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Vertebrate and Floristic Inventories at Minuteman Missile National Historic Site: 2007 Status Report

Natural Resource Technical Report NPS/NGPN/NRTR—2008/124

ON THE COVER
Swift fox den at Minuteman Missile National Historic Site
Photograph by: Rikk Flohr

Vertebrate and Floristic Inventories at Minuteman Missile National Historic Site: 2007 Status Report

Natural Resource Technical Report NPS/NGPN/NRTR—2008/124

Marcia H. Wilson
National Park Service
Northern Great Plains Inventory and Monitoring Network
231 East Saint Joseph Street
Rapid City, SD 57701

Robert A. Gitzen
University of Missouri
Northern Great Plains I&M Network
231 East Saint Joseph Street
Rapid City, SD 57701

Michael Bynum
National Park Service
Northern Great Plains I&M Network
231 East Saint Joseph Street
Rapid City, SD 57701

September 2008

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

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Please cite this publication as:

Wilson, M. H., R. A. Gitzen, and M. Bynum. 2008. Vertebrate and floristic inventories at Minuteman Missile National Historic Site: 2007 status report. Natural Resource Technical Report NPS/NGPN/NRTR—2008/124. National Park Service, Fort Collins, Colorado.

NPS D-18, September 2008

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Acknowledgements

The NPS personnel at Minuteman Missile National Historic Site, Badlands National Park, and the Northern Great Plains Network Inventory and Monitoring Program supported this survey, particularly M. Herberger, M. Hosking, J. Black, P. Griswold, E. Childers, B. Kenner, J. Brumm, D.Licht, and J. Wrede constructed gopher traps used in this inventory. In addition, R. Griebel from the Wall Ranger District assisted in one morning bird survey. Dan Uresk from USDA Forest Service and B. Smith from Black Hills State University provided helpful insights. We thank D. Backlund (South Dakota Department of Game, Fish, and Parks), R. Griebel (USDA Forest Service), E. Childers (National Park Service) and K. Paintner (National Park Service) for review comments. Carmen Thomson facilitated production of this report.

Introduction

Minuteman Missile National Historic Site (MIMI), established in 1999, is one of the nation's newest national park units. The park consists of two former U.S. military installations: a Launch Control Facility (Delta-01) and a missile silo (Delta-09). Although the park focuses on providing an opportunity for visitors to explore the history of the Cold War, visitors may also encounter a surprising number of plant and animal species. To increase its knowledge about which species are present at MIMI, the park requested that the Northern Great Plains Inventory and Monitoring Network conduct a general biological inventory of the two sites. The objectives of this study were to assess species occurrence of small to medium-sized mammals, birds, and vascular plants as well as to document incidental observations of larger wild mammals, reptiles, and amphibians in and around Delta-01 and Delta-09.

Study Area

Both sites are situated in mixed grass prairies east of Rapid City, South Dakota. The sites are approximately 16 aerial km apart. Delta-01 is located in western Jackson County just north of I-90 at exit 127. The Launch Control Facility is about 2.4 ha in size. It includes several structures as well as two sewage lagoons and a helicopter pad (Fig. 1). The private land surrounding Delta-01 supports two large stock ponds: one east and one west of the site. These water bodies are less than 0.3 km from the facility. The pasture immediately around Delta-01 was grazed by a large herd of horses during the sampling period.

Figure 1. Delta-01 Launch Control Facility at Minuteman Missile NHS.

Delta-09 is located in eastern Pennington County just south of I-90 at exit 116. The Launch Facility is about 0.4 ha in size, has several low profile surface structures above the underground missile silo, and is surrounded by chain-link fence (Fig. 2). At the time of this inventory, it appeared that cattle had grazed the vegetation to a low level (~8cm high) all around the Delta-09 site. Both sites are in a region that has experienced drought conditions since 2000 (E. Childers, National Park Service, personal communication).

Figure 2. Delta-09 Launch Facility at Minuteman Missile NHS.

Methods

Small Mammals

We inventoried mammals during May and early June of 2007. For our primary sampling, we recorded visual observations and we used both folding and non-folding large Sherman live traps (8 x 9 x 23cm) baited with a mix of peanut butter, molasses, and rolled oats. We put polyester batting in traps for insulation. We placed traps in groups throughout vegetated portions of the Delta-01 and Delta-09 sites (Fig. 3). We focused more sampling effort on Delta-01 because it was larger and supported higher habitat diversity. Because of the small size of the sites, we did not use a fixed transect length or distance, but simply spaced clusters of traps within each site and set traps every 5-10 m within each cluster. We placed traps near burrows, potential runways, and other cover objects when available. We trapped throughout the Delta-01 site. No traps were placed in most of the interior of Delta-09, which consisted of packed gravel and little vegetation. During trapping sessions, traps were opened on the first day between 8-11 a.m., left open continuously for 1-4 days, and checked each morning. In addition to this trapping and direct observation, we used a Havahart cage trap and gopher live traps for a few additional trap nights, and attempted to survey larger mammals with infrared digital cameras.

For most captured mammals, we recorded species, sex, weight, tail length, and external reproductive characteristics. We marked individuals with a black marker and released them. Deer mice (*Peromyscus maniculatus)* were distinguished from white-footed mice *(P. leucopus*) by examining tail length (usually ≤70mm in deer mice), hind foot (≤20mm for deer mice), and tail bicolor (usually sharply bicolored in deer mice; Higgins et al. 2000).

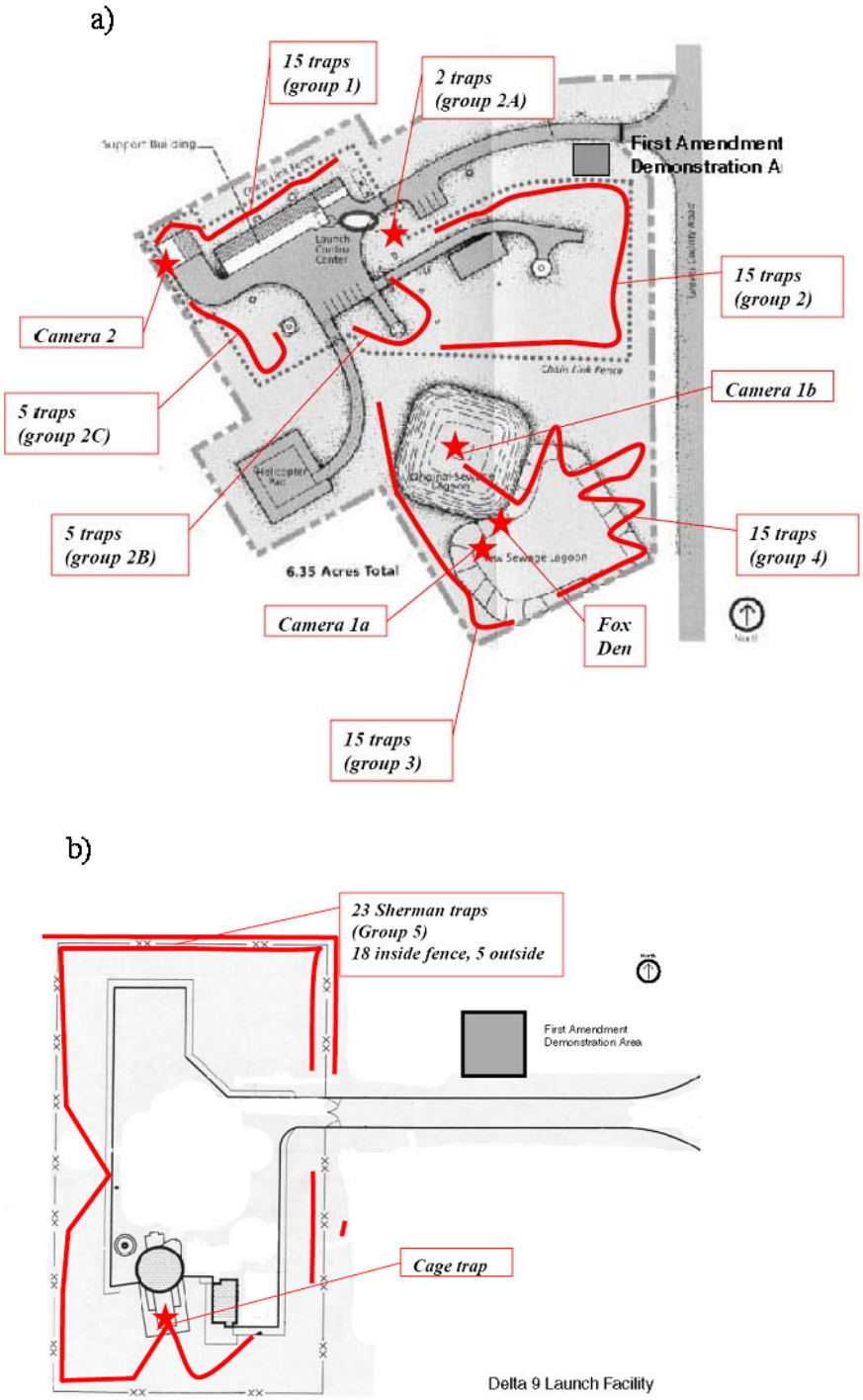

Figure 3. Sampling locations for mammals, reptiles, and amphibians.
a) Delta-01 Control facility (~2.4 ha in size). b) Delta-09 Launch facility (~0.4 ha in size).

Birds

We conducted four early morning bird surveys in 2007: 30-31 May, 6 June, and 20 July. On the last survey, Randy Griebel from the USDA Forest Service office in Wall, South Dakota assisted in one morning inventory. Field observers searched each site and the adjacent area recording all bird species heard or seen. Most birds observed during the inventory, particularly small passerines, were assumed to be breeding in the park or surrounding vicinity, except for wide-ranging species whose nesting needs were not likely to be met in the park (e.g. bank-nesting swallows). In addition, Network staff recorded observations of avifauna while inventorying mammals, herpetefauna, and plants at MIMI.

Reptiles and Amphibians

We relied primarily on direct observations for surveying reptiles and amphibians at both sites within MIMI. After finding a live snake in one of the Sherman live traps, we used traps as cover objects to sample snakes. In between trapping sessions, we left these traps open and accessible to snakes but with back doors open, so that no mammal would be captured. Animals were identified in our Rapid City office; live animals were returned to the site and released.

Vascular Plants

We surveyed the Delta-01 and Delta-09 sites three times during the 2007 growing season to document the occurrence of vascular plant species. Sampling was conducted on May 17, July 11, and September 6, 2007. Species determinations were facilitated by the plant keys and descriptions within the *Flora of the Great Plains* (Great Plains Flora Association 1986), *Plants of the Black Hills and Bear Lodge Mountains* (Larson and Johnson 1999), and *Vascular Plants of Wyoming* (Dorn 2001).

Results and Discussion

Mammals

We recorded six mammal species on the MIMI sites (Tables 1 & 2). At the Delta-01 site, we frequently observed a desert cottontail within the chain-link fence, a feral cat outside of the fence north of the control facility, and swift foxes near a known den on the sewage lagoon bank. The latter species is a state-listed threatened species in South Dakota, and is the most noteworthy element of MIMI's mammalian fauna. Prior to our inventory park staff were aware of this species and had worked with Badlands National Park biologists to photograph it.

During 333 trap nights (one trap opened for one night = 1 trap night), we captured deer mice and a thirteen-lined ground squirrel (Table 3; Fig. 4). Deer mice were present throughout the Delta-09 site (nine mice captured), and within the chain-link fence at the Delta-01 site (six mice captured) – mostly near the support buildings and garage. Based on tail length, hind foot length, tail bicolor, all mice we captured were deer mice rather than white-footed mice. The latter species generally is found in woody habitats, which are absent from the sites. Deer mice are among the most widespread species of North America, and their occurrence on the site was expected. However, captures within the Delta-09 area (which is mostly a gravel pad surrounded by grasslands) were higher than expected.

Table 1. Mammal survey methods during 2007 at Minuteman Missile NHS.

Method	Site	Target fauna	Species observed	Dates	Effort
Sherman live traps	Delta-01	Small rodents, shrews	Deer mice, thirteen-lined ground squirrel	30 May – 1 June; 5 June – 8 June	5 nights * 57-61 traps = 287 trap nights (TN). Includes 29 sprung traps
	Delta-09		Deer mice	30 May – 1 June	2 nights * 23 traps = 46 TN. Includes 3 sprung traps
Gopher live traps	Delta-01	Pocket gophers	None captured	20-21 June	3 traps * 1 night = 3 TN
Large cage trap	Delta-09	Woodrats, rabbits	None captured	30-May – 1 June1	2 nights * 1 trap = 2 TN
Direct observation	Delta-01 Delta-09	Any visible species	Desert cottontail, swift fox, pocket gophers (mounds), domestic cat	30 May – 1 June, 5 June – 8 June, 20 June – 21 June	~1-2 hrs/day (8-1030 am) * 9 days
Remote digital cameras	Delta-01	Medium / large mammals	None; probably system malfunction	Several nights in 3 spots	Systems probably not working properly

Table 2. Mammals observed at Minuteman Missile NHS, May – June 2007.

Scientific Name	Common Name	Unit	Number	Notes
Sylvilagus audubonii	Desert cottontail	Delta-01	~1	Seen most days on lawn near support building
Spermophilus tridecemlineatus	Thirteen-lined ground squirrel	Delta-01	1	Unsure whether more were present. Trap group 2. See trap results
Thomomys talpoides or *Geomys bursarius*	Northern or plains pocket gopher	Delta-01	~1	Near trap group 1; all visits
Peromyscus maniculatus	Deer mouse	Delta-01, Delta-09	15	Trap groups 1, 2, 2C, 5. See trap results
Vulpes velox	Swift fox	Delta-01	1+	Lagoon-bank den. Observed on several mornings
Felis catus	Domestic cat	Delta-01	1	Outside fence; 30 May

Table 3. Summary of mammals captured at Minuteman Missile NHS, 2007. See figures for trap group locations.

Common Name	Date	Unit: Group	Sex	Mass (g)	Tail length (mm)	Hind foot (mm)	Notes
Thirteen-lined ground squirrel	7 June	Delta-01: G2	F				Large nipples / lactating
Deer mouse	31 May	Delta-01: G1	M	23	70	20	Intermediate-sized testes, big adult
			F	20	63	19	Not reproductively active. Caught immediately again in next trap
			F	23	63	18	Medium nipples, probably pregnant
		Delta-09: G5	M	16	60	18	Adult, not reproductively active
	1 June	Delta-01: G1	M		67		Recapture from previous day. Male, probably turning scrotal
			F	17	61	19	Adult. Not reproductively active. Tail bicolor somewhat indistinct
			F				Adult, ran under garage
		Delta-09: G5	M	27	66	20	Adult, scrotal
			F	27	63		Looked like F from yesterday but no mark seen. Adult, medium nipples, pregnant
			F	20	64	19	Adult, medium nipples, pregnant
			F	27	59	18	Adult, medium nipples, pregnant
			M	18			Scrotal; escaped
			M	17	56		Subadult, scrotal
			F		57	17	Subadult, not reproductively active. Wt. 21 but wet, unreliable
			M	22.5	65	20.5	Scrotal, adult
	6 June	Delta-01					No captures
	7 June	Delta-01: 2C	M				Adult, scrotal. No measurements taken

Figure 4. Thirteen-lined ground squirrel captured at Minuteman Missile NHS, June 2007

Active ground squirrel burrows were scattered within the Delta-01 chain-link fence southeast of the support building (e.g., volleyball court). However, we saw no active ground squirrels except for the single lactating female captured once. The Delta-01 site's short-grass lawn and surrounding pastures and grasslands are typical habitat for this species (Higgins et al. 2000). We were surprised at our difficulty in confirming its presence. Despite seeing active burrows, we had no visual observations of this species apart from the single female trapped. This animal was not captured until the 4th day of trapping.

North of the Delta-01 support building, we observed a cluster of recent pocket gopher diggings inside and outside of the fence; however, no gophers were captured in our single trap night focusing on the species. We did not observe other active diggings within sight of these mounds. Based on mound size and number of mounds the site likely supports a single northern pocket gopher, a widespread species in the region. However, further effort with specialized traps is needed to confirm the species (northern vs. plains pocket gopher) present at MIMI. [Note that pocket gophers and ground squirrels are distinct species groups. In some regions, ground squirrels are colloquially referred to as "gophers"; the mascot for the Minnesota Golden Gophers is a thirteen-lined ground squirrel, not a pocket gopher.]

We did not capture anything in the cage trap at the Delta-09 silo apron. We observed no evidence of woodrats, and the structure is far from suitable habitat (cliffs, old buildings). We recorded no clear pictures using remote cameras, and were not confident that the traps were operating in the field.

Lawns and graveled areas comprise much of the Delta-01 and Delta-09 sites. We expected low small-mammal diversity on these small sites. However, the Delta-01 area near the sewage lagoon seemed to provide more suitable habitat for grassland voles, and perhaps other small rodents and shrews. Near the lagoon, we observed old holes or runways of voles or ground squirrels, or from eroded old gopher diggings. However, we recorded no capture of any mammals in the lagoon areas, even though it was the most highly vegetated part of the site. It is plausible that swift fox could locally eradicate small populations of voles or other species around the fox den (D. Uresk, USDA Forest Service, personal communication). Abundance and habitat occupancy of small mammals varies seasonally and annually; other species might be captured if our sampling was repeated in the fall or in another year. We cannot confirm that some species were present but not

detected. However, we saw no clear, recent runways used by voles; most other mice species (e.g., harvest mice) do not avoid traps; and even small shrews often spring large Sherman traps. Moreover, even when they do not spring the trap, small shrews may enter and leave feces in a large Sherman trap (R. Gitzen, personal observation); we did not see any such sign. Given the small size of the lagoon area and our trap effort in this area (150 trap nights over 5 nights), we likely would have detected any resident small mammal species present during our trapping sessions.

Birds

We recorded 29 bird species, including ten species occurring within one or both sites, four species that were observed flying over one site, and 25 species observed in adjacent habitats (Table 4). The most common species found at both sites were species we expected to see such as the killdeer, mourning dove, horned lark, western meadowlark, brown-headed cowbird, and the lark bunting. We often observed these species using the fence, fence posts, or helipad as singing perches.

We found evidence that several of these more common species were breeding, for example:

- Western meadowlark eggs were found near the Delta-09 fence.
- While walking through the short grassy area on the way to the impoundment southeast of Delta-01 we flushed juvenile mourning doves.
- Delta-09 offered suitable nesting habitat for killdeer, which lay their eggs on rocky, barren areas. Indeed two pairs of killdeer were demonstrating behavior characteristic of incubating birds; their defensive behavior indicated that active nests were present.

We detected two landbird species, the lark bunting (Fig. 5) and the grasshopper sparrows (heard just outside of the Delta-09 fence), that have been identified as species of continental importance in the prairie biome (Rich et al. 2004). Although the grasshopper sparrow is still widespread throughout the prairie biome, this sparrow has declined by 50% or more in the past 30 years (Rich et al. 2004).

Figure 5. Male lark bunting (*Calamospiza melanocorys)*. This species is a common breeder in the area and was found at both Minuteman Missile NHS sites, June 2007. Photo by Dan Licht.

Table 4. Bird species detected in and around Minuteman Missile NHS, June – July 2007.

Scientific Name	Common Name	Delta-01	Delta-09
Charadrius vociferus	Killdeer	X	X
Zenaida macroura	Mourning Dove	X	X
Eremophila alpestris	Horned Lark	X	X
Calamospiza melanocorys	Lark Bunting	X	X
Sturnella neglecta	Western Meadowlark	X	X
Molothrus ater	Brown-headed Cowbird	X	X
Sayornis saya	Say's Phoebe	X	
Tyrannus verticalis	Western Kingbird	X	
Turdus migratorius	American Robin	X	
Quiscalus quiscula	Common Grackle	X	
Pelecanus erythrorhynchos	American White Pelican	X (f)	
Chordeiles minor	Common Nighthawk	X **	X
Hirundo rustica	Barn Swallow	X (f)	
Bartramia longicauda	Upland Sandpiper	X**	X**
Tyrannus tyrannus	Eastern Kingbird	X**	X**
Petrochelidon pyrrhonota	Cliff Swallow	X**	X**
Agelaius phoeniceus	Red-winged Blackbird	X**	X**
Branta canadensis	Canada Goose	X**	
Anas discors	Blue-winged Teal	X**	
Anas strepera	Gadwall	X**	
Anas platyrhynchos	Mallard	X**	
Anas acuta	Northern Pintail	X**	
Numenius americanus	Long-billed Curlew	X** (f)	
Lanius ludovicianus	Loggerhead Shrike	X**	
Stelgidopteryx serripennis	Northern Rough-winged Swallow	X**	
Icterus spurius	Orchard Oriole	X**	
Tringa semipalmata	Willet		X (f)
Ammodramus savannarum	Grasshopper Sparrow		X**
Buteo jamaicensis	Red-tailed Hawk	X(f)	

** = reported outside Delta-01 and -09 boundaries

f = flying over

The Delta-01 site and surrounding areas offered diverse habitats, including several permanent wetlands (Fig. 6), grasslands, lagoons, and buildings. Several species, including Say's phoebe, western kingbird, and American robin were seen at the Delta-01 site (Table 4). On June 6, we observed two Say's phoebe attempting to copulate on the roof of the Launch Control Facility building. This species often nests on or near buildings (Tallman et al. 2002). We found a dead barn swallow inside the Delta-01 site near the building, but did not determine the cause of death.

South of Delta-01, there were two impoundments as well as an intermittent stream with Russian olive trees (*Elaeagnus angustifolia*) growing along the stream banks (Fig. 6). Most of the species we observed outside of Delta-01 boundaries were associated with these wetlands. The orchard oriole (we observed adults and a first year male) and the loggerhead shrike were found perched in the Russian olive trees along this stream. In addition, we found a western kingbird nest located about 3 meters high in a Russian olive tree. On the larger impoundment southwest of Delta-01 we observed several species of waterfowl, including a hen mallard with four ducklings (Table 4). We observed Canada geese on the smaller impoundment across the road and southeast from the site.

Likewise, Delta-09 had an impoundment to the northeast along with drainages north and south of the site (Fig. 7). The moist areas associated with both sites attracted several species of swallows and common nighthawks, which were observed feeding on insects over the sites and in the surrounding areas. We observed nests of the cliff swallows under the I-90 bridges at the exits nearest the sites. Several house sparrows (*Passer domesticus*) were also observed on the farm side of exit 116 before the ramp to west I-90.

Although no owls were heard or seen in July, we found a great horned owl feather by the entrance to the Delta-09 gate.

Future surveys at MIMI likely would detect additional species. Our inventories consisted of several partial-day visits during the breeding season. Although these visits coincided with the peak period of detectability among most breeding birds, the list of avian species is not conclusive. Additional surveys by I&M program staff and careful observations by park staff and visitors likely will expand the park species list further.

Figure 6. Aerial photo of Delta-01 and nearby wetlands.

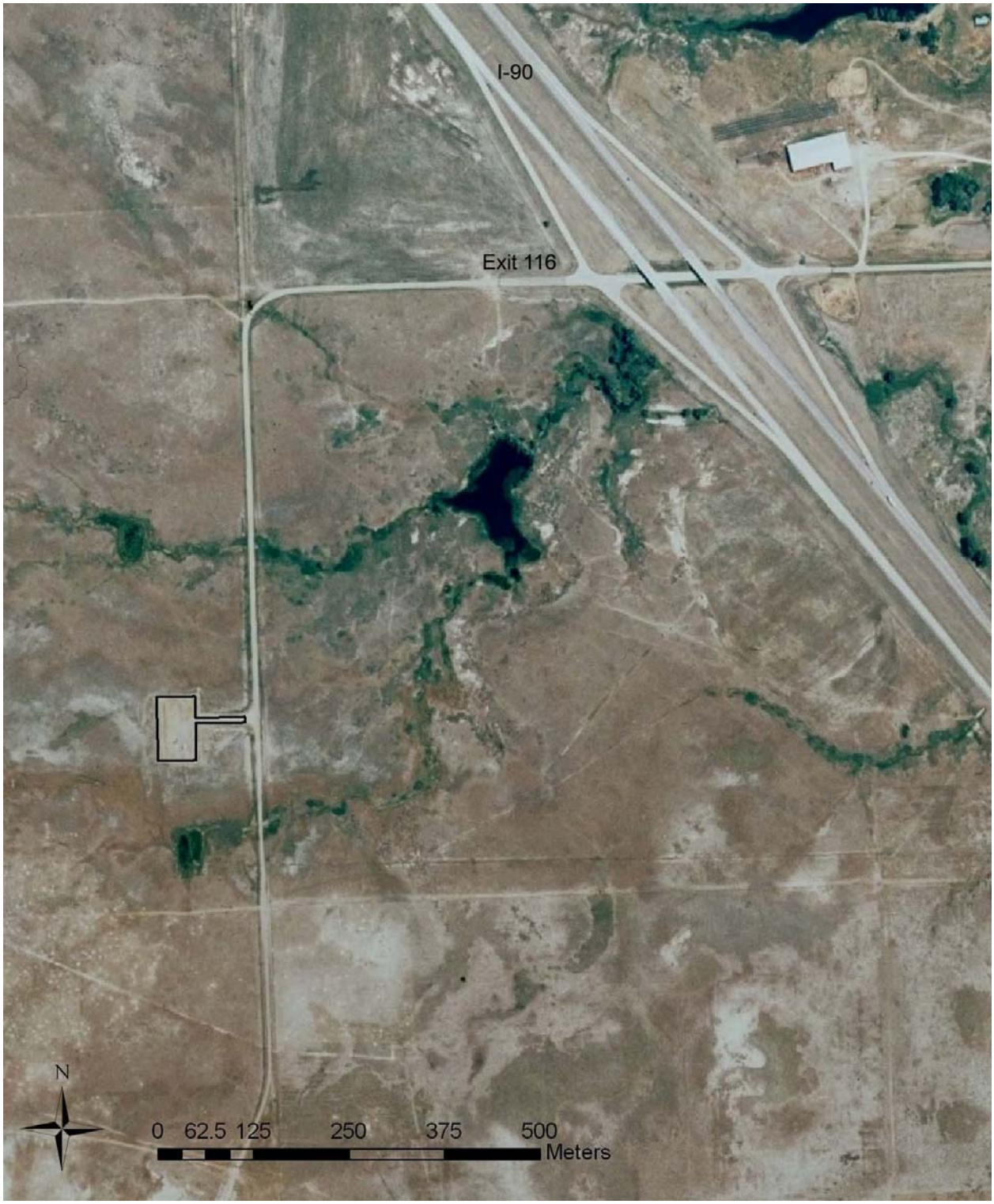

Figure 7. Aerial photo of Delta-09 and nearby wetlands.

Reptiles and Amphibians

We documented three herpetefaunal species (Table 5). At Delta-01, we captured one live gopher snake that had squeezed into a Sherman trap overnight (5 June). No additional snakes were captured in our experimental use of traps as cover objects. At Delta-09 on 21 June, we found two shed skins of gopher snakes: one near a grate on the launch pad, and one near a culvert outside of the fence. Gopher snakes occur throughout South Dakota except in the northeastern part of the state (Kiesow 2006). Even though gopher snakes are constrictors, they will hiss while shaking their tail to mimic rattlesnakes. Unfortunately, these two species are confused with each other.

Table 5. Herpetefauna survey methods during 2007 at Minuteman Missile NHS.

Method	Site	Target fauna	Species observed	Dates	Effort
Direct observation	Delta-01, Delta-09	Any visible species	Great Plains toad (*Bufo cognatus*), painted turtle (*Chrysemys picta*), gopher snake (*Pituophis catenifer*)	30 May – 1 June, 5 June – 8 June, 20 June – 21 June	~1-2 hrs/day (8-1030 am) * 9 days
Sherman traps left open as cover objects	Delta-01	Snakes	Gopher snake	1 June – 5 June; 8 June – 20 June	47 traps 1-5 June; 15 traps 8-20 June
	Delta-09	Snakes	None	8 June – 21 June	10 traps

In the southeast corner of the chain-link fence north of the Delta-01 sewage lagoon, we found one old turtle shell, identified as a painted turtle. We observed two painted turtles on the impoundment southwest of Delta-01. This species of turtle is the most common turtle in the state and is found in permanent water or sometimes in temporary wetlands. Given that painted turtles were observed basking on a log in the impoundment southwest of Delta-01, this might be the source for the turtle found at the Launch Control Facility. Breeding takes place from May to early June with egg-laying in sandy areas in June and hatching in August (Kiesow 2006).

During most visits, we found no amphibians. However, on 20-21 June, we found hundreds of toadlets apparently dispersing across the Delta-01 site (Fig. 8). We took pictures and confirmed them as Great Plains toads with Dr. Brian Smith, Black Hills State University, Spearfish, SD. Spring rains probably stimulated the Great Plains toads to breed in temporary wetlands. The fertilized eggs usually hatch within one week and the tadpoles change into toadlets one month later (Kiesow 2006). Dr. Smith reported that he has not seen this species for several years. Almost all of the ones he has seen have been around the Badlands National Park, suggesting that the Badlands/MIMI region may be important for supporting this species.

Figure 8. Great Plains toadlets from Minuteman Missile NHS, 2007.

Vascular Plants

We identified 110 plant species at MIMI. Of these, 79 species occurred at Delta-01; 73 species occurred at Delta-09; and 42 of these species were found growing at both sites. During the initial survey in May, we recorded 59 plant species at the two sites (Table 6), including one unidentified species ("unknown forb)." As a result, 36 forbs (e.g., Fig. 9), 18 graminoids (sedges and 16 grasses), three cacti, and two subshrubs (the sageworts) were detected. On the second visit, an additional 32 plant species were encountered for the first time at MIMI. One shrub/tree species (Russian olive), 18 forbs, and 13 grasses were observed. In addition, seven species documented on the initial visit at only one of the two sites were encountered at the other site during the second survey.

On the final visit in September, 21 new species were observed on MIMI sites. The majority of these (15) were forbs, while four were grasses, one was a cactus, and one was a shrub/tree species. At the same time, three species previously located at one site or the other, on earlier visits, were found to be growing on a second site.

Figure 9. Scarlet globemallow (*Sphaeralcea coccinea*).The species is a native forb that occurred at both Minuteman Missile NHS sites, and is sometimes called cowboy's delight. Photo from NPS archive by J.W. Stockert, 1973.

At least 75 of the vascular plant species encountered at MIMI are considered to be native to the U.S. (Table 6), including 25 graminoids (e.g., buffalo grass and needleleaf sedge), 45 forbs (e.g., prairie coneflower, slimflower scurfpea, and white heath aster), and four shrubs (i.e., all four species of cacti present at MIMI are native). At the same time, 31 species occurring at MIMI are considered to be introduced and therefore nonnative (e.g., cheatgrass, field bindweed, and Russian olive). Four other species (i.e., dandelions, smooth brome, Kentucky bluegrass, and lambsquarters) may have either native or nonnative origins, depending upon circumstances (see USDA, NRCS 2007).

Appendixes A and B (adapted from Bynum 2007) are provided to supply park personnel with additional information regarding introduced plant species. Appendix A lists species that are considered by law to be regulated pests in South Dakota, or nearby states, and require control efforts. Many of these species are targeted for treatment by the Northern Great Plains Exotic Plant Management Team. Appendix B ranks introduced plant species based on their ability to negatively impact native ecosystems. Species with medium (M) or high (H) ranks may pose special concerns for management.

Table 6. Vascular plant species observed at Minuteman Missile NHS, 2007.

Scientific Name	Delta-01	Delta-09	D*	H*	N*	Common Name
Agropyron cristatum	x**	x**	p	g	i	crested wheatgrass
Allium textile		x	p	f	n	textile onion
Alyssum desertorum	x	x	a	f	i	desert madwort
Amaranthus albus		x**	a	f	n	prostrate (tumble) pigweed
Amaranthus retroflexus	x***		a	f	n	redroot amaranth
Ambrosia artemisiifolia	x**		a/p	f	n	annual (common) ragweed
Ambrosia psilostachya	x***		p	f	n	Cuman (Western) ragweed
Andropogon gerardii	x**		p	g	n	big bluestem
Androsace occidentalis	x		a	f	n	western rockjasmine
Arctium minus	x***		b	f	i	lesser burdock
Aristida purpurea	x**	x**	a/p	g	n	purple threeawn
Artemisia frigida	x	x	p	ss	n	prairie (fringed) sagewort
Artemisia ludoviciana	x**	x	p	f/ss	n	white (cudweed) sagebrush
Atriplex subspicata	x**		a	f	n	saline saltbush (orach)
Bassia scoparia	x	x**	a	f	i	burningbush (kochia)
Bouteloua curtipendula		x	p	g	n	sideoats gramma
Bouteloua dactyloides	x	x	p	g	n	buffalograss
Bouteloua gracilis	x	x**	p	g	n	blue gramma
Brickellia eupatorioides	x**		p	f/s	n	false boneset
Bromus arvensis	x**	x**	a	g	i	field brome (Japanese brome)
Bromus inermis	x		p	g	n/i	smooth brome
Bromus tectorum	x	x	a	g	i	cheatgrass
Calamovilfa longifolia	x		p	g	n	prairie sandreed
Camelina microcarpa		x	a/b	f	i	littlepod false flax
Carex duriuscula	x		p	g	n	needleleaf sedge
Carex vulpinoidea	x		p	g	n	fox sedge
Chamaesyce glyptosperma		x**	a	f	n	ribseed sandmat
Chamaesyce serpens	x***	x**	a/p	f	n	matted sandmat
Chamaesyce stictospora	x***		a	f	n	slimseed sandmat
Chenopodium album	x		a	f	n/i	lambsquarters
Chenopodium berlandieri	x**		a	f	n	pitseed goosefoot
Cirsium undulatum	x**		b/p	f	n	wavyleaf thistle
Convolvulus arvensis	x	x	p	f/v	i	field bindweed
Conyza canadensis	x**	x	a/b	f	n	Canadian horseweed
Dalea spp.		x***	p	f	n	prairie clover
Descurainia sophia	x		a/b/p	f	i	flixweed tansymustard
Distichlis spicata	x**		p	g	n	inland saltgrass
Dyssodia papposa		x**	a	f	n	fetid marigold
Echinochloa crus-galli		x**	a	g	i	barnyard grass
Elaeagnus angustifolia		x**	p	s/t	i	Russian olive
Elymus canadensis	x		p	g	n	Canada wildrye
Elymus elymoides	x		p	g	n	squirreltail
Elymus repens	x		p	g	i	quackgrass
Elymus trachycaulus	x	x	p	g	n	slender wheatgrass
Eragrostis cilianensis		x**	a	g	i	stinkgrass
Eragrostis pectinacea	x***	x***	a/p	g	n	tufted lovegrass
Erysimum asperum		x	b/p	f	n	western wallflower
Escobaria missouriensis	x		p	s	n	Missouri pincushion
Euphorbia marginata		x***	a	f	n	snow on the mountain

Table 6. Vascular plant species observed at Minuteman Missile, NHS, 2007 (continued).

Scientific Name	Delta-01	Delta-09	D*	H*	N*	Common Name
Gaura coccinea	x**		p	f	n	scarlet beeblossom
Grindelia squarrosa	x	x	p	f	n	curlycup gumweed
Gutierrezia sarothrae		x**	p	f/ss	n	broom snakeweed
Hedeoma hispida	x**		a	f	n	rough false pennyroyal
Hordeum jubatum	x**	x**	p	g	n	foxtail barley
Iva axillaris		x**	p	f/ss	n	poverty weed
Koeleria macrantha		x***	p	g	n	prairie Junegrass
Lactuca serriola	x**	x	a/b	f	i	prickly lettuce
Lappula occidentalis	x		a/b	f	n	flatspine stickseed
Lepidium densiflorum	x	x	a/b	f	n	common pepperweed
Lepidium perfoliatum	x**		a/b	f	i	clasping pepperweed
Leptochloa fusca ssp. *fascicularis*		x**	a	g	n	bearded sprangletop
Liatris punctata	x**		p	f	n	dotted blazingstar (gayfeather)
Lomatium foeniculaceum	x	x	p	f	n	desert biscuitroot
Machaeranthera pinnatifida	x***		p	f/ss	n	lacy tansyaster
Medicago lupulina	x	x***	a/p	f	i	black medick
Medicago sativa	x	x	a/p	f	i	alfalfa
Melilotus officinalis	x**	x	a/b/p	f	i	yellow sweetclover
Monroa squarrosa	x***	x***	a	g	n	false buffalograss
Muhlenbergia cuspidata		x	p	g	n	plains muhly
Musineon divaricatum	x	x	p	f	n	leafy wildparsley
Nassella viridula	x**	x**	p	g	n	green needlegrass
Opuntia fragilis	x***		p	s	n	brittle pricklypear
Opuntia macrorhiza	x	x	p	s	n	twistspine (bigroot) pricklypear
Opuntia polyacantha		x	p	s	n	plains pricklypear
Oxalis dillenii	x		p	f	n	yellow (grey-green) woodsorrel
Panicum capillare		x**	a	g	n	common witchgrass
Panicum hallii var. *hallii*		x***	p	g	n	Hall's panicgrass
Pascopyrum smithii	x	x	p	g	n	western wheatgrass
Pediomelum argophyllum		x**	p	f	n	silverleaf scurfpea
Physalis longifolia	x***		p	f	n	longleaf groundcherry
Plantago patagonica	x	x	a	f	n	wooly plantain
Poa compressa		x	p	g	i	Canada bluegrass
Poa pratensis	x	x	p	g	n/i	Kentucky bluegrass
Polanisia dodecandra ssp. *trachysperma*		x***	a	f	n	sandyseed clammyweed
Polygonum aviculare		x**	a/p	f	i	prostrate knotweed
Polygonum convolvulus		x**	a	f/v	i	climbing buckwheat (black bindweed)
Polygonum erectum	x		a	f	n	erect knotweed
Polygonum lapathifolium		x	a	f	n	curlytop knotweed
Portulaca oleracea	x***	x***	a	f	i	common purslane
Potentilla recta	x		p	f	i	sulphur cinquefoil
Psoralidium tenuiflorum	x	x	p	f	n	slimflower scurfpea
Ratibida columnifera	x	x	p	f	n	prairie coneflower
Rumex crispus	x**	x	p	f	i	curly dock
Salsola kali	x		a	f	i	Russian thistle
Schedonnardus paniculatus		x**	p	g	n	tumblegrass
Setaria viridis	x***	x	a	g	i	green bristlegrass

Table 6. Vascular plant species observed at Minuteman Missile, NHS, 2007 (continued).

Scientific Name	Delta-01	Delta-09	D*	H*	N*	Common Name
Sisymbrium altissimum	x		a/b	f	i	tall tumblemustard
Solidago missouriensis		x***	p	f	n	Missouri goldenrod
Sonchus arvensis ssp. *uliginosus*		x***	p	f	i	perennial (moist) sowthistle
Sonchus asper		x***	a	f	i	spiny sowthistle
Sphaeralcea coccinea	x	x	b/p	f	n	scarlet globemallow
Sporobolus cryptandrus	x	x	p	g	n	sand dropseed
Symphyotrichum ericoides	x	x	p	f	n	white heath aster
Taraxacum officinale	x	x	p	f	n/i	common dandelion
Tragopogon dubius	x	x	a/b	f	i	yellow salsify
Tribulus terrestris	x***	x***	a	f	i	puncturevine
Ulmus pumila	x***		p	s/t	i	Siberian elm
unknown forb		x		f		
Urtica dioica		x***	p	f	n	stinging nettle
Verbena bracteata	x		a/b/p	f	n	bigbract (prostrate) verbena
Vicia americana		x	p	f/v	n	American vetch
Vulpia octoflora	x	x	a	g	n	sixweeks fescue

Species occurrences: x = first recorded on May 17, 2007; x** = first recorded on July 11, 2007, x*** = first recorded on September 6, 2007, *D = Duration: a—annual, b—biennial, p—perennial; H = Habit: f—forb, g—graminoid, s—shrub, ss—subshrub, t—tree, v—vine; N = Nativity: i—introduced in the U.S., n—native to the U.S. Scientific names and duration, growth habit, and nativity designations for Table 1 were derived from the PLANTS Database (USDA, NRCS 2007).

Recommendations

Future Sampling

Although MIMI encompasses two small sites, additional sampling in these areas could capture more species not present during our surveys. In particular, we recommend that the following be considered:

- If the pocket gopher remains active on the site, a small amount of trapping with specialized traps could confirm its species. If any gophers are found dead by park staff, the NGPN I&M program should examine the specimen to identify species.
- Additional Sherman trapping in the lagoon area during other seasons and years could document other small mammals on Delta-01 that may not have been present during our short-term sampling. In addition, use of pitfall traps in the lagoon area would more effectively sample shrews (e.g. Kirkland and Sheppard 1994) and small pocket mice (D. Backlund, South Dakota Department of Game, Fish and Parks, personal communication) if they occupy this area. Because of overlap in external characteristics of small shrews (such as *Sorex haydenis* vs. *S. cinereus*), any shrew captured should be identified by museum experts.
- We captured no house mice or Norway rats on the sites, but either could occur. If any mice with naked (hairless) tails are captured in the buildings, the specimen could be frozen and park staff should contact I&M.

- If water is present in the sewage lagoon during summer, it could be used by feeding bats. If park staff observes bats using the site or buildings, they could notify I&M. Evening surveys during June-mid-September could document bats using the sites, but specialized techniques would be necessary to confirm species.
- Park staff can continue to expand the certified species list for the site by recording observations and discussing them with I&M. This would be especially useful for reptiles and amphibians, which may be visible during only parts of the year or may be on sites only temporarily. Observations of species other than gopher snakes would be valuable if documented with photos or careful descriptions.
- Given that I&M staff only surveyed the avifauna during the breeding season, we would recommend that avian surveys also be conducted in the early spring/fall for migrating birds (especially with the wet areas just south of Delta-01) and in the winter to determine which species are resident.
- Early spring through early summer months would be a good time to set out digital recordings to determine if other frogs/toads are present.

Management Recommendations

- The heavily disturbed, historical conditions at MIMI provide little suitable habitat for most mammals. However, by maintaining higher vegetation cover in the lagoon area, the site could attract additional species characteristic of surrounding grasslands, particularly voles (*Microtus* spp.), possibly other mice (harvest mice [*Reithrodontomys*] or pocket mice [*Perognathus* spp. and *Chaetodipus hispidus*]), and possibly *S. haydeni* or other grassland shrews.
- Presence of deer mice within buildings should be discouraged, and any accumulations of dried feces in the building should be treated with bleach due to concerns about hantavirus. The I&M Office can provide literature about this disease.
- Caution should be used when walking the gravel areas of both Delta-01 and Delta-09 sites to avoid stepping on killdeer eggs. Less caution is needed after eggs hatch. The young are very precocial and capable of running right after hatching.
- Despite the low diversity of breeding avifauna observed directly using the sites, the surrounding habitats increase the number of potential species, providing a good diversity of species overall for observation. Checklists for local birds, mammals, amphibians, reptiles and vascular plants would enhance the visitor experience.
- Park personnel are encouraged to seek advice from the Northern Great Plains Exotic Plant Management Team or the Inventory and Monitoring Network regarding the control of nonnative plant species. The presence of species such as cheatgrass or sulphur cinquefoil may pose a treat to the integrity of local grasslands (see Appendix B).

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Appendix A. State-listed Noxious Weeds or Regulated Nonnative Plant Species. Highlighted species are of concern in South Dakota.

Scientific name **(common name) and CODE**	**STATE**			
	NE	**ND**	**SD**	**WY**
Acroptilon repens (Russian knapweed) ACRE3		✓	✓	✓
*Ambrosia tomentosa*** (skeletonleaf bursage) AMTO3				✓
Arctium minus (common burdock) ARMI2				✓
Artemisia absinthium (absinth wormwood) ARAB3		✓		
Cardaria draba (hoary cress, whitetop) CADR			✓	✓
Cardaria pubescens (hoary cress, whitetop) CAPU6				✓
Carduus acanthoides (plumeless thistle) CAAC	✓		✓*	✓
Carduus nutans (musk thistle) CANU4	✓	✓	✓*	✓
Centaurea diffusa (diffuse knapweed) CEDI3	✓	✓	✓*	✓
Centaurea solstitialis (yellow starthistle) CESO3		✓	✓*	
Centaurea maculosa[+] (spotted knapweed)	✓	✓	✓*	✓
Chondrilla juncea (rush skeletonweed) CHJU			✓*	
Cirsium arvense (Canada thistle) CIAR4	✓	✓	✓	✓
Convolvulus arvensis (field bindweed) COAR4		✓	✓*	✓
Crupina vulgaris (common crupina) CRVU2			✓*	
Cuscuta (dodder) CUSCU			✓*	
Cynoglossum officinale (houndstongue) CYOF				✓
Elaeagnus angustifolia (Russian olive) ELAN				✓[1]
Elymus repens (quackgrass) ELRE4				✓
Euphorbia esula (leafy spurge) EUES	✓	✓	✓	✓
Euphorbia esula var. *esula* (leafy spurge) EUESE			✓*	
Hypericum perforatum (common St. Johnswort) HYPE			✓*	✓
Isatis tinctoria (dyers woad) ISTI				✓
Lepidium latifolium (perennial pepperweed) LELA2			✓*	✓
Leucanthemum vulgare (ox-eye daisy) LEVU				✓
Linaria dalmatica (Dalmatian toadflax) LIDA			✓*	✓
Linaria dalmatica ssp. *dalmatica* (Dalmatian toadflax) LIDAD		✓		
Linaria vulgaris (yellow toadflax) LIVU2			✓*	✓
Lythrum salicaria (purple loosestrife) LYSA2	✓	✓	✓	✓
Lythrum virgatum (purple loosestrife) LYVI3	✓	✓	✓*	
Myriophyllum spicatum (Eurasian water milfoil) MYSP2			✓*	
Onopordum acanthium (Scotch thistle) ONAC				✓
Phragmites australis (common reed) PHAU7***	✓[2]			
Rosa multiflora (multiflora rose) ROMU			✓*	
Sonchus arvensis (perennial sowthistle) SOAR2			✓	✓
Sorghum halepense (Johnsongrass) SOHA			✓*	
Tamarix (saltcedar) TAMAR2			✓	✓
Tamarix chinesis (saltcedar) TACH2		✓		
Tamarix parviflora (saltcedar) TAPA4	✓	✓		
Tamarix ramosissima (saltcedar) TARA	✓	✓		
Tanacetum vulgare (common tansy) TAVU				✓

*****Nonnative species subject to regulation by law (SDCL 38-24A-6) in South Dakota.
******The only species in this table that has U.S. nativity.
*******The USDA PLANTS Database does not yet recognize subspecies for the common reed--the code given above simply relates to *Phragmites australis*. However, numerous plant experts refer to the introduced common reed as *Phragmites australis* ssp. *australis*, and the native common reed as *Phragmites australis* ssp. *americanus*. An illustrated fact sheet is available at http://www.nps.gov/plants/ALIEN/fact/phau1.htm for differentiating between the two taxa.

[+]Spotted knapweed is often listed as *Centaurea maculosa* on State Noxious Weeds List, but this name is considered to be misapplied, and has no recognized code. *Centaurea biebersteinii* DC. (CEBI2) is the current scientific name recognized for spotted knapweed. [Note: *Centaurea stoebe* L. ssp. *micranthos* (CESTM) has also been used as a scientific name for this species, but should be avoided.]

[1]The Wyoming Board of Agriculture approved the listing of Russian olive as a prohibited noxious weed on February 17, 2007. The complete list is available online at http://www.wyoweed.org/docs/designated_weeds_pests.html.

[2]The Nebraska Department of Agriculture (NDA) temporarily listed the non-native common reed (i.e., *Phragmites australis* ssp. *australis*) as a noxious weed in the Republican River Basin in 2007. In April of 2008, this designation was expanded to include the entire state. The NDA hopes to move this introduced species onto the permanent noxious weed list before February of 2009, when the latest order expires.

The rest of the information in this table was gleaned from the USDA PLANTS Database, available online at http://plants.usda.gov/index.html (accessed March 13, 2007); and the USDA, NAL National Invasive Species Information Center, available online at http://www.invasivespeciesinfo.gov (accessed March 14, 2007).

Appendix B. Risk Assessment for Invasive Species: Generalized rankings for nonnative plants known to occur outside of cultivation in the U.S. and capable of establishing within native species habitats (Rankings are from NatureServe 2007, see full citation below). At this time, only the highlighted species have been confirmed at MIMI.

Scientific and Common Name	**Potential Impact on Native Species and Biodiversity**						
	NYA	**EI**	**CDA**	**TDA**	**MD**	**IR**	**RIR**
Agropyron cristatum (crested wheatgrass)		M/L	H/M	M/L	M/L	M/L	**M**
Alyssum desertorum (desert madwort)	✓						
Arctium minus (lesser burdock)		L/I	M	H/L	M/I	M/I	**U**
Artemisia absinthium (absinth wormwood)		I	H/M	M/L	L/I	L/I	**L**
Bassia scoparia (burningbush [kochia])		L/I	M	M/L	H/M	L	**L**
Bromus arvensis (field brome [Japanese brome])	✓						
*Bromus inermis** (smooth brome)		M	H	M/L	M	H/M	**H**
Bromus tectorum (cheatgrass)		H	H/M	M	H/M	H	**H**
Camelina microcarpa (littlepod false flax)	✓						
Cardaria draba (whitetop)	✓						
Carduus acanthoides (plumeless thistle)		M/I	M	H/M	NR	M/L	**M**
Carduus nutans (musk thistle)		M/I	H/M	H/M	H/M	H/L	**U**
Centaurea diffusa (diffuse knapweed)		H/M	H/M	H/M	H/M	H/M	**H**
Centaurea solstitialis (yellow starthistle)		H/M	H	H/M	H/M	H/M	**H**
Centaurea maculosa[+] (spotted knapweed)		M	H	H/M	H/L	H/M	**H**
Chenopodium album (lambsquarters)	✓						
Chondrilla juncea (rush skeletonweed)		L/I	M/I	M	M/L	M/I	**U**
Cirsium arvense (Canada thistle)		M/L	H	M/L	H/M	H/M	**H**
Cirsium vulgare (bull thistle)		M/L	H/M	M/L	M/L	M/L	**M**
Conium maculatum (poison hemlock)		L	H/M	M/L	L/I	M/L	**M**
Convolvulus arvensis (field bindweed)		L/I	H/M	H/M	H/M	M/L	**M**

Scientific and Common Name	**NYA**	**EI**	**CDA**	**TDA**	**MD**	**IR**	**RIR**
Cuscuta (dodder)	✓						
Cynoglossum officinale (houndstongue)		L/I	H	M/L	M/L	M/L	**M**
Descurainia sophia (flixweed tansymustard)		M/L	M	M/L	M/L	M/L	**M**
Echinochloa crus-galli (barnyard grass)		L/I	M	H/L	U	M/I	**U**
Elaeagnus angustifolia (Russian olive)		H/M	H	H/M	H	H	**H**
Elymus repens (quackgrass)		M/L	H	M/L	H/M	H/M	**H**
Eragrostis cilianensis (stinkgrass)		L/I	H/M	H/L	U	M/I	**U**
Euphorbia esula (leafy spurge)		M	H	H/L	H	H/M	**H**
Hyoscyamus niger (black henbane)		M/I	M/L	H/L	M/L	M/I	**U**
Hypericum perforatum (common St. Johnswort)		M/L	H	H/M	M	H/M	**H**
Lactuca serriola (prickly lettuce)		I	M/L	M/I	U	L/I	**L**
Lepidium latifolium (perennial pepperweed)		H	M	H/M	H/M	H	**H**
Lepidium perfoliatum (clasping pepperweed)		I	H/M	L/I	M/I	L/I	**L**
Leucanthemum vulgare (ox-eye daisy)		L/I	H	M/L	H/M	M/L	**M**
Linaria vulgaris (yellow toadflax)		M/L	H/M	M/L	H/M	H/L	**U**
Lythrum salicaria (purple loosestrife)		H	H	H	H	H	**H**
Lythrum virgatum (purple loosestrife)	✓						
Marrubium vulgare (horehound)		M/I	M	M/L	M/L	M/L	**M**
Medicago lupulina (black medick)		M/I	M	M/I	M	M/I	**M**
Medicago sativa (alfalfa)		I	M/L	L/I	I	I	**I**
Melilotus officinalis (yellow sweetclover)		M	H/M	M/L	M	M/L	**M**
Myriophyllum spicatum (Eurasian water milfoil)		H	H	H	H	H	**H**
Onopordum acanthium (Scotch thistle)	✓						
*Phragmites australis** (common reed)		H	H	H	H/M	H	**H**

Scientific and Common Name	NYA	EI	CDA	TDA	MD	IR	RIR
Poa compressa (Canada bluegrass)		M/L	H/M	H/L	H/L	H/L	**U**
*Poa pratensis** (Kentucky bluegrass)		M	H	M/L	M/L	M	**M**
Polygonum aviculare (prostrate knotweed)		L/I	H	L	L	L	**L**
Polygonum convolvulus (climbing buckwheat)	✓						
Portulaca oleracea (common purslane)	✓						
Potentilla recta (sulphur cinquefoil)		H/L	H	H/M	M/L	H/M	**H**
Rhamnus cathartica (common buckthorn)		M	H	H/L	M	H/M	**H**
Rosa multiflora (multiflora rose)		L	H	M/L	L	M/L	**M**
Rumex crispus (curly dock)	✓						
Salsola (Russian thistle)	✓						
Setaria viridis (green bristlegrass)	✓						
Sisymbrium altissimum (tall tumblemustard)	✓						
Sonchus arvensis (perennial (moist) sowthistle)		L/I	H	M/L	H/L	M/L	**M**
Soncuus asper (spiny sowthistle)	✓						
Sorghum halepense (Johnsongrass)		M/L	H	M/L	H/M	H/M	**H**
Tamarix chinesis (saltcedar)	✓						
Tamarix parviflora (saltcedar)	✓						
Tamarix ramosissima (saltcedar)		H	H	H/L	H/M	H	**H**
Tanacetum vulgare (common tansy)		I	M	L	M	L	**L**
Taraxacum officinale (common dandelion)	✓						
Tragopogon dubius (yellow salsify)		L/I	H	M/L	M/I	M/L	**M**
Tribulus terrestris (puncturevine)	✓						
Ulmus pumila (Siberian elm)		M/L	H	M/L	M/L	M	**M**
Verbascum Thapsus (common mullein)		M/L	H	M	L	M	**M**

Legend: **NYA**—Not Yet Assessed. **EI**—Ecological Impact (Takes into account alterations of ecosystem processes, community structure and composition; individual impacts on native species of plants and animals; and the conservation value of the areas and species threatened by the invasive.). **CDA**—Current Distribution and Abundance (An evaluation of current range; the variety of habitats and ecoregions invaded; and the percentage of range inhabited by the species where biodiversity has been diminished.). **TDA**—Trend in Distribution and Abundance (Assesses recent changes in range and population numbers; the capacity for dispersal over long distances and reproductive potential; the extent to which the species has moved into potential habitat; and the ability of the species to exploit undisturbed environments or natural areas of concern.). **MD**—Management Difficulty (Considers the feasibility of control with respect to the susceptibility of the species; the minimum time, effort, and finances required for such operations; field access; and collateral effects on native species.). **IR**—I-Rank, or the Invasive Species Impact Rank, indicates the overall potential for the nonnative species to threaten native species and ecological communities, and is calculated, on a weighted basis, using the EI, CDA, TDA, and MD subrank values (see Morse et. al 2004 for details). **RIR**—Rounded I-Rank, the simplified version of I-Rank without ranges. Rank values are as follows: **L**—Low, indicates a small but significant threat; **M**—Medium, a moderate threat; **H**—High, a severe threat; **U**—Unknown, threat uncertain, due to high variability, or undetermined; **I**—Insignificant, a negligible threat exists; and the forward slash (/) separating rank values indicates that the impact varies somewhere between the stated values. [+]*Centaurea biebersteinii* DC. (CEBI2) is the current scientific name recognized for spotted knapweed. *****Note: Some occurrences of this grass species are believed to be indigenous to the U.S. (i.e., native), while other populations are considered nonnative.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS D-18, September 2008

National Park Service
U.S. Department of the Interior

Natural Resource Program Center
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

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