An Assessment of Richardson's Ground Squirrel Activity and Potential Barriers to Limit Access to Sensitive Sites at Malmstrom Air Force Base, Montana

Gary Witmer, **Rachael Moulton**, and **Jenna Swartz**
USDA APHIS WS, National Wildlife Research Center, Fort Collins, Colorado
Jason Gibbons
Malmstrom Air Force Base, Great Falls, Montana

Abstract: Small mammals pass through or under chain link security fences, triggering sensors and undermining facility infrastructure at sensitive military sites. Traditional methods of rodent control are not practical because of the vastness of land to be maintained with limited manpower. Permanent barriers (above and below ground) and low-maintenance, long-term bait stations offer potential permanent and cost-effective solutions to mitigate rodent intrusions. We assessed Richardson's ground squirrel populations, activities, and burrows at Malmstrom Air Force Base, MT. We also conducted preliminary barrier trials in the outdoor rodent buildings of the USDA National Wildlife Research Center in Fort Collins, CO. Ground squirrels were very numerous and active at most sites visited in Montana. Burrows were both simple and short as well some being elaborate and deep (to 5+ ft). Squirrels readily passed through and under the 2-inch mesh chain link fences as well as under site gates. Several effective barriers were identified in pen trials that prevented above-ground and below-ground intrusions. These will need to be field tested. Future studies will investigate designs for a low-maintenance, long-term rodenticide bait stations for deployment at remote sites.

Key Words: barriers, exclusion, fence intrusions, ground squirrels, Richardson's ground squirrel, rodenticide bait station, *Spermophilus richardsonii*

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INTRODUCTION

Richardson's ground squirrels (*Spermophilus richardsonii*) apparently pass through and/or under chain link security fences, triggering security sensors and undermining facility infrastructure at sensitive military sites such as Intercontinental Ballistic Missile (ICBM) silos. Traditional methods of rodent control (rodenticides and traps; Witmer 2007) are not practical because of the large number of remote sites scattered over a large area and because of the limited resources and personal. Among potential solutions, permanent barriers (above and below ground) and low-maintenance, long-term bait stations offer permanent and cost-effective solutions to mitigate rodent intrusions. This poses challenges, however, as barriers are rarely used for small animals over large areas (Marsh et al. 1990). Barriers over sizable areas are used, however, to slow the expansion of prairie dog (*Cynomys ludovicianus*) colonies (Witmer et al. 2008). We assessed Richardson's ground squirrel populations, activities, and burrows at Malmstrom Air Force Base (MAFB). We also conducted preliminary barrier trials in the outdoor rodent buildings of the USDA National Wildlife Research Center in Fort Collins, CO. In this brief paper, we present our preliminary findings. Additional details are reported in the two final reports (Witmer 2012a,b). We also discuss the potential for a long-term, low-maintenance rodenticide bait station for use at remote locations.

GROUND SQUIRREL OBSERVATIONS

We documented substantial ground squirrel numbers, activities, and burrowing at the deactivated missile launch facilities (LFs) and missile alert facilities (MAFs) surveyed at select MAFB sites, using direct observation and remote, motion-sensitive cameras. Numerous animals and burrows were observed both inside and immediately outside of the chain link perimeter fences. As many as 11 ground squirrels were observed at a single time at some sites. While ground squirrels were found at all sites visited, the relative abundance levels varied widely across sites, especially at LFs. All MAFs, however, had moderate to high abundance levels, probably because the large (3-4 ac) grassy areas provide higher quality and quantity of suitable habitat. In contrast, LFs are smaller (1 ac) and mostly gravel covered. Squirrels were observed in many activities including running, digging, feeding, and chasing each other. They were also observed to use various base facilities and structures, especially going under elevated structures, entering any open culverts or pipes, burrowing under foundations and access roads, etc. We found squirrels to readily pass through and under the standard chain link fences as well as under the site gates. Hence, it is understandable that there would be numerous motion-detector alarm events caused by the ground squirrels at these remote military sites. We surmised that the LFs and MAFs provided reasonably good habitat for the ground squirrels throughout their active period of the year, and importantly, habitat that experiences very little disturbance, relative to the surrounding agricultural areas.

We observed various other species of animals using the sites, both through direct observation and in the camera pictures. These animals included deer (*Odocoileus virginianus*), pronghorn antelope (*Antilocapra Americana*), rabbits (*Sylvilagus* spp.), weasels (*Mustela* spp.), songbirds, game birds, hawks, and badger (*Taxidea taxus*) holes. However, the only animals larger than the ground squirrels that we observed inside the perimeter fences were rabbits.

Table 1. Dimensions of burrow excavation.

	Maximum	Minimum	Average
Depth (at deepest point)	4' 9" *	Just beneath the surface	1.9'
Total Length	12' 1.5"	3" (plugged)	5.07'
Diameter of Burrow	3 × 3"	2 × 2"	2.5 × 2.5"
Diameter of Entrance	8.5 × 5"	2 × 2"	3.3"

*Note: Excavation of this burrow was not finished, but it clearly went at least 5' deep.

Table 2. Barrier trial materials, dates, and results (breached/not breached by Richardson's ground squirrels).

Trial 1				
ORB No.	Underground Barrier	Above-ground Barrier	Breached (Y/N)	Dates
22	pea gravel-filled trench	expanded metal mesh (24" ht.)	Y	6/1-3/2011
22	pea gravel-filled trench	clear plastic (30" ht.)	N	6/3-10/2011
23	steel wool fabric	expanded metal mesh (24" ht.)	Y	6/1-6/2011
23	expanded metal mesh	clear plastic (30" ht.)	N	7/1-11/2011
24	1" sharp metal mesh	clear plastic (30" ht.)	Y	6/1-3/2011
24	expanded metal mesh	2x4" wire mesh (322" ht.) w/2-strand electrified tape near ground level	N	7/7-15/2011
Trial 2				
ORB No.	Underground Barrier	Above-ground Barrier	Breached (Y/N)	Dates
22	pea gravel-filled trench	clear plastic (30" ht.)	N	7/1-10/2011
23	expanded metal mesh	clear plastic (30" ht.)	N	7/18-27/2011
Trial 3				
ORB No.	Underground Barrier	Above-ground Barrier	Breached (Y/N)	Dates
22	pea gravel-filled trench	clear plastic (30" ht.)	N	7/18-27/2011

BURROW SYSTEM EXCAVATION

For burrow excavations, we used the methods described by Berentsen and Salmon (2001). In our survey of burrow systems, most were only about 5 ft long and we found relatively few to be ≥4 ft in depth. This suggested that underground barriers that extend to a 4 ft depth would exclude virtually all ground squirrel access to LFs and MAFs via underground routes. Once effective above and below ground barriers are identified, it will be necessary to develop an additional type of barrier to prevent ground squirrels from entering LFs and MAFs by passing under the sites' gates. The burrow excavations are summarized below and in Table 1:

- Burrows excavated: 34
- Burrows with one nest chamber: 3
- Burrows with two nest chambers: 3
- Burrows that forked: 4
- Burrows with two openings to surface: 4
- Burrows with three openings to surface: 1

BARRIER TRIALS

We tested several barrier systems in the outdoor rodent buildings (ORBs) of the USDA National Wildlife Research Center in Fort Collins, Colorado, using wild-caught Richardson's ground squirrels from deactivated ICBM sites of MAFB. The ORBs contain about 4 feet of topsoil. Barrier systems included an above ground barrier and a below ground barrier that extended to the cement floor (Table 2). Several barrier systems failed because the ground squirrels could climb over them, squeeze through sharp, 1-inch chain link fencing, or claw through a geotextile (steel wool-like) fabric. Several barrier systems were identified, however, that had a high potential to prevent ground squirrel intrusions of standard, chain link-fenced areas at LFs and MAFs. The effective above ground barriers were 1) clear, polycarbonate plastic, and 2) 2 × 4-inch woven wire fencing with 2 strands of electrified tape near the soil surface (Figure 1). The effective below ground barriers were a pea gravel-filled trench, and 2) small-mesh expanded metal sheets (Figure 1). The barriers prevented both above ground and below ground intrusions. These barrier systems will need to be field-tested at actual ICBM sites to verify their effectiveness. Additionally, effective barriers for under site gates will need to be selected and tested at the field sites. A potential barrier for under gates might be a simple as a hard rubber or asphalt "speed bump" strip.

A. Clear polycarbonate plastic above ground.

C. Small-mesh, expanded metal below ground.

B. Pea gravel-filled trench below ground.

D. Large-mesh woven wire above ground with electrified, 2-strand electric tape near ground surface.

Figure 1. Pictures of barrier types that were not breached by a pair of Richardson's ground squirrels.

NOVEL RODENTICIDE BAIT STATIONS

We also propose to investigate long-term, low maintenance rodenticide bait stations for use at remote military sites such as those of MAFB. The bait stations would need to meet certain criteria:

- Must be durable and weatherproof
- Must require very infrequent checks and refilling
- Must be self-activated by ground squirrels (weigh about 300-450 g each), based on ground squirrel average weight to reduce hazards to smaller non-target animals
- Must be self-resetting and not be able to drop another bait for a predetermined time (≥1 hour) to prevent bait hoarding/caching by ground squirrels
- Should have a low power requirement (if any); if needed, supplied by small solar panel & battery

We believe that the mechanical and electrical requirements of such a device would be relatively simple. Because the remote sites are small and have relatively few ground squirrels which are active only about 5 months of the year, a large reservoir of baits in the stations would not be needed. We are currently pursuing design options with engineering students of Colorado State University and colleagues with Lincoln University and Connovation, Ltd., New Zealand.

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