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Small Mammal Survey in Upland Habitats at the Savanna Army Depot,  
Carroll and Jo Daviess Counties, Illinois

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The Savanna Army Depot was established in 1917 along the Mississippi River in Carroll and Jo Daviess counties in northwestern Illinois (Figure 1). Until its closure under the Base Realignment and Closure Act on 18 March 2000 the Depot was used primarily for munitions storage. The site covers 5288 ha (13,062 a). More than 3600 ha (9000 a) of the Depot will be incorporated into the Upper Mississippi River National Wildlife and Fish Refuge and named the Lost Mound Unit. Lost Mound Unit will be managed by the U.S. Fish and Wildlife Service in cooperation with the Illinois Department of Natural Resources (IDNR). An additional 120 ha (300 a) of Depot land will be transferred to the IDNR.

The Savanna Army Depot is recognized as a statewide significant natural area by the Illinois Natural Areas Inventory (IDNR, Division of Natural Heritage). The Depot's bottomlands are part of the Mississippi River Section of the Upper Mississippi River and Illinois River Bottomlands Natural Division of Illinois (Schwegman 1973); they include floodplain forest and backwater sloughs and lakes. Uplands on the Depot lie within the Mississippi River Section of the Illinois River and Mississippi River Sand Areas Natural Division of Illinois (Schwegman 1973) and consist of a sand terrace nearly 19 km (12 mi) long. The uplands support the largest contiguous remnant of native sand prairie and sand savanna in Illinois. The Army's main form of habitat management at the Depot was intensive cattle grazing to keep the vegetation short and minimize the risk of wildfire.

A small mammal survey conducted during 1994 employed single transects in grazed and ungrazed sand prairie, grazed sand savanna, and ungrazed sand forest (Anderson et al. 1994). More individuals and species were trapped in the ungrazed prairie than the grazed prairie, but the numbers of individuals and species were higher in the grazed savanna than the ungrazed forest (Anderson et al. 1994). In neither case, however, did the number of animals caught in the grazed and ungrazed habitats differ significantly (prairie:  $\chi^2 = 1.2$ , 1 df,  $p > 0.05$ ; wooded:  $\chi^2 = 0.5$ , 1 df,  $p > 0.05$ ). Fewer cattle were placed on the Depot during 1998 and 1999 than during previous years and grazing was discontinued in 2000. The current small mammal survey, funded by the Illinois Wildlife Preservation Fund (IDNR), was conducted during September and October 2000. Our objectives were (1) to inventory small mammal populations after the change in grazing pressure and (2) to select sites for permanent transects for future surveys after habitat management practices have been implemented. The survey was confined to upland habitats, with transects established in sand prairie, sand savanna, and sand forest.

### Study Area

The upland plant communities at the Savanna Army Depot are located on an extensive sand terrace that has a northwest to southeast orientation and is nearly 19 km (12 mi) long and up to 2.7 km (1.7 mi) wide (Robertson et al. 1997). Along the Mississippi River the sand has formed high dunes, but the rest of the terrace has gently rolling topography. The sand was originally deposited by glacial melt waters and spread over a wide area by prevailing west winds (Schwegman 1973). The most prevalent community is dry-mesic sand prairie (Robertson et al. 1997), much of which is located within a complex of munitions bunkers and storage buildings that includes more than 40 parallel roads spaced at 150-m intervals. These prairie areas are dominated by little bluestem (*Schizachyrium scoparium*), but also contain substantial amounts of Indian grass (*Sorghastrum nutans*), June grass (*Koeleria macrantha*), sand dropseed (*Sporobolus cryptandrus*), needlegrass (*Stipa spartea*), and non-native Kentucky bluegrass (*Poa pratensis*). In drier areas with more patches of bare sand three-awn grass (*Aristida tuberculosa*) and hairy panic grass (*Panicum villosissimum*) tend to be dominant. The shrubs redroot (*Ceanothus herbaceus*) and sand fragrant sumac (*Rhus aromatica* var. *arenaria*) occur throughout the prairie areas.

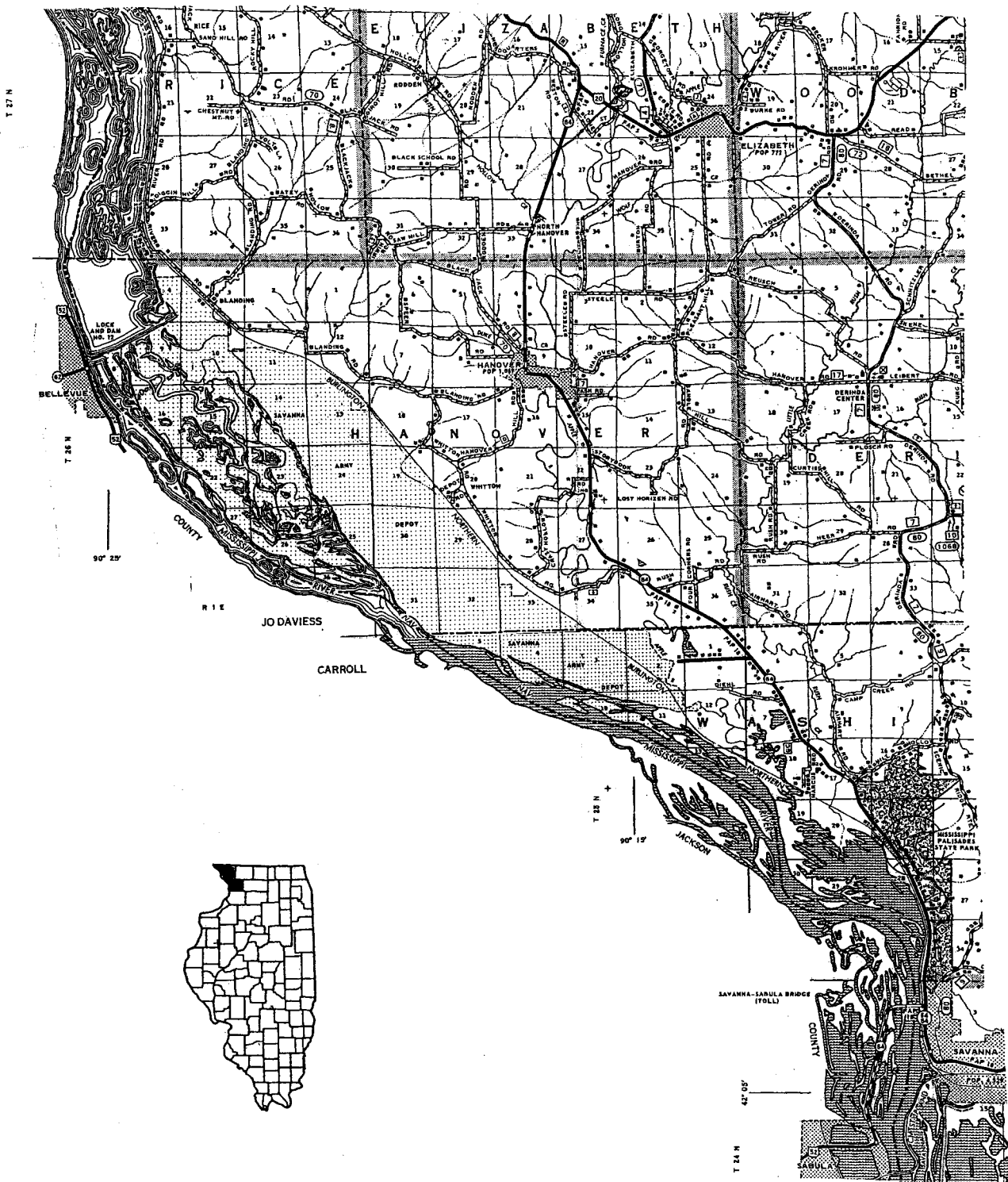


Figure 1. Location of the Savanna Army Depot, Carroll and Jo Daviess counties, Illinois

Dry and dry-mesic sand savanna occurs on dunes along the Mississippi River and in the northern part of the bunker complex. These sand savannas contain prairie vegetation with an open overstory of black oak (*Quercus velutina*) and occasional green ash (*Fraxinus pennsylvanica*). The lack of fire has led to considerable encroachment of fire-intolerant species such as black cherry (*Prunus serotina*), honey locust (*Gleditsia triacanthos*), and red cedar (*Juniperus virginiana*). Dry sand forest occurs on the river dunes, dry-mesic sand forest mostly in the northern part of the Depot. The dry sand forest is dominated by black oak, but white oak (*Q. alba*) is important in dry-mesic sand forest. The forests also contain northern red and bur oak (*Q. rubra* and *Q. macrocarpa*), several hickory species (*Carya*), black walnut (*Juglans nigra*), black cherry, green ash, and black locust (*Robinia pseudoacacia*). The natural communities at the Savanna Army Depot are described in detail by Robertson et al. (1997).

## Methods

Trap sites were established at ten locations: six areas of sand prairie, two sand savannas, and two sand forests (Figure 2, Table 1). Because of the possible presence of unexploded ordinance we were unable to place permanent markers at these sites. One hundred folding Sherman live traps (8 x 9 x 23 cm) were used at each trap site. Traps were spaced at approximately 10-m intervals and positioned so as to increase the chance of capturing an animal, e.g. next to a log or tree, or in a runway. At most sites traps were placed in a single line. In Beaty Creek woods (Figure 2) two roughly parallel lines of 50 traps were established. At the F800/F1200 savanna site (Figure 2) traps were placed in two parts of the savanna: a row of 46 traps south of (and parallel to) road F800 and a row of 54 traps south of (and parallel to) road F1200. Traps were baited with millet, black oil sunflower seeds, cracked corn, wheat, and safflower seeds (Garver No Waste Mix) supplemented with striped sunflower seeds. During October a small wad of polyester fiberfill (batting) also was placed in the traps to protect captured animals from hypothermia. Trapping was conducted for three consecutive nights at each site. Traps were checked in the mornings and rebaited or reset as necessary. Because all sites could not be trapped simultaneously temperature, precipitation, and the amount of moonlight, all of which can affect the activity (and, therefore, trappability) of small mammals (Call 1986), varied somewhat. Trapping was conducted during three weeks in the autumn (on the nights of 28-30 September, 17-19 October, and 23-25 October 2000) when temperatures were similar and the moon was not full.

To the extent possible the following information was recorded for each individual captured: species, sex, age, reproductive condition, and weight. The sex of shrews usually cannot be determined by external examination. The position of the testes (either abdominal or scrotal) was used as a general indicator of the reproductive status of male rodents. Females were classified as reproductively active if they had an open vulva, were pregnant (as determined visually or by gentle palpation of the abdomen), or showed evidence of recent lactation (based on examination of the teats). Juvenile mice were identified by their juvenal pelage; juvenile and subadult voles were distinguished from adults by weight (Getz et al. 1979). Animals were weighed with a Pesola scale and weights were recorded to the nearest 0.5 gram. To determine the number of individuals of each species trapped at a site, every animal captured on the first or second morning of a trapping session was marked temporarily by clipping a small patch of fur on its flank. Thus, it was possible to distinguish individuals that were recaptured from those that were caught for the first time. After examination animals were released at the trap location.

For each site the numbers of captures and individuals of each species were tabulated. The relative abundance ( $[\text{number of individuals}/\text{number of trap-nights}] \times 100$ ) of each species also was calculated.

Table 1. Legal locations of small mammal trapping sites, Savanna Army Depot, Carroll and Jo Daviess counties, Illinois, September and October 2000

<u>Site</u>	<u>County</u>	<u>TRS</u>	<u>7.5' Topo</u>
G-area prairie	Carroll	T.25N, R.2E, Sec. 3	Green Island, IA-IL
F100 prairie	Jo Daviess	T.26N, R.1E, Sec. 13	Green Island, IA-IL
E1200 prairie	Jo Daviess	T.26N, R.2E, Sec. 29, 30	Green Island, IA-IL
E1700 prairie	Jo Daviess	T.26N, R.2E, Sec. 29, 30	Green Island, IA-IL
E800 prairie	Jo Daviess	T.26N, R.2E, Sec. 31, 32	Green Island, IA-IL
Whitton gate prairie	Jo Daviess	T.26N, R.2E, Sec. 20, 29	Green Island, IA-IL
River dune savanna	Jo Daviess	T.26N, R.2E, Sec. 31	Green Island, IA-IL
F800/F1200 savanna	Jo Daviess	T.26N, R.1E, Sec. 14	Hanover, IL
River-edge woods	Carroll	T.25N, R.2E, Sec. 3, 4	Green Island, IA-IL
Beaty Creek woods	Jo Daviess	T.26N, R.1E, Sec. 10	Bellevue, IA-IL

### Results

River-edge woods, F100 prairie, G-area prairie, and Beaty Creek woods were surveyed on the nights of 28-30 September 2000. Overnight low temperatures during the trapping session increased from 5°C to 10.6°C at nearby Mt. Carroll, Illinois (Midwestern Regional Climate Center data). There was no precipitation and a waxing crescent moon. The E1200 prairie, E1700 prairie, and F800/F1200 savanna sites were trapped on the nights of 17-19 October 2000. Overnight low temperatures measured at the Depot increased over the period from about 5°C to 12°C. No precipitation occurred and there was a waning gibbous moon. River dune savanna, Whitton gate prairie, and E800 prairie were surveyed on the nights of 23-25 October 2000. The minimum temperature at the Depot was about 15°C for the first and third nights of the session and about 13°C on the second night. The moon was in the waning crescent phase, but the skies were cloudy or partly cloudy each night.

There were 886 captures of small mammals for 2998 trap-nights (one trap-night = one trap set for one night) in this survey (two traps were not found on the final morning, decreasing the number of trap-nights from the planned 3000). This represents a total trapping success ([number of captures/number of trap-nights] x 100) of about 29.5%. Nine species were trapped: masked shrew (*Sorex cinereus*), northern short-tailed shrew (*Blarina brevicauda*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), western harvest mouse (*Reithrodontomys megalotis*), white-footed mouse (*Peromyscus leucopus*), deer mouse (*P. maniculatus*), prairie vole (*Microtus ochrogaster*), meadow vole (*M. pennsylvanicus*), and least weasel (*Mustela nivalis*) (Table 2). A total of 17 species of small mammals (small enough to be caught in the traps used during this survey) are known or likely to occur in northwestern Illinois (Hoffmeister 1989). Thus, the species trapped at the Depot represent 53% of the region's small mammal fauna.



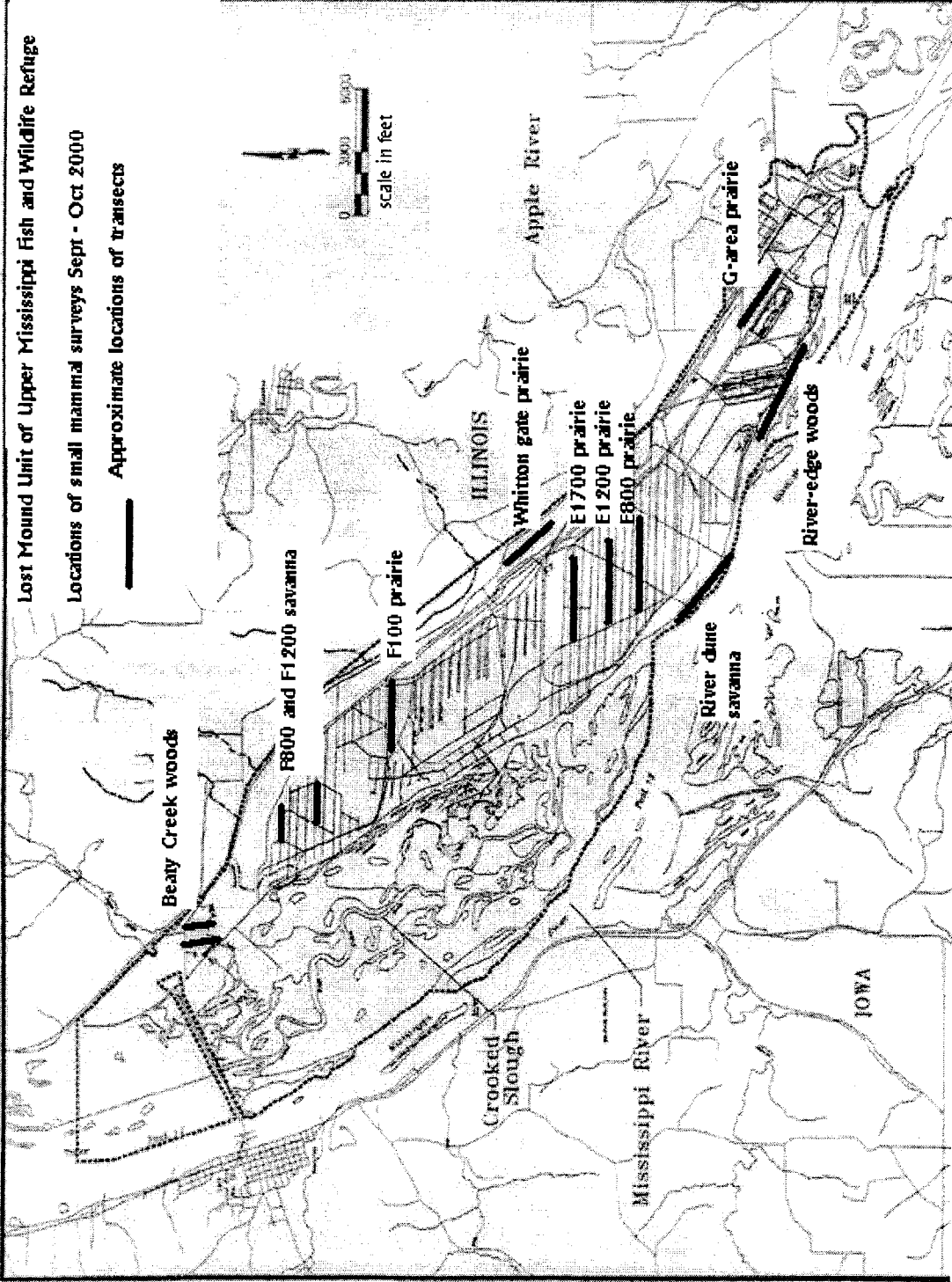


Figure 2. Locations of small mammal trapping sites, Savanna Army Depot, Carroll and Jo Daviess counties, Illinois, September and October 2000

The largest number of species was trapped at the sand prairie sites -- all nine species were caught in this type of habitat (Table 2). Four species were captured only in prairie and the only species that occurred in all three habitat types was the white-footed mouse (Table 2). The total number of individuals caught during the survey was about 709 (Table 2); the exact number probably was between 704 and 711 (a few animals escaped before they could be marked or checked for marks). Overall, the most frequently trapped species was the white-footed mouse; it accounted for 49.4% of all captures and 46.1% of all individuals.

Table 2. Small mammal species trapped in three upland habitats, Savanna Army Depot, Carroll and Jo Daviess counties, Illinois, September and October 2000  
inds = individuals, SP = sand prairie, SS = sand savanna, SF = sand forest

<u>Species</u>	<u># captures</u>	<u># inds</u>	<u>SP</u>	<u>SS</u>	<u>SF</u>
<i>Sorex cinereus</i>	2	2	X		
<i>Blarina brevicauda</i>	25	24	X		X
<i>Spermophilus tridecemlineatus</i>	14	11	X		
<i>Reithrodontomys megalotis</i>	13	12	X		
<i>Peromyscus leucopus</i>	437	327	X	X	X
<i>P. maniculatus</i>	302	251	X	X	
<i>Microtus ochrogaster</i>	53	51	X		X
<i>M. pennsylvanicus</i>	36	29	X		X
<i>Mustela nivalis</i>	2	2	X		
Totals	884*	709	9	2	4

\* total = 884 because two animals escaped before they could be identified

Sand prairie. There were 426 small mammal captures at the six sand prairie sites (Table 3), for an overall trapping success of 23.7% in this habitat type. A total of 364 individuals were caught in prairie. The most frequently trapped species was the deer mouse which accounted for 64.7% of all captures and 62.4% of all individuals. Results for each of the prairie sites are presented below.

Table 3. Small mammal trapping results for 1799 trap-nights at six sand prairie sites, Savanna Army Depot, Carroll and Jo Daviess counties, September/October 2000

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Sorex cinereus</i>	2	2	0.11
<i>Blarina brevicauda</i>	22	22	1.22
<i>Spermophilus tridecemlineatus</i>	14	11	0.61
<i>Reithrodontomys megalotis</i>	13	12	0.67
<i>Peromyscus leucopus</i>	11	11	0.61
<i>P. maniculatus</i>	275	227	12.62
<i>Microtus ochrogaster</i>	51	49	2.72
<i>M. pennsylvanicus</i>	35	28	1.56
<i>Mustela nivalis</i>	2	2	0.11
Totals	425*	364	

\* total = 425 because one animal escaped before it could be identified

G-area prairie: Part of this dry-mesic sand prairie site, located in the southern portion of the Depot, was enclosed with a barbed wire fence and had not been grazed. The herbaceous vegetation throughout the site was relatively tall and very dense. There were 101 captures at this prairie, a trapping success of 33.7%. Eight species were captured (Table 4), giving this site the highest species richness in the survey. The most frequently trapped species was the meadow vole (28% of identified captures, 28.6% of individuals), but numerous prairie voles, deer mice, and northern short-tailed shrews also were caught (Table 4).

Table 4. Small mammal trapping results for 300 trap-nights at the G-area prairie site, Savanna Army Depot, Carroll County, 28-30 September 2000

R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Sorex cinereus</i>	2	2	0.67
<i>Blarina brevicauda</i>	17	17	5.67
<i>Spermophilus tridecemlineatus</i>	10	7	2.33
adult male NR		2	
adult female NR		4	
juvenile male		1	
<i>Reithrodontomys megalotis</i>	5	4	1.33
adult male NR		2	
adult female R		2	
<i>Peromyscus maniculatus</i>	19	15	5.00
adult male NR		5	
adult female R		1	
adult female NR		9	
<i>Microtus ochrogaster</i>	17	15	5.00
adult male R		3	
adult/subadult male NR		5	
adult female R		3	
adult female NR		3	
juvenile female		1	
<i>M. pennsylvanicus</i>	28	22	7.33
adult/subadult male NR		6	
adult female R		3	
adult/subadult female NR		10	
juvenile female		3	
<i>Mustela nivalis</i>	2	2	0.67
Totals	100*	84	

\* total = 100 because one animal escaped before it could be identified

F100 prairie: At this dry-mesic prairie site, located in the northern part of the bunker complex, there was very sparse herbaceous cover and large areas of exposed sand were present. Trapping success was 34.3%, but the deer mouse was essentially the only species caught at the site (Table 5).

Table 5. Small mammal trapping results for 300 trap-nights at the F100 prairie site, Savanna Army Depot, Jo Daviess County, 28-30 September 2000  
R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Peromyscus maniculatus</i>	102	83	27.67
adult male R		3	
adult male NR		39	
adult female R		19	
adult female NR		12	
juvenile male		5	
juvenile female		4	
<i>Microtus ochrogaster</i>	1	1	0.33
adult female R		1	
Totals	103	84	

E1200 prairie: There were 60 captures, a trapping success of 20.0%, at this dry and dry-mesic prairie in the southern portion of the bunker complex (Table 6). Six species were caught, a relatively high species richness for this survey. The most frequently trapped species was the deer mouse which accounted for 66.7% of all captures and individuals.

Table 6. Small mammal trapping results for 300 trap-nights at the E1200 prairie site, Savanna Army Depot, Jo Daviess County, 17-19 October 2000  
R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Spermophilus tridecemlineatus</i>	1	1	0.33
adult male NR		1	
<i>Reithrodontomys megalotis</i>	6	6	2.00
adult male NR		3	
adult female R		2	
adult female NR		1	
<i>Peromyscus leucopus</i>	1	1	0.33
adult female NR		1	
<i>P. maniculatus</i>	40	38	12.67
adult male NR		24	
adult female NR		13	
juvenile female		1	
<i>Microtus ochrogaster</i>	8	8	2.67
adult male R		1	
adult male NR	2		
adult female R	1		
adult/subadult female NR		2	
juvenile male	1		
juvenile female		1	
<i>M. pennsylvanicus</i>	4	3	1.00
adult/subadult male NR		1	
adult/subadult female NR		2	
Totals	60	57	

E1700 prairie: This dry and dry-mesic site also was located in the southern portion of the bunker complex. Trapping success was only 17.7% (53 captures), but this prairie had the second highest species richness (seven species) of all sites surveyed (Table 7). The deer mouse accounted for 71.7% of all captures and 68.1% of individuals.

Table 7. Small mammal trapping results for 300 trap-nights at the E1700 prairie site, Savanna Army Depot, Jo Daviess County, 17-19 October 2000  
R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Blarina brevicauda</i>	1	1	0.33
<i>Spermophilus tridecemlineatus</i>	2	2	0.67
adult female NR		2	
<i>Reithrodontomys megalotis</i>	1	1	0.33
adult male NR		1	
<i>Peromyscus leucopus</i>	2	2	0.67
adult male NR		1	
adult female NR		1	
<i>P. maniculatus</i>	38	32	10.67
adult male NR		15	
adult female R		1	
adult female NR		13	
juvenile male		1	
juvenile female		2	
<i>Microtus ochrogaster</i>	7	7	2.33
adult/subadult female R		2	
subadult female NR		1	
juvenile female		3	
<i>M. pennsylvanicus</i>	2	2	0.67
subadult female NR		1	
juvenile		1	
Totals	53	47	

Whitton gate prairie: This dry-mesic sand prairie, located outside the bunker complex near the eastern edge of the Depot, included some areas of dense herbaceous cover and other areas with large patches of bare sand. There were 58 small mammal captures (trapping success of 19.3%) and species richness was relatively high (six species) at this site (Table 8). The deer mouse accounted for 74.1% of all captures and 68.1% of individuals.

Table 8. Small mammal trapping results for 300 trap-nights at the Whitton gate prairie site, Savanna Army Depot, Jo Daviess County, 23-25 October 2000  
R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Blarina brevicauda</i>	4	4	1.33
<i>Spermophilus tridecemlineatus</i>	1	1	0.33
adult male NR		1	
<i>Reithrodontomys megalotis</i>	1	1	0.33
adult male NR		1	

Table 8 concluded on following page

Table 8 (concluded). Small mammal trapping results for 300 trap-nights at the Whitton gate prairie site, Savanna Army Depot, Jo Daviess County, 23-25 October 2000  
R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Peromyscus leucopus</i>	4	4	1.33
adult male NR		1	
adult female R		2	
adult female NR		1	
<i>P. maniculatus</i>	43	32	10.67
adult male NR		5	
adult female R		1	
adult female NR		9	
<i>Microtus ochrogaster</i>	5	5	1.67
adult male NR		1	
adult female R		1	
juvenile male		1	
juvenile female		2	
Totals	58	47	

E800 prairie: Trapping success was 17.1% (51 captures) at this dry-mesic sand prairie near the southern end of the bunker complex. Only four species were caught (Table 9) and species richness was lower than at all other prairie sites except F100. Again, the species caught most often was the deer mouse (64.7% of all captures, 60.0% of individuals).

Table 9. Small mammal trapping results for 299 trap-nights at the E800 prairie site, Savanna Army Depot, Jo Daviess County, 23-25 October 2000  
R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Peromyscus leucopus</i>	4	4	1.34
adult male NR		3	
juvenile female		1	
<i>P. maniculatus</i>	33	27	9.03
adult male NR		19	
adult female R		2	
adult female NR		6	
<i>Microtus ochrogaster</i>	13	13	4.35
adult male R		2	
adult/subadult male NR		5	
subadult female NR		4	
juvenile male		2	
<i>M. pennsylvanicus</i>	1	1	0.33
subadult female R		1	
Totals	51	45	

Sand savanna. There were 206 small mammal captures at the two sand savanna sites that were surveyed at the Depot, representing a trapping success of 34.4%. Only two species, however, was captured in this habitat type (Table 10). The white-footed mouse was the most frequently caught species in the savannas (86.8% of captures, 85.5% of individuals). Results for the individual savanna sites are reported below.

Table 10. Small mammal trapping results for 599 trap-nights at two sand savanna sites, Savanna Army Depot, Jo Daviess County, October 2000

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Peromyscus leucopus</i>	178	141	0.24
<i>P. maniculatus</i>	27	24	0.04
Totals	205*	165	

\* total = 205 because one animal escaped before it could be identified

F800/F1200 savanna: This dry-mesic site, in the northern portion of the bunker complex, contained scattered oak trees interspersed with herbaceous vegetation. Trapping success was 29.3% (87 captures). There was uncertainty about the identification of a few of the *Peromyscus* caught at this site. Both species were definitely present, but the white-footed mouse was more common in the areas that were trapped (Table 11).

Table 11. Small mammal trapping results for 300 trap-nights at the F800/F1200 savanna site, Savanna Army Depot, Jo Daviess County, 17-19 October 2000

R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Peromyscus leucopus</i>	61	46	15.33
adult male NR		22	
adult female R		8	
adult female NR		14	
juvenile female		1	
<i>P. maniculatus</i>	26	23	7.67
adult male NR		12	
adult female R		1	
adult female NR		8	
juvenile female		2	
Totals	87	69	

River dune savanna: Parts of this dry sand savanna, located on the dunes bordering the Mississippi River, had an open canopy, but in other areas the canopy was closed or there were dense shrub thickets. There were 118 captures and trapping success was 39.5%. All but one animal caught at this site was a white-footed mouse (Table 12).

Table 12. Small mammal trapping results for 299 trap-nights at the River dune savanna site, Savanna Army Depot, Jo Daviess County, 23-25 October 2000  
R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Peromyscus leucopus</i>	117	95	31.77
adult male NR		52	
adult female R		8	
adult female NR		30	
juvenile male		3	
juvenile female		1	
<i>P. maniculatus</i>	1	1	0.33
adult female NR		1	
Totals	118	96	

Sand forest. There were 254 small mammal captures in the two forested sites trapped at the Depot (Table 13). The combined trapping success was 42.3%. The only species caught in appreciable numbers in this habitat was the white-footed mouse (97.6% of all captures, 97.2% of individuals).

Table 13. Small mammal trapping results for 600 trap-nights at two sand forest sites, Savanna Army Depot, Carroll and Jo Daviess counties, September 2000

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Blarina brevicauda</i>	3	2	0.33
<i>Peromyscus leucopus</i>	248	175	29.17
<i>Microtus ochrogaster</i>	2	2	0.33
<i>M. pennsylvanicus</i>	1	1	0.17
Totals	254	180	

River-edge woods: Trapping success in this tract of dry sand forest, located on the dunes bordering the Mississippi River, was 49.0% (147 captures; Table 14). Three species were captured, although the prairie vole is actually a grassland species. The white-footed mouse accounted for 97.3% of all captures and 96.9% of all individuals at this site.

Table 14. Small mammal trapping results for 300 trap-nights at the River-edge woods site, Savanna Army Depot, Carroll County, 28-30 September 2000  
R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Blarina brevicauda</i>	2	1	0.33
<i>Peromyscus leucopus</i>	143	93	31.00
adult male R		17	
adult male NR		38	
adult female R		23	

Table 14 concluded on following page



Table 14 (concluded). Small mammal trapping results for 300 trap-nights at the River-edge woods site, Savanna Army Depot, Carroll County, 28-30 September 2000

R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
adult female NR		10	
juvenile male		1	
juvenile female		3	
<i>Microtus ochrogaster</i>	2	2	0.67
adult female R		1	
subadult female NR		1	
Totals	147	96	

Beaty Creek woods: This tract of dry-mesic sand forest is located in the northern part of the Depot (beyond the bunker complex). There were 107 small mammal captures, for a trapping success of 35.7% (Table 15). Three species were trapped, but the meadow vole is a grassland species. The vole was caught in a part of the woods where there was a gap in the canopy and dense herbaceous cover. White-footed mice accounted for 98.1% of all captures and 97.6% of individuals at this site.

Table 15. Small mammal trapping results for 300 trap-nights at the Beaty Creek woods site, Savanna Army Depot, Jo Daviess County, 28-30 September 2000

R = reproductively active, NR = non-reproductive

<u>Species</u>	<u># captures</u>	<u># individuals</u>	<u>Relative Abundance</u>
<i>Blarina brevicauda</i>	1	1	0.33
<i>Peromyscus leucopus</i>	105	82	27.33
adult male R		12	
adult male NR		33	
adult female R		18	
adult female NR		11	
juvenile male		2	
juvenile female		5	
<i>M. pennsylvanicus</i>	1	1	0.33
subadult female R		1	
Totals	107	84	

## Discussion

To evaluate the benefits and success of a conservation and restoration program such as that planned for the Lost Mound Unit of the Upper Mississippi River Wildlife and Fish Refuge, it is helpful to have a set of baseline data documenting conditions at the onset of the program. Populations of small mammals are notoriously variable in both time and space. Although it generally is not practical to conduct a controlled scientific experiment that includes numerous replicates of "managed" and "unmanaged" sites to evaluate the effects of conservation efforts, an adaptive management approach that documents changes in faunal communities over time in correspondence with changing management practices can be highly informative. The ten small mammal survey sites established in this study, including

two sand forests, two sand savannas, and six sand prairies, should provide good spatial coverage of the Lost Mound Unit and replication of major habitat types adequate for monitoring small mammal diversity and relative abundance. Continued monitoring of these sites at regular intervals should provide insight into the responses of the small mammal communities to new management practices.

Our survey detected nine of 17 species of small mammal that might be expected to occur at the Savanna Army Depot (Hoffmeister 1989). Most of these are common, widespread species (no species of terrestrial small mammal native to this region is listed as threatened or endangered by the Illinois Endangered Species Protection Board [1999]). However, the capture of two least weasels, a grassland species that may be decreasing in abundance in Illinois, shows the potential value of protecting prairie habitat at this site. Some species may not have been caught because a given trapping method does not work equally well for all types of small mammals (Call 1986). The southern flying squirrel (*Glaucomys volans*) is mostly arboreal and rarely caught in live traps placed on the ground, but is likely to be present in wooded areas at the Depot. Shrews are best surveyed with pitfall traps which it was not possible for us to use at the Depot at this time. Use of pitfall traps might have resulted in the capture of the least shrew (*Cryptotis parva*), a grassland species. However, Hoffmeister (1989) located no specimens of least shrews from northwestern Illinois and none have been caught during recent surveys in the region using a variety of methods (Kelt 1991, Anderson et al. 1994, Hofmann and Handel 1995).

Similarly, the woodland vole (*Microtus pinetorum*) can be difficult to capture and might be found at the Depot with additional effort. We know of only one record for this species in northwestern Illinois (Hoffmeister 1989, Kelt 1991, Anderson et al. 1994, Hofmann and Handel 1995). The southern bog lemming (*Synaptomys cooperi*) and meadow jumping mouse (*Zapus hudsonius*) generally occur in mesic habitats and might have been caught if we had trapped the marsh at the Depot. However, jumping mice have been captured in a mesic deciduous forest and a ridgetop shrubland in Jo Daviess County (Hofmann and Handel 1995). Hoffmeister (1989) lists only one record for the southern bog lemming in northwestern Illinois so it would be interesting to know if this species occurs at the Depot. A further inventory of species at the Depot might seek to confirm the presence or absence of these species. Eastern chipmunks (*Tamias striatus*), on the other hand, are readily detected and should have been caught if they were present in wooded areas. Their apparent absence is interesting because they have been documented in forests in Jo Daviess County (Hofmann and Handel 1995) and at nearby Mississippi Palisades State Park (Hoffmeister 1989). On the positive side, the absence of non-native house mice (*Mus musculus*) and Norway rats (*Rattus norvegicus*) from our transects, despite the abundance of human-made structures at the site, suggests that the benefits of conservation efforts should accrue primarily to native species.

Sand forests and savannas displayed the lowest diversity of small mammal species, with only two or three species trapped per site and numerical dominance by white-footed mice. Variation between replicates of each habitat type was minimal. The two vole species caught in the sand forests are grassland animals and presumably are not a major component of the forest small mammal community. Essentially, two species were found in the sand forests as well as the sand savannas (Table 2). This situation is not likely to change greatly over time, although documentation of woodland voles or chipmunks could increase the species list slightly. Similarly, only two species and a preponderance of white-footed mice were caught in a sand savanna in Winnebago County (Szafoni 1988) and in sand forests in Cass County (Hofmann and Handel 1997).

In contrast, sand prairie had a greater overall species richness and diversity, although there was considerable variation among the six sites that were surveyed. The number of species

per site varied from two to eight and trapping success ranged from 17.1 to 34.3%. One site displayed numerical domination by a single species (the deer mouse at F100 prairie), but others had a more even, diverse assemblage. Species richness at a site was not related to the number of individuals captured on a transect nor to trapping effort, which was constant among sites. Thus, the variation is not an artifact of sampling. Rather, we believe the small mammal communities at each site reflect the complexity, diversity, and maturity of the prairie vegetation. The most diverse small mammal assemblage was captured at the site (G-area prairie) where the prairie vegetation was relatively tall and most dense. This site also yielded the only captures of least weasels and masked shrews. In contrast, the F100 site where essentially only deer mice were caught had very sparse vegetative cover. Although other sites may not be able to support similar vegetative complexity, the G-area prairie provides a benchmark of the diverse small mammal community possible in prairie habitat for the Lost Mound Unit.

Relative abundance values were calculated for each species at each trapping site (Tables 3-15). Because the trappability of small mammal species varies, these values are of limited use for interspecific comparisons (Call 1986, Slade and Blair 2000). For example, relative abundance of shrews was consistently low in this survey, but they are not readily caught in live traps and probably are more common than these values suggest. Relative abundances were included for comparisons of the same species at different sites and comparison with future monitoring efforts.

We did not observe any Franklin's ground squirrels (*Spermophilus franklinii*) during our surveys. Franklin's ground squirrel has become a species of concern in the eastern part of its range (Lewis and Rongstad 1992, Johnson and Choromanski-Norris 1992), and may have declined considerably in distribution and abundance in Illinois as well. Some areas at the Depot may prove suitable for the introduction of this species; we recommend this option be considered as management plans for the Lost Mound Unit are formulated.

Some species that appear to have declined recently, such as least weasels and Franklin's ground squirrels, may ultimately benefit from conservation and restoration efforts at the Lost Mound Unit. Common and widespread species of small mammal also have important roles to play in healthy ecosystems, however. Burrowing and herbivorous species such as voles and ground squirrels can affect the species composition of plant communities, often increasing plant species diversity. Many small mammal species provide an important prey base for higher trophic levels. For example, the maintenance of overwintering raptors and nesting success of hawks and owls can be dependent on good populations of voles and *Peromyscus*. Bird surveys during 1994-1998 showed no breeding by several raptors (e.g. northern harrier, short-eared owl) that were occasionally observed at the Depot (Anderson et al. 1995, 1996; Anderson and Kirk 1998; Anderson in litt.). Although the failure of these species to breed there usually has been attributed to a lack of suitable nesting habitat resulting from intensive grazing (Bowles 1993), an inadequate prey base also may have been a factor. Mammalian carnivores from least weasels to coyotes and bobcats also rely on small mammals as prey to varying extents, as do many species of snake. Voles are particularly important for many predators because they are active diurnally as well as nocturnally. We found that small mammals were numerous even in areas of sparse vegetation, but species richness was greater and more voles were caught in denser cover. Conservation efforts that benefit small mammals not only protect a component of biodiversity important in its own right, but can promote the health of maintenance of other taxa and trophic levels as well.

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