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POPULATIONS OF SMALL MAMMALS IN NORTH-CENTRAL OKLAHOMA

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ABSTRACT. Populations of small mammals were assessed in six major habitat types (moderately and heavily grazed grasslands, lowland and upland forests, cropland, and prairie relic) in north-central Oklahoma using four grids of live traps and 26 traplines. Animals were sampled during March, May, and August of 1975, with a total of 23,280 trap-nights in the grid analysis and 1,699 on the lines. Five to eight species were captured in both the grassland and woodland habitats. Population densities were higher in March than in May or August. For the moderately grazed grassland, total small mammal density in March was 8.4 animals/ha, with deer mice (*Peromyscus maniculatus*) predominant (3.2/ha); total density in May was 4.2/ha (deer mice, 0.7); and 0.9 (no deer mice) in August. Comparable values for the heavily grazed grassland were: March, 8.8/ha (6.4); May, 4.8 (1.2); and August, 5.9 (1.5). Densities in the lowland forest were considerably higher and white-footed mice (*P. leucopus*) were most abundant. Total densities (and those for white-footed mice) were: March, 35.4/ha (34.5); May, 20.6 (18.1); and August, 20.8 (13.6). Estimates for the upland forest were: March, 24.3/ha (23.4); May, 14.8 (9.7); and August, 13.7 (18.9). Species composition in the prairie relic was similar to that for the other grasslands. White-footed mice and hispid cotton rats (*Sigmodon hispidus*) were the most common forms in croplands. Survivorship, as indicated by recapture in subsequent sampling periods, was higher for white-footed mice than for deer mice. Apparently prairie voles (*Microtus ochrogaster*), which were found in relatively low numbers, do not exhibit marked population cycles on the site, while white-footed and deer mice undergo substantial population fluctuations. Species with western continental distributions were restricted to grasslands, while eastern forms were found primarily in the wooded areas of the study site.

The mammalian fauna of Oklahoma has received attention from biologists for the past four decades, although no recent comprehensive treatment is available. Blair and Hubbell (1938) and Blair (1939) described faunal relationships of biotic districts in the state, and various investigators have conducted ecological studies involving single species. A few areas have been studied in detail. Blair (1938) conducted an intensive investigation of the mammals of the Bird Creek region in Tulsa Co., and Hays (1958) trapped small mammals in McClain Co. Three reports have focused on the small mammals of grassland sites (Phillips 1936; Birney 1974; Risser et al., in press). The studies of Birney (1974) and Risser et al. (in press) were conducted in such a way that densities of the various species could be estimated; most other treatments of small mammals in the state include only relative abundance estimates.

Our study was designed to characterize the small mammal fauna of typical habitats in north-central Oklahoma. Much of the state, including our study area, has been strongly influenced by man's activities, particularly the use of land for crops and for grazing. The study site is situated at the western edge of a transition zone of approximately 150 km that extends between the deciduous forests characteristic of much of eastern North America and the grasslands of the Great Plains (Blair and Hubbell 1938, Küchler 1964). Thus, species with both eastern and western affinities occur in the region. We have estimated small mammal population densities for the major habitat types and described faunal relationships among habitats. In addition, we have compared results with those from previous studies in Oklahoma.

STUDY AREA. The study area was 37 km N Stillwater in Pawnee and Noble counties, Oklahoma. Grids of live traps were established in four habitat types—moderately grazed grassland, heavily grazed grassland, lowland forest, and upland forest—to obtain density estimates for small mammals (Fig. 1). In addition, trap lines were run in adjacent areas (i.e., within 5 km of the grids) in these and two other habitats (cropland and a prairie relic) to establish whether the small mammal species composition of the gridded areas was typical of the area.

For a 4,250-ha area centered on the grids, percentages of land in various habitat types as established from aerial photographs and ground surveys were as follows: moderately grazed grassland, 67.3%; heavily grazed grassland, 2.4%; lowland forest, 10.0%; upland forest, 0.9%; cropland, 17.9%; prairie relic, less than 0.1%; and other (including farm ponds, etc.), 1.5%. We estimate vegetational species composition and cover in the grassland habitats during April-May, June, July, and September of 1975 using 0.5–m^2 quadrats placed in grids (80 in each of the two major grassland types and 20 in the prairie relic) adjacent to the mammal grids and traplines. The upland and lowland forest herbaceous understory also were sampled during the same four periods. Frequency was estimated from species occurrence in 15–m segments of three lines. Forest overstories were sampled for tree species density in June using 20 circular 100–m^2 quadrats in the lowland forest and 10 in the upland forest.

In the moderately grazed grassland, little bluestem (*Schizachyrium scoparium*) was the major species with Scribner panicum (*Panicum scribnerianum*), three-

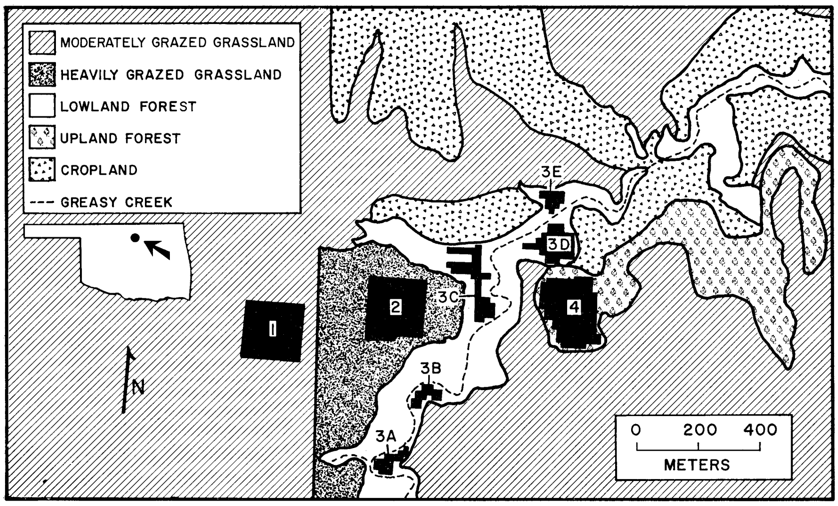

Fig. 1. Map of area adjacent to Greasy Creek in Pawnee and Noble counties showing distribution of major habitat types and placement of trapping grids in: (1) moderately grazed grassland; (2) heavily grazed grassland; (3) lowland forest; and (4) upland forest.

awns (*Aristida* spp.), common ragweed (*Ambrosia artemisiifolia*), and common yarrow (*Achillea glandulosa*) also important. Cheatgrass (*Bromus* spp.), Elliott bentgrass (*Agrostis elliottiana*), and several rushes (*Juncus* spp.) were predominant in the early spring, but the forbs and warm-season grasses constituted most of the cover during summer and fall. Total above-ground biomass (dry weight g/m^2) estimates were 1,263 (May), 177 (June), 176 (July) and 219 (September).

During the April-May sampling the most common species in the heavily grazed grassland were common yarrow, common ragweed, threeawn, slender plantain (*Plantago elongata*), rushes, and prairie fleabane (*Erigeron strigosus*). By July common ragweed was the predominant plant and asters (*Aster* spp.) were very abundant; common yarrow and rushes also were characterized by high frequencies. Common yarrow was again the most abundant species in September, and threeawn, lovegrass (*Eragrostis* sp.), Scribner panicum, little bluestem, and asters were less important but frequent. Above-ground biomass values were 912 g/m^2 (May), 95 (June), 54 (July) and 143 (September).

These grasslands represent vegetation typical for this part of Oklahoma (Kelting 1954, Sims and Dwyer 1965). Differences in species composition between the two grasslands (and their differences from the prairie relic) probably are the result of different grazing pressures (Penfound 1964, Hazell 1967).

The ungrazed prairie relic contained Indiangrass (*Sorghastrum nutans*) and little bluestem as the most common species, along with switchgrass (*Panicum virgatum*). These three species, in addition to big bluestem (*Andropogon gerardii*), which also occurred in this habitat type, are dominants of the virgin tall-grass prairie (Buck and Kelting 1962). Herbage biomass was estimated in July at 653 g/m^2.

In the lowland forests, coralberry (*Symphoricarpos orbiculatus*) was the most frequent shrub. Sedges (*Carex* spp.), wild chervil (*Chaerophyllum procumbens*), and catchweed bedstraw (*Galium aparine*) were also abundant in May. American elm (*Ulmus americana*), the predominant woody species (99/ha), was associated with chittamwood (*Bumelia lanuginosa*, 89), ash (*Fraxinus* spp., 74), and hackberry (*Celtis* spp., 40). This forest is similar to many found in north-central Oklahoma (Rice 1965).

In the upland forest, coralberry and Virginia creeper (*Parthenocissus quinquefolia*) were the most common understory species found during all sampling periods. The blackjack oak (*Quercus marilandica*, 979/ha) forest is typical of many ridgetops in this part of the state (Rice and Penfound 1959, Risser and Rice 1971).

Small grains, particularly wheat, were the most frequently planted on the croplands in the area. In some cases plowed fields were sampled.

METHODS. We sampled small mammals using Sherman live traps (7.5 X 7.5 X 23 cm) arranged in grids and lines from 11-23 March, 16-31 May, and 2-15 August 1975. In addition, some traplines were also set on 2 March. Traps were baited in the late afternoon with a mixture of rolled oats and peanut butter, and checked in the morning. In the grids mammals were marked by a system of toe clippings and ear punches for individual identification, and released.

Each of the four grids (see Fig. 1) was composed of a series of stations 15 m apart. Stations were marked with 1.2-m wooden stakes and had two traps each. The 144-station grid in the moderately grazed grassland was square, while that in the heavily grazed grassland had an additional six stations at the south end. Since the lowland forest was limited to the edges of Greasy Creek, the 144-station grid was dissected by the creek into five parts (Fig. 1). The grid in the upland forest contained 144 stations, but was somewhat elongated to conform to habitat boundaries.

The gridded areas were sampled for 6 days in March and 7 in May and August, as follows: heavily grazed grassland and upland forest, 11 and 13-17 March, 17-23 May, and 2-8 August; moderately grazed grassland, 18-23 March, 24-30 May, 9-15 August; and lowland forest, 18-23 March, 25-31 May, 9-15 August. Traps were closed on 12 March because of inclement weather.

The Jolly-Seber stochastic model (Jolly 1965, Seber 1973) was employed to estimate numbers in each habitat and sampling period if more than 10 individuals of a species were marked. We chose the highest daily estimate obtained from this approach. When fewer animals were caught, the conditional binomial method of Zippin (1956) was applied to live-trap data, where only newly trapped animals are considered. Sometimes, because the distribution of captures through a sampling period deviated substantially from the expected frequency distribution, it was not possible to obtain a population estimate with this method. In these cases the total number of animals captured was used as the best estimate of population size.

In the forests, because most edges of these grids were bounded by different habitat types, we considered each station to be centered on the stake and sampling a square of 225 m^2. Thus, 3.24 ha were sampled in each of the forest grids.

Estimates of numbers from the grasslands were converted to densities by dividing each by the effective area of trap-grid influence, which is a function of the extent of movements by the species (French and Grant 1974). All grid locations where an individual was captured during a sampling period were plotted, and the greatest distance between any two of these locations was measured. These distances were averaged for all recaptured individuals of each species to yield a mean maximum distance moved. The effective area of trap-grid influence was then considered to be circumscribed by a line one-half the mean maximum distance moved beyond the outermost traps on the grid. If the mean maximum distance moved was less than 7.5 m (one-half the distance between grid points), we assumed that the effective area covered by the grid was 3.24 ha in the moderately grazed grassland and 3.38 ha in the heavily grazed grassland. Species diversity was calculated using the Shannon-Weaver equation with natural logarithms.

As a supplement to the grid analyses, lines of from 40 to 159 traps were set for single nights at various locations in the six habitat types. The traps were placed 5 to 10 m apart. A representative series of specimens from these trap lines has been deposited in the Stoval Museum of Science and History at the University of Oklahoma.

Due to the high degree of similarity between some deer mice (*Peromyscus maniculatus*) and white-footed mice (*P. leucopus*) from the study area, portions of the liver and a kidney from 64 specimens were saved for electrophoretic analysis of sorbitol dehydrogenase (M. H. Smith, pers. commun.). Results of this analysis confirmed previous tentative identifications.

Nomenclature in this paper follows Jones et al. (1973).

RESULTS. We caught the following 12 species on one or more of the four trap grids: southern short-tailed shrew, *Blarina carolinensis*; least shrew, *Cryptotis parva*; thirteen-lined group squirrel, *Spermophilus tridecemlineatus*; hispid pocket mouse, *Perognathus hispidus*; plains harvest mouse, *Reithrodontomys montanus*; deer mouse, *Peromyscus maniculatus*; white-footed mouse, *P. leucopus*; Texas mouse, *P. attwateri*; hispid cotton rat, *Sigmodon hispidus*: eastern woodrat, *Neotoma floridana*; prairie vole, *Microtus ochrogaster;* and woodland vole, *M. pinetorum*. Table 1 indicates the numbers of individuals captured, estimated population values, effective area of grid influence, and density estimates for each species in the four habitats.

Many individuals were captured more than once during a sampling period. In addition, a number of animals captured in March were retrapped in May and August. Population densities for the more common species in May were markedly lower than those recorded in March. Young animals seldom were observed and few females in the later stages of pregnancy were captured in May, indicating there was little reproductive activity in the small mammals in May. Most of the August values were roughly equivalent to those in May. The major exception was the moderately grazed

TABLE 1. *Numbers and population estimates for mammal species in four habitats based on grid-trapping analysis.*

Species	Date	No. caught	Zippin (no.±SE)	Jolly-Seber (no.±SE)	Effective grid size[a] (ha)	Density (no./ha)
MODERATELY GRAZED GRASSLAND						
Thirteen-lined ground squirrel	May	1	—	—	X	0.31
Hispid pocket mouse	May	2	—	—	X	0.62
Plains harvest mouse	Mar	13	14.4±1.1	18.0±80.8	3.52	5.11
	May	5	7.7±6.5	—	5.13	1.50
Deer mouse	Mar	18	18.2±0.0	14.7±2.4	4.52	3.25
	May	3	3.6±0.7	—	5.21	0.69
Prairie vole	May	2	3.4±11.3	—	X	1.05
	Aug	3	—	—	X	0.93
HEAVILY GRAZED GRASSLAND						
Hispid pocket mouse	Mar	1	—	—	X	0.30
Plains harvest mouse	Mar	4	—	—	X	1.18
Deer mouse	Mar	35	36.1±0.5	26.3±3.0	4.09	6.43
	May	5	5.0±0.0	—	4.17	1.20
	Aug	5	7.7±6.5	—	5.09	1.51
White-footed mouse	Mar	2	2.0±0.0	—	3.49	0.57
	May	2	2.0±0.0	—	X	0.59
	Aug	4	6.8±10.7	—	X	2.01
Hispid cotton rat	Aug	1	—	—	3.38	0.30
Prairie vole	Mar	1	—	—	3.38	0.30
	May	13	—	10.3±4.3	3.38	3.05
	Aug	5	9.6±27.3	—	4.52	2.12
LOWLAND FOREST						
White-footed mouse	Mar	132	135.4±1.2	111.8±13.9	X	34.51
	May	38	40.2±1.2	58.5±40.4	X	18.06
	Aug	38	39.4±0.6	44.0±10.6	X	13.58
Hispid cotton rat	Mar	1	1.0±0.0	—	X	0.31
Eastern woodrat	Mar	2	2.0±0.0	—	X	0.62
	May	11	11.1±0.0	8.3±2.9	X	2.56
	Aug	28	29.1±0.6	23.3±12.3	X	7.19

TABLE 1 (continued)

Species	Date	No. caught	Zippin (no.±SE)	Jolly-Seber (no.±Se)	Effective grid size[a] (ha)	Density (no./ha)
		UPLAND FOREST				
Southern short-tailed shrew	May	1	—	—	X	0.31
Least shrew	May	3	—	—	X	0.93
	Aug	3	4.2±2.9	—	X	1.30
White-footed mouse	Mar	86	88.2±0.8	75.8±7.3	X	23.40
	May	37	39.4±1.3	31.3±2.8	X	9.66
	Aug	27	41.4±15.8	28.7±8.8	X	8.86
Texas mouse	May	2	2.0±0.0	—	X	0.62
	Aug	1	1.0±0.0	—	X	0.31
Hispid cotton rat	Aug	1	—	—	X	0.31
Eastern woodrat	Mar	2	2.0±0.0	—	X	0.62
	May	3	3.6±0.7	—	X	1.11
	Aug	6	6.5±0.3	—	X	2.01
Prairie vole	Mar	1	1.0±0.0	—	X	0.31
	May	1	1.2±0.2	—	X	0.37
Woodland vole	May	6	—	—	X	1.85
	Aug	3	—	—	X	0.93

[a] An "X" indicates that the standard grid size of 3.38 ha (heavily grazed grassland) or 3.24 ha (other habitats) was used.

grassland, in which populations of all species continued to decline.

In general, trapping success on the grids was highest in March and lowest in August (Table 2). We captured considerably more individuals per trap-night in the woodlands than in the grasslands. Since relatively few species were trapped and usually one or two species showed a predominance in numbers, species diversity indices were low (Table 2).

Survivorship (as indicated by recapture) of the white-footed mice on the woodland grids was high. In May we recaptured 24% of the 86 white-footed mice originally caught in the upland forest in

TABLE 2. *Numbers, trapping success, density, and diversity based on grid trapping in four habitats.*

Date	No. captures[a]	Trapping success (per cent)	No. species	No. individuals	Density (per ha)	Diversity[b]
		MODERATELY GRAZED GRASSLAND				
Mar	70	4.05	2	31	8.36	0.67
May	23	1.14	5	13	4.17	1.49
Aug	4	0.20	1	3	0.93	0.00
Total	97	1.68	5			
		HEAVILY GRAZED GRASSLAND				
Mar	109	6.06	5	43	8.78	0.91
May	50	2.38	3	20	4.84	0.89
Aug	30	1.43	4	15	5.94	1.23
Total	189	3.15	6			
		LOWLAND FOREST				
Mar	313	18.11	3	135	35.44	0.14
May	89	4.41	2	49	20.62	0.38
Aug	174	8.63	2	66	20.77	0.65
Total	576	10.00	3			
		UPLAND FOREST				
Mar	234	13.54	3	89	24.33	0.19
May	181	8.98	7	53	14.85	1.21
Aug	100	4.96	6	41	13.72	1.14
Total	515	8.94	8			

[a] Includes recaptures.
[b] Based on density estimates.

March. Furthermore, 16% of the March-caught mice were again recaptured in August. Of the 16 new captures of this species in May 44% were subsequently recaptured in August. For the lowland forest, the recapture percentages of the white-footed mouse were: March to May, 16%; March to August, 16%; May to August, 65%.

The survivorship of deer mice was somewhat lower. For the 53 first obtained from the two grassland grids, 13% were recaptured in May, whereas only 6% of the March captures were again trapped in August. Only one new capture of a deer mouse occurred in May, and this animal was not recaptured in August.

For the trap lines, a summary of the number of individuals captured in the six habitat types and the number of total trap-nights in each is provided in Table 3. Only one species (the house mouse, *Mus musculus*) not found on any of the grids was captured on a

TABLE 3. *Summary of captures of small mammals for trap lines placed in six habitat types.*[a]

Species	Date	MGG	HGG	LF	UF	C	PR
Deer mouse	Mar	6			1		
	May		1			3	2
	Aug		4				3
White-footed mouse	Mar			16	20	2	
	May			19	10	7	
	Aug	7		13	4	3	
Hispid cotton rat	Mar	1		4			2
	May	1		2		2	
	Aug	5		4		13	
Eastern woodrat	Mar				2		
	May			2			
	Aug	1		2	3	1	
Prairie vole	Mar						5
	May						2
	Aug						1
	May			2			
House mouse	May					1	
Total no. species		4	1	4	3	5	3
Total no. individuals		21	5	64	40	32	15
Trap-nights	Mar	169		109	155	40	100
	May	75	10	105	40	80	40
	Aug	349	167	100	40	80	40
Total		593	177	314	235	200	180

[a]MGG=moderately grazed grassland; HGG=heavily grazed grassland; LF=lowland forest; UF=upland forest; PR=prairie relic; C=cropland.

trap line. The findings for trap lines with respect to species composition were similar to those from the grids for the four main habitat types. We obtained five species on the trap lines in the croplands and three in the prairie relic. Trapping success on the lines averaged 10.42% (for 1,699 total trap-nights), with 10.30% (573) in March, 15.43% (350) in May, and 8.25% (776) in August. Table 3 indicates that most of the captures involved white-footed mice in the forests or the cropland, with hispid cotton rats being the next most commonly trapped form.

DISCUSSION. The numbers of species captured in the various habitats on the study area are typical for the region. During each sampling period we found from five to eight species of small mammals in the grasslands and a similar number in woodland areas. In McClain (central Oklahoma) Hays (1958) recorded six species of small mammals in a grassland and three in a wooded ravine. Blair (1938) found about eight species in grasslands and a similar number in woodlands in the Bird Creek region near Tulsa.

In Osage Co., 55 km NE our study area, Risser et al. (in press) found from four to eight species of small mammals in tallgrass prairie. Although relative abundances of species were considerably different from those for our study area (i.e., prairie voles were a much more important component on the Osage Co. site), the small mammal species diversity values for grasslands in the two areas were similar. The vole population on an ungrazed grassland at the Osage site periodically attained high density and exhibited pronounced population cycles. Birney et al. (1976) hypothesized that a site-dependent threshold level of vegetative cover is essential for a vole population to attain sufficient numbers to undergo a multiyear cycle. Furthermore, subthreshold levels of cover sometimes support resident (noncycling) breeding populations of voles. These authors suggested that for the Osage location the critical threshold was about 450 to 500 g/m^2 above-ground biomass of vegetation (i.e., standing plants and litter). For both the heavily grazed and moderately grazed grasslands on our site, cover values were considerably below this level during most of the growing season, with only the May estimates being higher (see description of study area). Thus, vegetative cover on our grasslands was probably insufficient to support a cyclic vole population. Of course, since our data are from only a single year, we we cannot evaluate this point critically. However, given the findings of Birney et al. (1976), it is likely that the relatively low vole densities we found are characteristic of the grazed grasslands on our study site, which is near the southern extent of the range of the prairie vole (Hall and Kelson 1959). Presumably the level of cover found on the ungrazed prairie relic (653 g/m^2 in July) would support a cycling population of voles; however, this area was probably too small to allow for any substantial buildup in numbers.

Results of our sampling procedures indicated that white-footed mice were confined primarily to the woodlands, while deer mice most frequently were found in grassland areas. Although white-footed mice were occasionally captured in grasslands (Table 1 and 3), these were at stations adjacent to areas of woody vegetation. The one deer mouse found on an upland forest trap line (Table 3) was in a trap placed in a small grassy clearing. These differences in habitat preferences of white-footed and deer mice are similar to those recorded by other investigators. In a study area in central Oklahoma (Hays 1958), the white-footed mouse was the species most often captured in a wooded ravine, and deer mice were confined almost entirely to grasslands. Beckwith (1954), studying successional stages of abandoned fields in southern Michigan, found highest numbers of deer mice in the early successional communities; white-footed mice were found in a somewhat broader range of habitats, but their highest numbers were in the late forested stages. In another investigation in southern Michigan, white-footed mice were limited primarily to areas containing trees and shrubs (Getz 1961). Whereas white-footed mice sometimes are found in grassy situations (Blair 1940, Howard 1949), Getz (1961) concluded that they do not permanently inhabit such areas. Blair's (1940) investigation suggests, however, that deer mice are considerably more habitat specific than are white-footed mice. Apparently, deer mice are more limited in ecological distribution than white-footed mice even in geographic areas where one or both exhibit habitat preferences considerably different from those encountered in Oklahoma (see for example Klein 1960, Choate 1973).

Brown (1964) studied three *Peromyscus* species in southern Missouri and found deer mice to be restricted primarily to grasslands and old-field successional areas, white-footed mice to hardwood forests, and Texas mice to cedar glades. (Only in the latter habitat type were the three forms likely to be found together.) Blair (1939) and Long (1961) suggested that the Texas mouse is most abundant on rocky wooded slopes and cliffs. In our studies the Texas mouse was found only in a small portion of the upland forest grid (Table

1). This limited cedar glade had shallow soils and was characterized by sandstone outcrops and a few junipers (*Juniperus virginiana*), neither of which was found elsewhere in the upland forest or in other habitats on the site. Thus, our study site supported only a relatively low number of this species.

Blair and Hubbell (1938) found that for the Oklahoma mammalian fauna 30% of the species are primarily western in their continental distributions, while another 30% are mainly eastern forms. For the 12 small mammal species we captured during the grid analysis, 17% are western forms (hispid pocket mouse, plains harvest mouse) and 33% are eastern (southern short-tailed shrew, least shrew, eastern woodrat, woodland vole). The six remaining species are widespread or have some other pattern of distribution. Not unexpectedly, the two western forms were restricted to the grasslands on our site. The eastern species were found only in forests, with three of the four being restricted to the upland forest.

The three eastern forms and the one other species restricted to the upland forest (Texas mouse) were always found in low densities (see Table 1). Furthermore, none was captured in March—a period when the density of white-footed mice in the upland forest was relatively high. It is unlikely that all four of these species were absent from the site in March. Because the limited extent of upland forest habitat in the region, immigration by the four species to our study site between March and May is improbable. Assuming that these species were present in March, their absence from our traps may be explainable in one or both of the following ways. Studies by Brown (1964) and others indicate that white-footed mice commonly are aggressive in interspecific encounters. As mentioned, this species was abundant on the site in March; clearly it readily enters live traps, and its presence in high numbers may have precluded access to traps by the four low density species. Alternatively, behavioral patterns of the four species during the relatively cold weather of March may be responsible for the lack of captures (e.g., one or more of the species may reside beneath the leaf litter during such a period). Unfortunately, the behavioral information currently available for these forms is incomplete and does not allow for a critical evaluation of this possibility.

Two species with widespread continental distributions predominate in the small mammal fauna of our study area. The white-footed mice of the woodlands and the deer mice of the grasslands exhibit considerable temporal fluctuations in densities. Thus, while their numbers probably do not change as dramatically as in cyclic vole populations supported in the extensive grasslands to the north, the variations are substantial. These two *Peromyscus* species are the primary components of the small mammal fauna in the ecologically transitional zone represented by our study area.

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