along the creek with numerous seedlings and saplings found in the adjacent area. This can be a very invasive tree in CHIC riparian habitats and this observed population located near the headwaters of the creek will continue to provide propagules for further expansion until eradicated. The riparian area downstream from this population should be investigated for additional populations of this tree.

The remaining exotic plant species observed at CHIC were observed in small, limited populations, making them prime candidates for eradication before they begin to spread throughout the habitat. Japanese brome (*Bromus japonicus*) and red-stem stork's-bill (*Erodium cicutarium*) were found in limited numbers along the trail, as were prickly lettuce (*Lactuca serriola*), Japanese honeysuckle (*Lonicera japonicus*), and western salsify (*Tragopogon dubius*). Bermudagrass (*Cynodon dactylon*) was found in only one vector block, but was establishing in scattered patches. The area between Antelope Springs and the abandoned road contained several exotics found nowhere else along the vector. These included a few plants of dandelion (*Taraxacum officinale*) and jungle ricegrass (*Echinochloa colona*), and larger patches of creeping bentgrass (*Argosies gigantea*).

3.4 Fort Larned NHS

Overall sampling at Fort Larned occurs in the main unit only and includes all trails, both paved and unpaved roads, and some boundary over the three-year rotation (Appendix A, Figure A4). In 2009, exotic-plant monitoring occurred at FOLA for two days in early June. The vectors sampled were a dirt maintenance road and a mown-grass trail (Figure 3.4-1). Fifty-six vector blocks were monitored, for a total of 1,400 linear meters sampled on both sides. Additionally, 15 permanent transects within the landscape of FOLA have been monitored for the occurrence of exotic plants in a total of 75 1-m^2 plots (Figure 3.4-2). FOLA comprises a heavily impacted historical site, degraded riparian area, and previously plowed fields undergoing prairie restoration. In addition, the park is surrounded by miles of row-crop agriculture. The variety and density of exotic plants found at the park reflects these conditions.

Smooth brome (*Bromus inermis*) and dandelion (*Taraxacum officinale*) were found in almost every vector block monitored (Table 3.4, Appendix B, Table B4). Smooth brome often forms a matrix wherever it is not mowed and is ubiquitous in all areas of the landscape. Smooth brome was present in 60 interior plots for 80% of the total transects. Dandelion was found in scattered patches to even distributions, only in frequently mowed areas. Cheatgrass (*Bromus tectorum*), henbit (*Lamium amplexicaule*), green bristlegrass (*Setaria viridus*) and kochia (*Kochia scoparia*) were also frequently found throughout the monitored vector. Cheatgrass occasionally formed a matrix deep into the landscape, but generally was evenly distributed in areas not mowed. Kochia often formed a matrix into the landscape, but was always found in areas that receive mowing treatments. Kochia was observed in nine of the 75 interior plots and in 33% of the transects sampled. Green bristlegrass and henbit were found only in and along the edges of mowed areas. Green bristlegrass often formed a matrix along the vector, while henbit was found in scattered patches to even distributions.

Redroot pigweed (*Amaranthus retroflexus*) and poison hemlock (*Conium maculatum*) were prevalent in the landscape and forming matrices where present. Poison hemlock was limited to riparian areas but appeared to quickly colonize disturbed areas in the adjacent floodplain. Redroot pigweed was ubiquitous in open areas, including areas that are mowed. Spiny sowthistle (*Sonchus asper*) and field bindweed (*Convolvulus arvensis*) are frequently found in the vector blocks monitored. Both were spotted up to 30 meters into the landscape, often evenly distributed, although spiny sowthistle was predominately within the first 10 meters from the vector. It is known that field bindweed is found throughout the park landscape, as it was observed in 25 interior plots on 67% of the transects sampled. Shepard's-purse (*Capsella bursa-pastoris*) and hairy crabgrass (*Digitaria sanguinalis*) were observed primarily at the edge and within the mowed areas.

Both species presented a scattered patchy to even distribution, seldom observed more than a few meters into the landscape.

Common lambsquarters (*Chenopodium album*), black medic clover (*Medicago lupulina*), prostrate knotweed (*Polygonum arenastrum*) and western salsify (*Tragopogon dubius*) were found in up to 30% of the vector blocks monitored. Western salsify was prevalent on both sides of the dirt maintenance road in scattered patches, and was found establishing itself in vector blocks 15 and 17 along the mowed trail. This new invasion would be easy to halt at this time, but will quickly spread into the new area within the next few years. Common lambsquarters, black medic clover, and prostrate knotweed were observed primarily in the mowed areas in scattered patches, although knotweed and lambsquarters exhibited an even distribution in a few vector blocks. Lambsquarters also spread further into the landscape than the knotweed or clover and was observed on only one interior plot. Prostrate pigweed (*Amaranthus blitoides*), garlic mustard (*Alliaria petiolata*), and yellow sweetclover (*Melilotus officinalis*) were found in a similar number of vector blocks but in very different areas of the landscape. Prostrate pigweed and garlic mustard were found in one group of blocks

Table 3.4. Number and percentage of primary and secondary sample units where each species was detected, Fort Larned NHS, 2009.

Scientific name	Common name	Primary vector blocks (n=56)		Secondary transects (n=15)	
		Total	Percent where IEP found	Total[1]	Percent where IEP found
Bromus inermis	smooth brome	55	98%	12	80%
Taraxacum officinale	dandelion	55	98%	0	0
Bromus tectorum	cheatgrass	44	79%	0	0
Kochia scoparia	kochia	43	77%	5	33%
Lamium amplexicaule	henbit	42	75%	0	0
Setaria viridis	green bristlegrass	42	75%	0	0
Conium maculatum	poison hemlock	33	59%	0	0
Amaranthus retroflexus	redroot pigweed	31	55%	0	0
Sonchus asper	spiny sowthistle	31	55%	0	0
Capsella bursa-pastoris	shepard's purse	24	43%	0	0
Convolvulus arvensis	field bindweed	23	41%	10	67%
Digitaria sanguinalis	hairy crabgrass	21	38%	0	0
Chenopodium album	common lambsquarters	15	27%	1	7%
Tragopogon dubius	western salsify	12	21%	0	0
Polygonum arenastrum	prostrate knotweed	11	20%	0	0
Amaranthus blitoides	prostrate pigweed	9	16%	0	0
Medicago lupulina	black medic clover	8	14%	0	0
Melilotus officinalis	yellow sweetclover	6	11%	8	53%
Alliaria petiolata	garlic mustard	6	11%	1	7%
Rumex crispus	curly dock	4	7%	0	0
Calystegia sepium ssp.	hedge bindweed	3	5%	0	0
Cannabis sativa ssp.	marijuana	2	4%	0	0
Tribulus terrestris	puncturevine	2	4%	0	0
Elaeagnus angustifolia	Russian olive	1	2%	0	0
Eragrostis cilianensis	stinkgrass	1	2%	0	0
Cirsium vulgare	bull thistle	1	2%	0	0
Cynodon dactylon	Bermudagrass	1	2%	0	0
Descurainia sophia	herb sophia; flixweed	1	2%	0	0

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

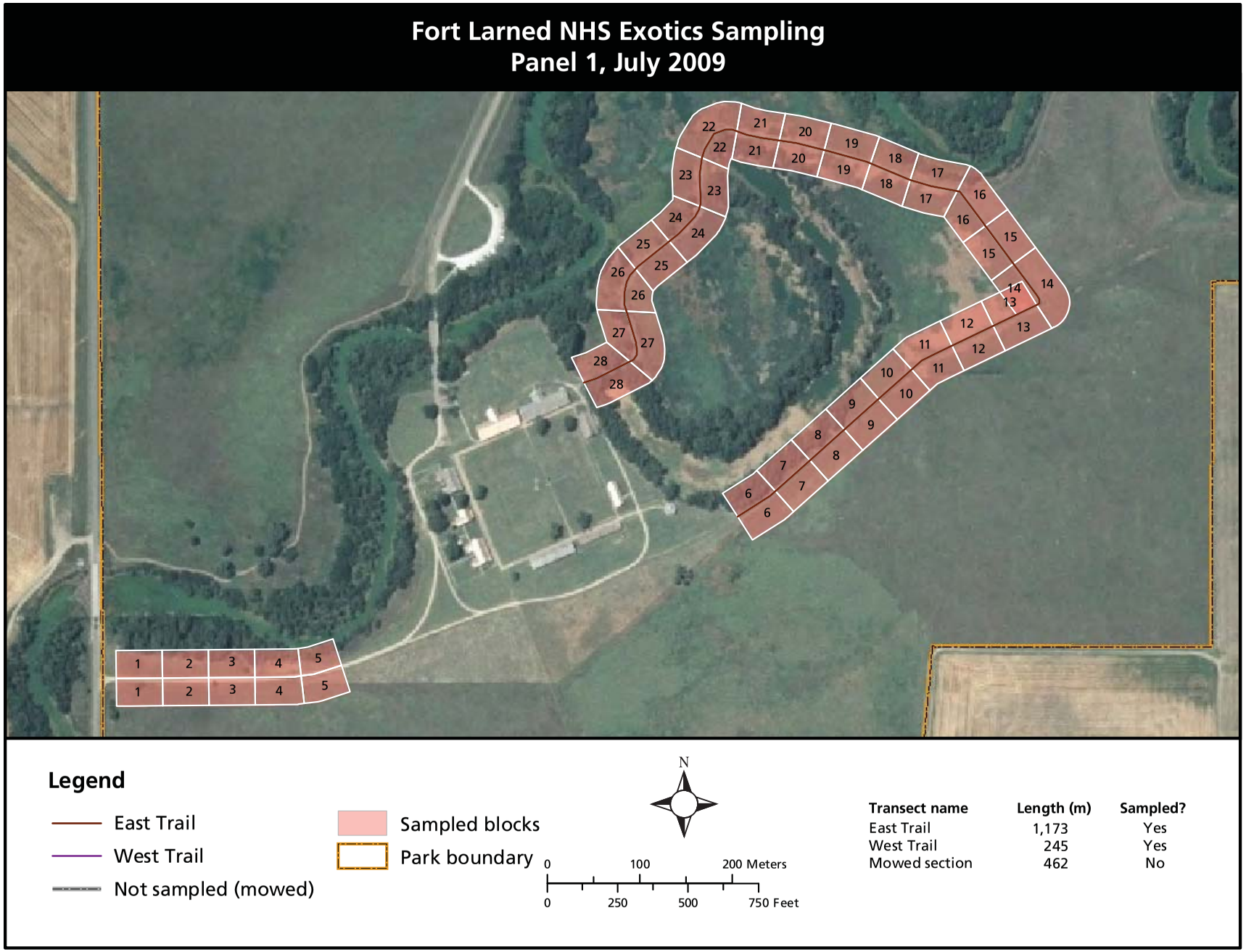

Figure 3.4-1. Individual vector blocks sampled, Fort Larned NHS, 2009.

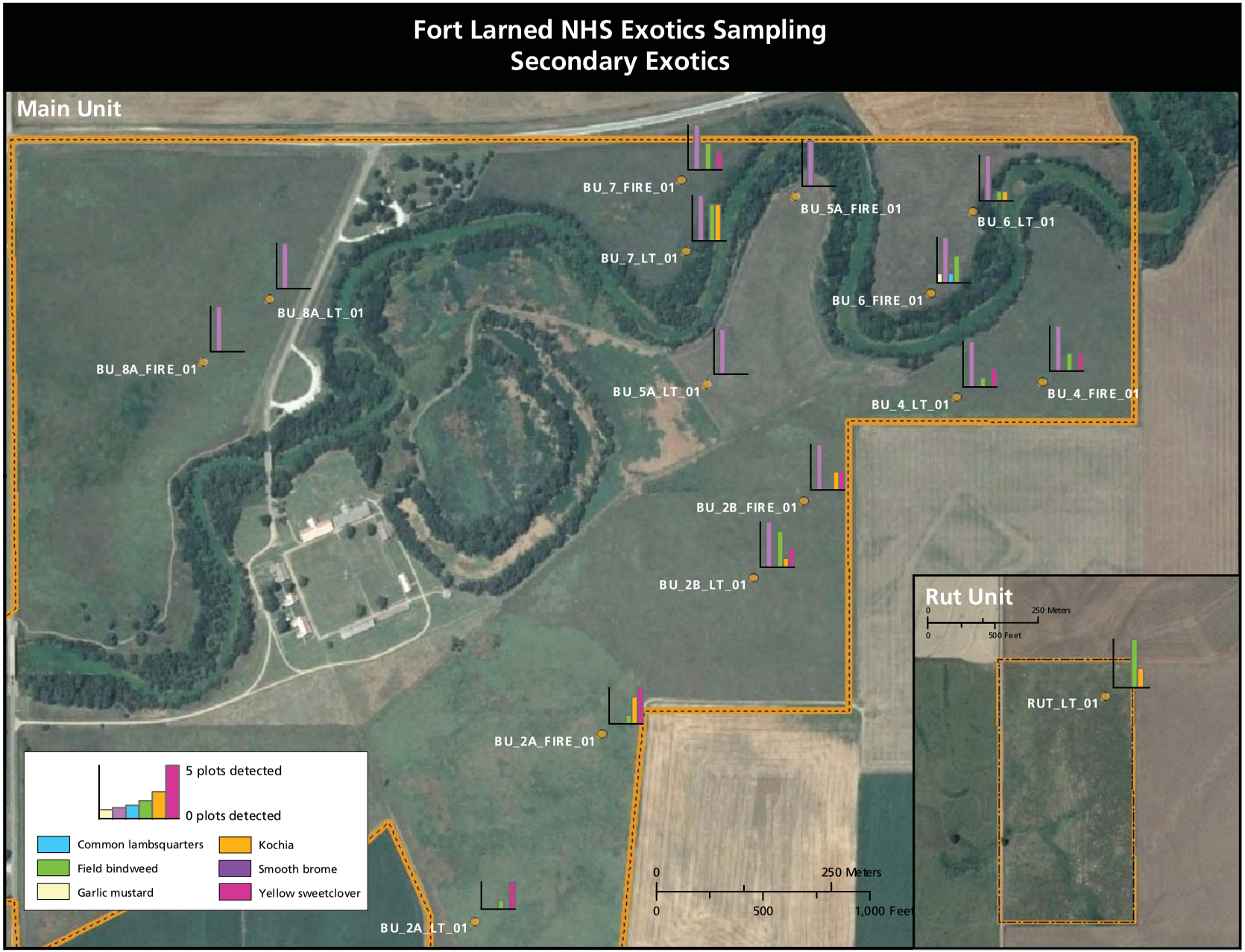

Figure 3.4-2. Secondary sample locations, Fort Larned NHS, 2009. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

(except for one vector block at the fort), primarily in the mowed areas and in scattered patches. Garlic mustard was observed on only one interior plot of the secondary sampling. Yellow sweetclover was observed only over 20 meters into the landscape in even distributions to a matrix. It is known that this species is found in pockets throughout the park and it was detected in 18 interior plots on 53% of the transects sampled.

The numerous remaining exotic species were found in small numbers in a limited number of blocks and are prime targets for control before they establish further. One Russian olive (*Elaeagnus angustifolia*) tree was observed at 20+ meters from the vector, on the edge of the riparian area. Bermudagrass (*Cynodon dactylon*) and punctureveine (*Tribulus terrestris*) were found only in the mowed areas. A few plants of bull thistle (*Cirsium vulgare*) were seen moving into the landscape from the vector. Marijuana (*Cannabis sativa*) was found in scattered patches along the edge of the mowstrip, while only a few plants of curly dock (*Rumex crispus*), hedge bindweed (*Calystegia sepium* ssp. *sepium*), herb sophia (*Descurainia sophia*), and stinkweed (*Eragrostis cilianensis*) were found in this same area.

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 (Appendix A, Figure A5). In 2009, exotic-plant monitoring occurred at FOUN for two days in late August. The vector sampled was a dirt maintenance road around the fort ruins and to a rubble pile. Seventy-eight vector blocks were monitored, for a total of 1,950 linear meters sampled on both sides (Figure 3.5). This was the greatest number of vector blocks completed this season, due primarily to the excellent weather conditions and the nature of the habitat: short vegetation, combined with relatively flat terrain. This area is slated for monitoring again in 2012. There was no grassland monitoring at FOUN in 2009; thus, no secondary exotic monitoring took place within the interior landscape.

Kochia (*Kochia scoparia*) was found in almost every vector block monitored and on both sides of the vector, primarily in scattered patches to even distributions, although the bench areas surrounding the old corrals often exhibited matrix densities (Table 3.5, Appendix B, Table B5). White sweetclover (*Melilotus alba*) was frequently observed scattered throughout the landscape. Its presence within the prairie is of concern, and eradication efforts should be considered to prevent further spread. Common lambsquarters (*Chenopodium alba*) occurred almost exclusively between the vector and the fort and suttler's ruins in scattered patches, as did prickly Russian thistle (*Salsola tragus*), in occasionally even distributions.

Horehound (*Marrubium vulgare*) was observed growing exclusively around and on ruins, generally in scattered patches, but displayed an even distribution around the hospital area. David's toothed spurge (*Eupatorium davidi*) was found in scattered patches up to 10 meters into the landscape. Of note was an extremely dense patch of this species in the vicinity of the rock rubble pile; it is seldom seen in these densities and this area bears watching to determine if it persists or spreads.

A concerted effort has been made to control field bindweed (*Convolvulus arvensis*) in parts of the park, and it appears that these efforts are making

Table 3.5. Number and percentage of primary sample units where each species was detected, Fort Union NM, 2009.

Scientific name	Common name	Primary vector blocks (n=78)	
		Total	Percent where IEP found
Kochia scoparia	kochia	74	95%
Melilotus alba	white sweetclover	41	53%
Chenopodium album	common lambsquarters	24	31%
Salsola tragus	prickly Russian thistle	20	26%
Eupatorium davidi	toothed spurge	16	21%
Marrubium vulgare	horehound	10	13%
Convolvulus arvensis	field bindweed	3	4%
Tragopogon dubius	western salsify	1	1%

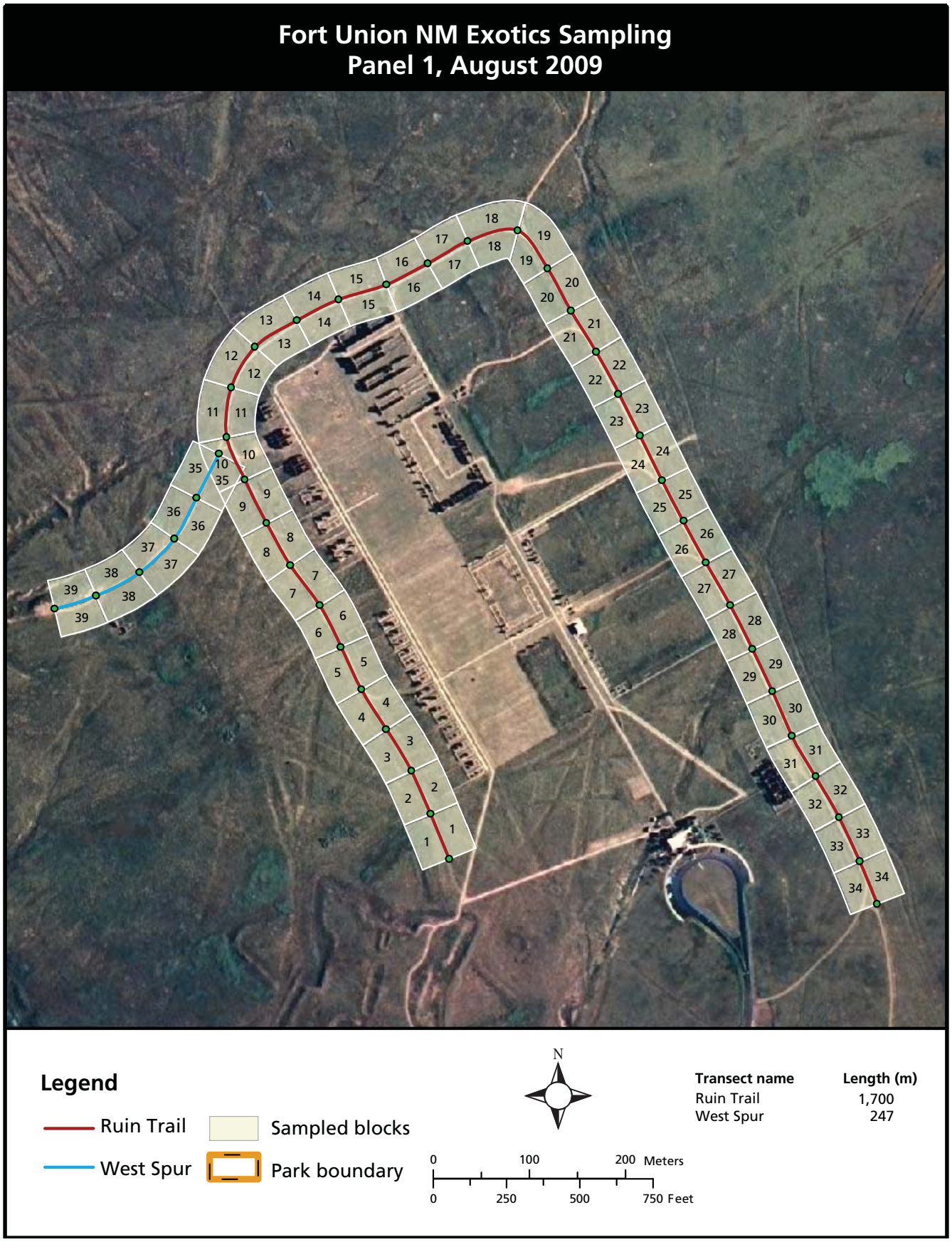

Figure 3.5. Individual vector blocks sampled, Fort Union NM, 2009.

a difference. Field bindweed was found in three vector blocks monitored at the north end of the fort ruins: two work areas within the vector limits and one block on the prairie side of the vector. These scattered patches should be included in management control efforts to prevent further spread, especially into the prairie. Western salsify (*Tragopogon dubius*) was observed up to 20 meters into the landscape but in very limited numbers. This species will also spread easily if not controlled.

3.6 Lake Meredith NRA/Alibates Flint Quarries

Overall sampling at LAMR/ALFL includes a selection of paved and unpaved roads over a full three-year rotation (Appendix A, Figures A6-1, A6-2, and A6-3). In 2009, exotic-plant monitoring occurred at ALFL for one day in early August. Two monitoring teams worked simultaneously, accomplishing an amount of work in one day similar to that usually accomplished in two days. The vector sampled was the unpaved road from the boundary with LAMR into the monument (Figure 3.6-1). Sixty-two vector blocks were monitored, for a total of 1,550 linear meters sampled on both sides. It is possible that a centrally located section of road was dropped out of the monitoring. This section, if indeed left out of the sample, will be included in the next monitoring period, scheduled for 2012. Secondary exotic monitoring took place on 14 permanent transects in areas of LAMR, for a total of 70 interior plots (Figure 3.6-2).

Kochia (*Kochia scoparia*) was observed in more than half of the vector blocks monitored (Table 3.6). This population was found in one continuous series of blocks on both sides of the vector, in scattered patches to even distributions, up to 20 meters into the landscape. Green bristlegrass (*Setaria viridus*) was also well established along this vector, found deep into the landscape, generally in scattered patches but occasionally in even distributions. Prickly Russian thistle (*Salsola tragus*) was also prevalent, but found only in the first 10 meters from the vector, in scattered patches, and in six interior plots on 14% of the transects. The grassland monitoring team also observed five interior plots containing "tumbleweed" on 29% of the transects. It has not been determined if they were referring to prickly Russian thistle, commonly called tumbleweed, or another species.

Several exotic plant species were found in numbers small enough to warrant quick eradication. Western salsify (*Tragopogon dubius*) was present up to 20 meters into the landscape, but only in scattered patches. Both hairy crabgrass (*Digitaria sanguinalis*) and oakleaf goosefoot (*Chenopodium glaucum*) were found up to 10 meters from the vector, also in scattered patches. Just a few plants of dandelion (*Taraxacum officinale*) were observed in only one vector block. Common lambsquarters (*Chenopodium album*) was not seen along the ALFL vector, but was observed in 10 interior plots on 36% of the transects.

Table 3.6. Number and percentage of primary and secondary sample units where each species was detected, Lake Meredith NRA and Alibates Flint Quarries NM, 2009.

Scientific name	Common name	Primary vector blocks (n=62)		Secondary transects (n=14)	
		Total	Percent where IEP found	Total[1]	Percent where IEP found
Kochia scoparia	kochia	34	55%	0	0
Setaria viridis	green bristlegrass	24	39%	0	0
Salsola tragus	prickly Russian thistle	15	24%	2	14%
Tragopogon dubius	western salsify	5	8%	0	0
Digitaria sanguinalis	hairy crabgrass	4	7%	0	0
Chenopodium glaucum	oakleaf goosefoot	3	5%	0	0
Taraxacum officinale	dandelion	1	2%	0	0
Chenopodium alba	common lambsquarters	0	0	5	36%
?? (possibly *Salsola)*[2]	tumbleweed	0	0	4	29%

[1] The number of individual plots on secondary transects is shown in Figure 3.6-2.
[2] Uncertainty (miscommunication) in re: field ID; this problem should be resolved in future years.

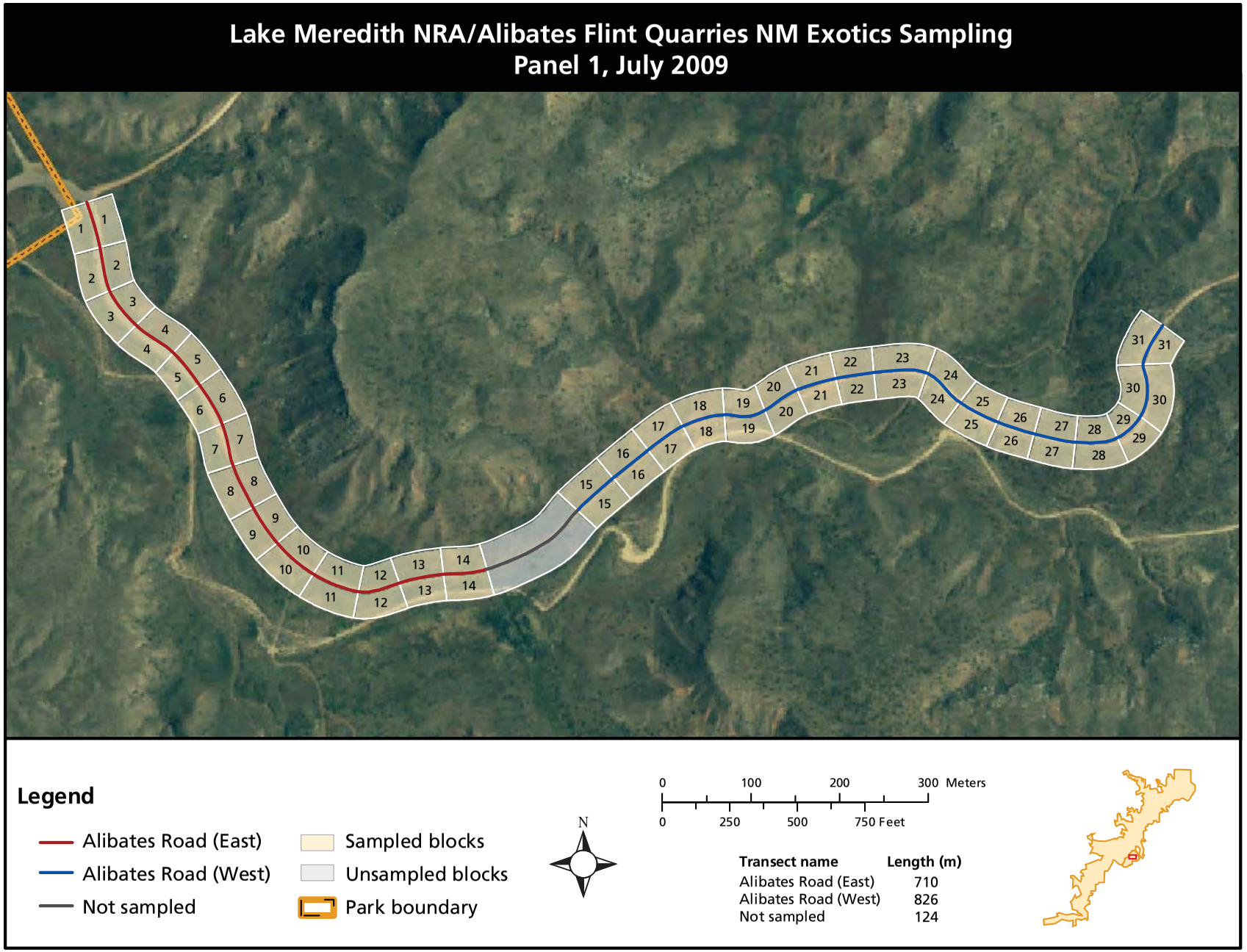

Figure 3.6-1. Individual vector blocks sampled, Lake Meredith NRA and Alibates Flint Quarries NM, 2009.

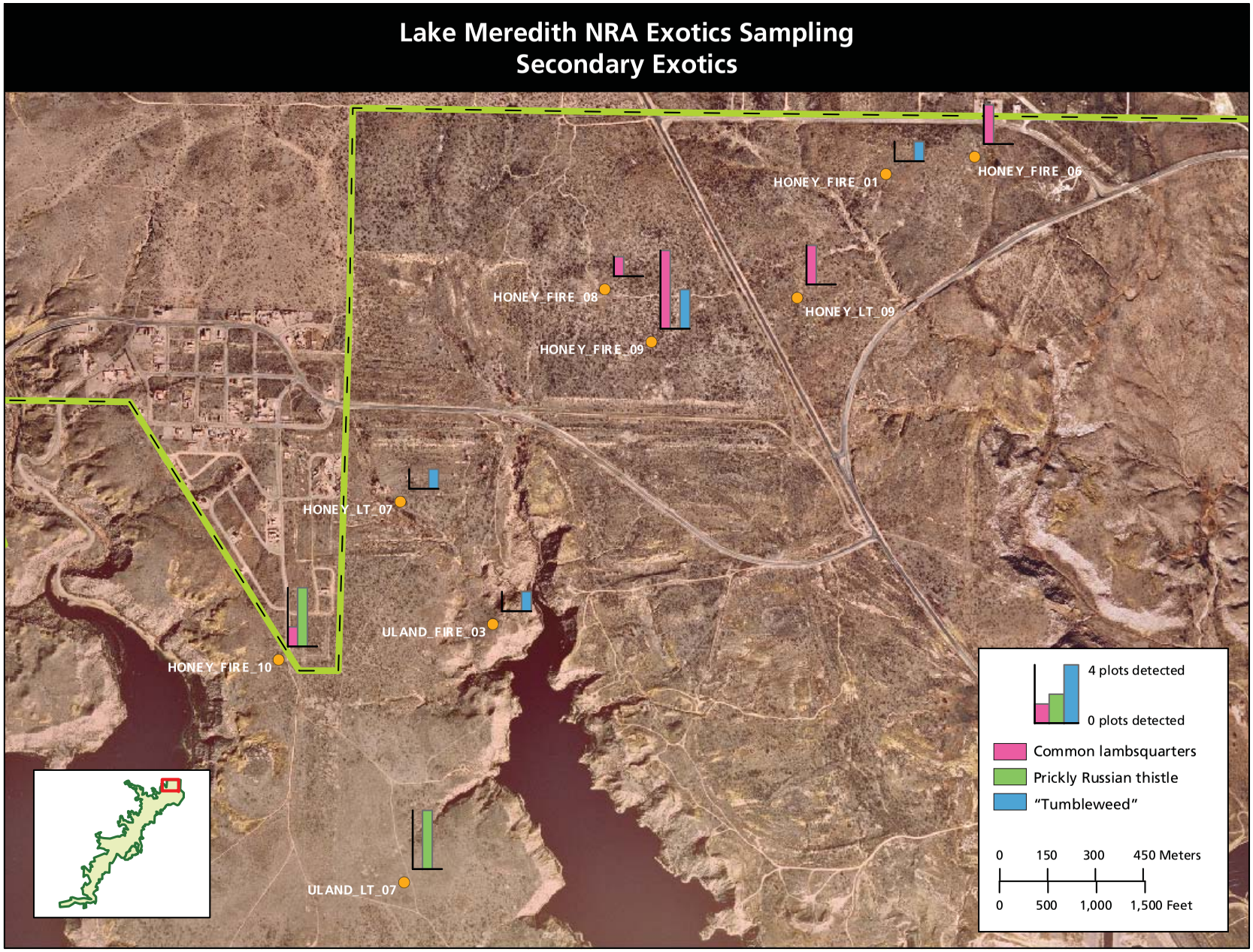

Figure 3.6-2. Secondary sample locations, Lake Meredith NRA, 2009. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

3.7 Lyndon B. Johnson NHP

Overall sampling at Lyndon B. Johnson NHP currently includes unpaved trail in the Johnson City unit on a three-year rotation (Appendix A, Figure A7). In 2009, exotic-plant monitoring occurred at LYJO for one day in early September. The vector sampled was a dirt maintenance road on the western boundary of the Johnson Settlement unit. Eighteen vector blocks were monitored, for a total of 450 linear meters sampled on both sides (Figure 3.7-1). Monitoring was limited by an extreme drought that impacted plant growth, as well as the necessity for this cultural park to mow extensively for both interpretive and safety reasons. Further examination of this park's management practices has led to the conclusion that only the trail surrounding the prairie restoration area will be monitored in future years. This section will be monitored in 2010, and thereafter on a three-year rotation. Secondary monitoring of exotics in the landscape interior will continue annually. In 2009, two permanent transects were established, for a total of ten 1-m^2 plots (Table 3.7, Figure 3.7-2, Appendix B, Table B7).

Exotic grasses have a major impact on the grounds of LYJO. King Ranch (K.R.) bluestem (*Bothriochloa ischaemum*), Bermudagrass (*Cynodon dactylon*), Japanese brome (*Bromus japonicus*), and Johnsongrass (*Sorghum halepense*) were observed in all vector blocks monitored. Bermudagrass was prevalent only along the edges of the vector, moving less than 10 m into the landscape on two vector blocks. Its spread appears to be limited by the tenacious K.R. bluestem, a mat-forming exotic found in all distance classes in an even distribution to matrix. K.R. bluestem was observed in one interior plot on one transect. Johnsongrass was also found deep into the landscape in scattered patches, generally along fencelines and in bar-ditches, although it was observed in only one interior plot of one transect. Johnsongrass occasionally forms even distributions. Japanese brome was quite prevalent from the vector up to 10 m into the landscape in scattered patches to an even distribution.

Maltese starthistle (*Centaurea melitensis*) continues to spread along vectors. This forb was observed in scattered patches in over 20% of the vector blocks monitored in the unmowed portions nearest the vector. Mediterranean lovegrass (*Eragrostis barrelieri*), horehound (*Marrubium vulgare*), and mullein (*Verbascum thapsus*) appeared in numbers small enough in this area to warrant control efforts. The mullein appeared to have been treated with herbicide.

Table 3.7. Number and percentage of primary and secondary sample units where each species was detected, Lyndon B. Johnson NHP, 2009.

Scientific name	Common name	Primary sample units (n=18)		Secondary sample units (n=2)	
		Total	Percent where IEP found	Total[1]	Percent where IEP found
Bothriochloa ischaemum	K.R. bluestem	18	100%	1	50%
Sorghum halepense	Johnsongrass	15	83%	1	50%
Bromus japonicus	Japanese brome	12	67%	0	0
Cynodon dactylon	Bermudagrass	10	56%	0	0
Centaurea melitensis	Malta starthistle	4	22%	0	0
Eragrostis barrelieri	Mediterranean lovegrass	2	11%	0	0
Marrubium vulgare	horehound	1	6%	0	0
Verbascum thapsus	mullein	1	6%	0	0

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

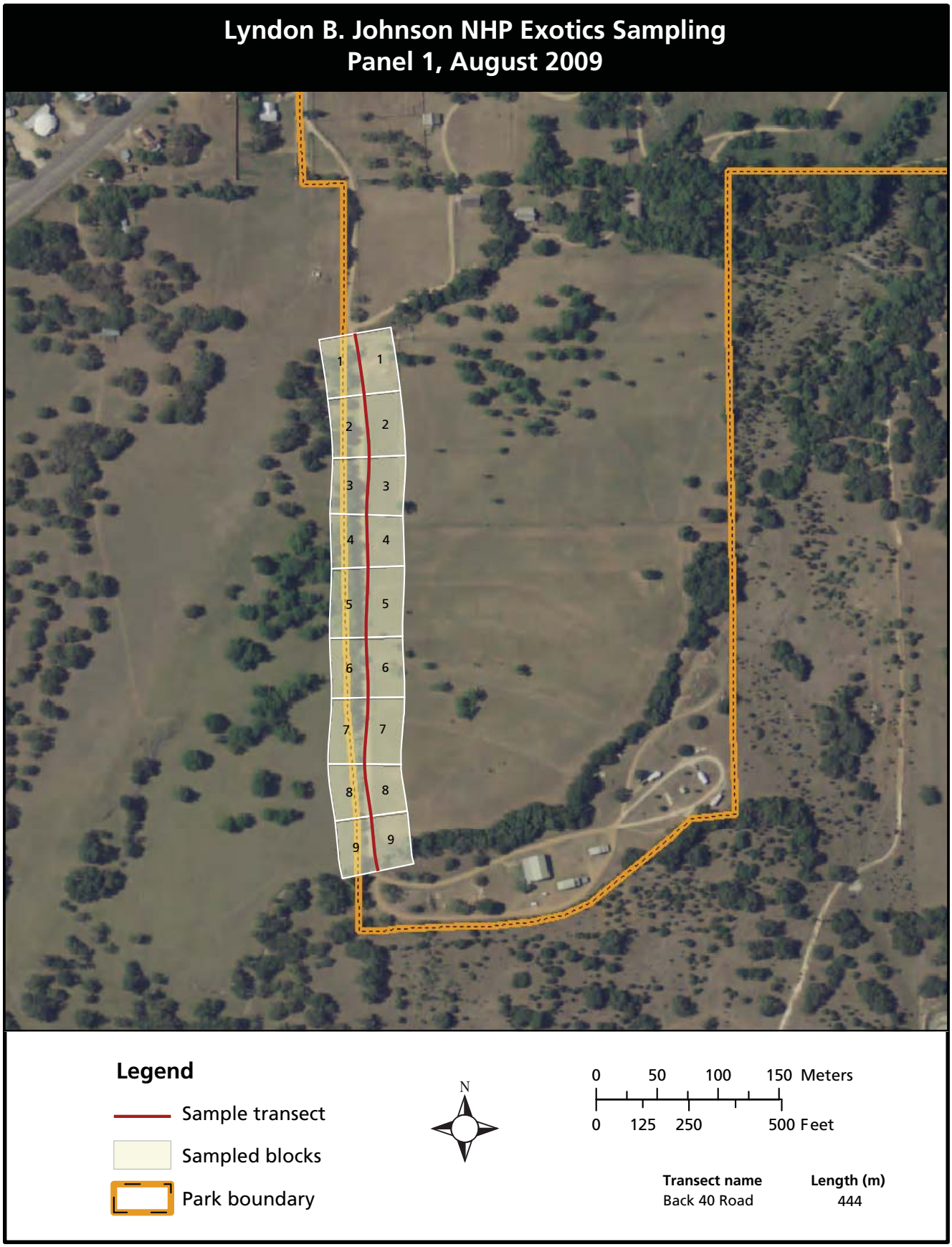

Figure 3.7-1. Individual vector blocks sampled, Lyndon B. Johnson NHP, 2009.

Figure 3.7-2. Secondary sample locations, Lyndon B. Johnson NHP, 2009. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

3.8 Pecos NHP

Overall sampling at Pecos includes a selection of paved and unpaved roads over its full three-year rotation (Appendix A, Figure A8). In 2009, exotic-plant monitoring occurred at PECO for two days in late August. The vector sampled was a dirt maintenance road from the maintenance yard behind the Trading Post to the Forked Lightning Ranch headquarters (Figure 3.8). Sixty vector blocks were monitored, for a total of 1,500 linear meters sampled on both sides. This area is slated for repeat monitoring in 2012. There was no grassland monitoring at PECO in 2009; thus, no secondary interior exotic data was collected.

Kochia (*Kochia soparia*) was the most prevalent exotic plant, detected in almost 40% of the vector blocks monitored (Table 3.8, Appendix B, Table B8). This plant was most common from the edge of the vector up to 10 meters into the landscape, but was observed deep into the landscape nearer the ranch house. Yellow sweetclover (*Melilotus officianalis*), western salsify (*Tragopogon dubius*), and mullein (*Verbascum thapsus*) were also fairly prevalent along this vector. Western salsify was observed only up to 10 meters into the landscape in densities no greater than scattered patches. Yellow sweetclover was seen in similar densities in these distance classes, but was observed up to 30 meters into the landscape in one vector block near the ranch house. Mullein was seen throughout the landscape in scattered patches, but most incidences had been treated with herbicide.

In general, greater numbers and diversity of exotic plants were found nearer the ranch headquarters and spreading back up the road toward the Trading Post. Common lambsquarters (*Chenopodium album*) was observed only up to 10 meters into the landscape in scattered patches. Mediterranean lovegrass (*Eragrostis barrelieri*) was found right along the edge of the vector predominately in scattered patches, although a few blocks presented even distributions. A species of brome (probably *Bromus japonicus*) was found in scattered patches up to 10 meters into the landscape. Prickly Russian thistle (*Salsola tragus*) was scattered along the edge of the vector and up to 20 meters away near the ranch house in scattered patches. David's toothed spurge (*Eupatorium davidii*) occurred in scattered patches along the vector, but as an even distribution up to 10 meters in one vector block. Field bindweed (*Convolvulus arvensis*) was found most often in conjunction with ground squirrel disturbance up to 10 meters from the vector, usually in scattered patches, but displaying an even distribution in a few blocks. Field bindweed was also observed in scattered patches up to 20 meters away in one vector block. Puncturevine (*Tribulus terrestris*) was found only in the loose sands at the side of the vector in scattered patches.

Several exotic plant species were found in numbers and densities small enough to possibly warrant rapid eradication to prevent further spread. The majority of these species was found on the ranch house end of the vector. An unidentified species of mustard (*Brassicaceae* spp.) was found in scattered patches to even distributions up to 20 meters into the landscape. This plant appeared as dead remnants of spring growth, and efforts should be made

Table 3.8. Number and percentage of primary sample units where each species was detected, Pecos NHP, 2009.

Scientific name	Common name	Primary sample units (n=60)	
		No. primary vector blocks	% blocks sampled
Kochia scoparia	kochia	39	65%
Verbascum thapsus	mullein	19	32%
Melilotus officinalis	yellow sweetclover	17	28%
Tragopogon dubius	western salsify	17	28%
Eragrostis barrelieri	Mediterranean lovegrass	15	25%
Eupatorium davidii	David's spurge	15	25%
Chenopodium album	common lambsquarters	14	23%
Salsola tragus	prickly Russian thistle	14	23%
Bromus species	unidentified bromes	11	18%
Convolvulus arvensis	field bindweed	11	18%
Tribulus terrestris	puncturevine	8	13%
Lactuca serriola	prickly lettuce	6	10%
Brassicaceae	mustard species	5	8%
Bromus inermis	smooth brome	4	7%
Melilotus alba	white sweetclover	4	7%
Agropyron desertorum	clustered wheatgrass	4	7%
Cirsium vulgare	bull thistle	2	3%
Erodium cicutarium	red-stem stork's-bill	1	2%

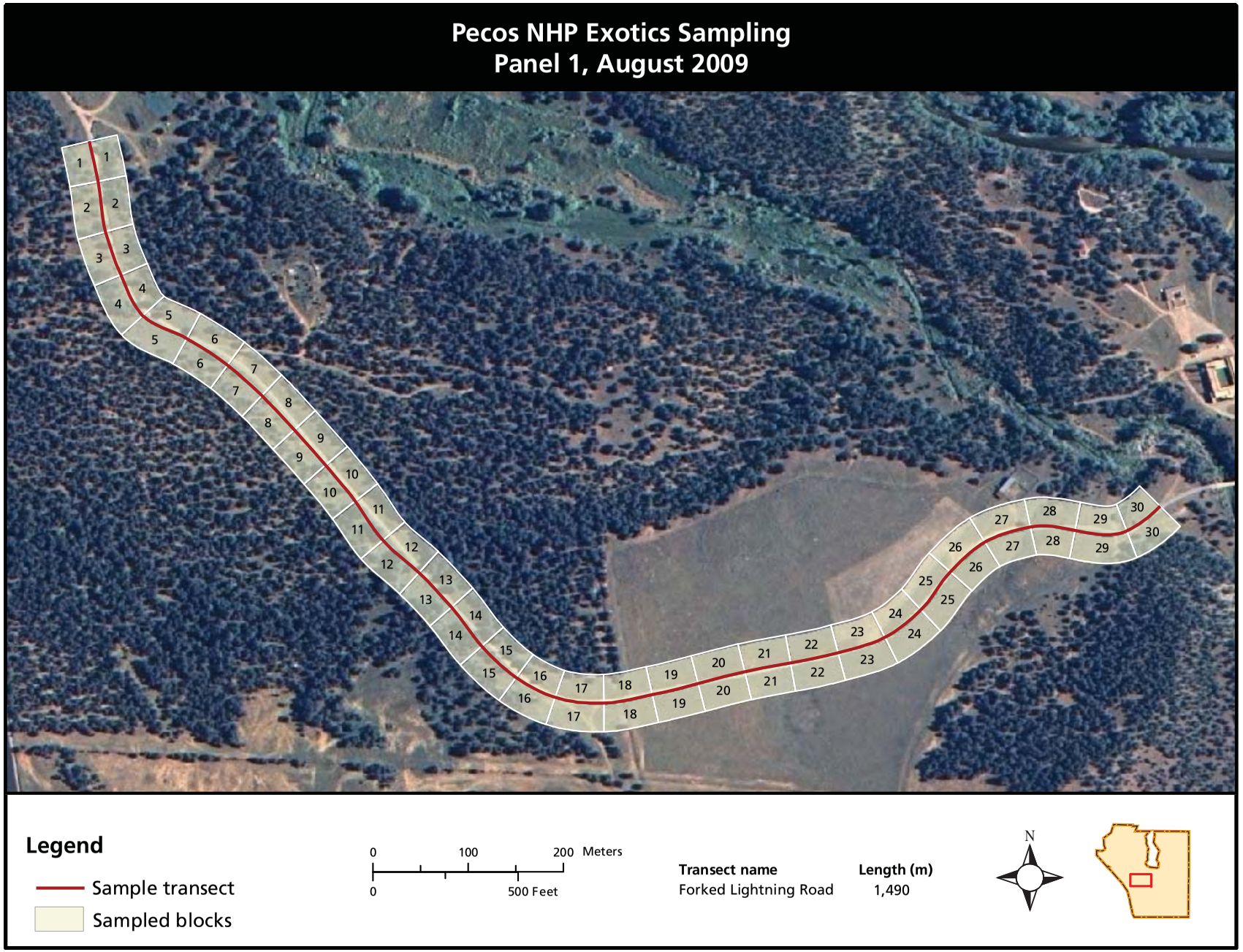

Figure 3.8. Individual vector blocks sampled, Pecos NHP, 2009.

next spring to identify the nativity of this plant. Smooth brome (*Bromus inermis*) was present as scattered patches in four of the vector blocks monitored, primarily within two meters of the vector but beginning to move into the landscape in one block. Prickly lettuce (*Lactuca serriola*) was found as occasional plants from the vector edge up to 20 meters into the landscape. A white-flowered sweetclover (possibly *Melilotus alba*) was observed in scattered patches up to 10 meters into the landscape. It is possible that this is just a pale/faded yellow sweetclover, so further identification is required. Clustered wheatgrass (*Agropyron desertorum*) was found up to 10 meters into the landscape in scattered patches. Bull thistle (*Cirsium vulgare*) was seen on only two vector blocks as scattered plants, and these plants had been treated with herbicide. Red-stem stork's-bill (*Erodium cicutarium*) was observed in scattered patches along the edge of the vector in one vector block.

3.9 Sand Creek Massacre NHS

Overall sampling at Sand Creek Massacre NHS includes a selection of paved and unpaved roads and unpaved trail over its full three-year rotation (Appendix A, Figure A9). In 2009, exotic-plant monitoring occurred at SAND for two days in late July. The vectors sampled were the dirt access road to the overlook and the dirt entrance road (Figure 3.9-1). Fifty-two vector blocks were monitored, for a total of 1,300 linear meters sampled on both sides. Monitoring effort was hampered by extreme heat, resulting in less distance covered than anticipated. This area is slated for monitoring again in 2012. Secondary exotic monitoring of the landscape interior took place on 13 permanent transects, for a total of 65 1-m^2 plots (Table 3.9, Figure 3.9-2, Appendix B, Table B9).

Prickly Russian thistle (*Salsola tragus*) was listed as the most prevalent exotic encountered, present in almost all vector blocks monitored up to 10 meters into the landscape in scattered patches and even distributions. Due to the nature of the monitoring, it is possible that prickly Russian thistle was confused with a similar exotic, kochia (*Kochia scoparia*), subsequently increasing the amount of kochia encountered and lessening the amount of prickly Russian thistle. These two exotics appear to fill the same niche and are generally found growing together throughout the SOPN parks. Either exotic provides the same challenge to management and steps will be taken in the future to provide better identification. Prickly Russian thistle was observed within the landscape in only 21 of the 65 secondary plots, but these plots

Table 3.9. Number and percentage of primary and secondary sample units where each species was detected, Sand Creek Massacre NHS, 2009.

Scientific name	Common name	Primary sample units (n=52)		Secondary sample units (n=13)	
		Total	Percent where IEP found	Total[1]	Percent where IEP found
Salsola tragus	prickly Russian thistle	50	96%	13	100%
Chenopodium album	common lambsquarters	34	65%	6	46%
Tragopogon dubius	western salsify	10	19%	0	0
Buglossoides arvensis	corn gromwell	8	15%	0	0
Setaria viridis	green bristlegrass	8	15%	0	0
Kochia scoparia	kochia	6	12%	11	85%
Bromus arvensis	field brome	2	4%	0	0
Bromus tectorum	cheatgrass	1	2%	0	0
Poa pratensis	Kentucky bluegrass	1	2%	0	0
Cirsium arvense	Canada thistle	0	0	1	8%
Convolvulus arvensis	field bindweed	0	0	2	15%
Taraxacum officinalis	dandelion	0	0	2	15%
Descurainia sophia	herb sophia	0	0	1	8%
Melilotus officinalis	yellow sweetclover	0	0	1	8%
Brassicaceae species	mustard species	0	0	2	15%

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

Figure 3.9-1. Individual vector blocks sampled, Sand Creek Massacre NHS, 2009.

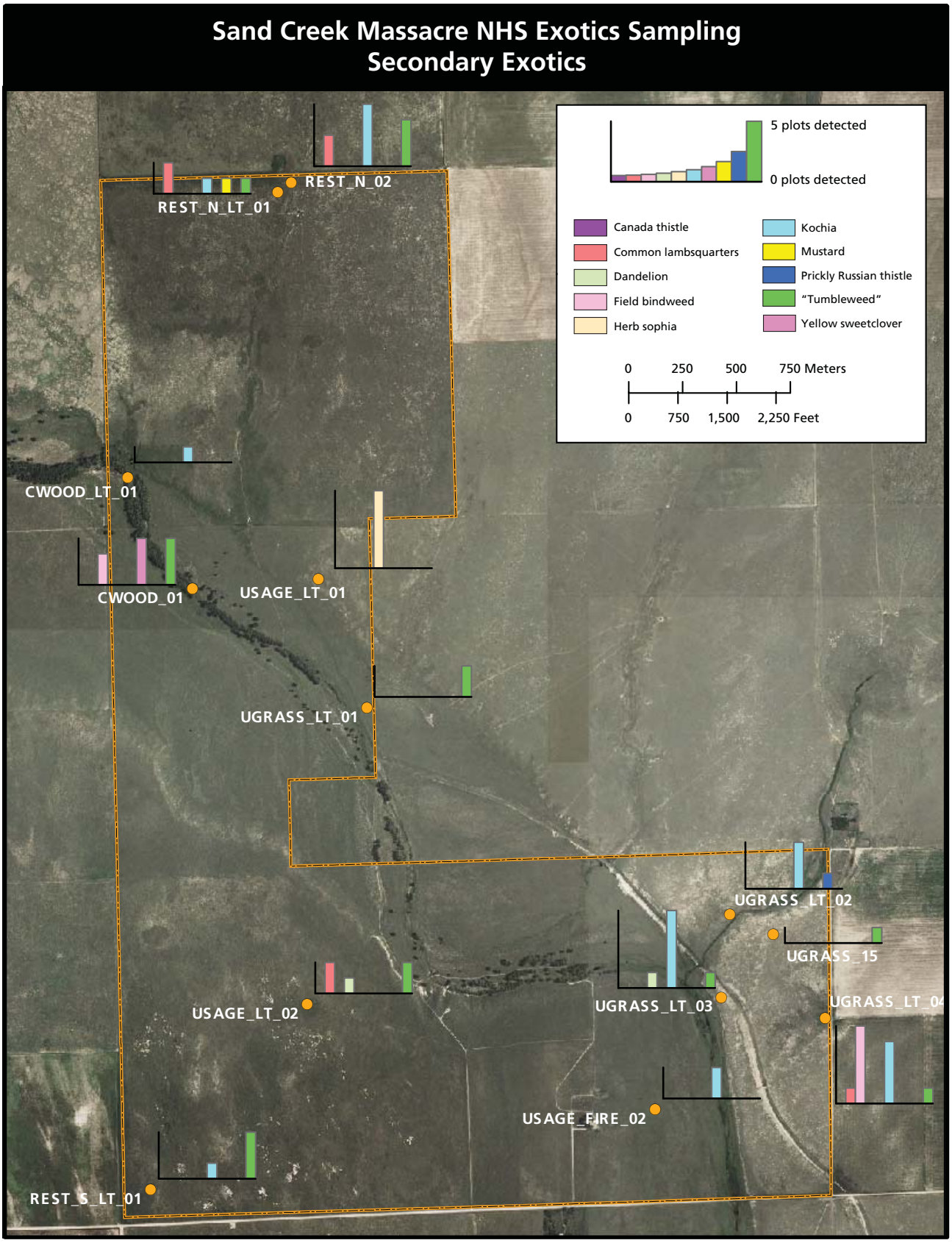

Figure 3.9-2. Secondary sample locations, Sand Creek Massacre NHS, 2009. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

existed on every transect sampled. Kochia was as ubiquitous within the landscape, being observed in more plots (31) but only 85% of the transects. Common lambsquarters (*Chenopodium album*) was also prevalent in scattered patches from the edge of the vector up to 20 meters in the landscape and was observed in 12 interior plots on 46% of the transects.

Western salsify (*Tragopogon dubius*), corn gromwell (*Buglossoides arvensis*), green bristlegrass (*Setaria viridis*), and kochia (*Kochia scoparia*) were encountered in up to 20% of the vector blocks monitored. Western salsify was most often found 2–10 meters into the landscape in scattered patches, and as occasional plants at the edge of the vector and from 10–20 meters into the landscape. Corn gromwell was seen up to 10 meters into the landscape as occasional plants. When these isolated plants were encountered, they were eradicated to prevent further spread. Green bristlegrass was found in scattered patches along the edge of the main entrance road. These small populations should be quickly controlled to prevent further invasion, as this species exhibits a strong ability to spread along maintained roadsides, responding well to mowing. Kochia was seen in scattered patches to even distributions up to 20 meters into the landscape.

Occasional plants of field brome (*Bromus arvensis*) were discovered in two vector blocks located at the site of an old corral and a few plants of cheatgrass (*Bromus tectorum*) were seen near the main entrance. These few plants were pulled before they could release their seed to prevent further spread. A few plants of Kentucky bluegrass (*Poa pratensis*) were seen in the area of the old corral and could be eradicated.

Several exotic plant species were found within the landscape during secondary monitoring that were not observed along the sampled vector. Field bindweed (*Convolvulus arvensis*) found in seven plots on two transects. Herb sophia (*Descurainia sophia*) was observed on all five plots on only one transect. Yellow sweetclover (*Melilotus officinalis*) inhabited three plots of one transect, while both dandelion (*Taraxacum officinalis*) and the dried remains of an unidentified mustard species occupied only two plots each of two transects. Canada thistle (*Cirsium arvense*) was found in only one plot on one transect.

3.10 Washita Battlefield NHS

Overall sampling at Washita Battlefield NHS includes all unpaved trails, unpaved roads, and a section of boundary over its full three-year rotation (Appendix A, Figure A10). In 2009, exotic-plant monitoring occurred at WABA for two days in late June. Vectors sampled included the unpaved loop trails (Figure 3.10-1). Fifty-six vector blocks were monitored, for a total linear effort of 1,400 meters sampled on both sides. Monitoring effort was curtailed due to extreme heat, preventing the completion of the lower loop trail. This section will be included in the next monitoring of the trail, scheduled for 2012. Additionally, secondary monitoring within the landscape took place on 13 permanent transects, for a total of 65 1-m^2 plots.

Japanese brome (*Bromus japonicus*) was the most prevalent exotic observed, occurring in 82% of the vector blocks sampled (Table 3.10, Appendix B, Table B10). This grass was ubiquitous, occurring from the vector edge deep into the landscape in scattered patches to even distributions. Japanese brome was present in 23 interior plots on 46% of the transects. Johnsongrass (*Sorghum halepense*) was also frequently present in scattered patches throughout the landscape, being found in 5 plots on 31% of the transects (Figure 3.10-2). Western salsify (*Tragopogon dubius*) was seen up to 20 meters into the landscape in scattered patches. Spiny sowthistle (*Sonchus asper*) was almost as prevalent as western salsify, but only observed up to 10 meters into the landscape in similarly scattered patches.

White sweetclover (*Melilotus alba*) was found in 16% of the vector blocks monitored, but only near the vector edge as occasional plants; only one vector block contained scattered patches. It was also observed in one plot on one transect. Siberian elm (*Ulmus pumila*) was spotted as short, dense sprouts, either as occasional plants or in scattered patches up to 10 meters into the landscape, but not in the mowed verges. The diminutive nature of the Siberian elm at this stage of growth made it easy for them to hide among the tall grass, so a more thorough search is recommended. Siberian elm was found in eight interior plots on 23% of the transects. K.R. bluestem (*Bothriochloa ischaemum*) is a particularly invasive grass and was found in a series of six vector blocks along the

lower loop, up to 20 meters into the landscape. It is also known to occur in other areas of the park. Kochia (*Kochia scoparia*) was also observed in a series of seven blocks in scattered patches up to 20 meters into the landscape. It was present in 28 interior plots on 62% of the transects. Prickly Russian thistle (*Salsola tragus*) was found as occasional plants up to 10 meters into the landscape, although one vector block did have growing densities to scattered patches. It was also observed in one interior plot on one transect.

A number of exotic plants have been observed in small numbers and limited areas, and are prime candidates for early eradication to prevent future problems. Curly dock (*Rumex crispus*) was found in scattered patches up to 10 meters into the landscape, with one vector block exhibiting an even distribution. Field bindweed (*Convolvulus arvensis*) was seen as an occasional plant in one vector block, running up to 10 meters into the landscape. It was also found in three interior plots on only one transect. An occasional plant of toothed spurge (*Euphorbia dentata*) along the edge of the vector could be quickly eradicated. Yellow sweetclover (*Melilotus officinalis*) was observed 2–10 meters into the landscape as an occasional plant. It was also found in 10 interior plots on 31% of the transects. One large plant of saltcedar (*Tamarix ramosissima*) was seen at the bottom of the loop trail on the banks of the Washita River. Previous eradication efforts at WABA appear to have been effective, but reconnaissance along the riparian area for re-sprouts and new introductions should be implemented soon to prevent recurrence of this undesirable plant.

Table 3.10. Number and percentage of primary and secondary sample units where each species was detected, Washita Battlefield NHS, 2009.

Scientific name	Common name	Primary sample units (n=56)		Secondary sample units (n=13)	
		Total	Percent where IEP found	Total[1]	Percent where IEP found
Bromus japonicus	Japanese brome	46	82%	6	46%
Sorghum halepense	Johnsongrass	28	50%	4	31%
Tragopogon dubius	western salsify	24	43%	0	0
Sonchus asper	spiny sowthistle	23	41%	0	0
Ulmus pumila	Siberian elm	10	18%	3	23%
Melilotus alba	white sweetclover	9	16%	1	8%
Kochia scoparia	kochia	7	13%	8	62%
Bothriochloa ischaemum	K.R. bluestem	6	11%	0	0
Salsola tragus	prickly Russian thistle	5	9%	1	8%
Rumax crispus	curly dock	3	5%	0	0
Convolvulus arvensis	field bindweed	1	2%	1	8%
Eupatorium dentata	toothed spurge	1	2%	0	0
Melilotus officinalis	yellow sweetclover	1	2%	4	31%
Tamarix ramosissima	saltcedar	1	2%	0	0

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

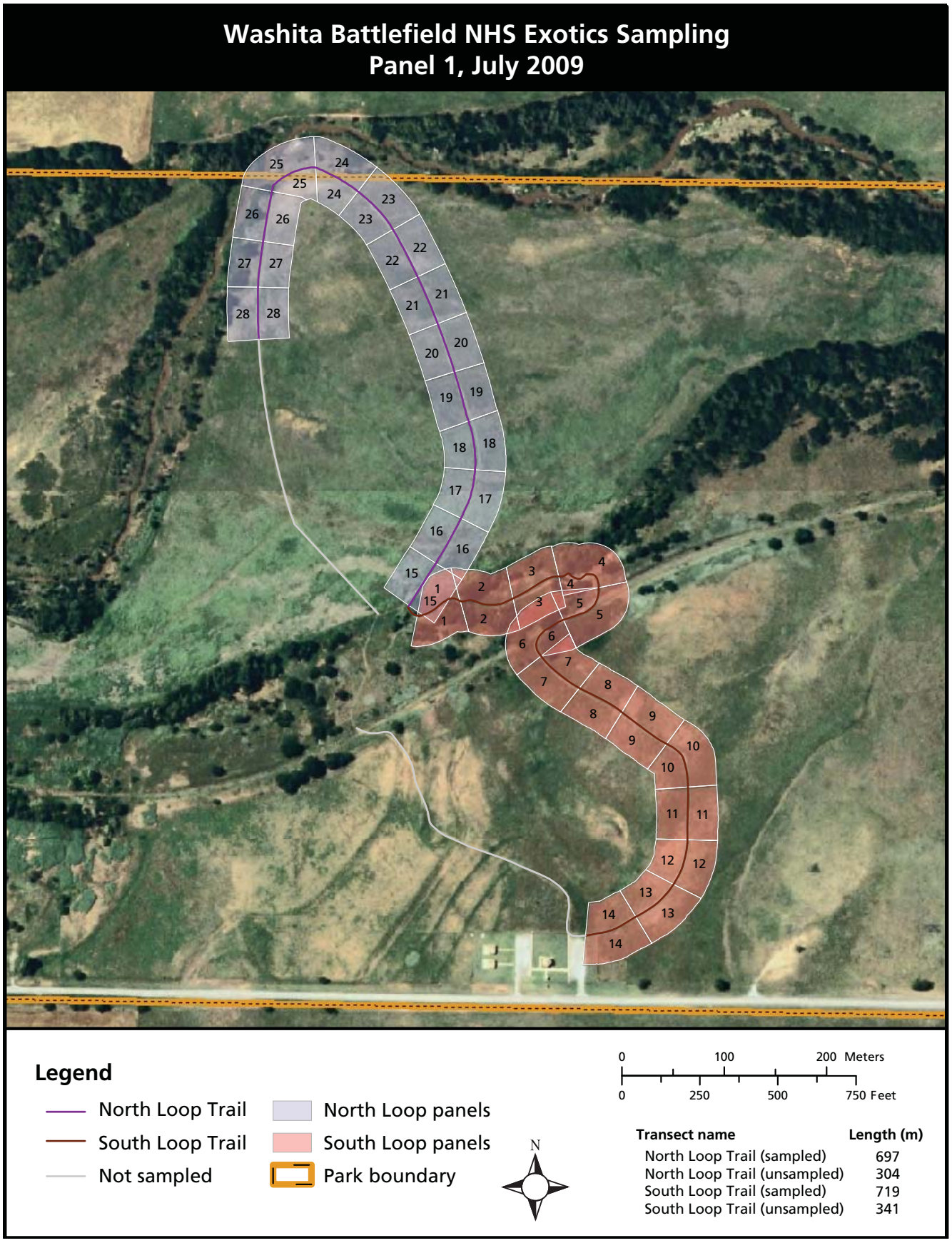

Figure 3.10-1. Individual vector blocks sampled, Washita Battlefield NHS, 2009.

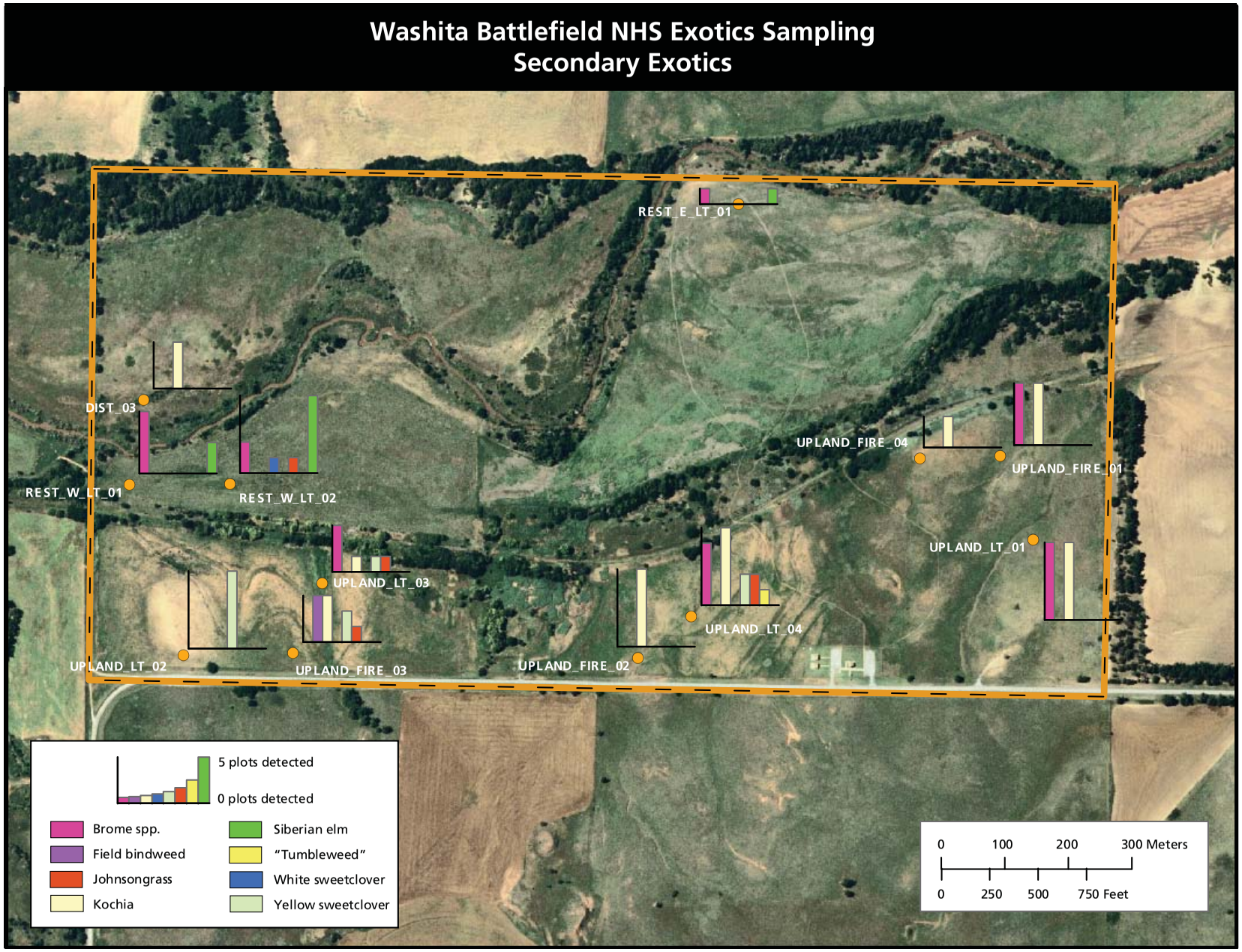

Figure 3.10-2. Secondary sample locations, Washita Battlefield NHS, 2009. Map also shows the invasive species detected, and the number of individual plots (out of five) for each transect where they were detected.

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 CHIC (easternmost park), it becomes nonexistent 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 CAVO, FOUN, and LAMR, 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 viridus*), 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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Appendix A. Supplemental Figures

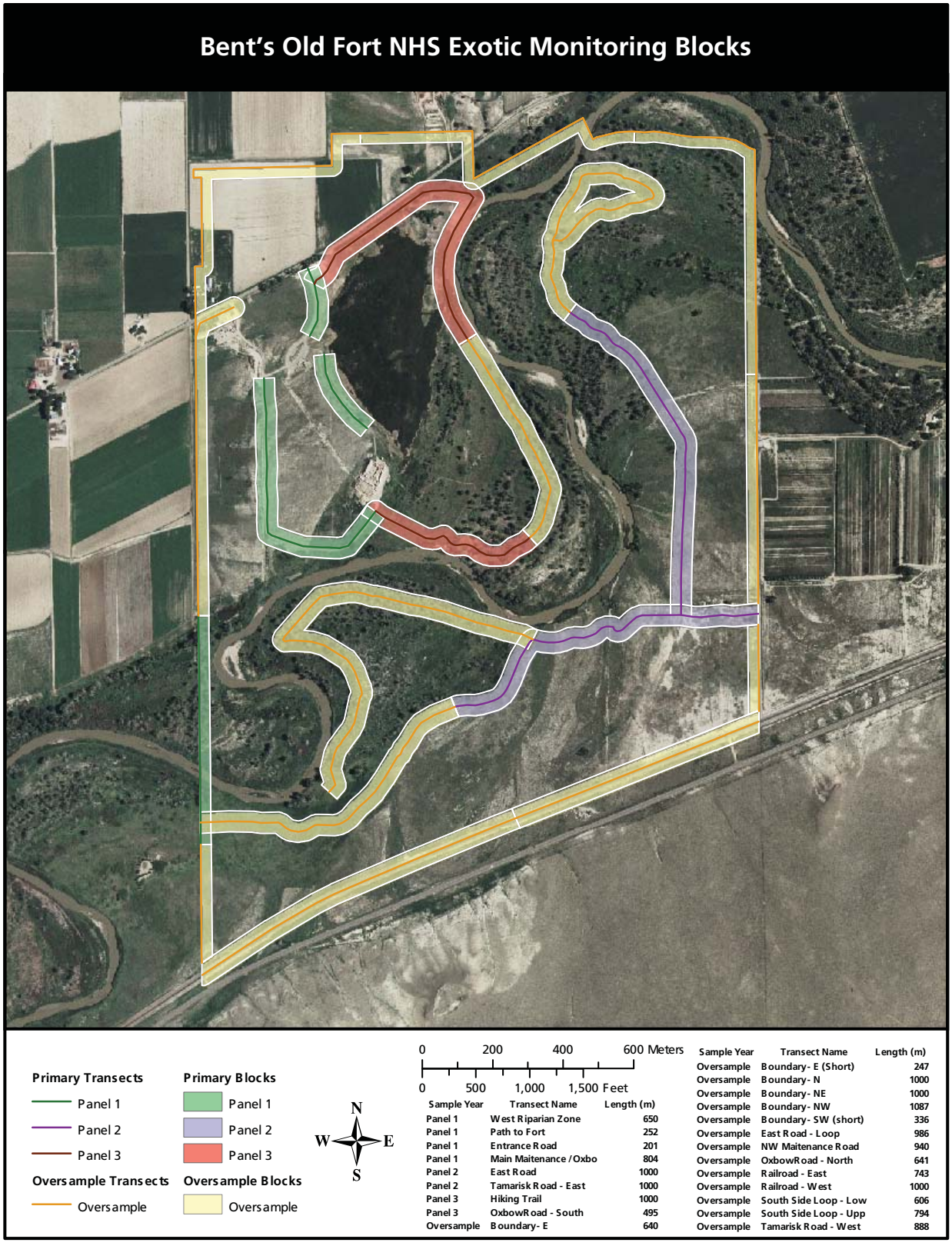
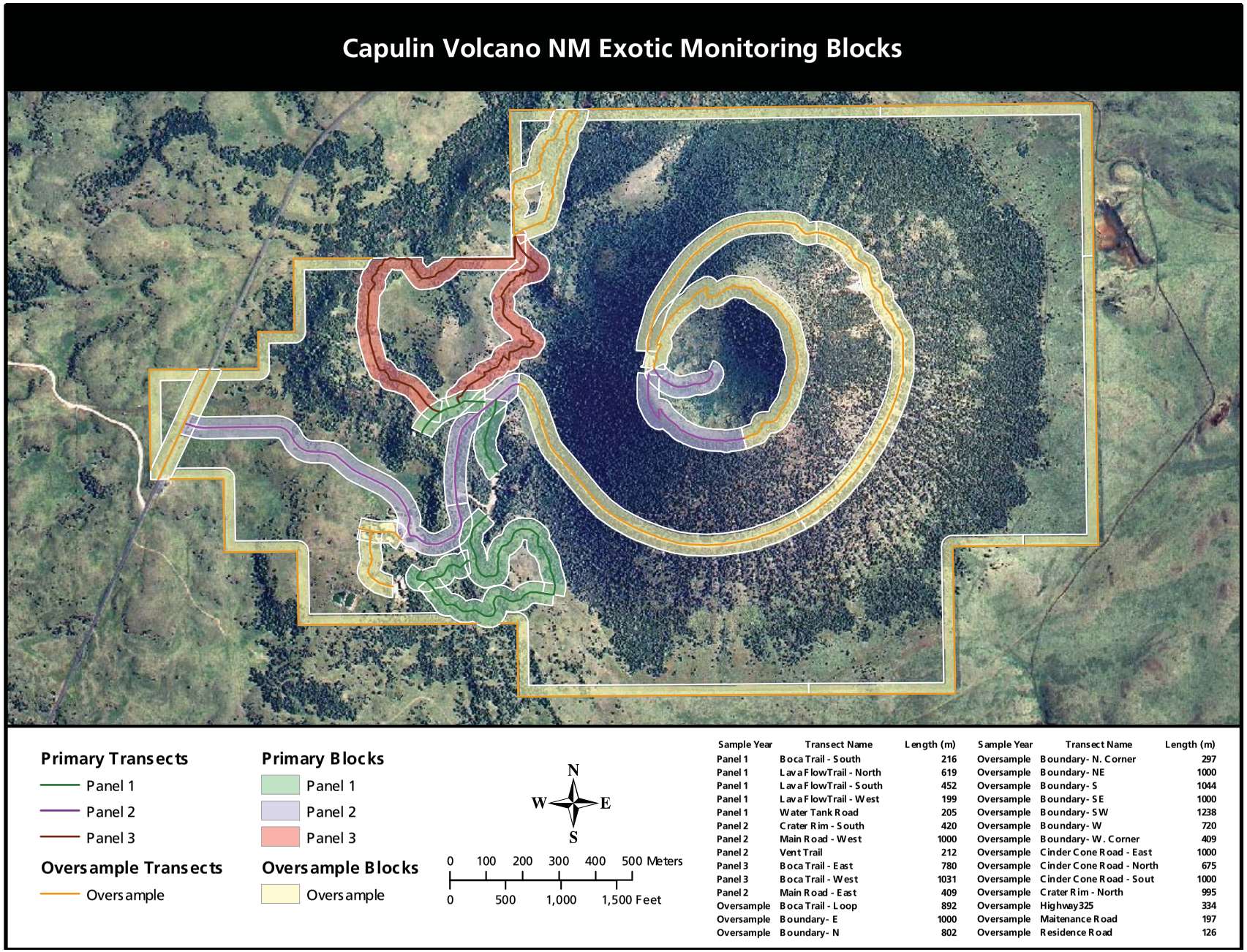


Figure A1. Overall planned sampling scheme for panels (annual samples) at Bent's Old Fort NHS for a full three-year rotation.



Sample Year	Transect Name	Length (m)	Sample Year	Transect Name	Length (m)
Panel 1	Boca Trail - South	216	Oversample	Boundary- N. Corner	297
Panel 1	Lava FlowTrail - North	619	Oversample	Boundary- NE	1000
Panel 1	Lava FlowTrail - South	452	Oversample	Boundary- S	1044
Panel 1	Lava FlowTrail - West	199	Oversample	Boundary- SE	1000
Panel 1	Water Tank Road	205	Oversample	Boundary- SW	1238
Panel 2	Crater Rim - South	420	Oversample	Boundary- W	720
Panel 2	Main Road - West	1000	Oversample	Boundary- W. Corner	409
Panel 2	Vent Trail	212	Oversample	Cinder Cone Road - East	1000
Panel 3	Boca Trail - East	780	Oversample	Cinder Cone Road - North	675
Panel 3	Boca Trail - West	1031	Oversample	Cinder Cone Road - Sout	1000
Panel 2	Main Road - East	409	Oversample	Crater Rim - North	995
Oversample	Boca Trail - Loop	892	Oversample	Highway325	334
Oversample	Boundary- E	1000	Oversample	Maitenance Road	197
Oversample	Boundary- N	802	Oversample	Residence Road	126

Figure A2. Overall planned sampling scheme for panels (annual samples) at Capulin Volcano NM for a full three-year rotation.

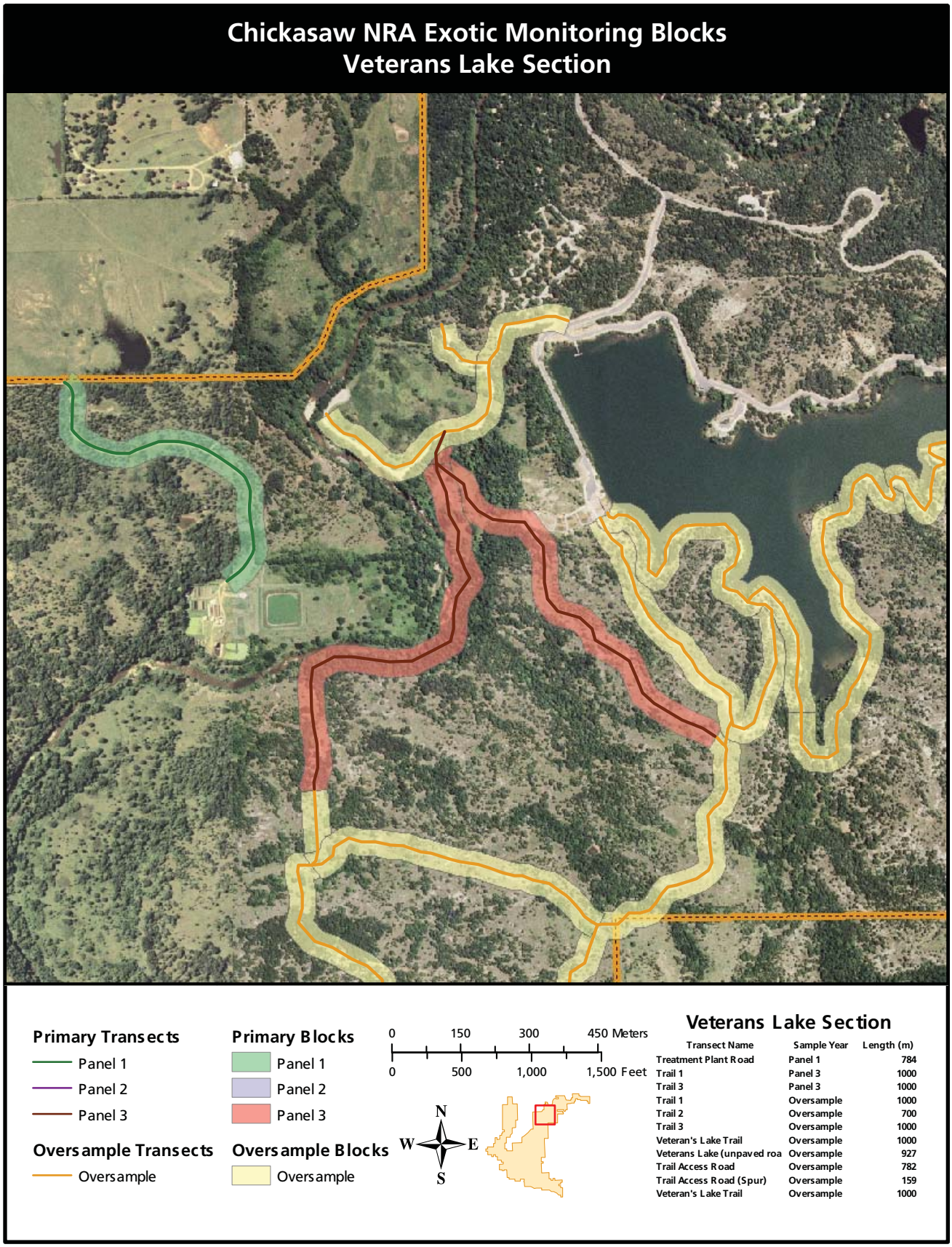


Figure A3-1. Overall planned sampling scheme for panels (annual samples) in the Veterans Lake vicinity of Chickasaw NRA for a full three-year rotation.

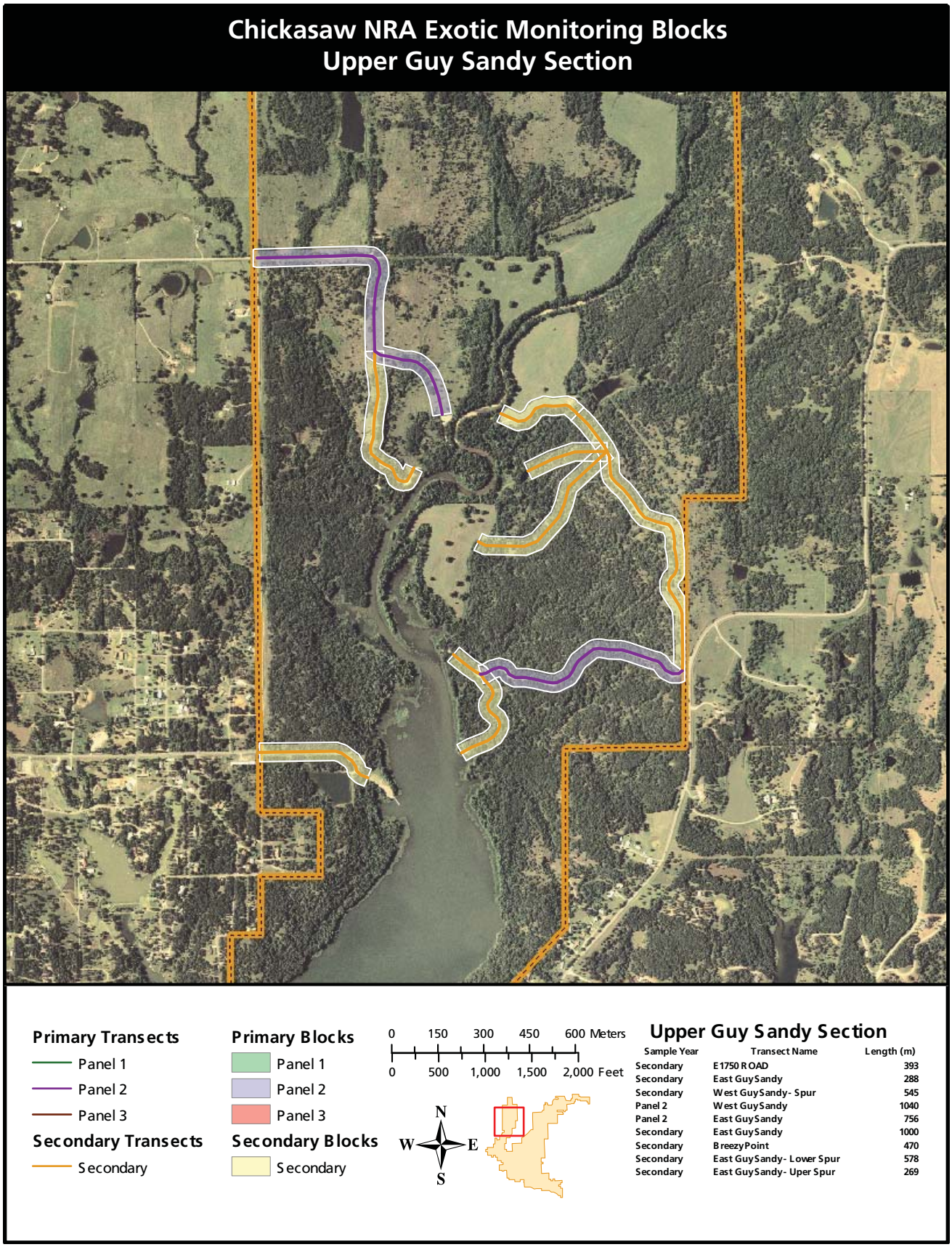


Figure A3-2. Overall planned sampling scheme for panels (annual samples) in the Guy Sandy vicinity of Chickasaw NRA for a full three-year rotation.

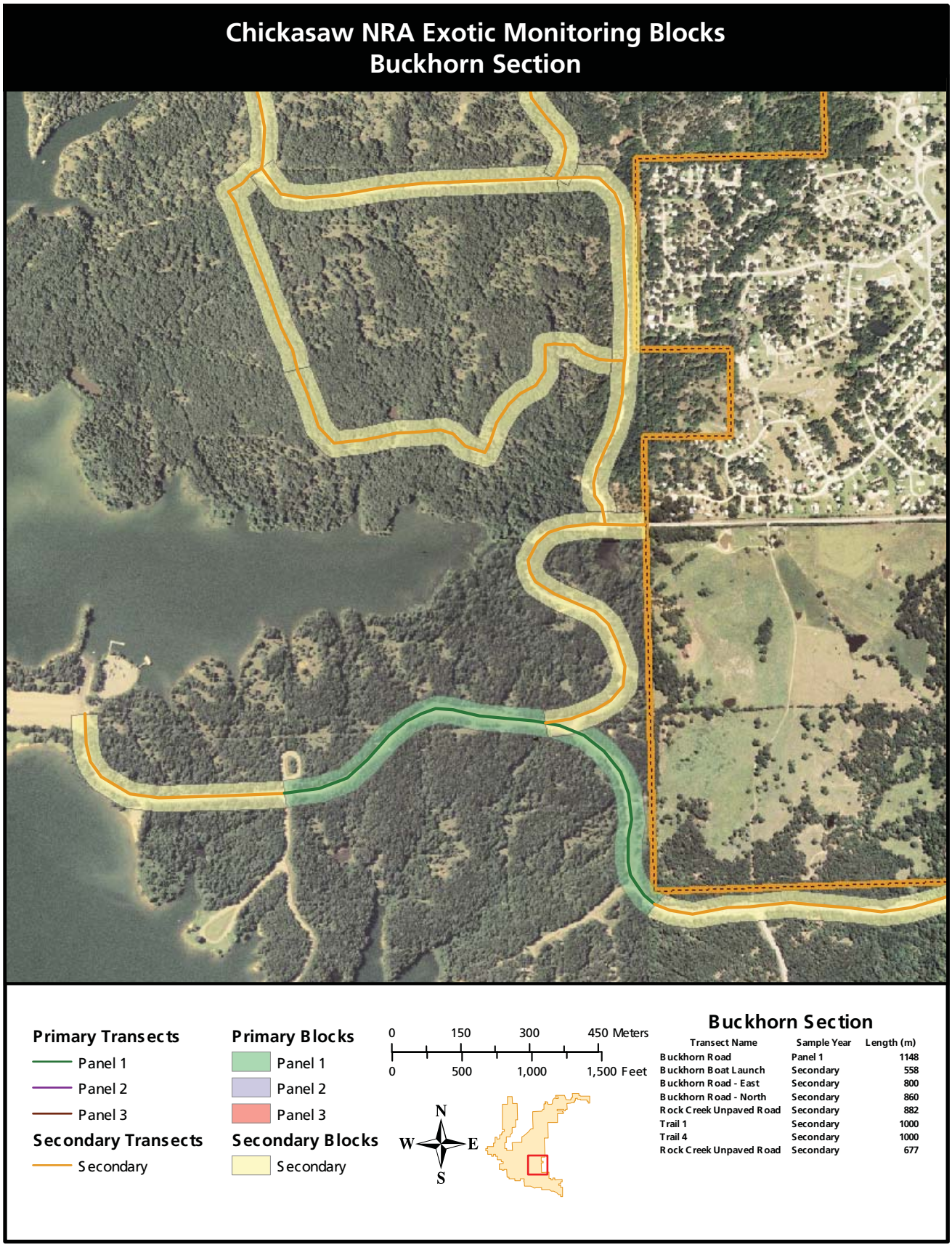
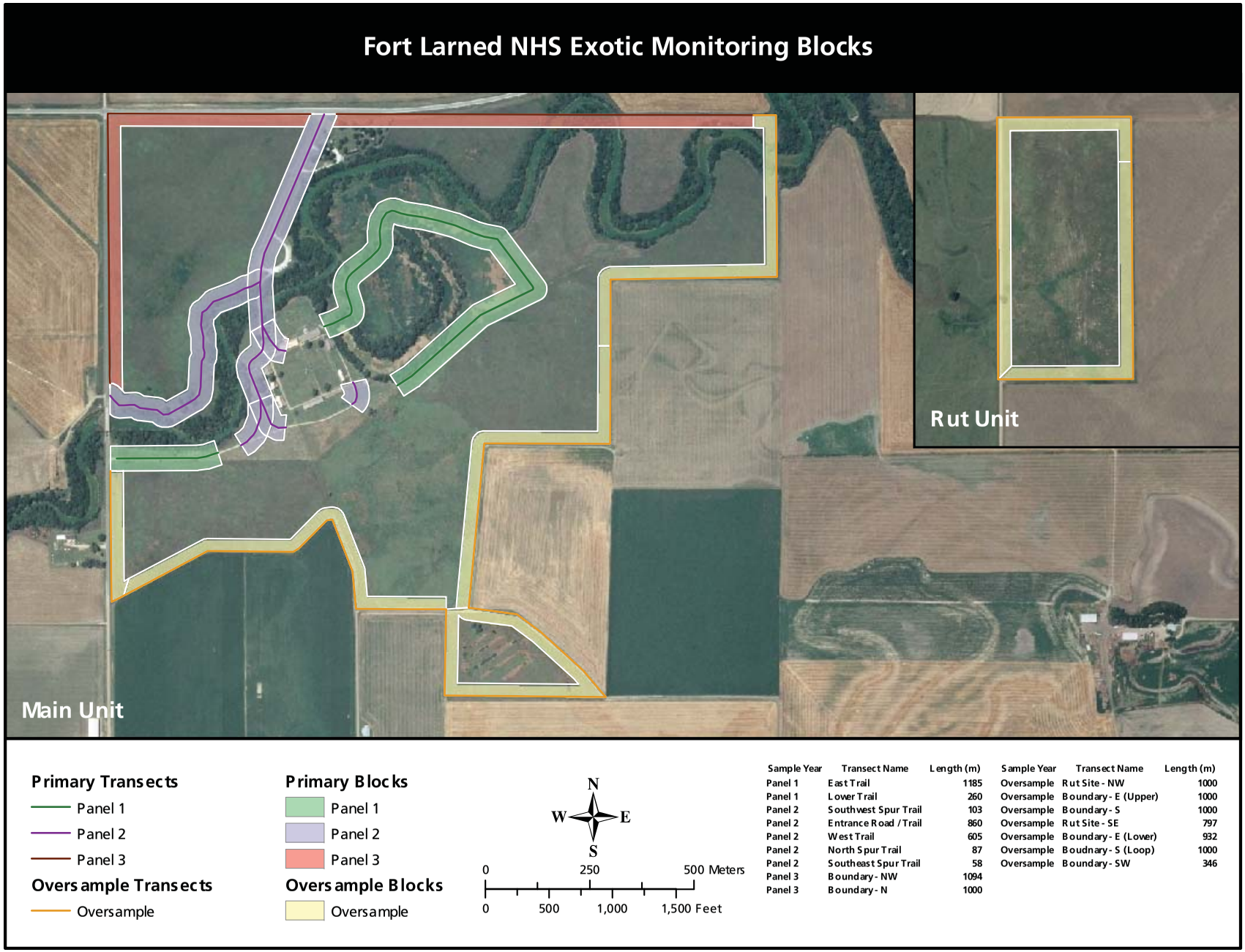


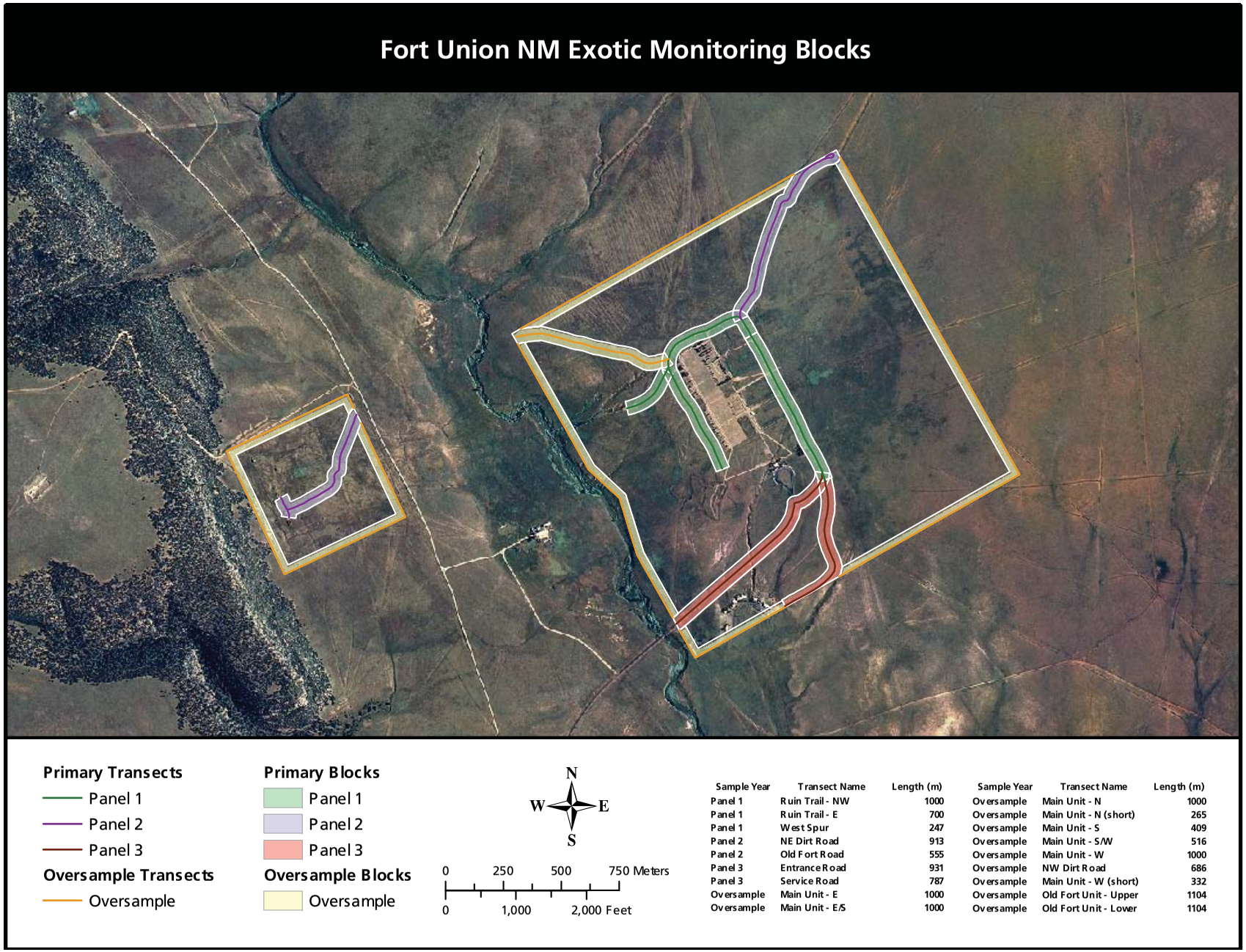
Figure A3-3. Overall planned sampling scheme for panels (annual samples) in the Buckhorn vicinity of Chickasaw NRA for a full three-year rotation.



Sample Year	Transect Name	Length (m)
Panel 1	East Trail	1185
Panel 1	Lower Trail	260
Panel 2	Southwest Spur Trail	103
Panel 2	Entrance Road / Trail	860
Panel 2	West Trail	605
Panel 2	North Spur Trail	87
Panel 2	Southeast Spur Trail	58
Panel 3	Boundary - NW	1094
Panel 3	Boundary - N	1000

Sample Year	Transect Name	Length (m)
Oversample	Rut Site - NW	1000
Oversample	Boundary - E (Upper)	1000
Oversample	Boundary - S	1000
Oversample	Rut Site - SE	797
Oversample	Boundary - E (Lower)	932
Oversample	Boudnary - S (Loop)	1000
Oversample	Boundary - SW	346

Figure A4. Overall planned sampling scheme for panels (annual samples) at Fort Larned NHS for a full three-year rotation.



Sample Year	Transect Name	Length (m)	Sample Year	Transect Name	Length (m)
Panel 1	Ruin Trail - NW	1000	Oversample	Main Unit - N	1000
Panel 1	Ruin Trail - E	700	Oversample	Main Unit - N (short)	265
Panel 1	West Spur	247	Oversample	Main Unit - S	409
Panel 2	NE Dirt Road	913	Oversample	Main Unit - S/W	516
Panel 2	Old Fort Road	555	Oversample	Main Unit - W	1000
Panel 3	Entrance Road	931	Oversample	NW Dirt Road	686
Panel 3	Service Road	787	Oversample	Main Unit - W (short)	332
Oversample	Main Unit - E	1000	Oversample	Old Fort Unit - Upper	1104
Oversample	Main Unit - E/S	1000	Oversample	Old Fort Unit - Lower	1104

Figure A5. Overall planned sampling scheme for panels (annual samples) at Fort Union NM for a full three-year rotation.

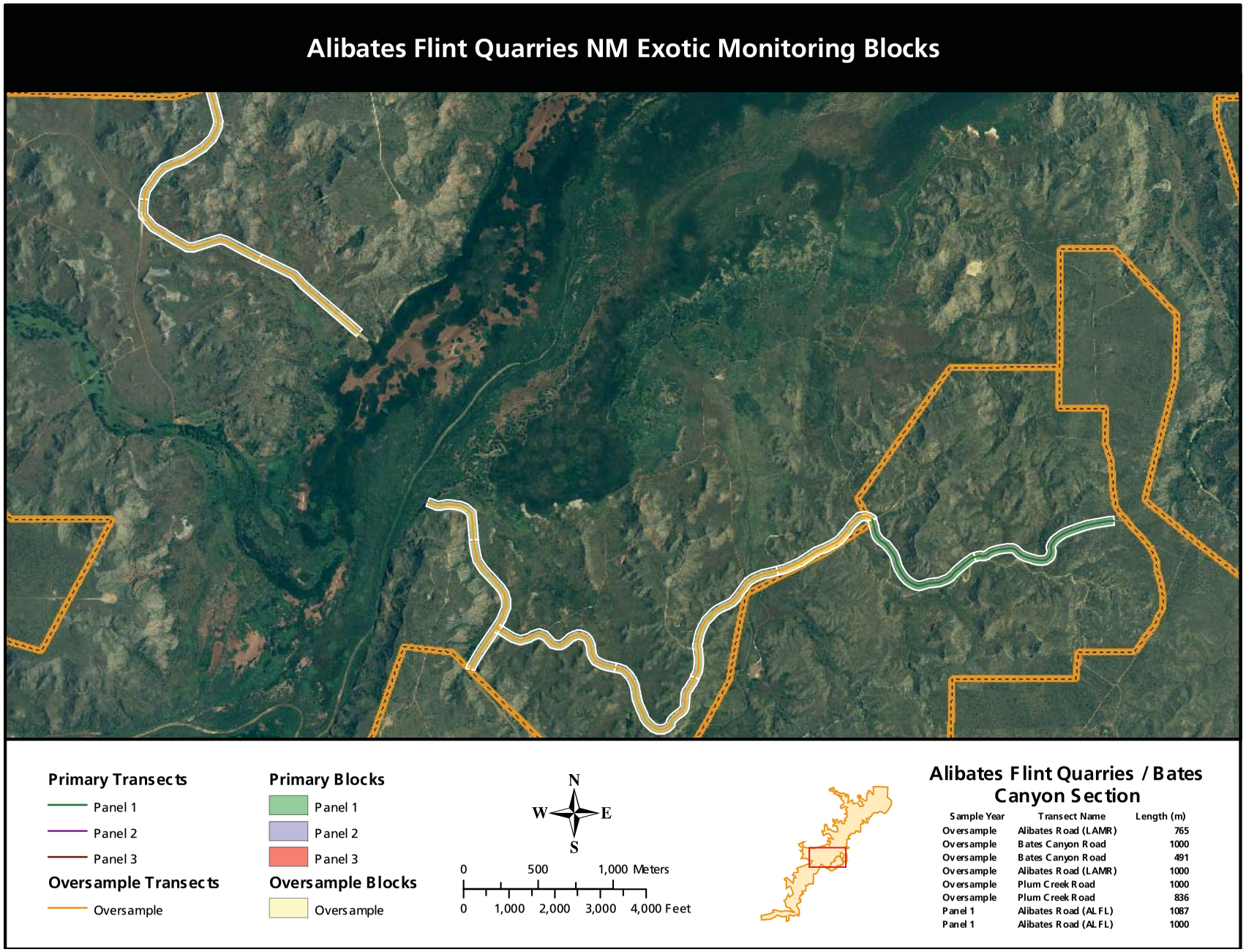


Figure A6-1. Overall planned sampling scheme for panels (annual samples) in the Alibates Flint Quarries NM vicinity for a full three-year rotation.

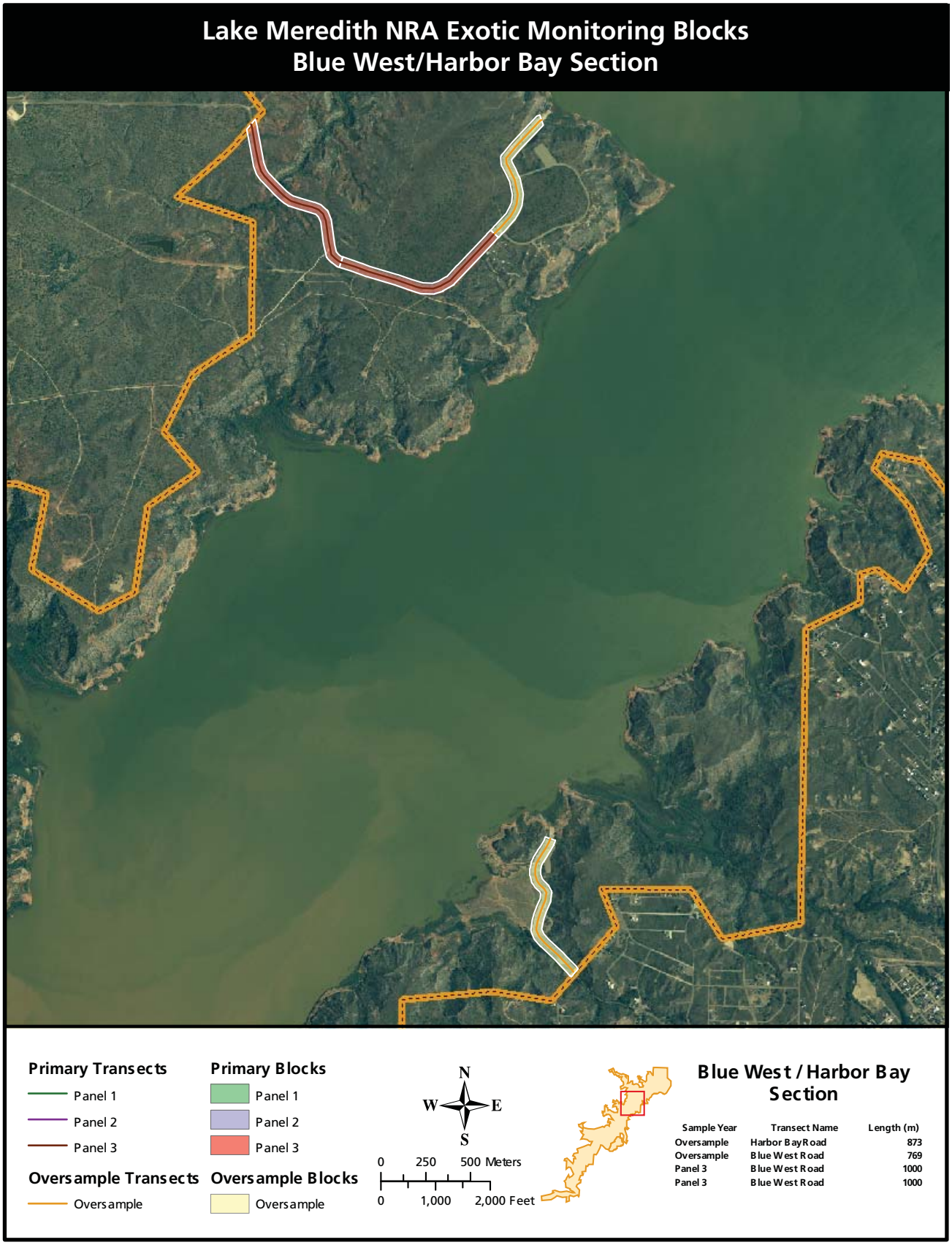


Figure A6-2.Overall planned sampling scheme for panels (annual samples) in the Blue West/Harbor Bay vicinity of Lake Meredith NRA for a full three-year rotation.

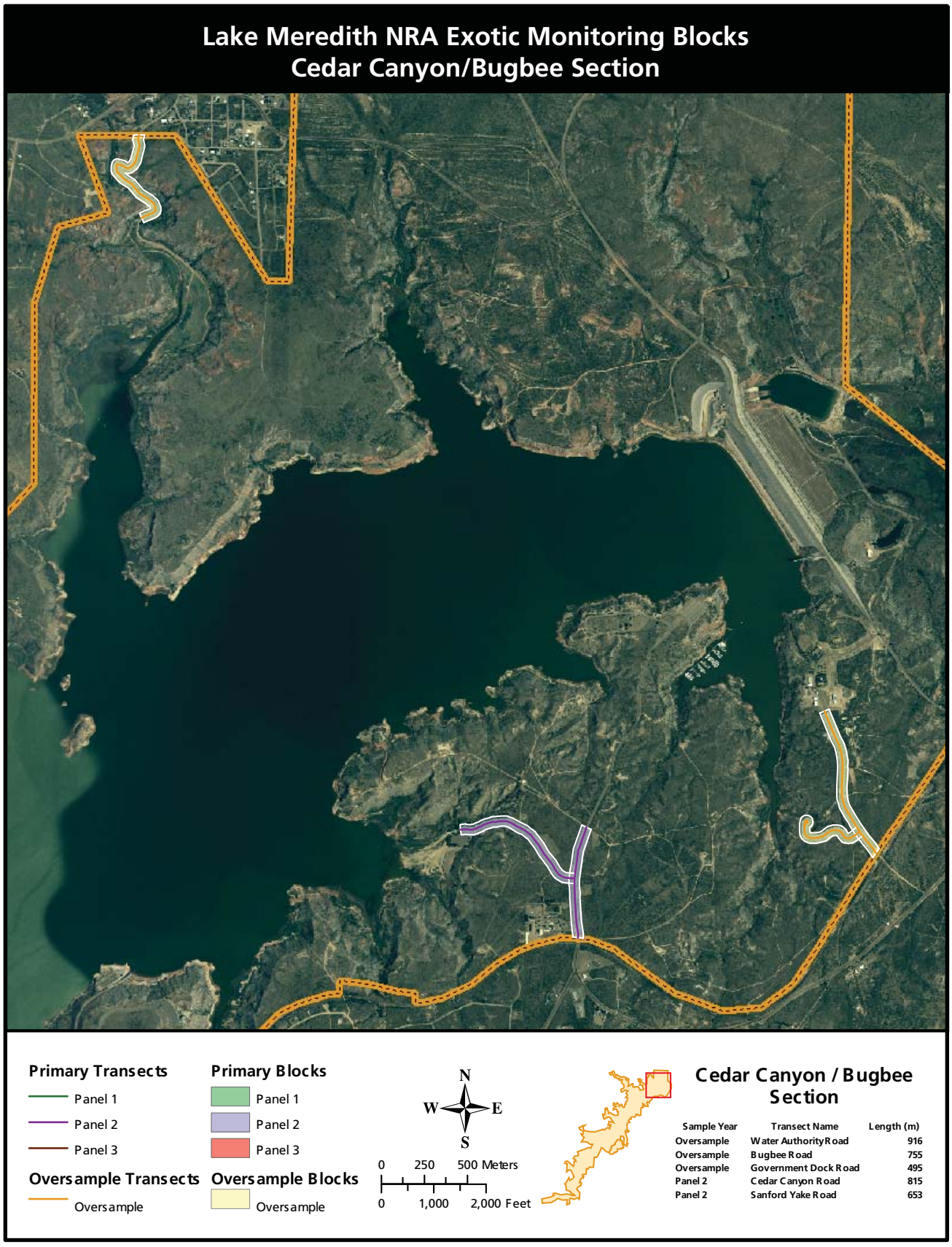


Figure A6-3. Overall planned sampling scheme for panels (annual samples) in the Cedar Canyon/Bugbee vicinity of Lake Meredith NRA for a full three-year rotation.

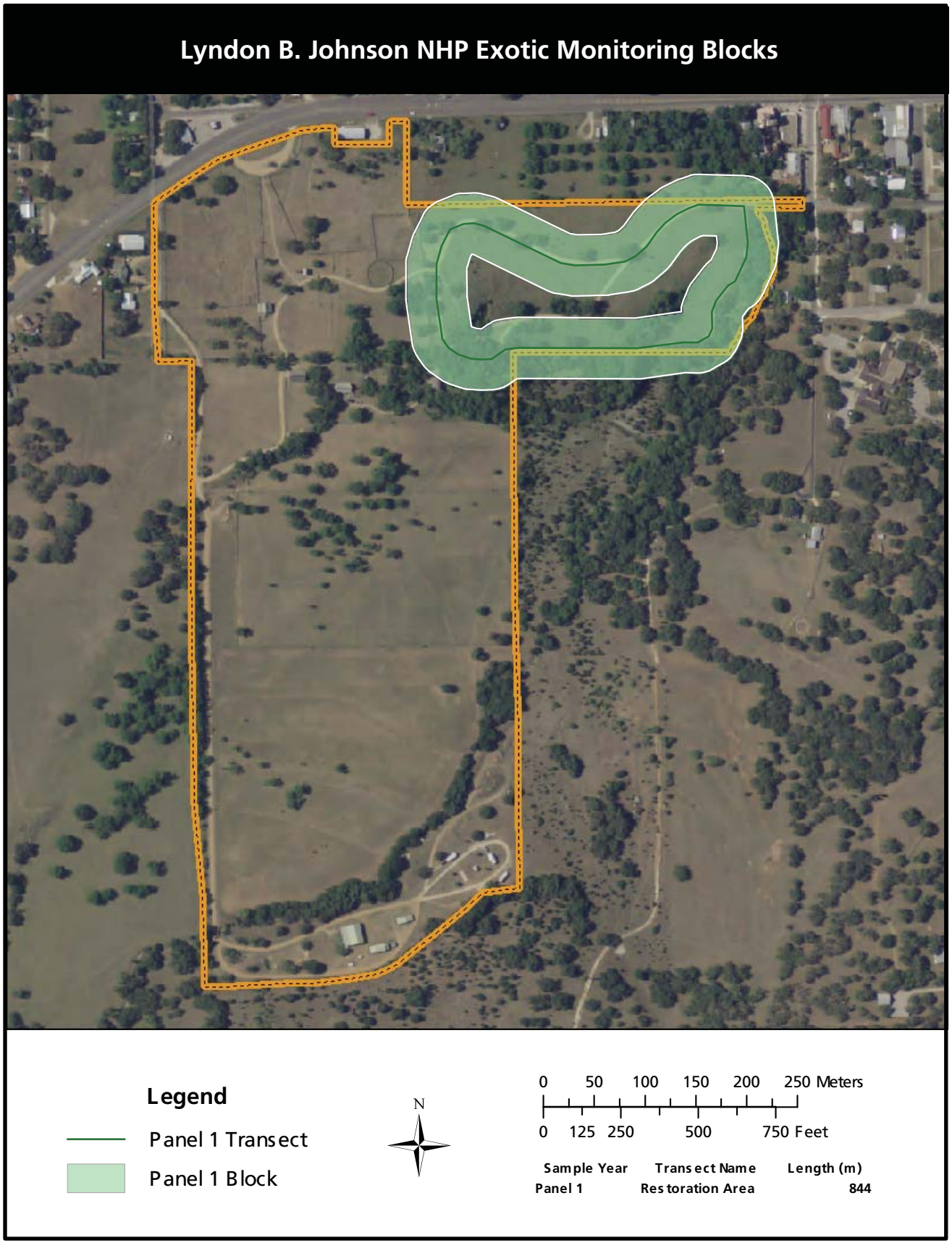


Figure A7. Overall planned sampling scheme for panels (annual samples) at Lyndon B. Johnson NHP for a full three-year rotation.

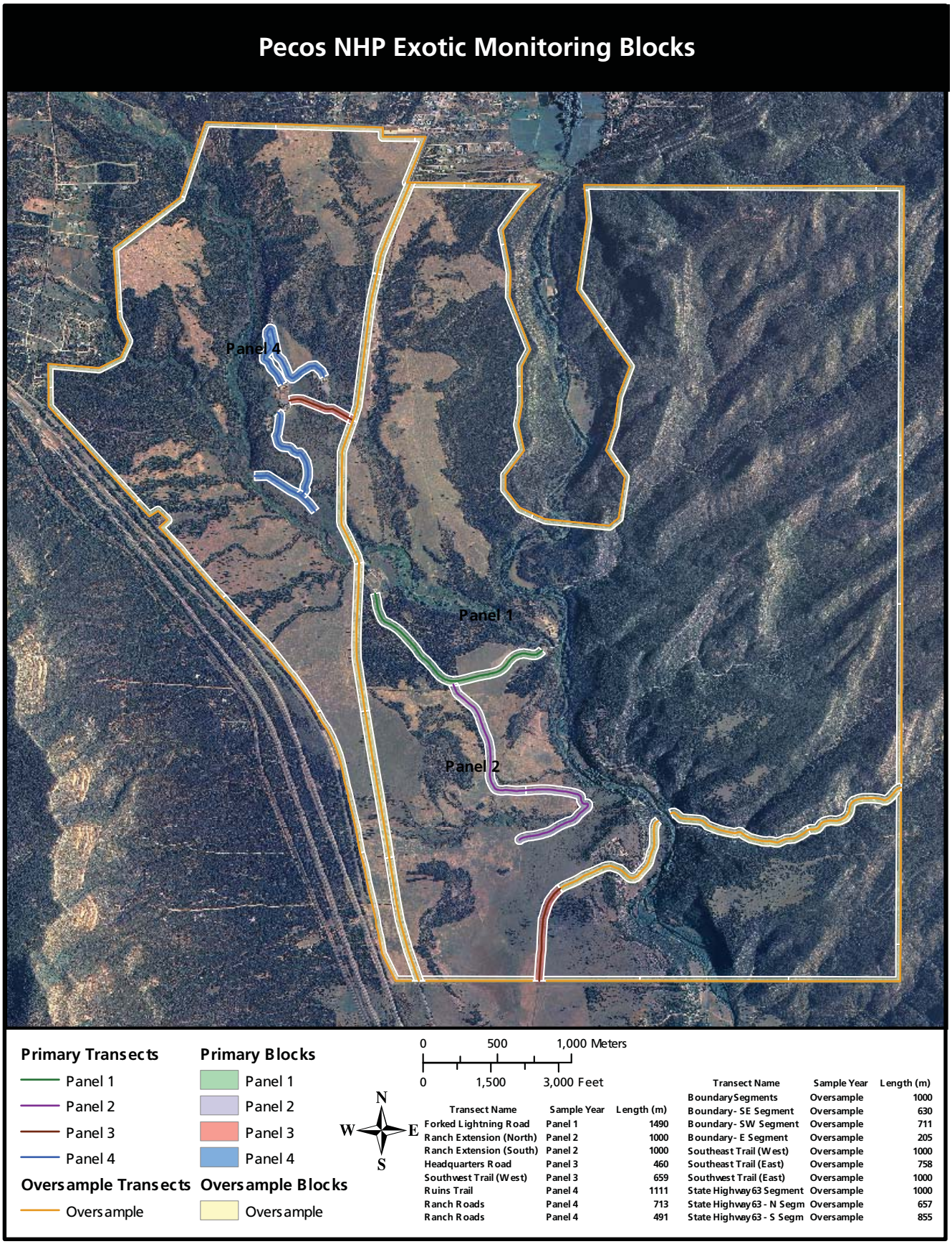


Figure A8. Overall planned sampling scheme for panels (annual samples) at Pecos NHP for a full three-year rotation.

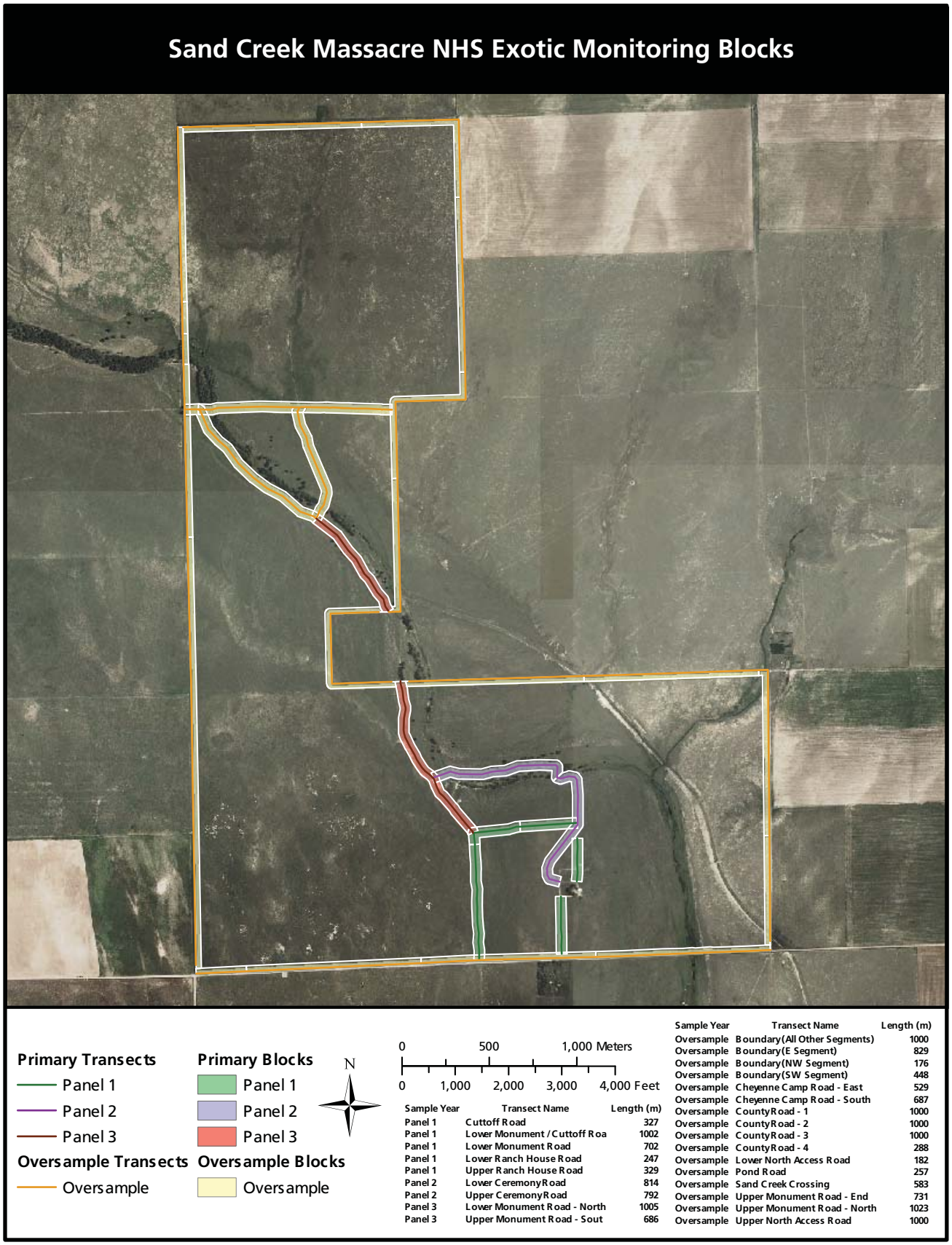


Figure A9. Overall planned sampling scheme for panels (annual samples) at Sand Creek Massacre NHS for a full three-year rotation.

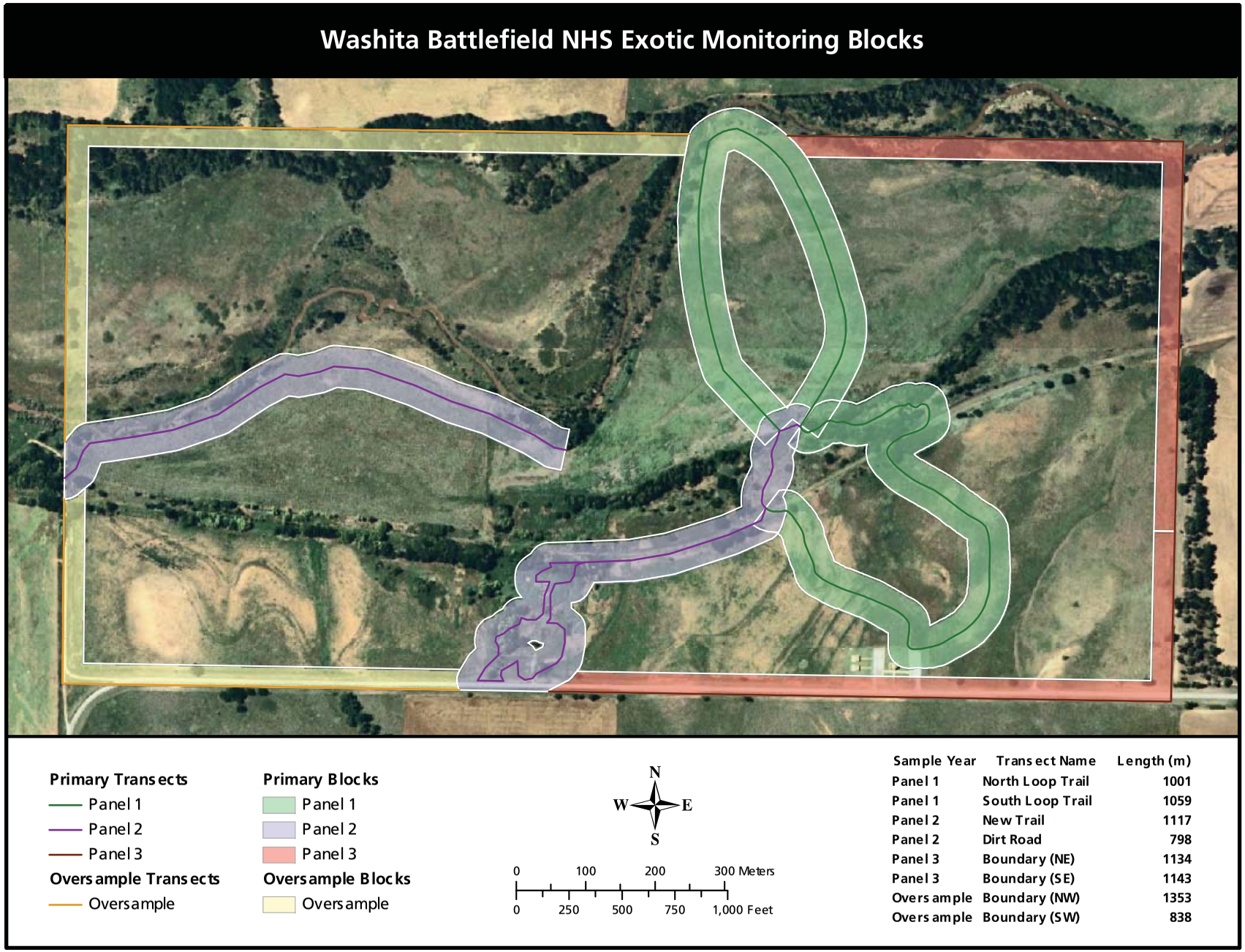


Figure A10. Overall planned sampling scheme for panels (annual samples) at Washita Battlefield NHS for a full three-year rotation.

Appendix B. Supplemental Tables

Table B1. Locations where exotic plant species were observed, Bent's Old Fort NHS, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Amaranthus retroflexus	redroot pigweed	R	28	2	0	0	0
		L	29	1	0	0	0
Bromus arvensis	field brome	L	2	0	2	0	0
		R	2	2	0	0	0
		L	3	1	1	0	0
		R	3	2	0	0	0
		L	4	1	1	0	0
		L	6	0	2	0	0
		R	6	2	2	0	0
		R	7	3	3	0	0
		R	9	2	0	0	0
		R	13	2	0	–	–
		L	16	0	2	0	0
		R	21	0	2	0	0
		L	22	0	3	2	0
		R	22	0	3	0	0
		L	23	0	3	3	0
		R	23	0	2	0	0
		L	24	0	3	3	0
		R	24	0	2	0	0
		L	25	0	3	3	0
		L	26	0	3	3	0
		R	26	2	3	–	0
		L	27	0	3	0	0
		R	27	3	3	0	0
		R	28	3	3	0	0
Cirsium arvense	Canadian thistle	R	10	0	1	1	0
		R	22	0	2	0	0
		R	23	0	2	0	0
		R	24	0	3	0	0
		R	25	0	2	0	0
		R	26	0	1	–	0
		R	27	2	2	0	0
Convolvulus arvensis	field bindweed	L	1	1	1	0	0
		R	1	2	0	0	0
		L	2	1	1	0	0
		R	2	2	0	0	0
		R	3	2	0	0	0
		R	4	1	0	0	0
		R	5	2	0	0	0

Table B1. Locations where exotic plant species were observed, Bent's Old Fort NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Convolvulus arvensis, cont.	field bindweed	R	6	2	0	0	0
		R	9	0	1	0	0
		L	11	2	0	0	0
		R	11	2	0	0	0
		L	12	2	1	0	0
		R	12	3	3	–	–
		L	13	3	0	0	0
		R	13	3	3	–	–
		L	14	2	3	0	0
		R	14	3	3	0	–
		L	15	2	2	0	0
		L	16	1	0	0	0
		R	21	0	2	0	0
		R	22	2	3	0	0
		R	23	2	3	0	0
		R	24	2	3	0	0
		R	25	2	3	0	0
		L	26	1	2	2	0
		R	26	2	3	–	0
		L	27	0	3	0	0
		R	27	3	3	0	0
		L	28	0	2	0	0
		R	28	3	3	0	0
		L	29	0	2	2	0
Eupatorium dentata	toothed spurge	R	23	0	1	0	0
		L	26	0	1	0	0
		R	26	0	1	–	0
		R	27	0	1	0	0
Kochia scoparia	kochia	L	1	3	0	0	0
		R	1	3	3	2	0
		L	2	1	1	0	0
		R	2	3	3	0	0
		L	3	2	0	0	0
		R	3	3	3	0	0
		L	4	2	0	0	0
		R	4	3	3	0	0
		L	5	1	0	0	0
		R	5	3	2	0	0
		L	6	1	0	0	0
		R	6	3	3	0	0
		L	7	1	0	0	0
		R	7	3	3	0	0
		L	8	2	0	0	0

Table B1. Locations where exotic plant species were observed, Bent's Old Fort NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Kochia scoparia, cont.	kochia	R	8	3	3	0	0
		L	9	3	2	0	0
		R	9	3	3	3	0
		L	10	3	2	0	0
		R	10	3	3	2	0
		L	11	2	0	0	0
		R	11	0	3	0	0
		L	12	2	1	3	0
		R	12	2	0	–	–
		L	13	2	0	0	0
		R	13	3	2	–	–
		L	14	2	4	4	0
		R	14	3	2	2	–
		L	15	2	4	4	4
		R	15	3	0	2	–
		L	16	2	0	3	4
		R	16	2	0	0	0
		L	21	2	1	0	0
		R	21	2	2	0	0
		L	22	2	2	1	0
		R	22	0	2	0	0
		L	23	2	0	0	0
		R	23	0	2	0	0
		L	24	3	0	0	0
		R	24	2	3	0	0
		L	25	3	2	0	0
		R	25	3	3	0	0
		L	26	0	2	3	3
		R	26	2	3	–	0
		L	27	1	2	3	0
		R	27	2	3	0	0
		L	28	2	2	0	0
		R	28	3	2	0	0
		L	29	2	3	3	0
Lactuca serriola	prickly lettuce	R	13	0	1	–	–
		R	22	2	2	0	0
		R	23	2	0	0	0
		R	24	0	2	0	0
		R	26	1	0	–	0
Melilotus alba	white sweetclover	R	11	0	1	0	0
		R	12	0	1	–	–
Rumex crispus	curly dock	R	11	0	2	0	0

Table B1. Locations where exotic plant species were observed, Bent's Old Fort NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Salsola tragus	prickly Russian thistle	R	3	1	0	0	0
		L	6	2	0	0	0
		L	7	1	0	0	0
		R	7	1	0	0	0
		L	8	2	0	0	0
		R	10	2	2	0	0
		L	11	2	0	0	0
		R	11	2	2	0	0
		R	12	2	2	–	–
		R	21	0	2	0	0
		R	22	0	2	0	0
Setaria viridis	green bristlegrass	R	1	0	2	0	0
		R	27	1	0	0	0
Tragopogon dubius	western salsify	R	12	0	1	–	–
		R	21	0	1	0	0
		R	26	0	1	–	0
Typha angustifolia	narrowleaf cattail	R	10	0	0	4	0
		R	11	0	0	4	0
		R	21	0	0	3	4
		R	22	0	0	3	4
		R	23	0	0	3	4
		R	24	0	0	3	4
		R	25	0	3	4	4
		R	26	0	0	–	3
		R	27	0	0	4	4
		R	28	0	0	4	4

Table B2. Locations where exotic plant species were observed, Capulin Volcano NM, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Bromus spp.	unidentified bromes	L	1	2	2	2	0
		R	1	2	3	0	0
		L	2	2	2	2	0
		R	2	0	2	3	0
		L	3	2	2	0	0
		R	3	0	2	–	–
		L	4	2	2	3	0
		R	4	0	2	0	0
		L	5	3	3	2	0
		R	5	2	2	0	–
		L	6	2	2	2	0
		R	6	0	2	0	–
		L	7	2	2	2	0
		R	7	2	2	0	–
		L	8	0	3	3	0
		L	9	2	3	3	0
		R	9	2	2	0	0
		L	10	2	2	2	0
		R	10	2	3	3	0
		L	11	0	3	0	0
		R	11	0	3	0	0
		L	12	0	2	3	0
		R	12	2	3	3	0
		R	13	0	2	0	0
		L	14	2	2	0	0
		L	15	1	0	0	0
		L	16	1	0	0	0
		R	16	0	2	0	0
		L	17	0	2	0	0
		R	17	0	2	0	0
		L	18	2	2	0	0
		R	18	0	2	0	0
		L	19	2	2	3	0
		L	20	2	2	3	0
		R	20	2	2	0	0
		L	21	2	2	3	0
		R	21	2	2	2	0
		L	22	1	2	2	0
		R	22	0	2	0	0
		L	23	2	2	3	0
		R	23	1	1	0	0

Table B2. Locations where exotic plant species were observed, Capulin Volcano NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Bromus spp., cont.	unidentified bromes	L	24	2	3	0	0
		R	24	2	2	0	0
		L	25	2	2	2	0
		R	25	2	2	0	0
		L	26	2	2	2	3
		R	26	2	2	0	0
Chenopodium alba	common lambsquarters	L	3	0	1	0	0
		R	3	1	0	–	–
		L	4	0	1	0	0
		R	4	1	0	0	0
		L	5	1	0	0	0
		R	5	1	0	0	–
		R	7	1	0	0	–
		R	8	2	1	0	–
		L	10	1	0	0	0
		R	10	1	2	0	0
		R	11	1	2	0	0
		L	13	0	1	0	0
		L	14	1	0	0	0
		L	15	1	1	0	0
		R	15	0	1	0	0
		L	17	1	1	0	0
		L	18	1	1	0	0
		R	18	1	2	0	0
		L	19	1	1	0	0
		R	19	1	2	0	0
Convolvulus arvensis	field bindweed	L	2	0	0	1	0
Cynoglossum officinale	houndstongue	L	2	1	0	0	0
		L	5	2	2	0	0
		R	5	2	2	2	–
Descurainia sophia	herb sophia	L	2	0	1	0	0
		R	5	1	0	0	–
		L	6	0	2	0	0
		R	6	0	2	0	–
		L	7	2	3	2	0
		R	7	2	2	0	–
		L	8	2	2	2	0
		R	8	2	0	0	–
		L	9	0	2	2	0
		R	9	2	1	0	0
		L	17	1	0	0	0

Table B2. Locations where exotic plant species were observed, Capulin Volcano NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Marrubium vulgare	horehound	R	16	0	2	2	0
		R	17	0	2	2	0
		L	18	0	2	2	0
		L	20	0	2	2	0
		R	21	0	2	0	0
		L	23	0	1	1	0
		R	23	0	2	0	0
		L	24	0	1	0	0
		R	24	0	2	0	0
		R	25	0	2	0	0
Melilotus officinalis	yellow sweetclover	R	5	1	0	0	–
		L	14	1	0	0	0
		R	14	1	0	0	0
		L	16	2	2	0	0
		R	16	0	2	0	0
		R	17	0	2	0	0
		R	18	0	1	0	0
		L	26	2	2	2	0
		R	26	2	0	0	0
Polygonum convolvulus	climbing bindweed	L	5	0	1	0	0
		R	5	1	0	0	–
Salsola tragus	prickly Russian thistle	R	25	0	2	0	0
		L	26	1	0	0	0
		R	26	1	2	0	0
Setaria viridis	green bristlegrass	L	2	1	0	0	0
Sonchus asper	spiny sowthistle	R	5	1	0	0	–
Taraxacum officinale	dandelion	R	3	1	0	–	–
		R	5	2	0	0	–
Tragopogon dubius	western salsify	R	3	2	0	–	–
		R	5	2	0	0	–
		R	6	1	2	0	–
		L	7	1	0	0	0
		R	7	1	0	0	–
		R	8	1	0	0	–
		L	12	0	1	0	0
		R	12	0	1	0	0
		R	14	0	1	0	0
		L	17	1	0	0	0
		R	18	1	0	0	0
		R	22	1	0	0	0
		L	25	1	1	0	0

Table B2. Locations where exotic plant species were observed, Capulin Volcano NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Tragopogon dubius, cont.	western salsify	R	25	2	2	0	0
		L	26	1	0	0	0
		R	26	2	2	0	0
Verbascum thapsus	mullein	L	1	1	0	0	0
		R	1	0	1	2	0
		L	2	1	2	3	3
		R	2	1	1	0	0
		L	3	0	2	2	0
		R	3	1	1	–	–
		L	4	0	2	0	0
		R	4	0	2	2	2
		L	5	2	2	3	0
		R	5	2	2	2	2
		L	6	0	1	0	0
		R	6	0	2	2	–
		L	7	0	2	2	1
		R	7	0	2	2	–
		L	8	2	2	0	2
		R	8	0	2	2	–
		L	9	2	2	2	3
		R	9	0	3	3	3
		L	10	0	1	0	0
		R	10	0	3	3	0
		L	11	0	2	3	0
		R	11	0	2	3	0
		L	12	0	2	3	0
		R	12	0	2	3	0
		L	13	1	2	3	3
		R	13	1	2	3	3
		L	14	1	2	2	3
		R	14	2	2	3	3
		L	15	0	2	2	0
		R	15	0	2	3	3
		L	16	0	2	0	0
		R	16	0	3	3	0
		L	17	0	2	2	0
		R	17	0	3	3	0
		L	18	2	2	3	0
		R	18	0	2	3	0
		L	19	0	3	0	0
		R	19	0	2	3	3

Table B2. Locations where exotic plant species were observed, Capulin Volcano NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Verbascum thapsus, cont.	mullein	L	20	0	2	3	3
		R	20	0	2	3	3
		L	21	0	1	0	0
		R	21	0	2	2	3
		L	22	1	2	3	0
		R	22	0	2	3	2
		L	23	0	2	3	3
		R	23	0	0	2	2
		L	24	0	2	3	3
		R	24	1	2	2	2
		L	25	1	2	2	3
		R	25	0	2	2	2
		L	26	0	2	2	2
		R	26	0	2	0	0

Table B3. Locations where exotic plant species were observed, Chickasaw NRA, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Agrostis gigantea	creeping bentgrass	R	26	1	1	0	–
		R	27	0	1	–	–
Albizia julibrissin	mimosa tree	L	20	1	1	–	–
		L	21	2	2	–	–
		R	21	3	2	–	–
		R	23	1	0	–	–
		L	24	0	1	–	–
		L	26	2	2	–	–
		R	27	1	0	–	–
Bromus japonicus	Japanese brome	L	17	1	0	–	–
		R	17	1	0	–	–
		L	18	1	1	–	–
		R	18	1	0	–	–
		L	22	1	0	–	–
Cynodon dactylon	Bermudagrass	L	22	2	0	–	–
		R	22	1	0	–	–
Cyperus esculentus(?)	yellow nutgrass(?)	L	1	2	1	–	–
		R	1	2	2	–	–
		L	2	1	0	–	–
		R	2	2	1	–	–
		L	3	2	0	–	–
		R	3	2	1	–	–
		L	4	1	0	–	–
		R	4	2	2	–	–
		L	5	1	0	–	–
		R	5	2	1	–	–
		L	6	1	0	–	–
		R	6	2	0	–	–
		L	7	1	0	–	–
		R	7	1	0	–	–
		L	8	1	0	–	–
		R	8	1	–	–	–
		L	9	1	0	–	–
		R	9	1	1	–	–
		L	10	2	0	–	–
		R	10	1	0	–	–
		L	11	2	0	–	–
		R	11	1	1	–	–
		L	12	2	0	–	–
		R	12	1	0	–	–
		L	13	2	–	–	–

Table B3. Locations where exotic plant species were observed, Chickasaw NRA, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Cyperus esculentus(?), cont.	yellow nutgrass(?)	R	13	1	–	–	–
		L	14	2	2	–	–
		R	14	1	1	–	–
		L	15	2	2	–	–
		L	16	3	3	2	–
		R	16	2	2	–	–
		L	17	2	0	–	–
		R	17	2	2	–	–
		L	18	2	0	–	–
		R	18	3	1	–	–
		L	19	2	2	–	–
		R	19	2	2	–	–
		L	20	2	2	–	–
		R	20	2	2	–	–
		L	21	2	2	–	–
		R	21	2	1	–	–
		L	22	2	0	–	–
		R	22	2	2	–	–
		L	23	2	2	–	–
		R	23	2	2	–	–
		L	24	2	2	–	–
		R	24	2	1	–	–
		L	25	2	0	–	–
		R	25	2	1	–	–
		R	26	2	0	0	–
		L	27	2	–	–	–
		R	27	2	0	–	–
		L	28	2	–	–	–
		R	28	1	0	–	–
Echinochloa colona	jungle ricegrass	R	27	1	0	–	–
Erodium cicutarium	redstem storksbill	R	1	1	0	–	–
		R	2	1	0	–	–
		L	11	1	1	–	–
		R	11	1	1	–	–
Eupatorium dentata	toothed spurge	L	13	2	–	–	–
		R	13	2	–	–	–
		L	14	2	2	–	–
		R	14	2	0	–	–
		L	15	2	0	–	–
		R	15	1	0	–	–
		L	16	2	2	0	–

Table B3. Locations where exotic plant species were observed, Chickasaw NRA, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Eupatorium dentata, cont.	toothed spurge	R	16	2	0	–	–
		L	17	2	2	–	–
		R	17	2	0	–	–
		R	20	2	0	–	–
		L	24	2	1	–	–
Lactuca serriola	prickly lettuce	L	1	1	0	–	–
		R	1	1	0	–	–
		L	2	1	0	–	–
Lespedeza cuneata	sericea lespedeza	L	15	1	0	–	–
		L	19	2	0	–	–
		L	23	1	0	–	–
		R	23	1	0	–	–
		R	24	1	0	–	–
		L	26	2	0	–	–
		R	26	1	1	0	–
		L	27	3	3	–	–
		L	28	2	–	–	–
Lonicera japonicus	Japanese honeysuckle	L	13	1	–	–	–
Taraxacum officinale	dandelion	L	26	1	0	–	–
		R	26	0	1	0	–
Tragopogon dubius	western salsify	R	16	1	0	–	–

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Alliaria petiolata	garlic mustard	R	1	0	2	0	0
		R	2	0	2	0	0
		R	3	0	2	0	0
		R	27	0	2	0	0
		L	28	0	2	0	0
		R	28	0	2	0	0
Amaranthus blitoides	prostrate pigweed	L	16	1	0	0	0
		R	16	2	0	0	0
		L	17	2	2	0	0
		R	17	2	0	–	–
		L	18	2	0	0	0
		L	20	2	0	0	0
		L	21	1	0	0	0
		R	21	1	0	0	0
		L	28	0	1	0	0
Amaranthus retroflexus	redroot pigweed	R	2	0	2	1	1
		R	4	0	2	0	0
		R	5	0	2	0	0
		L	9	0	1	0	0
		R	10	0	3	0	0
		L	11	0	0	0	1
		R	11	0	3	2	0
		L	12	0	0	2	2
		R	12	0	1	0	3
		R	13	0	2	0	0
		L	15	0	1	0	1
		L	16	0	1	1	1
		R	16	0	2	0	0
		L	17	0	1	0	0
		L	18	0	2	1	0
		R	18	0	2	0	–
		L	19	0	2	0	0
		L	20	0	0	1	0
		R	21	0	2	0	0
		R	22	0	2	3	0
		R	23	0	0	4	–
		L	24	0	1	1	0
		R	24	2	2	0	0
		L	25	0	3	3	0
		R	25	2	3	2	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Amaranthus retroflexus, cont.	redroot pigweed	L	26	2	3	2	0
		R	26	0	4	4	0
		L	27	2	4	2	0
		R	27	0	3	3	2
		L	28	0	2	2	2
		R	28	0	3	2	0
Bromus inermis	smooth brome	L	1	0	4	4	4
		R	1	0	3	4	4
		L	2	0	4	4	3
		R	2	0	4	4	4
		L	3	0	4	4	–
		R	3	0	4	4	4
		L	4	0	3	3	–
		R	4	3	4	4	4
		L	5	0	4	–	–
		R	5	3	4	4	4
		L	6	0	4	4	–
		R	6	0	4	4	4
		L	7	0	4	–	–
		R	7	3	4	4	4
		L	8	0	4	–	4
		R	8	3	4	4	4
		L	9	0	4	0	4
		R	9	3	4	4	4
		L	10	0	4	4	3
		R	10	3	3	4	4
		L	11	0	2	2	2
		R	11	0	3	4	4
		L	12	0	2	0	4
		R	12	0	2	4	4
		L	13	2	3	4	4
		R	13	2	3	4	4
		L	14	2	4	4	4
		R	14	4	4	4	4
		L	15	2	4	4	4
		R	15	3	4	4	4
		L	16	2	4	4	4
		R	16	3	4	4	4
		L	17	2	4	4	4

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Bromus inermis, cont.	smooth brome	R	17	0	4	–	–
		L	18	0	2	4	4
		R	18	2	4	3	–
		R	19	3	4	4	4
		L	20	2	3	4	4
		R	20	0	4	4	4
		L	21	0	2	0	0
		R	21	0	2	4	4
		L	22	0	2	2	2
		R	22	0	4	4	4
		L	23	0	3	0	0
		R	23	2	3	–	–
		L	24	0	3	3	2
		R	24	3	4	4	0
		L	25	3	4	4	4
		R	25	0	4	4	4
		L	26	4	4	4	4
		R	26	2	4	3	3
		L	27	2	4	4	4
		R	27	3	4	3	0
		L	28	0	2	2	2
		R	28	2	2	0	0
Bromus tectorum	cheatgrass	L	1	0	2	0	0
		R	1	0	3	2	0
		L	2	0	2	0	–
		R	2	0	3	2	0
		L	3	0	2	0	–
		R	3	3	3	0	0
		L	4	0	3	3	–
		R	4	0	2	0	0
		L	5	0	3	–	–
		R	5	2	2	0	0
		L	6	0	3	0	–
		R	6	0	1	2	0
		L	8	0	0	–	3
		L	10	0	2	0	0
		R	10	2	2	0	0
		L	11	0	2	2	2
		R	11	2	4	0	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Bromus tectorum, cont.	cheatgrass	L	12	0	3	4	4
		R	12	2	4	0	0
		L	13	0	2	3	2
		R	13	2	4	0	0
		L	15	0	0	2	2
		R	16	0	2	2	0
		L	17	0	2	2	0
		R	17	3	3	–	–
		L	18	0	3	2	0
		R	18	3	4	3	3
		L	19	0	3	2	2
		R	19	0	2	2	–
		L	20	0	3	2	0
		R	20	2	3	0	0
		L	21	0	3	2	0
		R	21	0	4	3	0
		L	22	0	3	2	2
		R	22	0	3	3	0
		L	23	0	2	0	0
		L	24	0	3	0	0
		L	25	0	3	0	0
		L	26	2	3	0	0
		R	26	0	3	0	0
		L	27	3	3	0	0
		R	27	2	2	0	0
		L	28	0	2	2	2
		R	28	2	0	2	0
Calystegia sepium ssp. *sepium*	hedge bindweed	L	1	0	1	0	0
		L	4	0	1	0	–
		L	18	0	1	0	0
Cannabis sativa ssp. *indica*	hemp	R	22	0	1	0	0
		R	23	0	2	0	–
Capsella bursa-pastoris	shepard's purse	R	10	2	0	0	0
		L	11	2	0	0	0
		R	11	0	2	0	0
		R	12	0	1	0	0
		L	13	2	0	0	0
		R	13	2	3	0	0
		L	14	2	0	0	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Capsella bursa-pastoris, cont.	shepard's purse	R	14	2	0	0	0
		L	17	2	0	0	0
		R	17	2	0	–	–
		L	18	2	0	0	0
		R	18	3	2	0	–
		L	19	2	0	0	0
		L	20	2	2	0	0
		R	20	3	0	0	0
		L	21	0	3	0	0
		R	21	3	0	0	0
		L	22	2	2	0	0
		R	22	3	0	0	0
		L	23	0	2	0	0
		R	23	2	0	0	–
		L	27	3	0	0	0
		L	28	0	2	2	0
		R	28	2	0	0	0
Chenopodium alba	common lambsquarters	L	16	0	1	0	0
		L	17	0	2	0	0
		L	18	0	1	0	0
		L	20	0	2	0	0
		L	22	2	2	0	0
		L	23	1	0	0	0
		R	23	0	1	0	–
		L	24	2	0	0	0
		R	24	1	0	0	0
		R	25	0	2	0	0
		L	26	2	0	0	0
		R	26	2	3	0	0
		R	27	3	2	0	0
		L	28	0	2	0	0
		R	28	2	0	0	0
Cirsium vulgare	bull thistle	L	3	1	1	0	–
Convolvulus arvensis	field bindweed	L	3	2	3	2	–
		L	4	0	2	2	–
		L	6	2	2	2	–
		R	6	1	3	0	0
		R	7	2	3	1	0
		L	11	1	0	0	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Convolvulus arvensis, cont.	field bindweed	R	11	3	3	1	0
		L	13	0	2	2	0
		R	13	2	2	0	0
		L	14	2	2	0	0
		R	14	3	3	0	0
		R	16	3	3	3	0
		R	17	2	2	–	–
		R	18	3	3	0	–
		L	19	0	3	0	0
		R	19	3	3	0	–
		L	20	0	3	0	0
		R	20	3	3	0	0
		R	24	3	3	0	0
		R	25	3	3	3	0
		R	26	3	3	0	0
		L	28	0	1	0	2
		R	28	0	2	0	0
Conium maculatum	poison hemlock	R	1	0	1	0	0
		L	3	0	0	3	–
		R	3	2	2	0	0
		L	4	0	2	2	–
		L	5	0	2	–	–
		L	6	0	0	1	–
		L	7	0	0	–	2
		L	8	0	0	–	3
		L	9	0	0	3	3
		L	10	0	0	0	3
		R	16	1	2	0	0
		L	17	2	2	2	0
		R	17	2	4	4	–
		L	18	0	2	0	0
		R	18	2	4	4	4
		L	19	0	0	0	3
		R	19	0	0	4	4
		L	20	0	0	2	4
		R	20	0	0	0	4
		L	21	0	3	3	4
		R	21	0	0	0	4
		L	22	0	2	3	4

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Conium maculatum, cont.	poison hemlock	R	22	2	4	0	4
		L	23	2	3	3	4
		R	23	4	4	–	–
		R	24	2	4	2	4
		R	25	0	2	3	4
		L	26	2	2	0	0
		R	26	0	3	3	4
		L	27	2	2	0	0
		R	27	2	3	4	3
		L	28	0	2	2	2
		R	28	2	3	3	4
Cynodon dactylon	Bermudagrass	R	1	1	0	0	0
Descurainia sophia	herb sophia	R	3	0	1	0	0
Digitaria sanguinalis	hairy crabgrass	L	6	3	0	0	–
		R	6	3	0	0	0
		L	7	3	0	–	–
		R	7	3	0	0	0
		L	8	3	0	–	0
		R	8	3	0	0	0
		L	9	2	0	0	0
		R	9	2	0	0	0
		R	10	2	0	0	0
		R	11	3	0	0	0
		R	12	2	0	0	0
		L	13	1	0	0	0
		R	13	2	0	0	0
		R	14	2	0	0	0
		L	17	0	1	0	0
		R	25	3	0	0	0
		L	26	3	0	0	0
		R	26	2	0	0	0
		L	27	3	0	0	0
		R	27	2	0	0	0
		R	28	2	0	0	0
Elaeagnus angustifolia	Russian olive	L	24	0	0	0	1
Eragrostis cilianensis	stinkgrass	L	28	0	1	0	0
Kochia scoparia	kochia	L	4	0	2	3	–
		R	6	2	3	0	0
		R	7	0	3	0	0
		R	8	3	3	0	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Kochia scoparia, cont.	kochia	L	9	2	2	0	0
		R	9	3	3	0	0
		L	10	3	3	0	0
		R	10	3	3	0	0
		L	11	3	3	3	0
		R	11	3	4	0	0
		L	12	3	3	0	0
		R	12	3	4	0	3
		L	13	2	2	2	2
		R	13	3	4	0	0
		L	14	2	2	0	0
		R	14	2	0	0	0
		L	15	2	0	2	2
		R	15	2	0	0	0
		L	16	2	0	0	0
		R	16	2	3	3	0
		L	17	3	2	0	0
		R	17	2	3	–	–
		L	18	0	2	0	0
		R	18	3	3	0	–
		L	19	2	2	0	0
		R	19	3	2	0	–
		L	20	2	2	0	0
		R	20	3	2	0	0
		L	21	0	3	2	0
		R	21	3	4	0	0
		L	22	2	2	3	2
		R	22	3	4	0	0
		L	23	1	2	2	2
		R	23	3	3	–	–
		L	24	3	3	3	3
		R	24	3	2	0	0
		L	25	3	2	0	0
		L	26	3	2	0	0
		R	26	3	3	0	0
		L	27	3	2	0	0
		R	27	4	3	0	0
		L	28	2	3	3	2
		R	28	4	4	0	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Lamium amplexicaule	henbit	L	1	2	0	0	0
		R	1	1	0	0	0
		R	2	2	0	0	0
		R	3	2	0	0	0
		L	5	2	0	–	–
		R	6	2	2	0	0
		R	8	2	0	0	0
		L	9	2	0	0	0
		R	9	3	0	0	0
		L	10	3	0	0	0
		R	10	2	0	0	0
		L	11	3	2	0	0
		R	11	3	3	0	0
		L	12	2	2	0	0
		R	12	0	2	0	0
		L	13	3	0	0	0
		R	13	3	0	0	0
		L	14	2	0	0	0
		R	14	2	0	0	0
		L	15	3	0	0	0
		R	15	2	0	0	0
		L	17	0	2	0	0
		R	17	2	3	–	–
		L	18	2	0	0	0
		R	18	3	0	0	–
		R	19	2	0	0	–
		L	20	2	0	0	0
		R	20	2	0	0	0
		L	21	0	3	0	0
		R	21	2	2	0	0
		L	22	0	2	0	0
		R	22	2	2	0	0
		L	23	0	2	0	0
		R	23	2	3	0	–
		L	24	2	0	0	0
		R	24	2	2	0	0
		L	25	2	0	0	0
		L	26	3	0	0	0
		R	26	2	0	0	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Lamium amplexicaule, cont.	henbit	L	27	0	2	0	0
		R	27	3	2	0	0
		R	28	2	0	0	0
Medicago lupulina	black medik clover	L	1	2	0	0	0
		L	2	2	0	0	–
		L	3	2	0	0	–
		L	5	2	0	–	–
		L	7	1	0	–	–
		L	8	2	0	–	0
		L	9	2	0	0	0
		R	9	1	0	0	0
Melilotus officinalis	yellow sweetclover	L	1	0	0	0	2
		R	6	0	0	2	3
		R	7	0	0	0	3
		R	13	0	0	0	4
		R	14	0	0	0	4
		R	15	0	0	0	1
Polygonum arenastrum	prostrate knotweed	L	17	2	0	0	0
		R	17	2	0	–	–
		L	18	3	0	0	0
		R	18	2	0	0	0
		L	19	2	1	0	0
		R	19	3	0	0	–
		L	20	1	0	0	0
		R	23	2	0	0	–
		R	27	2	0	0	0
		L	28	2	0	0	0
		R	28	1	0	0	0
Rumex crispus	curly dock	R	1	0	1	0	0
		R	2	0	1	0	0
		R	4	0	1	0	0
		L	21	0	1	0	0
Setaria viridis	green bristlegrass	L	1	4	0	0	0
		R	1	3	2	2	0
		L	2	4	0	0	–
		R	2	3	2	0	0
		L	3	4	0	0	–
		R	3	3	0	0	0
		L	4	4	0	0	–
		R	4	3	0	0	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Setaria viridis, cont.	green bristlegrass	L	5	4	0	–	–
		R	5	2	0	0	0
		R	6	2	2	0	0
		L	7	2	0	–	–
		R	7	2	0	0	0
		R	8	2	0	0	0
		L	9	2	0	0	0
		R	9	3	0	0	0
		L	10	2	0	0	0
		R	10	3	0	0	0
		L	11	3	0	0	0
		R	11	3	2	0	0
		L	12	4	0	0	0
		R	12	3	3	0	0
		L	13	4	0	0	0
		R	13	3	2	0	0
		L	14	4	0	0	0
		R	14	4	0	0	0
		L	15	4	0	0	0
		R	15	3	0	0	0
		L	16	4	0	0	0
		R	16	3	0	0	0
		L	17	3	0	0	0
		L	18	3	0	0	0
		R	18	2	0	0	–
		R	21	2	0	0	0
		R	22	2	0	0	0
		R	23	2	0	0	–
		R	25	2	0	0	0
		L	26	3	0	0	0
		R	26	2	0	0	0
		L	27	3	0	0	0
		R	27	2	0	0	0
		R	28	2	0	0	0
Sonchus asper	spiny sowthistle	L	1	2	2	0	0
		R	1	2	2	0	0
		R	2	2	2	0	0
		L	3	0	1	0	–
		R	3	1	0	0	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Sonchus asper, cont.	spiny sowthistle	R	5	2	1	0	0
		R	5	2	1	0	0
		L	11	2	0	0	0
		R	11	0	1	0	0
		L	12	0	2	0	0
		L	13	0	2	0	0
		R	14	1	0	0	0
		L	15	0	1	0	0
		L	17	0	2	1	0
		L	18	0	2	0	0
		R	18	3	3	0	–
		L	19	0	1	0	0
		R	19	3	2	0	–
		R	20	2	0	0	0
		L	21	0	2	0	0
		R	21	2	0	0	0
		L	22	0	1	0	0
		R	22	0	2	0	0
		L	23	0	1	0	0
		L	25	2	2	0	0
		R	25	3	2	0	0
		L	26	3	3	0	0
		R	26	2	2	0	0
		L	27	2	3	0	0
		R	27	2	3	0	0
		L	28	0	0	0	2
Taraxacum officinale	dandelion	L	1	3	0	0	0
		R	1	2	2	0	0
		L	2	3	0	0	0
		R	2	3	0	0	0
		L	3	3	0	0	–
		R	3	3	2	0	0
		L	4	3	0	0	–
		R	4	3	0	0	0
		L	5	3	0	–	–
		R	5	3	0	0	0
		L	6	3	0	0	–
		R	6	3	2	0	0
		L	7	3	0	–	–

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Taraxacum officinale, cont.	dandelion	R	7	3	0	0	0
		L	8	3	0	–	0
		R	8	2	0	0	0
		L	9	3	0	0	0
		R	9	2	0	0	0
		L	10	3	0	0	0
		R	10	2	0	0	0
		L	11	2	0	0	0
		R	11	2	0	0	0
		L	12	2	0	0	0
		R	12	2	0	0	0
		L	13	2	0	0	0
		R	13	2	0	0	0
		L	14	3	0	0	0
		R	14	3	0	0	0
		L	15	3	0	0	0
		R	15	2	0	0	0
		L	16	2	0	0	0
		R	16	3	0	0	0
		L	17	3	0	0	0
		R	17	3	0	–	–
		L	18	3	0	0	0
		R	18	3	0	0	–
		L	19	3	0	0	0
		R	19	3	0	0	–
		L	20	3	0	0	0
		R	20	3	0	0	0
		L	21	2	0	0	0
		R	21	3	0	0	0
		L	22	2	0	0	0
		R	22	3	2	0	0
		R	23	1	0	–	–
		L	24	2	0	0	0
		R	24	2	0	0	0
		L	25	2	0	0	0
		R	25	3	0	0	0
		L	26	3	0	0	0
		R	26	4	0	0	0
		L	27	3	0	0	0

Table B4. Locations where exotic plant species were observed, Fort Larned NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Taraxacum officinale, cont.	dandelion	R	27	3	0	0	0
		L	28	2	0	0	0
		R	28	3	0	0	0
Tragopogon dubius	western salsify	L	1	0	2	0	0
		R	1	0	1	0	0
		L	2	0	1	0	–
		R	2	0	2	0	0
		L	3	0	2	1	–
		R	3	0	2	0	0
		L	4	0	2	2	–
		R	4	0	2	1	1
		L	5	0	2	–	–
		R	5	0	2	0	0
		R	15	1	0	0	0
		R	17	0	1	–	–
Tribulus terrestris	puncturevine	L	17	2	0	0	0
		R	17	2	0	–	–

Table B5. Locations where exotic plant species were observed, Fort Union NM, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Brassicaceae species	Mustard species	L	35	1	0	0	0
Chenopodium alba	common lambsquarters	R	2	0	0	2	2
		R	3	0	0	2	0
		R	4	0	0	2	0
		R	8	0	0	1	0
		R	9	1	0	0	0
		R	10	2	2	2	0
		R	11	2	0	0	0
		R	12	2	0	0	0
		R	14	2	0	0	0
		R	15	2	0	0	0
		R	16	2	2	–	–
		R	18	2	0	0	0
		R	19	2	0	1	0
		R	20	0	2	2	0
		R	21	0	2	0	0
		R	22	0	2	2	0
		R	23	0	2	2	2
		R	25	0	0	2	–
		R	26	0	1	0	0
		R	30	0	0	1	0
		L	35	1	0	0	0
		L	36	1	0	0	0
		L	37	2	2	2	0
		L	38	0	2	0	0
Convolvulus arvensis	field bindweed	L	11	2	2	0	0
		L	15	1	0	0	0
		R	15	2	2	0	0
Eupatorium davidii	David's spurge	R	10	0	2	0	0
		R	11	2	0	0	0
		L	17	2	2	0	0
		R	17	2	0	0	0
		L	18	2	2	0	0
		R	18	2	0	0	0
		L	19	0	1	0	0
		R	19	2	0	0	0
		R	20	2	0	0	0
		L	27	1	0	0	0
		R	27	1	0	0	0

Table B5. Locations where exotic plant species were observed, Fort Union NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Eupatorium davidii, cont.	David's spurge	R	29	1	0	0	0
		R	34	1	0	0	0
		R	37	2	2	0	0
		L	38	2	0	0	0
		R	38	2	3	2	0
Kochia scoparia	kochia	L	1	0	3	3	2
		R	1	0	0	2	0
		L	2	0	1	0	0
		R	2	0	0	2	3
		L	3	0	2	0	0
		R	3	0	0	3	2
		L	4	0	2	0	0
		R	4	0	2	2	0
		L	5	0	2	0	0
		R	5	1	2	3	2
		R	6	0	2	2	2
		L	7	0	2	0	0
		R	7	0	0	3	2
		R	8	1	0	2	0
		L	9	1	2	0	0
		R	9	0	2	2	2
		L	10	2	2	2	2
		R	10	2	3	2	2
		L	11	2	3	3	0
		R	11	3	3	3	2
		L	12	1	0	2	0
		R	12	2	2	2	2
		L	13	1	0	0	0
		L	14	0	2	0	0
		R	14	2	0	0	0
		L	15	2	0	0	0
		R	15	0	2	0	0
		L	16	2	2	0	0
		R	16	3	3	–	–
		L	17	2	2	1	0
		R	17	3	2	2	2
		L	18	3	3	2	0
		R	18	3	3	2	0
		L	19	3	2	1	2

Table B5. Locations where exotic plant species were observed, Fort Union NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Kochia scoparia, cont.	kochia	R	19	3	4	0	3
		L	20	3	0	0	2
		R	20	3	4	2	3
		L	21	1	2	0	0
		R	21	3	4	2	0
		L	22	2	1	0	0
		R	22	3	3	2	2
		L	23	2	2	0	0
		R	23	3	3	2	2
		R	24	0	0	2	2
		L	25	1	0	0	0
		R	25	0	0	3	–
		L	26	2	2	2	0
		R	26	2	2	3	2
		L	27	1	0	0	0
		R	27	2	2	3	0
		L	28	2	2	1	0
		R	28	2	2	2	2
		L	29	2	0	0	0
		R	29	0	2	2	2
		L	30	2	0	0	0
		R	30	2	0	2	2
		L	31	2	0	0	0
		R	31	0	1	0	–
		L	32	2	2	0	0
		R	32	2	0	0	2
		L	33	2	1	0	0
		R	33	2	1	0	0
		L	34	0	0	2	0
		R	34	3	2	2	0
		L	35	0	1	0	0
		R	35	1	2	3	2
		L	36	2	0	0	0
		R	36	0	3	3	2
		L	37	2	2	2	2
		R	37	2	2	2	0
		L	38	3	2	3	2
		R	38	2	2	3	2
		L	39	2	0	2	2

Table B5. Locations where exotic plant species were observed, Fort Union NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Kochia scoparia, cont.	kochia	R	39	0	2	–	–
Marrubium vulgare	horehound	R	4	0	0	1	0
		R	5	0	0	2	1
		R	6	0	0	0	1
		R	7	0	0	2	0
		R	8	0	0	0	1
		R	10	0	0	0	1
		R	14	0	0	0	1
		R	15	1	0	0	0
		R	31	0	0	3	–
		R	32	0	0	2	2
Melilotus alba	white sweetclover	R	2	0	0	2	0
		L	4	1	0	0	0
		L	6	2	2	0	0
		R	6	0	1	1	0
		R	7	0	2	2	0
		L	8	1	2	1	1
		R	8	0	1	0	0
		L	9	1	2	3	2
		R	9	0	3	2	0
		L	10	2	1	1	0
		R	10	0	2	0	0
		L	12	1	1	0	1
		R	12	2	2	2	0
		L	13	0	2	1	0
		R	13	2	3	3	0
		L	15	0	1	1	0
		R	15	0	2	3	0
		L	16	0	0	0	1
		R	16	0	2	–	–
		L	20	0	0	2	0
		L	21	0	1	1	0
		R	21	1	0	0	0
		R	23	1	1	0	0
		L	24	1	2	0	0
		R	24	1	0	1	0
		L	27	0	2	0	0
		L	28	0	2	0	0
		R	28	2	2	2	0

Table B5. Locations where exotic plant species were observed, Fort Union NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Melilotus alba, cont.	white sweetclover	L	30	0	1	0	0
		L	31	1	1	0	0
		R	31	0	0	2	–
		L	32	0	1	0	0
		R	32	0	2	2	0
		L	33	0	1	1	1
		L	34	0	0	1	0
		L	35	0	1	0	0
		R	36	0	1	0	0
		L	37	0	0	2	2
		R	37	1	1	0	0
		R	38	0	1	0	0
		R	39	0	2	–	–
Salsola tragus	prickly Russian thistle	L	1	0	2	2	0
		R	1	0	0	2	0
		R	2	0	0	2	0
		R	5	0	0	2	0
		R	10	0	1	0	0
		R	11	2	0	0	0
		R	16	2	2	–	–
		R	17	2	2	0	0
		R	18	2	2	0	0
		R	19	2	2	0	0
		R	22	2	0	0	0
		R	27	1	0	0	0
		R	28	2	2	0	0
		R	32	2	0	0	0
		R	33	0	1	0	0
		R	34	0	1	0	0
		L	35	0	1	0	0
		L	37	2	2	2	0
		L	38	2	2	0	0
		L	39	2	0	0	0
Tragopogon dubius	western salsify	R	5	0	0	1	0

Table B6. Locations where exotic plant species were observed, Lake Meredith NRA and Alibates Flint Quarries NM, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Chenopodium glaucum	oakleaf goosefoot	R	25	1	0	0	0
		L	26	0	2	0	–
		R	26	1	0	–	–
Digitaria sanguinalis	hairy crabgrass	L	2	1	0	0	0
		R	2	2	0	0	0
		R	3	2	2	0	0
		R	6	2	0	0	0
Kochia scoparia	kochia	L	15	3	2	2	0
		R	15	2	0	0	0
		L	16	2	2	2	0
		R	16	2	0	–	–
		L	17	3	2	2	0
		R	17	3	–	–	–
		L	18	2	2	3	0
		R	18	3	3	0	0
		L	19	3	3	2	0
		R	19	3	3	0	0
		L	20	3	2	2	0
		R	20	3	2	0	0
		L	21	3	3	3	0
		R	21	3	2	0	0
		L	22	3	3	3	0
		R	22	2	2	0	0
		L	23	3	3	3	0
		R	23	2	2	0	0
		L	24	2	2	2	0
		R	24	1	0	0	0
		L	25	3	3	0	0
		R	25	2	0	0	0
		L	26	3	3	3	–
		R	26	2	2	–	–
		L	27	3	3	0	0
		R	27	3	2	0	0
		L	28	2	3	3	0
		R	28	2	2	0	0
		L	29	3	3	–	–
		R	29	2	2	0	0
		L	30	2	3	–	–

Table B6. Locations where exotic plant species were observed, Lake Meredith NRA and Alibates Flint Quarries NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Kochia scoparia, cont.	kochia	R	30	2	2	–	–
		L	31	2	3	0	0
		R	31	3	2	0	0
No exotics found	–	R	11	0	–	–	–
		R	12	0	–	–	–
		R	13	0	–	–	–
Salsola tragus	prickly Russian thistle	L	1	2	0	0	0
		R	1	0	1	0	0
		L	2	1	1	0	0
		L	3	1	0	0	0
		L	4	1	0	0	0
		L	6	0	1	0	0
		L	7	2	0	0	0
		L	8	2	0	0	0
		L	10	1	0	0	0
		L	11	2	–	–	–
		L	12	1	–	–	–
		L	13	1	–	–	–
		L	15	2	0	0	0
		R	15	2	0	0	0
		L	30	0	1	–	–
Setaria viridis	green bristlegrass	L	1	1	2	2	0
		R	1	0	2	2	0
		L	2	1	2	2	0
		R	2	0	2	2	0
		L	3	1	2	2	0
		R	3	0	2	0	0
		L	4	0	3	3	2
		R	4	0	2	0	0
		L	5	0	3	2	2
		R	5	0	2	0	0
		L	6	1	2	2	1
		R	6	0	2	0	0
		L	7	1	2	1	1
		R	7	2	2	0	0
		L	8	2	2	2	3
		R	8	2	2	0	0
		L	9	1	2	0	2
		R	9	0	2	2	0

Table B6. Locations where exotic plant species were observed, Lake Meredith NRA and Alibates Flint Quarries NM, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Setaria viridis, cont.	green bristlegrass	R	10	0	1	0	0
		L	13	2	–	–	–
		L	14	2	2	2	–
		R	14	1	0	0	0
		R	20	1	2	2	0
		R	21	1	0	2	0
Taraxacum officinale	dandelion	L	29	1	0	–	–
Tragopogon dubius	western salsify	L	15	0	1	2	0
		L	17	0	1	2	0
		L	20	0	2	2	0
		L	23	0	2	2	0
		L	28	1	0	0	0

Table B7. Locations where exotic plant species were observed, Lyndon B. Johnson NHP, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Bothriochloa ischaemum	K.R. bluestem	L	1	3	3	0	0
		R	1	2	1	–	–
		L	2	3	3	3	0
		R	2	3	2	–	–
		L	3	3	3	3	0
		R	3	3	3	–	–
		L	4	3	3	4	3
		R	4	3	3	–	–
		L	5	4	3	4	3
		R	5	3	3	–	–
		L	6	4	3	4	3
		R	6	3	3	–	–
		L	7	3	3	3	3
		R	7	3	3	–	–
		L	8	3	3	3	3
		R	8	3	3	–	–
		L	9	3	3	3	0
		R	9	3	3	–	–
Bromus japonicus	Japanese brome	L	1	0	3	0	0
		R	1	1	1	–	–
		L	2	0	3	0	0
		R	2	0	1	–	–
		L	4	0	2	0	0
		L	5	0	2	0	0
		R	5	0	2	–	–
		L	6	0	2	0	0
		R	6	1	0	–	–
		R	8	1	0	–	–
		L	9	0	2	0	0
		R	9	2	2	–	–
Centaurea melitensis	Malta starthistle	L	1	0	2	0	0
		L	2	0	2	0	0
		L	7	0	2	0	0
		L	9	0	2	0	0
Cynodon dactylon	Bermudagrass	L	1	3	3	0	0
		L	2	3	2	0	0
		L	3	3	0	0	0
		R	3	2	0	–	–
		L	4	2	0	0	0

Table B7. Locations where exotic plant species were observed, Lyndon B. Johnson NHP, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Cynodon dactylon, cont	Bermudagrass	L	5	3	0	0	0
		L	6	3	0	0	0
		L	7	3	0	0	0
		L	8	3	0	0	0
		L	9	3	0	0	0
Eragrostis barrelieri	Mediterranean lovegrass	L	1	0	2	2	0
		R	1	1	0	–	–
Marrubium vulgare	horehound	L	9	0	2	2	0
Sorghum halepense	Johnsongrass	L	1	0	2	2	2
		R	1	2	3	–	–
		L	2	0	0	0	2
		R	2	0	3	–	–
		L	3	0	0	0	2
		R	3	0	2	–	–
		L	4	0	2	2	0
		R	4	0	2	–	–
		L	5	0	2	0	0
		R	5	0	2	–	–
		R	6	0	2	–	–
		R	7	1	2	–	–
		R	8	2	3	–	–
		L	9	0	2	0	0
		R	9	0	2	–	–
Verbascum thapsus	mullein	L	9	0	0	1	0

Table B8. Locations where exotic plant species were observed, Pecos NHP, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Agropyron desertorum	clustered wheatgrass	L	23	1	0	0	0
		R	23	2	0	0	0
		R	24	2	0	0	0
		R	25	2	2	0	0
Brassicaceae species	mustard species	R	19	1	0	0	0
		R	21	2	2	0	0
		R	26	2	2	2	0
		R	27	0	2	0	0
		R	30	2	2	0	0
Bromus inermis	smooth brome	L	12	1	0	0	–
		R	26	1	0	0	0
		L	27	2	0	0	0
		R	30	2	2	0	0
Bromus species	unidentified bromes	R	18	0	2	0	0
		R	19	3	0	0	0
		R	20	2	0	0	0
		R	22	2	0	0	0
		R	23	2	0	0	0
		R	24	2	0	0	0
		R	25	2	0	0	0
		R	26	2	2	0	0
		L	28	2	2	0	0
		R	29	2	0	0	0
		R	30	1	0	0	0
Chenopodium alba	common lambsquarters	L	4	1	0	0	0
		L	5	1	0	0	0
		L	7	1	0	0	–
		L	12	2	2	0	–
		L	13	1	0	0	–
		L	14	2	1	0	–
		L	16	2	0	0	–
		R	18	2	0	0	0
		R	19	2	2	0	0
		R	26	0	2	0	0
		R	27	0	1	0	0
		L	28	0	2	0	0
		R	29	0	1	0	0
		L	30	0	2	0	0
Cirsium vulgare	bull thistle	R	18	0	1	0	0
		R	20	1	0	0	0
Convolvulus arvensis	field bindweed	L	8	3	2	0	–
		R	8	2	0	0	0

Table B8. Locations where exotic plant species were observed, Pecos NHP, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Convolvulus arvensis, cont.	field bindweed	L	9	2	2	0	–
		R	9	2	2	0	–
		R	10	2	2	2	–
		R	12	2	2	0	0
		R	13	2	0	0	0
		L	25	1	0	0	0
		R	25	1	0	0	0
		L	27	2	2	0	0
		L	30	3	0	0	0
Eragrostis barrelieri	Mediterranean lovegrass	L	13	1	0	0	–
		L	14	1	0	0	–
		L	16	1	0	0	–
		R	18	3	0	0	0
		L	19	1	0	0	0
		R	20	2	0	0	0
		L	21	2	0	0	0
		R	21	2	0	0	0
		L	22	3	0	0	0
		R	22	2	0	0	0
		R	23	2	0	0	0
		L	24	1	0	0	0
		L	25	2	0	0	0
		L	26	2	0	0	0
		L	27	1	0	0	0
Erodium cicutarium	red-stem stork's-bill	R	21	2	0	0	0
Eupatorium davidii	David's spurge	L	12	1	1	0	–
		R	12	1	0	0	0
		L	13	1	0	0	–
		R	13	1	0	0	0
		L	14	1	0	0	–
		R	14	1	0	0	0
		L	22	2	0	0	0
		R	22	2	0	0	0
		R	24	2	0	0	0
		L	25	2	0	0	0
		R	25	2	0	0	0
		R	26	3	0	0	0
		L	27	2	0	0	0
		R	27	0	3	0	0
		L	28	1	0	0	0
Kochia scoparia	kochia	R	3	2	0	0	0
		L	4	2	2	0	0
		L	5	3	0	0	0

Table B8. Locations where exotic plant species were observed, Pecos NHP, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Kochia scoparia, cont.	kochia	R	5	3	3	0	0
		R	6	1	0	0	–
		L	9	0	1	0	–
		R	9	1	0	0	–
		L	12	2	2	0	–
		R	12	1	0	0	0
		L	14	2	0	0	–
		L	16	2	0	0	–
		R	16	1	0	0	0
		L	17	2	0	0	–
		R	17	1	1	0	0
		L	18	2	2	0	0
		R	18	3	2	0	0
		L	19	0	1	0	0
		R	19	3	3	0	0
		R	20	3	2	0	0
		L	21	3	2	0	0
		R	21	3	2	0	0
		L	22	3	2	0	0
		R	22	3	2	0	0
		L	23	3	0	0	0
		R	23	3	0	0	0
		L	24	3	0	0	0
		R	24	3	0	0	0
		L	25	3	2	0	0
		R	25	3	2	2	2
		L	26	2	0	0	0
		R	26	3	2	2	0
		L	27	2	2	0	2
		R	27	2	2	0	0
		L	28	3	2	0	3
		R	28	2	2	2	2
		R	28	0	2	2	2
		L	29	3	2	0	0
		R	29	2	2	2	2
		L	30	2	2	0	0
Lactuca serriola	prickly lettuce	R	21	1	0	0	0
		L	28	1	0	0	0
		R	28	0	1	1	0
		L	29	1	0	0	0
		R	29	1	0	0	0
		R	30	1	0	0	0

Table B8. Locations where exotic plant species were observed, Pecos NHP, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Melilotus alba	white sweetclover	L	1	2	2	–	–
		L	2	1	0	0	–
		R	4	1	0	0	–
		L	13	0	1	0	–
Melilotus officinalis	yellow sweetclover	L	1	2	2	–	–
		L	2	2	0	0	–
		L	3	2	0	1	1
		L	5	2	0	0	0
		R	5	1	0	0	0
		L	7	2	0	0	–
		L	10	2	0	0	–
		L	15	1	0	0	–
		R	18	1	0	0	0
		R	21	1	0	0	0
		L	22	2	0	0	0
		R	22	2	0	0	0
		R	24	1	0	0	0
		R	25	2	0	0	0
		L	26	2	0	0	0
		L	27	1	0	0	0
		R	30	2	0	0	0
No exotics found	–	R	1	0	0	0	0
		R	2	0	0	0	0
		L	6	0	0	0	–
		L	11	0	0	0	–
		R	15	0	0	0	0
Salsola tragus	prickly Russian thistle	L	4	2	0	0	0
		L	5	1	0	0	0
		R	5	2	0	0	0
		R	19	1	0	0	0
		L	20	2	0	0	0
		R	20	2	0	0	0
		L	21	2	0	0	0
		R	21	1	0	0	0
		R	24	1	0	0	0
		L	25	1	0	0	0
		R	25	1	0	0	0
		R	26	1	0	0	0
		R	29	2	2	2	0
		R	30	2	2	0	0
Tragopogon dubius	western salsify	L	1	1	0	–	–
		L	3	2	0	0	–
		L	4	1	0	0	0

Table B8. Locations where exotic plant species were observed, Pecos NHP, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Tragopogon dubius, cont.	western salsify	L	7	1	0	0	–
		R	7	1	0	0	0
		L	8	1	0	0	–
		R	8	1	0	0	0
		L	10	0	1	0	–
		L	13	0	1	0	–
		R	20	0	1	0	0
		R	21	0	1	0	0
		R	23	1	0	0	0
		R	24	1	0	0	0
		R	26	1	0	0	0
		R	28	1	0	0	0
		R	29	1	0	0	0
		R	30	1	1	0	0
Tribulus terrestris	puncturevine	L	16	1	0	0	–
		L	20	2	0	0	0
		L	21	2	0	0	0
		L	22	1	0	0	0
		R	22	1	0	0	0
		L	24	1	0	0	0
		L	25	1	0	0	0
		R	28	1	0	0	0
Verbascum thapsus	mullein	R	3	1	0	0	0
		L	4	1	1	0	0
		R	5	0	1	0	0
		L	10	0	1	0	–
		L	12	0	0	1	–
		L	13	2	2	2	–
		R	13	2	2	0	0
		R	14	0	2	0	0
		L	18	1	0	0	0
		R	21	1	0	0	0
		R	24	0	1	0	0
		R	25	0	2	0	2
		R	26	0	2	0	2
		L	27	0	2	2	0
		R	27	0	2	0	0
		L	28	0	2	2	0
		R	28	1	0	0	0
		L	29	0	2	2	1
		R	29	0	0	0	2

Table B9. Locations where exotic plant species were observed, Sand Creek Massacre NHS, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Bromus arvensis	field brome	R	31	1	0	0	0
		R	32	1	0	0	0
Bromus tectorum	cheatgrass	R	21	0	1	0	0
Buglossoides arvensis	corn gromwell	R	2	0	1	0	0
		R	10	1	0	0	0
		L	12	0	1	0	0
		R	24	0	1	0	0
		R	25	1	0	0	0
		L	26	1	1	0	0
		R	26	1	0	0	0
		L	27	0	1	0	0
Chenopodium alba	common lambsquarters	L	1	2	2	1	0
		R	1	0	2	2	0
		L	2	0	1	1	1
		R	2	0	2	0	0
		R	3	0	1	0	0
		L	4	0	1	0	0
		L	5	0	1	1	0
		R	5	0	1	0	0
		L	9	0	1	1	0
		R	9	0	1	0	0
		L	10	0	2	2	0
		L	12	0	1	0	0
		L	14	0	1	0	0
		R	14	0	1	0	–
		R	21	0	2	0	0
		L	22	0	2	2	0
		R	22	0	2	0	0
		R	23	0	2	0	0
		L	24	0	1	0	0
		R	24	0	2	0	0
		L	25	0	1	0	0
		R	25	0	1	0	0
		L	26	0	1	0	0
		R	26	0	1	0	0
		L	27	0	1	0	0
		L	28	3	2	0	0
		R	28	2	3	0	0
		R	29	2	2	2	0
		L	30	2	2	0	0
		R	30	2	2	0	0
		L	31	0	1	0	0

Table B9. Locations where exotic plant species were observed, Sand Creek Massacre NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Chenopodium alba, cont.	common lambsquarters	R	31	0	2	0	0
		R	32	0	1	0	0
Kochia scoparia	kochia	L	1	2	2	0	0
		R	1	2	0	0	0
		L	2	1	0	0	0
		L	6	0	1	0	0
		R	29	0	3	3	0
		R	30	0	2	0	0
Polygonum arenastrum	prostrate knotweed	R	30	1	0	0	0
Salsola tragus	prickly Russian thistle	L	1	2	2	1	0
		R	1	3	3	0	0
		L	2	1	0	0	0
		R	2	2	2	0	0
		L	3	1	0	0	0
		R	3	2	2	0	0
		L	4	2	2	0	0
		R	4	2	1	0	0
		L	5	2	2	0	0
		R	5	2	2	0	0
		L	6	3	2	0	0
		R	6	1	0	0	0
		L	7	2	1	0	0
		R	7	1	1	0	0
		L	8	2	0	0	0
		R	8	1	0	0	0
		L	9	2	2	0	0
		R	9	2	2	0	0
		L	10	1	1	0	0
		R	10	2	2	0	0
		L	11	2	2	0	0
		R	11	2	2	0	0
		L	12	2	2	0	0
		R	12	2	2	0	–
		L	13	2	2	0	0
		R	13	2	2	0	–
		R	14	0	2	0	–
		L	21	2	2	0	0
		R	21	3	3	0	0
		L	22	2	1	0	0
		R	22	2	2	0	0
		L	23	2	1	0	0
		R	23	3	3	0	0

Table B9. Locations where exotic plant species were observed, Sand Creek Massacre NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Salsola tragus, cont.	prickly Russian thistle	L	24	2	1	0	0
		R	24	2	3	0	0
		L	25	2	1	0	0
		R	25	2	2	0	0
		L	26	2	1	0	0
		R	26	2	3	0	0
		L	27	2	1	0	0
		R	27	2	2	–	–
		R	28	2	3	0	0
		L	29	3	2	0	0
		R	29	2	3	0	0
		R	30	2	2	0	0
		R	31	2	0	0	0
		L	32	1	0	0	0
		R	32	2	0	0	0
Setaria viridis	green bristlegrass	L	21	2	0	0	0
		R	21	2	0	0	0
		R	22	2	0	0	0
		L	23	1	0	0	0
		R	26	2	0	0	0
		R	29	2	2	0	0
		R	30	2	0	0	0
Tragopogon dubius	western salsify	R	3	0	1	0	0
		R	4	0	1	0	0
		R	9	0	1	0	0
		R	13	0	1	0	–
		L	21	0	1	0	0
		R	21	0	1	0	0
		R	22	0	2	0	0
		R	23	0	2	0	0
		R	24	0	0	1	0
		R	26	1	1	0	0

Table B10. Locations where exotic plant species were observed, Washita Battlefield NHS, 2009.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Bothriochloa ischaemum	K.R. bluestem	L	17	1	0	0	0
		R	17	2	2	2	0
		L	18	2	0	0	0
		R	18	2	2	0	0
		L	19	1	0	0	0
		L	21	0	1	0	0
Bromus japonicus	Japanese brome	L	1	1	2	2	–
		R	1	2	3	2	–
		L	2	2	3	3	3
		R	2	2	3	3	–
		L	3	3	3	3	3
		R	3	3	3	2	–
		L	4	3	–	–	–
		R	4	0	3	0	–
		L	5	0	2	–	–
		L	6	2	3	3	–
		R	6	0	3	0	–
		L	7	2	3	2	0
		R	7	3	3	3	3
		L	8	3	3	3	3
		R	8	3	3	3	3
		L	9	2	3	3	3
		R	9	2	2	2	2
		L	14	0	3	3	3
		R	14	3	3	3	3
		L	15	0	3	3	2
		R	15	3	3	3	0
		L	16	0	3	2	2
		R	16	3	3	3	3
		L	17	0	3	3	0
		R	17	3	3	3	3
		L	18	2	2	2	0
		R	18	3	3	3	3
		L	19	0	3	2	0
		R	19	3	3	0	0
		L	20	3	2	2	0
		R	20	3	3	0	0
		L	21	0	2	0	0
		R	21	3	3	0	0
		L	22	2	2	0	0
		R	22	3	3	0	0
		L	23	0	2	0	0
		R	23	3	3	0	0
		L	24	0	3	0	0

Table B9. Locations where exotic plant species were observed, Washita Battlefield NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Bromus japonicus, cont.	Japanese brome	R	24	3	3	0	0
		L	25	0	2	0	0
		L	26	0	2	0	0
		R	26	3	3	0	–
		L	27	0	2	0	0
		R	27	0	2	0	0
		L	28	0	2	0	0
		R	28	1	2	0	–
Cirsium arvense	Canadian thistle	L	22	1	0	0	0
Convolvulus arvensis	field bindweed	R	18	1	1	0	0
Eupatorium dentata	toothed spurge	R	1	1	0	0	–
Kochia scoparia	kochia	L	15	3	3	2	0
		R	15	2	2	2	0
		L	16	3	2	0	0
		R	16	2	2	2	2
		L	17	2	2	0	0
		R	17	0	2	2	0
		L	18	2	0	0	0
Melilotus alba	white sweetclover	L	5	2	–	–	–
		L	9	1	0	0	0
		L	19	1	0	0	0
		R	20	1	0	0	0
		L	21	1	0	0	0
		R	21	1	0	0	0
		R	23	1	0	0	0
		R	24	1	0	0	0
		L	26	2	0	0	0
Melilotus officinalis	yellow sweetclover	L	24	0	1	0	0
No exotics found	–	L	10	0	0	0	0
		R	10	0	0	0	0
		L	11	0	0	0	0
		R	11	0	0	0	0
		L	12	0	0	0	0
		R	12	0	0	0	0
		L	13	0	0	0	0
		R	13	0	0	0	0
Rumex crispus	curly dock	L	1	0	2	3	–
		L	3	0	2	2	2
		R	15	0	1	0	0
Salsola tragus	prickly Russian thistle	L	7	1	1	0	0
		L	8	2	2	0	0
		L	9	0	1	0	0
		L	14	0	1	0	0
		R	14	0	1	0	0

Table B9. Locations where exotic plant species were observed, Washita Battlefield NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Sonchus asper	spiny sowthistle	L	1	0	1	0	–
		L	6	1	1	0	–
		R	7	2	2	0	0
		L	15	2	2	0	0
		R	15	1	0	0	0
		L	16	2	2	0	0
		R	16	1	1	0	0
		L	17	2	0	0	0
		R	17	1	1	0	0
		L	18	2	2	0	0
		R	18	1	1	0	0
		L	19	2	0	0	0
		R	19	1	1	0	0
		L	20	2	2	0	0
		R	20	1	0	0	0
		L	21	0	2	0	0
		L	22	2	0	0	0
		L	23	0	2	0	0
		R	24	0	1	0	0
		L	27	0	2	0	0
		R	27	0	1	0	0
		L	28	1	2	0	0
		R	28	1	1	0	–
Sorghum halepense	Johnsongrass	L	1	0	0	2	–
		L	3	0	0	0	2
		L	6	0	1	0	–
		R	6	0	2	0	–
		L	14	0	1	0	0
		R	14	2	2	0	0
		L	15	0	2	2	2
		R	15	0	2	2	0
		L	16	0	2	2	2
		L	17	0	2	2	2
		R	17	2	2	2	2
		L	18	0	0	0	2
		R	18	0	2	2	2
		L	19	0	0	2	0
		R	19	2	2	0	2
		L	20	0	0	0	2
		R	20	0	1	0	0
		R	21	0	0	2	2
		L	22	0	1	1	0
		R	22	0	0	2	2
		R	23	0	0	0	2

Table B9. Locations where exotic plant species were observed, Washita Battlefield NHS, 2009, cont.

Scientfic name	Common name	Vector side	Vector block	Distance class			
				1	2	3	4
Sorghum halepense	Johnsongrass	R	24	0	0	0	2
		L	25	0	1	0	0
		R	25	0	0	0	2
		L	26	0	0	0	2
		L	27	0	2	2	0
		R	27	0	2	0	2
		L	28	0	2	2	2
Tamarix ramosissima	saltcedar	R	25	0	0	0	1
Tragopogon dubius	western salsify	L	1	1	0	0	–
		R	1	2	2	0	–
		R	2	0	1	0	–
		L	3	0	2	2	0
		R	3	1	1	0	–
		R	4	0	1	0	–
		R	5	0	1	0	–
		L	6	0	1	0	–
		R	6	0	1	0	–
		L	7	0	2	2	0
		R	7	1	0	0	0
		L	8	0	2	0	0
		R	8	0	1	0	0
		L	9	0	1	0	0
		L	17	1	1	0	0
		L	18	2	1	0	0
		R	18	1	1	0	0
		L	19	2	2	0	0
		R	19	1	1	1	0
		L	20	2	2	1	0
		R	20	1	1	0	0
		L	22	1	0	0	0
		R	23	0	1	0	0
		L	28	1	0	0	0
Ulmus pumila	Siberian elm	L	18	0	1	0	0
		L	20	0	1	0	0
		R	20	0	1	0	0
		R	21	0	1	0	0
		L	22	0	1	0	0
		L	23	0	2	0	0
		R	23	0	1	0	0
		L	27	0	2	0	0
		L	28	0	2	0	0
		R	28	0	1	0	–

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