

OCCASIONAL PAPERS

THE MUSEUM

TEXAS TECH UNIVERSITY

NUMBER 37

19 DECEMBER 1975

SYNOPSIS OF NATIVE, RECENT MAMMALS OF ELLIS COUNTY, KANSAS

JERRY R. CHOATE AND EUGENE D. FLEHARTY

The mammalian fauna of Kansas historically has ranked as one of the most extensively studied of any in the country (see summary by Cockrum, 1952:4). However, most of those mammalogical investigations have been conducted by persons associated with The University of Kansas, near the eastern border of the state, and many of their expeditions to western Kansas have concentrated on areas of special biogeographical or paleontological importance (such as Cheyenne, Morton, Meade, and Barber counties) along the northern and southern borders of the state. As a result, the mammalian fauna of the interior of western Kansas received only sporadic attention (much of which dealt with ecological studies in and around Ellis County by personnel from Fort Hays Kansas State College) until the 1960's, when the collection of mammals now housed in the Museum of the High Plains at Fort Hays Kansas State College was founded. The continuing growth of this collection, together with the accumulation of ecological data from studies on the Mixed Prairie near Fort Hays Kansas State College and in other habitats in western Kansas, likely will result in dissemination of considerable additional information pertaining to the mammalian fauna of the region. Also, increasingly cooperative interaction between personnel from the Museum of the High Plains and The Museum of Texas Tech University affords a unique opportunity to elucidate systematic and both past and present biogeographic relationships of several species of mammals in western Kansas and in adjacent regions of the Great Plains. The purpose of this synopsis, therefore, is to summarize the historical and other kinds of data presently available that pertain to native, Recent mammals in Ellis County, to elucidate their past and present biogeographic rela-

tionships, and thereby to lay a foundation for future investigations of mammals on the Great Plains.

DESCRIPTION OF ELLIS COUNTY

Ellis County is situated in the northeastern quarter of the western half of Kansas (Fig. 1). The county is square (30 miles on a side) and encompasses 576,000 acres. Topography varies from rolling hills and flatlands to rugged breaks and canyons, and elevation declines from about 2400 feet in the southwest to 1700 feet in the northeast. About 53 per cent of the land in Ellis County presently is under cultivation, whereas 40 percent is rangeland. The remainder includes 6613 acres of farm ponds and other small impoundments, about 400 acres of natural woodland along watercourses and in ravines, and more than 550 acres of windbreaks and other plots of planted timber (Ely, 1971).

Ellis County was included within the Upper Sonoran area of the Upper Austral Life Zone by Merriam (1898), the Mixed Prairie Association by Clements (1920; see also Weaver and Bruner, 1954), the Northern Association of the Mixed Grass Plains Biotic District by Brumwell (1951), the Illinoian Biotic Province by Dice (1943), and the Grama Grass-Antelope Biome by Shelford (1945). Cockrum (1952) recognized two mammalian distributional areas in Kansas, and included Ellis County within the Blue Hills Subcenter of the Mixed Grass Plains Province, which, in turn, is part of the Great Plains Distributional Area.

Based on topography, geology, climate, and soils, Fly (1946 — see also Austin, 1965) divided Kansas into 25 Agricultural Resource Areas, three of which occur in Ellis County. Portions of northern (along the Saline River) and southwestern (south of the Smoky Hill River) Ellis County were included within the West Kansas Breaks and Canyons Section of the High Plains Breaks and Eroded Tablelands Region (“a transitional area between the High Plains and the rolling plains of central Kansas” in which most of the terrain is rough and broken, soils are shallow, ground water is scarce, and natural vegetation consists largely of short and mid-height grasses); part of the land between the Saline River and Big Creek (in central Ellis County) was included within the Moist Semi-arid Hardlands Section of the Colorado-Kansas Central High Plains Region (comprised of “unbroken smooth, treeless plains” or “narrow, gently rolling . . . High Plains remnants” on which vegetation consists largely of short grasses); the remainder of the county was included within the Shale-Limestone Section of the Central Kansas Rolling Plains Region (in

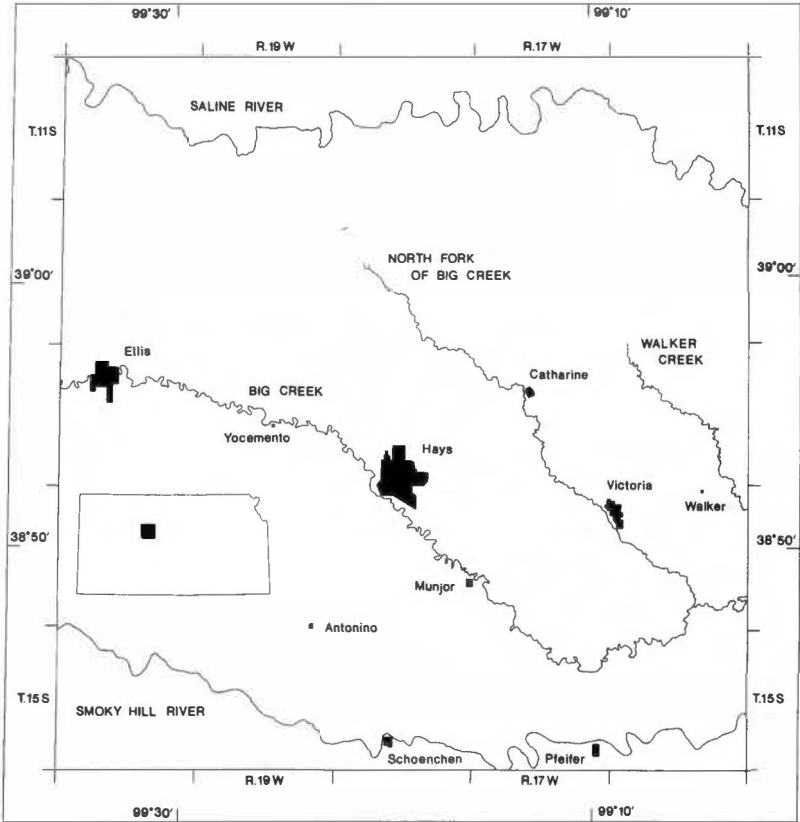


FIG. 1.—Map of Ellis County, Kansas, showing locations of places mentioned in text.

which ground water is scarce, and vegetation consists largely of short grasses but with tall and mid-height grasses on sandy soils in river valleys and a few scattered trees along the banks of streams).

Geologically, Ellis County is divided into two physiographic provinces, the High Plains to the west and the Smoky Hills to the east. The line separating these provinces is a dissected escarpment (the Fort Hays escarpment), extending roughly from southwest to northeast, that runs just to the west of the city of Hays. The bluffs of the escarpment are comprised largely of Cretaceous deposits capped primarily by Fort Hays Limestone, but in the extreme west this is overlain by Smoky Hill Chalk (Cretaceous) and the Ogallala Formation (Pliocene), the latter of which forms the caprock. Along the Saline River, these bluffs are undergoing periodic slumping, sometimes as much as 60 feet in depth. Bedrock to the east of the Fort Hays

escarpment consists of Blue Hill Shale and, still farther to the east, of Greenhorn Limestone.

Upland valleys contain soil comprised largely of Pleistocene loess, whereas the soil of river valleys is derived principally from Pleistocene alluvium. Terraces are evident along the Saline and Smoky Hill rivers; the upper terrace along the Smoky Hill is termed the Pfeifer Terrace (Illinoian in age), whereas the lower is the Schoenchen Terrace (Wisconsin). Terraces along the Saline River have not received formal designation, but probably represent the same geological time periods. The geological history of Big Creek has not been studied in detail as yet (Bass, 1926; Leonard and Berry, 1961).

The land of Ellis County is drained by three principal watercourses (the Saline River near the northern border of the county, Big Creek toward the center, and the Smoky Hill River near the southern border — Fig. 1) that flow roughly from west to east. Henderson (1960:14) reported the lengths of these watercourses in Ellis County as 49.0, 44.4, and 54.1 miles, respectively. Tributaries of these streams (excepting the North Fork of Big Creek, which usually contains water for about 11 miles above its mouth) are intermittent or dry throughout most of their lengths during at least part of an average year; therefore, the total length (162.3 miles) of permanent streams in Ellis County is only slightly greater than the sum (147.5 miles) of the lengths of the three principal streams. Both the North Fork of Big Creek and another ephemeral stream, Walker Creek, have their headwaters in Ellis County. Permanent standing water was scarce prior to construction of stock ponds and other artificial impoundments, although oxbows and ephemeral marshes doubtlessly existed along Big Creek (and perhaps also the Saline and Smoky Hill rivers) at various times during the Recent Epoch (R. J. Zakrzewski, personal communication).

Soils in Ellis County are of three principal types (Bidwell, 1956). Most soils north of the Smoky Hill River are dark grayish brown or grayish brown silt loams (Hastings, Holdredge, and Colby soils) that developed from loess overlying the parental material. A second type, consisting of reddish brown silty clay loam (Nuckolls soil) and silty clay loams (Crete and Hastings soils), occurs in a restricted area just north of the Smoky Hill River at the eastern border of the county (Nuckolls soil primarily on slopes along drainageways, and Crete and Hastings soils in relatively flat, cultivated areas). The third type is comprised of alluvial soils located along the floodplain and terraces of the Smoky Hill River. In Ellis County, these three principal soil types encompass a total of 33 different soil series (Dutt, 1970).

The climate of Ellis County is typically mid-continental, and weather is subject to periodic, abrupt changes. During summer, most

days are hot, dry, and windy, but nights are relatively cool. Winters usually are moderate, but are characterized by short periods of intense cold. Average annual temperature for the period 1907-1958 at the Fort Hays Agricultural Experiment Station was 54°F, and monthly averages ranged from 29°F in January to 80°F in July. Extreme temperatures during this period were -24° and 117°F. The average frost-free period was from 29 April until 14 October. Precipitation averaged 21.67 inches per year, with extremes of 9.21 inches in 1956 and 43.34 inches in 1951. Rainfall is sporadic in occurrence, but about 77 per cent occurs during the growing season and most of this in May and June. Snowfall averages 19.6 inches per year, is most prevalent during February and March, and covers the ground for about 25 days per year. Wind velocity during the growing season averages 8 miles per hour, and average seasonal evaporation is three times the average seasonal rainfall (Luebs, 1962; Ely, 1971).

Although included entirely within the Mixed Prairie (Clements, 1920), Ellis County contains both prairie and woodland vegetation (see Appendix for scientific names of plants referred to by common names in text). Most naturally forested areas in the county are restricted to ribbons of riparian habitat along the Saline River, Big Creek, the Smoky Hill River, and their tributaries. Additionally, a few planted plots of timber exist (and many more formerly existed) in the form of woodlots, windbreaks, and timber claims. Timber claims came into being as a result of the Timber Culture Act of 1873, which enabled a homesteader to acquire title to one-quarter section of public land if he would plant 40 acres of it to trees. This law was later (1878) amended to require only that 10 acres of trees be planted (Ware and Smith, 1939). The species commonly planted in Ellis County were Osage orange, black walnut, black locust, honey locust, green ash, and catalpa, but most of these trees did not survive the drought of 1933 to 1939 (Albertson and Weaver, 1945). In addition to timber claims, 13 per cent of the farms in western Kansas in 1939 had windbreaks (Ware and Smith, 1939), usually comprised of Osage orange, black locust, honey locust, or red cedar; of these, all but the red cedar had a high rate of mortality during the drought years of the 1930's (Albertson and Weaver, 1945).

Trees comprising riparian habitats also declined markedly during the drought, but their rate of mortality was less than that of trees that had been planted. Griswold (1942) determined that riparian communities associated with the Saline River, Big Creek, and the Smoky Hill River were comprised of 11, 10, and four species of trees, and of 80, 149, and 39 species of woody plants, respectively. In descending

order of dominance, silvan communities along the Saline River were comprised of green ash, American elm, common hackberry, and plains cottonwood; those associated with Big Creek consisted of green ash, common hackberry, American elm, plains cottonwood, and peach-leaved willow; those along the Smoky Hill River were comprised largely of plains cottonwood, peach-leaved willow, and green ash.

Prairie communities were described at length in the now classic study by Albertson (1937). He recognized three general types of prairie vegetation in Ellis County: the short grass type comprised 30 per cent of the Mixed Prairie, and was located principally on level uplands and at the bases of hills (particularly at the bases of south-facing slopes); the little bluestem type comprised 60 per cent of the Mixed Prairie, and occurred principally on hillsides and in shallow ravines; the big bluestem type comprised 10 per cent of the Mixed Prairie, and was restricted to deep ravines, relatively mesic lowlands, and near the bases of gently sloping hills.

In the short grass type, buffalo grass and blue grama were co-dominant and accounted for 80 per cent of the vegetation. Other characteristic grasses of the short grass type were purple three-awn and little bluestem, and less abundant species were squirreltail, side-oats grama, and western wheatgrass. Common (but not abundant) forbs included prickly pear, ashy goldenrod, scarlet globe mallow, and manyflower scurfpea.

The little bluestem type occurred in more mesic areas than those occupied by the short grass type. Little bluestem comprised 70 per cent of the vegetation in this type, although clumps of big bluestem were prominent in depressions and other mesic areas. Other grasses in this type included switchgrass and side-oats grama (on hillsides) and hairy grama and blue grama (in relatively arid situations near the tops of hills). The most conspicuous forbs in the little bluestem type of the Mixed Prairie were lead plant, purple coneflower, stemless *Hymenoxys*, and manyflower scurfpea.

The big bluestem type occurred only where soil moisture was adequate to permit lush growth. Big bluestem comprised 75 per cent of the vegetation in this type, and the principal sub-dominants were side-oats grama, western wheatgrass, and tall dropseed. In addition, switchgrass, Indian grass, Canada wild-rye, Virginia wild-rye, and heavy sedge were prevalent in especially mesic areas. The most abundant forbs in the big bluestem type of the Mixed Prairie were false bone set, heath aster, lead plant, manyflower scurfpea, pitcher sage, ironweed, Maximilian's sunflower, and woolly verbena. The

effects of drought on these three major grassland communities in Ellis County were described by Weaver and Albertson (1936, 1939, 1940, 1943, and 1944), Albertson and Weaver (1942, 1944, and 1946), Albertson *et al.* (1957), Albertson and Tomanek (1965), and Tomanek and Hulett (1970).

In another survey of the Mixed Prairie in Ellis County and adjacent regions of western Kansas, Hladek *et al.* (1972) characterized vegetation on the basis of moisture gradients and used indicator species to recognize four types of communities: very dry (indicator species, bladderpod and stemless *Hymenoxys*); dry-mesic (characterized by pitcher sage and tall dropseed); mesic (indicated by lead plant and spurge); and wet-mesic (characterized by Kentucky bluegrass, prairie rose, and snow-on-the-mountain). As would be expected, wet-mesic communities were located in level lowlands (where run-on is maximal and run-off negligible), and had easterly or northerly exposures, whereas, at the other extreme, very dry communities were situated on steep (10 to 29°), west or south-facing slopes (where run-on is negligible and run-off considerable).

A remnant of the Mixed Prairie in Ellis County has been the site of several of the ecological investigations mentioned herein. The remnant is located approximately 1 mi. S, 3 mi. W Hays (T. 14S, R. 19W, SE 1/4 sec. 1), and is situated on a dissected slope of the escarpment separating the High Plains and Smoky Hills physiographic provinces. Originally, the site was part of the Fort Hays Military Reservation, but it was given to the Western Branch of the Kansas Normal School of Emporia (now Fort Hays Kansas State College) in 1902. Since that time, the 35 acre plot has not been grazed by livestock, mowed, or burned, and the climax vegetation of all but a centrally-located draw has been protected from any consequential disturbance (Albertson, 1937). The draw originally was a "typical" lowland community, but was silted in after a dam broke in 1951 on an adjacent pasture. As a result, a weedy community developed on the deep, heavy soil in the draw (Martin, 1960), and weedy vegetation persists today on 5.51 acres of the remnant grassland; however, as noted by Hulett *et al.* (1972), weediness is not uncommon in lowland communities on the Mixed Prairie, and the draw might thus be as "typical" for low-lying habitats in this region as is the lowland community described by Albertson (1937). Eight communities of plants in the remnant were described by Hulett *et al.* (1972), and reference is made in several of the following accounts to preferred habitats of species of mammals that inhabit one or more of those communities. Some representative habitats in Ellis County are depicted in Figs. 2-5.



FIG. 2.—Short-grass rangeland on the High Plains in north-central Ellis County.



FIG. 3.—Limestone break sites and chalk bluffs on the High Plains near the Saline River.



FIG. 4.—Riparian woodland and farm land along the Saline River, as viewed from the top of the Fort Hays Escarpment.



FIG. 5.—Mixed grassland and riparian woodland adjacent to Rohr-Jacobs Lake in southwestern Ellis County.

HISTORY OF ELLIS COUNTY

The area now included within Ellis County has a rich and colorful history, and many of those historical events have affected the distributional patterns of mammals. Prior to occupancy by white settlers, the land between the Platte River (to the north) and the Arkansas River (to the south) was inhabited primarily by Cheyenne and Arapaho Indians, but bands of the Kaw, Pawnee, Sioux, Kiowa, and Comanche tribes made periodic incursions into the region in order to obtain food from the vast herds of bison that roamed the prairies (Leo Oliva, personal communication). This seemingly endless assemblage of bison either segregated naturally into northern and southern herds or became divided into northern and southern herds as a result of human activities along the Smoky Hill Trail, which crossed southern Ellis County. The Smoky Hill Trail was established in 1859 as the primary route across the Great Plains to the gold fields of Colorado. After the gold rush, this route was renamed the Butterfield Trail (after D. A. Butterfield of Denver) and served as the route for a stage line from Atchison to Denver.

Military installations were erected along the route to provide protection for wagon trains, settlers, and later the railroad, from raiding parties of Cheyennes and other Indians who were intent on retaining at least a vestige of their vast prairie. On 11 October 1865, one of these installations, Fort Fletcher (later renamed Fort Hays), was established on the bank of Big Creek at a place 14 miles southeast of the present city of Hays. On 3 June 1867, the fort was destroyed by a flood and the Department Commander (General Winfield Scott Hancock) ordered the installation moved to higher ground. On 4 July 1867, Fort Hays was formally relocated on a hill above Big Creek just to the south of the present city of Hays. The fort was the last military installation remaining in the western half of Kansas when it was finally abandoned on 8 November 1889.

The first white settlements in what was to become Ellis County were along the Butterfield Trail. Later, several small towns were founded along the route of the Kansas Pacific (= Union Pacific) Railroad. One such town, Rome, was established in April 1867 by William Rose and William Frederick ("Buffalo Bill") Cody on land northwest of Fort Hays at the place where the railroad supposedly would cross Big Creek. The Union Pacific Townsite Company attempted to buy controlling interest in the town, but Cody refused their offer. The company responded by establishing a new townsite (named Hays City, after the fort) and river crossing one-half mile east of Rome. This, coupled with a cholera epidemic in 1867, led to the

rapid abandonment of Rome. The railroad finally reached Hays City on 16 October 1867, and the city was formally established on 23 November 1868. Proceedings to organize the county had been initiated at Rome in 1867, but Ellis County did not become a functioning political unit until 1868 (Hill, 1938; Detwiler, 1952; Dale, 1964).

Several legendary figures are a part of the history of Ellis County. These include "Buffalo Bill" Cody (see above), and Martha ("Calamity Jane") Canary, both of whom earned their nicknames while living in Hays, plus James Butler ("Wild Bill") Hickock (who served unofficially from 1868 until 1871, but officially for only five months in 1869, as the chief law-enforcement officer of Hays City), and military leaders such as General Philip Henry Sheridan and the infamous Lieutenant Colonel (Brevet General) George Armstrong Custer.

The following historical accounts of the native mammals of Ellis County were copied verbatim from medical records kept at Fort Hays during the period 1867-1889. They consist of four entries, the last of which presupposes to summarize previous reports.

First Entry

To the Class *Mammalia* appearing in this vicinity belong — of the fifth order — Carnivora, family Canidae, several species of wolves, the large white or grey wolf, regarded by some as distinct species; and the small yellow wolf, or coyote, these being in great numbers, are chiefly nocturnal in their habits, and at times come in close proximity to the Post, breaking for a time the stillness of the night with their unwelcome salutations. The common prairie dog are also in large numbers throughout this section.

Of the *Mustelidae* occur the Pole Cat, rather numerous, quite domestic, taking up their habitations under the ground floors of the quarters and making frequent incursions on the poultry yard: the Otter of casual occurrence, and the Badger of the Ursidae or bear family, not numerous.

Of the seventh order — *Rodentia*, the family Sciuridae are represented solely by the Marmot species: the Castoridae by the beaver; the Hystricidae by the Porcupine; and the Leporidae by the Jack-ass rabbit, a species of large size.

Order tenth — *Ruminantia*, are more fully represented in the families Antelopidae and Bovidae, both appearing in large herds, the latter in the buffalo are frequently seen in herds of several thousand, this being the great range of the buffalo of the American plains, as their numerous trails readily evince, they only give the Post a short distance in their trips North and South, generally lingering in small parties in the vicinity grazing, and are generally found within a short distance throughout the year.

(Neither signed nor dated)

Second Entry

| | |
|------------------------|--|
| Canis | Large grey wolf |
| Canis Latrans | Coyote or Prairie wolf |
| Mephitis Bicolor | Skunk |
| Taxidea Americana | Missouri Badger |
| Cynomys Ludovicianus | Prairie Dog |
| Thomomys rufescens | Gopher |
| Lupus Townsendi | Jackass rabbit |
| " Nutalii | Least Hare |
| Cervus Macrotus | Mule (Blacktail) Deer |
| Antilocapra Americani | Prong horn Antelope |
| Bison Americani | American Buffaloe |
| Castor Canadensis | American Beaver |
| Lutra | Otter |
| Fiber | Musk rat |
| Mustela Lutreola | Mink |
| Jaculus hudsonius | Jumping Mouse |
| Mus Musculus | Common Mouse |
| Arvicolor hipana | Bank Mouse |
| Mus | Wood Rat |
| Nychugus Crepuscularis | Bat Seven Species |
| Felis Concolor | Catamount — 3 killed [unintelligible word] 73 [and] 4 |

(A list signed by John H. Janeway, Assistant Surgeon,
U.S. Army; no date)

Third Entry

The Buffaloe at this date (Apr 1877) no longer ranges in the vicinity of this Post and I am informed by residents, is not common between the Arkansas and Republican Rivers, anywhere to the Eastward of this Meridian.

During a short stay here in the year 1869, I saw several herds of them, quietly grazing on the adjacent hills. A hunting party from this post, last year proceeded in a Southwesterly direction toward the Arkansas finding small herds (probably bulls) at a distance of about 50 or 60 miles.

The antelope still lingers on the hills hereabout, but in diminished numbers; whether his stay is due to the peculiarity of his habits or to the fact that he eludes his pursuers more easily than the Buffalo, I do not know.

The Prairie Dog does not appear to pay much attention to the advancing frontier lives in his town, are still numerous in this vicinity.

The nightly serenade of the wolf is no longer heard at this Post but neighboring flocks are frequent sufferers from his depredations. (Signed by H. S. Kilbourne, Assistant Surgeon, U.S. Army; dated in text)

Fourth Entry

The wild animals found near the post are three varieties of the common bat, the American wild cat, gray wolf, coyote, long-tailed weasel, common mink, American badger, raccoons, skunk, American otter, American beaver, striped gopher, prairie dog, wood rats, yellow-haired porcupine, common American hare, prairie hare, jackass rabbit, American elk, antelope, two varieties of the

genus cerous. (Excerpt from unsigned and undated report that was "corrected and approved" by Major Geo. K. Brady, 18th Infantry, Commanding Post, on 20 June 1889)

J. A. Allen visited Fort Hays from 26 May until 3 July 1871 and traveled across northwestern Kansas from 25 December 1871 until 12 January 1872. During his visit, he recorded numerous important historical notes on abundance and habitats of birds and mammals in Ellis County. The following description of the region (Allen, 1872:131-134) is extracted from his account of "birds observed in the vicinity of Fort Hays . . .":

Fort Hays is situated on Big Creek, three hundred miles west of the Missouri River, about ten south of the Saline River, and about the same distance north of the Smoky River. The timber here is not only confined to the immediate vicinity of the streams, often to their beds, but generally occurs in thin, irregular belts or scattered clumps, and ceases entirely a few miles to the westward. The Smoky is already quite destitute of trees as far west as Fort Hays, and they soon disappear from the Saline. The observations on which the following notes are based are the result of about thirty-five days spent consecutively in the field, during which time an area of country of from fifteen to thirty miles' radius was quite thoroughly explored. . . . In further description of the locality, it may be added that the trees consist mainly of the white [American] and red elms, the ash-leaved maple [boxelder], cottonwoods [eastern and plains cottonwoods], black-walnut, and ash [green ash]. Most of the trees assume a spreading form, and grow to a large size. There is little undergrowth, except where the first growth has been removed, as it has been to a large extent on most of the streams within fifteen to twenty miles of the post. The undergrowth consists mainly of sumach [ill-scented sumac], dwarf-plum [wild plum], and *Amorpha fruticosa* [false indigo]. . . .

The 'Plains' are here, as usual, somewhat rolling broad level plateaus, being separated by low ridges, or broken by sharp ravines and moist hollows. They are covered with short grass, usually but two or three inches high, except in the hollows and near the streams, where it often grows to the height of one or two feet. On the plateaus and ridges, in consequence of the excessive heat and scanty fall of rain, the grass becomes parched and dry during the latter half of June, and for the rest of the year the landscape wears an arid and forbidding aspect, relieved only by the deep green foliage of the trees along the streams. During May and much of June, however, the fresh young grass is thickly dotted with a variety of showy flowers, which vary the landscape with their respective tints. They are mainly social plants, and, growing thickly, their bright colors are conspicuous, giving their several hues to large areas. Most characteristic among them are *Malvastrum coccineum* [scarlet globe mallow], and one or two other malvaceous species, *Verbena aubletia* [rose verbena], a *Lippia* [lippia], a *Scutellaria* [skullcap], and an aster-like composite plant, — all low forms and very prolific of large showy flowers. Among the coarser herbs are *Amorpha canescens* [lead plant], *Echinacea angustifolia* [black samson], *Delphinium azureum* [?], a *Lepachys* [coneflower], a *Dalea* [dalea], two species of *Linum* [flax], *Onosmodium carolinianum* [false gromwell], and *Verbena hastata* [blue verbena], all common in their respective localities, but generally of dwarfed

stature as compared with their size on the moister prairies to the eastward. The sensitive brier (*Schrankia uncinata*) was also abundant, and *Rosa lucida* [prairie rose] was agreeably frequent along the streams. Two species of *Melocactus* [?] and an *Opuntia* [prickly pear] attest by their abundance the dryness of the climate.

During our five weeks stay at Fort Hays, the maximum daily temperature in the shade usually ranged from 90° to 108°F. This temperature is frequently accompanied by parching winds, especially later in the season. . . .

ACCOUNTS OF SPECIES

Forty-one native species of mammals that presently occur in Ellis County, together with nine Recent species that formerly occurred in the county but have been extirpated therein, are treated in the following accounts. Appended is a list of 17 additional species that might occur there now or that conceivably occurred there in the past. Most accounts begin with a statement of subspecific status, and continue with observations and biological data of various kinds stemming largely from research conducted in Ellis County (data or observations from neighboring counties are included where informative). Lists of specimens examined are in telegraphic style and are arranged from north to south (the more westerly of two localities at the same latitude is listed first). Localities are listed (with minor editorial changes to ensure uniformity of style) as they appear on specimen labels; in a few instances we are reasonably sure those localities are incorrect, and have therefore placed them in quotation marks. What we believe to be the correct locality has been indicated in brackets. Also, to facilitate use of localities by persons who do not have access to land survey maps, localities identified only by township, range, and section are redefined (in brackets) with respect to one of the towns in Ellis County. Most of the more than 1400 specimens that were examined are housed in the Museum of the High Plains, Fort Hays Kansas State College; the abbreviation "TTU" in lists of specimens examined refers to specimens housed in The Museum, Texas Tech University. Lists of additional records usually refer to published accounts of specimens from Ellis County that are housed in museums other than the Museum of the High Plains. All measurements and weights are given in millimeters and grams.

Didelphis virginiana Virginia Opossum

We follow Gardner (1973) in use of the name *D. v. virginiana* Kerr for populations of this species in Ellis County.

Cockrum (1952:35) summarized historical records pertaining to the distribution of the opossum in Kansas, and concluded that the

species probably did not occur in the western part of the state before the turn of the century. Carter (1939a), on the other hand, alluded to the presence of the species in 16 counties in western Kansas before 1900, and listed the opossum as present in Ellis County by 1879. In this regard, it is perhaps noteworthy that no reference to opossums was made in records kept at Fort Hays (see historical account), and J. A. Allen (1874) made no mention of the species in a paper he wrote after spending five weeks of the summer of 1871 at Fort Hays and two weeks of the following winter "in northwestern Kansas." To the best of our knowledge, the first actual specimen to be cited from the county was obtained "on Big Creek about one mile west of Hays in Elliz [sic] county in the fall of 1926" (Carter, 1939a).

The Virginia opossum is relatively common at this time in riparian communities in Ellis County. It seems to prefer brushy habitats (and likely has benefited from the activities of European man), but occasionally traverses prairie communities that provide adequate cover (see also Fitch and Sandidge, 1953:312). For example, two individuals of this species were trapped on a remnant of the Mixed Prairie (more than one mile from riparian habitat along Big Creek) in June and September 1967. Both of these opossums were young (they were captured in 3 by 3 by 9-inch Sherman live traps), and both were caught in lowland communities dominated by big bluestem, annual sunflower, and Mexican fireweed. Opossums frequently are seen dead on roads in Ellis County.

Specimens examined (4). — 5 mi. N Hays, 1; 1/2 mi. N, 3/4 mi. E Hays, 1; Hays, 1; 2 mi. S, 1 mi. E Munjor, 1.

Blarina carolinensis

Southern Short-tailed Shrew

As shown by Genoways and Choate (1972), the systematic status of shrews formerly known by the names *B. brevicauda brevicauda* (Say) and "*B. b. carolinensis*" (Bachman) is still imperfectly understood although existing evidence suggests that the names *brevicauda* and *carolinensis* actually pertain to distinct species. Accordingly, the subspecific name *B. c. carolinensis* (Bachman) would apply, at least until ongoing studies of geographic variation in these shrews are completed, for populations in Ellis County.

In Ellis County, the short-tailed shrew is associated most closely with (but not restricted to) luxuriant, grassy communities that border riparian woodlands along the Saline River, Big Creek, the Smoky Hill River, and their tributaries. The series listed below from southwest of Antonino was collected in the mesic, grassy border of woodland adjacent to Rohr-Jacobs Lake. The species also inhabits other

mesic habitats, such as weedy draws and roadside ditches, where there is sufficient mulch to permit burrowing. On a remnant of the Mixed Prairie southwest of Hays, *B. carolinensis* prefers a mesic community (dominated by big bluestem) and avoids a relatively less mesic upland community (dominated by little bluestem, big bluestem, and side-oats grama) where shallow soil is interspersed among limestone breaksites. The two species of shrews (see account of *Cryptotis parva*) in Ellis County evidently are more or less segregated with respect to habitats, *B. carolinensis* frequenting mesic, low-lying communities and *Cryptotis parva* occurring in (but not restricted to) relatively more arid, upland communities (see Choate and Fleharty, 1973).

Specimens examined (45). — 15 mi. N, 7 mi. W Hays (T. 11S, R. 19W, SW 1/4 sec. 16), 8(TTU); 16 mi. N, 1 mi. W Hays [= 15 mi. N, 1 mi. W Hays], 3; T. 12S, R. 19W, NE 1/4 sec. 14 [10 mi. N, 4 mi. W Hays], 2; T. 12S, R. 19W, SE 1/4 sec. 14 [9 mi. N, 4 mi. W Hays], 1; 8 mi. N Hays (T. 12S, R. 18W, N 1/2 sec. 27), 6(TTU); Ellis, 1; 4 mi. N, 1/4 mi. W Hays, 1; 5 mi. N, 3 mi. E Hays (T. 13S, R. 17W, SW 1/4 sec. 6), 1(TTU); 1 mi. S, 6 mi. W Hays, 1; 1 mi. S, 2 mi. W Hays, 1; 2 1/2 mi. SW Hays, 1; 1 mi. S, 6 1/2 mi. W Antonino (T. 15S, R. 20W, sec. 2), 19.

Additional records. — 3 1/2 mi. W Ft. Hays State College Campus; 3/4 mi. S, 3 1/2 mi. W Hays (Cockrum, 1952:42).

Cryptotis parva

Least Shrew

The subspecific name *C. p. parva* (Say) applies for populations of this species in Kansas (see Hall and Kelson, 1959:57).

The least shrew apparently occurs in most natural habitats represented in Ellis County. On a remnant of the Mixed Prairie southwest of Hays, the preferred habitat of *C. parva* is a relatively mesic, upland community dominated by big and little bluestem and side-oats grama; however, the species exhibited no pronounced avoidance of any of the six plant communities that were studied (Choate and Fleharty, 1973). The species seldom is abundant in any habitat, although periodic outbreaks occur (usually in late autumn or early winter) in which individuals are captured in buildings and are found dead in swimming pools.

A female caught on 3 October 1964 contained five embryos that measured 4 mm in crown-rump length.

Specimens examined (13). — T. 12S, R. 19W, SE 1/4 sec. 14 [9 mi. N, 4 mi. W Hays], 1; 1 mi. N, 2 mi. W Hays, 2; 1 mi. N, 1/2 mi. W Hays, 2; Hays, 4; T. 14S, R. 18W, NE 1/4 sec. 5 [1 mi. W Hays], 1; T. 14S, R. 19W, SE 1/4 sec. 1 [1 mi. S, 3 mi. W Hays], 1; 1 1/2 mi. S, 2 mi. E Hays, 1; T. 15S, R. 20W, NE 1/4 sec. 11 [1 mi. S, 6 mi. W Antonino], 1.

Additional records. — Fort Hays State College, Hays; 1/2 mi. S, 4 mi. W Hays (Cockrum, 1952:47).

Scalopus aquaticus

Eastern Mole

As mapped by Cockrum (1952:48), the subspecific name *S. a. caryi* Jackson would apply for populations of the eastern mole in Ellis County.

No specimen of the eastern mole from Ellis County is available in any collection, but evidence exists that the species occurs infrequently in the county. A mole was found in the basement at the Clotfelter residence in Ellis in 1971, but was not saved. However, in November 1973 fresh surface runways were located less than 100 yards from the Clotfelter residence, near the bank of Big Creek. Attempts to trap the mole that had constructed the runways were unsuccessful.

Prior to discovery of *S. aquaticus* in Ellis County, the only records of occurrence for the species south of the Saline River in northwestern Kansas were the mention by Cockrum (1952:50) of a mole from an unspecified locality (presumably along the Smoky Hill River) in Logan County, and the comment by Baker (1889:57) that moles, in adjacent Trego County, were "found in low, moist ground; not common." The species probably occurs in suitably friable soils near watercourses in other areas of northwestern Kansas.

Myotis keenii

Keen's Myotis

The subspecific name *M. k. septentrionalis* (Trouessart) currently applies to all populations of Keen's Myotis in Kansas (see Jones *et al.*, 1967:7).

Myotis keenii was first reported from Ellis County by Fleharty and Farney (1965) on the basis of a female found in a storm sewer in Hays on 31 July 1964 and two additional females taken from the exterior of a building on the campus of Fort Hays Kansas State College in September 1964. Dates of most subsequent captures would seem to indicate that Ellis County is in the path of a migratory route followed by this species; five specimens were obtained in April 1965, two in April 1966, two in April 1967, one in July 1967, one in April 1970, one in April 1971, one in September 1971, and one in April 1972, all from the limestone exteriors of buildings on the campus at Hays.

Jones *et al.* (1967:8) mentioned a small limestone cave in northeastern Ellis County (13 mi. N Victoria — see below) that might serve as a hibernaculum but seemingly is not inhabited by the species in summer. Also, it is conceivable that the species hibernates in one or more of many other limestone crevices in the bluffs south of the Saline River in northeastern Ellis County.

Specimens examined (26). — 13 mi. N Victoria [= T. 11S, R. 16W, SW 1/4 sec. 31], 7; Hays (T. 14S, R. 18W, sec. 5), 19.

Eptesicus fuscus
Big Brown Bat

Howard (1967) tentatively assigned all populations of this species in Kansas to the subspecies *E. f. fuscus* (Palisot de Beauvois) although another subspecies, *E. f. pallidus* Young, was recognized by Jones *et al.* (1967) as occurring in eastern Gove County (the second county west of Ellis) and throughout the western one-third of Kansas.

Eptesicus fuscus is the most common species of bat in Ellis County, as it is throughout Kansas (Jones *et al.*, 1967:15). The big brown bat characteristically roosts in buildings, and commonly is observed foraging along rivers at twilight and in cities around light-posts at night. Several individuals have been caught in nets placed over Big Creek as part of a bird-banding operation, and others have been removed from a maternity colony located under the west stands of the football stadium and from hibernacula in several buildings on the campus of Fort Hays Kansas State College. A total of 63 specimens (all from the immediate vicinity of Hays) was examined from Ellis County.

In autumn of 1972, personnel from Fort Hays Kansas State College attempted to exterminate the maternity colony in the football stadium because of unsightly guano deposits that accumulate each summer beneath the colony. Such wanton destruction of a beneficial species is entirely unwarranted; the removal of a few pounds of guano each year is an insignificant price to pay for the annual destruction of tens of thousands of flying insects.

Lasiurus borealis
Red Bat

The subspecific name *L. b. borealis* (Müller) applies to all populations of the red bat in eastern United States, including Kansas (see Hall and Kelson, 1959:189).

The red bat is migratory, and occurs in Kansas only from mid-March until October (Jones *et al.*, 1967:17). Nine of the 10 specimens of this species examined from Ellis County (all from the city of Hays) were collected in June, and the other was caught in July.

Bats of this species commonly hang up in trees or shrubs, although one was observed roosting in big bluestem near Cedar Bluff Reservoir in adjacent Trego County. Typically, however, the red bat occurs primarily in riparian communities and in wooded areas around

cities. A female found on the ground under a tree in June 1966 was nursing four young.

Lasiurus cinereus

Hoary Bat

All populations of this species in North America currently are known (see Hall and Kelson, 1959:192) by the subspecific name *L. c. cinereus* (Palisot de Beauvois).

The hoary bat, like its relative the red bat, is migratory and roosts primarily in trees. The earliest date on which the species has been recorded in Kansas is in late March, and the latest date was provided by a female caught in Hays on 27 September 1965 (Jones *et al.*, 1967:21). The hoary bat is considerably less common than the red bat in Ellis County, and probably is restricted (except during migration) to riparian woodlands and areas of trees around cities and farmsteads. One of the specimens listed below was captured in a net placed over Big Creek on the campus of Fort Hays Kansas State College. A female caught on 30 June 1965 was accompanied by two young, one male and one female.

Specimens examined (7). — T. 13S, R. 17W, NW 1/4 sec. 8 [1 mi. N, 1 1/2 mi. W Catharine], 1; Hays, 6.

Tadarida brasiliensis

Brasilian Free-tailed Bat

The subspecific name *T. b. mexicana* (Saussure) applies to populations of the Brazilian free-tailed bat in Kansas (see Jones *et al.*, 1967:25).

The only records of this species in Ellis County are based on three bats (two of which were partially mummified and therefore discarded) found in June 1971 in Hays (in the football stadium on the campus of Fort Hays Kansas State College) and a fourth specimen caught on 12 September 1973 in a barn 12 mi. N, 2 mi. E Ellis (T. 11S, R. 20W, NE 1/4 sec. 10). The two discarded specimens almost certainly had died as young of the year, as indicated by their small external measurements (total length 60, 64; length of tail vertebrae 19, 19; length of hind foot 10, 9; length of ear from notch 7, 8). However, the other specimen from Hays and the specimen from northeast of Ellis are adults with fused phalangeal epiphyses and larger external measurements (95, 96; 35, 42; 7, 10; 16, 20).

Jones *et al.* (1967:26-27) summarized records of this species from three counties (Gove, Rawlins, and Trego) in northwestern Kansas, but pointed out that "most of the stations of known occurrence of this

species in Kansas are represented by bats but a few months old that wandered northward after leaving the caves [in northern Oklahoma?] in which they were born."

Homo sapiens

Man

The subspecific name that is usually applied to native North American populations of man is *H. s. americanus* Linnaeus (see Hall and Kelson, 1959:234).

As noted in the account of the history of Ellis County, the region was inhabited primarily by Cheyenne and Arapaho Indians, but was visited periodically by hunting parties representing the Pawnee, Kaw, Sioux, Kiowa, and Comanche tribes. Native populations were extirpated soon after settlement of the region by *H. s. sapiens* Linnaeus and no longer exist in Ellis County.

Dasypus novemcinctus

Nine-banded Armadillo

The subspecific name in current use (see Hall and Kelson, 1959:245) for all populations of the nine-banded armadillo in the United States is *D. n. mexicanus* Peters.

Records pertaining to northward dispersal of the nine-banded armadillo into southern Kansas were summarized by Cockrum (1952:88-89). Hall (1955:60) and Getz (1961:283) later recorded the species from additional localities in central and eastern Kansas, but the species still was not known from north of the Arkansas River in central or western Kansas. Subsequently, Smith and Lawlor (1964:48-49) reported armadillos north of the Arkansas River in Sheridan (the second county west and the first north of Ellis) and Saline (the third county east of Ellis) counties. Additionally, two specimens were obtained, in August 1971 and on 29 September 1972, at localities 5 mi. S, 1/2 mi. W Ardell, Edwards County (the third county south of Ellis), and 2 1/2 mi. W Offerle, in Ford County (the third county south and the first county west of Ellis), respectively. Recently, there have been several newspaper accounts of armadillos killed by farmers and ranchers at even more northerly localities than Sheridan County. The northernmost of these that we know of is "near Benkleman, [southwestern] Nebraska," where an armadillo was killed in December 1972 by Mr. Leon Baney. Mr. John P. Farney (Kearney State College, Nebraska) has informed us that armadillos occasionally are seen as far north in central Nebraska as the Platte River. Therefore, there is ample evidence that the species occurs, at least sporadically, all around Ellis County.

Our belief that the species is a resident of Ellis County is based on sightings of armadillos by local residents and students in the Saline River Valley and in cropland between Ellis and Hays, and on a road-killed individual found by a local resident (and identified by a high school biology teacher) on the Saline River Road, approximately 16 mi. N, 8 mi. E Hays. Unfortunately, this armadillo was buried and is not available for confirmation.

Lepus californicus
Black-tailed Jack Rabbit

All populations of this species on the Great Plains were referred by Hall (1951a:183) to the subspecies *L. c. melanotis* Mearns.

Reference to the "prairie hare" in records kept at Fort Hays (see historical account) probably pertains to this species. In Ellis County, the black-tailed jack rabbit is most abundant in short grass rangeland and overgrazed pastures, where "the short turf . . . [facilitates] a quick escape" (Brown, 1947b:43), but is occasionally seen in residential areas of Hays and other communities. The species almost never occurs in tall grasses or riparian woodland. The black-tailed jack rabbit formerly was more numerous in Ellis and surrounding counties than it is now. Bounties totaling more than \$5000 were paid for 111,400 jack rabbits obtained in nearby Gove County during the period 4 December 1926 through 5 April 1927. Wooster (1931) reported that 6199 were killed in a rabbit drive held in adjacent Rush County on 26 December 1930, and that another rabbit drive held in the same county one month later resulted in the death of 11,658 black-tailed jack rabbits. Such drives became increasingly common during the drought years of the mid-1930's (Wooster, 1935) when this species experienced a population explosion reminiscent of that of the introduced hare in Australia. Wooster (1935) reported that the density of black-tailed jack rabbits in Ellis County increased from 175 per square mile in November 1933 to more than 400 per square mile only one year later, and by March 1935 the population had reached a density of 484 per square mile.

Brown (1947b) reported that black-tailed jack rabbits on a short grass prairie near Hays feed primarily on parts of eight species of grasses (especially sand dropseed, western wheatgrass, blue grama, and buffalo grass), 15 species of forbs (especially broomweed, small soapweed, plains prickly pear, and sandy lily), and heavy sedge. During the drought they fed largely on pods of prickly pear, but utilization of grasses and forbs resumed when conditions became less arid (Riegel, 1941). Preferred foods in autumn include prickly pear, broomweed, pigweed, and sand dropseed (Riegel, 1942), but during

winter, when the ground is blanketed by snow, jack rabbits consume increasing amounts of prickly pear, dry Russian thistle, leaves of small soapweed, seed stalks and stems of sand dropseed, sand cherry, ill-scented sumac, and bark of honey locust trees (Riegel, 1941 and 1942). Based on studies conducted in Ellis County, Timmons (1942) and Brown (1947*b*) demonstrated that jack rabbits are instrumental in the dispersal of several species of prairie plants (especially plains prickly pear) by depositing viable seeds in their fecal pellets.

Specimens examined (6). — 17 mi. N Hays, 1; 2 mi. N, 1 1/2 mi. W Hays, 1; 5 mi. S, 2 mi. W Hays, 1; 5 mi. W Antonino (T. 15S, R. 20W, sec. 1), 1; 3 mi. S, 5 1/2 mi. W Antonino (T. 15S, R. 19W, sec. 14), 1; no specific locality, 1.

Lepus townsendii White-tailed Jack Rabbit

The subspecific name *L. t. campanius* Hollister applies to populations of this species that formerly occurred in Ellis County (Hall, 1951*a*:180).

Records kept at Fort Hays (see historical account) document the occurrence of the "jackass rabbit" in Ellis County at the time of settlement of the region by European man. In fact, the first entry referred only to this species, whereas subsequent entries referred also to the "least" or "common American hare" [= *Sylvilagus floridanus*] and, finally, to the "prairie hare" [= *Lepus californicus*]. These entries thus suggest that the white-tailed jack rabbit might have been declining in abundance (relative to other leporids) in Ellis County as early as the late 1800's. In this regard, Allen (1874:52) remarked that "a few [black-tailed jack rabbits were] seen in summer on the plains north of Fort Hays," but, for the white-tailed jack rabbit, all he could report was "I have good authority for its occurrence in Eastern Colorado and the western part of Kansas." The actual relative abundance of white-tailed and black-tailed jack rabbits in the area prior to human disturbance may never be known; most of the early settlers interviewed by Carter (1939*b*) and Brown (1940) stated that white-tailed jack rabbits once were more common than blacktails, but Mr. H. W. Chittinden (who, in 1931, had lived in Ellis County for 45 years) reported that "white-tailed jack rabbits once were here, but not nearly so numerous even then as the black-tailed jack rabbits."

Wooster (1931) listed only seven of 17,864 jack rabbits killed in adjacent Rush County in December 1930 and January 1931 as whitetails. In a subsequent paper, Wooster (1935) did not even mention the white-tailed jack rabbit although he recorded the density

of black-tailed jack rabbits in Ellis County as greater than 400 per square mile (see account of *L. californicus*). Therefore, to the best of our knowledge, the statement of Mr. Robert Solomon (Brown, 1940) regarding a white-tailed jack rabbit that he killed in Ellis County in December 1931 is the last reference in the literature to the presence of this species in the county.

Brown (1947a) concluded from interviews with early settlers that the decline in number of white-tailed jack rabbits in western Kansas was gradual, and was brought about by "changes in environmental conditions when man began to break up the prairie and plant crops, especially wheat." However, perusal of Brown's account of those interviews revealed that many of the early settlers also noted that these jack rabbits were large in size, could not run as fast as the blacktail, and consequently were killed more readily by coyotes and hunters. Another factor that might have been involved in the disappearance of the whitetail pertains to biogeography; the replacement of *L. townsendii* by *L. californicus* (which apparently began in the southernmost counties in Kansas in 1875, proceeded roughly from south to north, and was complete by about 1900— see Carter, 1939b) as the common jack rabbit of the central Great Plains might have been a natural consequence of a long-term trend toward warmer or more arid conditions than had previously existed (see also Wooster, 1935; Bronson and Tiemeier, 1959). It is noteworthy in this regard that the white-tailed jack rabbit probably disappeared completely and the black-tailed jack rabbit reached its greatest abundance almost simultaneously at the beginning of the great drought of 1933-1939.

So far as we know, no specimen of *L. townsendii* from Ellis County is available in any collection.

Sylvilagus floridanus

Eastern Cottontail

As mapped by Hall (1951a:155), four subspecies of the eastern cottontail occur in Kansas, the name *S. f. similis* Nelson applying to populations in Ellis County.

References to "Lupus Nutalii," "least Hare," and "common American hare" in records kept at Fort Hays (see historical account) probably refer to this species. Allen (1874:52) noted that the "Gray Rabbit," "*Lepus sylvaticus*," was "abundant, not only near the streams but quite distant from timber. Many were seen about the military post at Fort Hays, making their homes in the piles of wood in the woodyard at the post."

In Ellis County, the eastern cottontail prefers brushy habitats in draws, roadside ditches, and riparian communities, but regularly occurs in settlements such as Hays and Ellis and doubtlessly has benefited from activities associated with settlement of the region by European man. Brown (1947*b*) listed 31 species of plants eaten by *S. floridanus*, and noted that many of the seeds (especially those of buffalo grass, plains prickly pear, and smooth sumac) remain viable after passing through the digestive tracts of cottontails. He concluded that this species plays an important role in introducing seeds of certain prairie plants into abandoned fields or into rangeland that has been denuded by overgrazing or drought. Riegel (1942) noted that pods and fruits of prickly pear, roots of purple coneflower and blazing star, and rosettes of wild lettuce were important sources of food for the eastern cottontail during the great drought, whereas the species consumed broomweed, pigweed, and sand dropseed during more benevolent periods.

Specimens examined (11). — T. 13S, R. 20W, SW 1/4 sec. 25 [3 1/2 mi. S, 3 mi. E Ellis], 1; 1 mi. N, 2 mi. E Hays, 1; Hays, 4; 1/2 mi. S, 3 mi. W Hays (T. 14S, R. 19W, sec. 1), 1; 1/2 mi. S, 2 mi. W Hays, 1; 1 mi. S, 1 mi. W Hays, 2; 5 mi. S, 3 mi. W Hays, 1.

Sciurus niger

Fox Squirrel

The subspecific name *Sciurus niger rufiventer* É. Geof. St.-Hilaire presently applies to all populations of this species in Kansas (see Hall and Kelson, 1959:388).

The fox squirrel is the only species of tree squirrel in western Kansas, where it is restricted primarily to wooded areas along streams and in cities. All of the specimens listed below were obtained along the Saline River, Big Creek, the Smoky Hill River, or within the city limits of Hays.

It seems likely that the fox squirrel has only recently dispersed to Ellis County from farther to the east by means of suitable habitats along watercourses. Although Mead (1899*b*:280) reflected that "fox-squirrels abounded [in 1859] along the Solomon, Saline, and their tributaries" to the east of Ellis County, no reference was made to this easily seen diurnal species in records kept at Fort Hays (see historical account), and Allen (1874:49) noted that the fox squirrel was "said to be common on some of the wooded streams [probably east of Fort Hays], but we did not meet with it." Likewise, Baker (1889) made no mention of tree squirrels in adjacent Trego County. The species was first recorded from Phillips County (the second

county to the north of Ellis) before the turn of the century (Allen, 1895:270), and Carter (1939a) alluded to the presence of fox squirrels in Ellis County as early as 1885; however, we know of no published reference to *S. niger* in Ellis County prior to 1939 (Bugbee and Riegel, 1945).

The success of the fox squirrel in western Kansas was due in part to its ability to survive on foods (some of which were introduced by European settlers) other than those which are preferred in deciduous forests farther to the east (see Packard, 1956:36-41). In Ellis County, fox squirrels consume at least the following (see Bugbee and Riegel, 1945): petiole galls on plains cottonwood and seeds of common hackberry (in summer); nipple galls of common hackberry, berries of red cedar, pods of honey locust, black walnuts, bark of Russian olive, and seeds of buffalo gourd (in late summer and autumn); and seeds and buds of American elm, exudation on branches of black walnut, and fruit of Russian olive (in winter and spring). In addition, fox squirrels consume fruit of Osage orange (Whitaker, 1939:117), as well as corn and milo (whenever these grains are produced adjacent to riparian woodlands), and have been observed to remove kernels of corn from cobs stored in woven wire-ringed cribs.

Specimens examined (14). — 15 mi. N, 1/2 mi. E Hays, 1; 1/2 mi. N, 1 1/2 mi. W Hays (T. 13S, R. 18W, sec. 32), 1; Hays, 9; 3 mi. S, 3 mi. E Hays, 2; 10 mi. S, 3/4 mi. E Ellis, 1.

Cynomys ludovicianus Black-tailed Prairie Dog

The subspecific name *C. l. ludovicianus* (Ord) currently applies to all populations of the black-tailed prairie dog on the Great Plains (Hollister, 1916:14-19).

The black-tailed prairie dog no longer is common in Ellis County; in 1973, the U.S. Soil Conservation Service knew of only three prairie dog towns, totaling 25 acres, in the county (R. J. Little, personal communication). This is in marked contrast to conditions that existed when Fort Hays was occupied (see historical account) or when Allen (1874:49) commented that prairie dogs were "exceedingly abundant [in the vicinity of Fort Hays], their villages frequently covering areas of several square miles in extent, and embracing hundreds of families." Likewise, Scheffer (1911:115) wrote that one dog town "extended almost continuously for 125 miles along the Smoky Hill River and its tributaries in southern Trego [and presumably Ellis], Gove, Logan, and Wallace counties, and the northern parts of the counties adjoining these on the south." Mead

(1899b:281), reflecting on his experiences in central Kansas in 1859, made the following observations:

Prairie-dogs were innumerable. The divide between the Saline and Solomon in Ellsworth county [the second county east of Ellis] and west was a continuous dog town for miles; and, as a considerable portion of this locality was underlaid with horizontal beds of shale or limestone near the surface, it was a mystery where they got water. Not a drop could be found within several miles and none by digging above the rock, and not a particle of dew fell for weeks in the heat of summer. The scant grass was dry enough to burn an hour before sunrise; and I was forced to the conclusion that in this instance nature had constructed an animal capable of living for long periods of time without water. My pen cannot describe the extreme heat and drought which sometimes prevailed on these bare uplands during July and August. Prairie-dogs, except a few remnants, disappeared. The foot of the buffalo was necessary for their existence. As soon as the ground ceased to be tramped hard and the grass and weeds grew they perished.

Mead was only partly correct regarding the decline in number of prairie dogs. Because it was thought that dogs compete with cattle for range (but see Smith, 1958:10-13), legislative action directed at extermination of prairie dogs in Kansas was taken in 1901 and again in 1903, and by 1911 the species was no longer prevalent anywhere in western Kansas (Scheffer, 1911). Even today, prairie dogs undergo periodic depredations, as evinced by the fact that one of the remaining dog towns in Ellis County (located 15 mi. N, 1 mi. W Hays) was poisoned in the late 1960's and the few prairie dogs that survived (or subsequently immigrated into the deserted town) were again subjected to poison in 1972.

Specimens examined (11). — 17 mi. N, 2 mi. W Hays, 1; 17 mi. N, 1 mi. W Hays, 7; 16 mi. N, 1 mi. W Hays [= 15 mi. N, 1 mi. W Hays], 3.

Additional record. — Fort Hays (Hollister, 1916:18).

Spermophilus tridecemlineatus

Thirteen-lined Ground Squirrel

Armstrong (1972:125-126) discussed the subspecific status of thirteen-lined ground squirrels on the western Great Plains and recognized two subspecies in eastern Colorado, *S. t. pallidus* J. A. Allen in the north and *S. t. arenicola* (A. H. Howell) in the south. Pending additional study of geographic variation, we prefer not to attempt subspecific designation of specimens from Ellis County.

References to "Marmot species" and "striped gopher" in records kept at Fort Hays (see historical account) doubtlessly refer to this species. Allen (1874:49) noted that the "Striped Prairie Squirrel" was "more or less common generally [in the vicinity of Fort Hays], but most numerous near the streams and damp hollows."

| | |
|----------------------|------------------------------|
| Skeletonweed | <i>Lygodesmia juncea</i> |
| Skullcap | <i>Scutellaria</i> sp. |
| Small Soapweed | <i>Yucca glauca</i> |
| Smooth Sumac | <i>Rhus glabra</i> |
| Snow-on-the-mountain | <i>Euphorbia marginata</i> |
| Spurge | <i>Euphorbia dentata</i> |
| Squirreltail | <i>Sitanion hystrix</i> |
| Stemless Hymenoxys | <i>Hymenoxys acaulis</i> |
| Sudan Grass | <i>Sorghum sundanense</i> |
| Switchgrass | <i>Panicum virgatum</i> |
| Tallbread Scurfpea | <i>Psoralea cuspidata</i> |
| Tall Dropseed | <i>Sporobolus asper</i> |
| Texas Croton | <i>Croton texensis</i> |
| Virginia Wild-rye | <i>Elymus virginicus</i> |
| Wavyleaf Thistle | <i>Cirsium undulatum</i> |
| Western Ragweed | <i>Ambrosia psilostachya</i> |
| Western Wheatgrass | <i>Agropyron smithii</i> |
| Wheat | <i>Triticum aestivum</i> |
| Wild Grape | <i>Vitis vulpina</i> |
| Wild Lettuce | <i>Lactuca ludoviciana</i> |
| Wild Onion | <i>Allium drummondi</i> |
| Wild Plum | <i>Prunus americana</i> |
| Wild Sage | <i>Artemesia ludoviciana</i> |
| Woolly Verbena | <i>Verbena stricta</i> |

| | |
|------------------------|-----------------------------------|
| Heavy Sedge | <i>Carex gravida</i> |
| Honey Locust | <i>Gleditsia triacanthos</i> |
| Hooker's Dropseed | <i>Sporobolus asper hookeri</i> |
| Horseweed | <i>Conyza canadensis</i> |
| Ill-scented Sumac | <i>Rhus trilobata</i> |
| Indian Grass | <i>Sorghastrum nutans</i> |
| Ironweed | <i>Vernonia baldwini</i> |
| Japanese Brome | <i>Bromus japonicus</i> |
| Kentucky Bluegrass | <i>Poa pratensis</i> |
| Lead Plant | <i>Amorpha canescens</i> |
| Lippia | <i>Lippia</i> sp. |
| Little Barley | <i>Hordeum pusillum</i> |
| Little Bluestem | <i>Andropogon scoparius</i> |
| Manyflower Scurfpea | <i>Psoralea tenuiflora</i> |
| Mapleleaf Goosefoot | <i>Chenopodium gigantospermum</i> |
| Maximilian's Sunflower | <i>Helianthus maximiliani</i> |
| Mexican Fireweed | <i>Kochia scoparia</i> |
| Mexican Muhly | <i>Muhlenbergia mexicana</i> |
| Milo | <i>Sorghum vulgare</i> |
| November Goldenrod | <i>Solidago gigantea</i> |
| Osage Orange | <i>Maclura pomifera</i> |
| Pale Dock | <i>Rumex altissimus</i> |
| Peach-leaved Willow | <i>Salix amygdaloides</i> |
| Pennsylvania Smartweed | <i>Polygonum pensylvanicum</i> |
| Pigweed | <i>Amaranthus retroflexus</i> |
| Pitcher Sage | <i>Salvia azurea</i> |
| Plains Bristlegrass | <i>Setaria macrostachya</i> |
| Plains Cottonwood | <i>Populus sargentii</i> |
| Plains Prickly Pear | <i>Opuntia polyacantha</i> |
| Prairie Rose | <i>Rosa arkansana</i> |
| Prickly Pear | <i>Opuntia humifusa</i> |
| Purple Coneflower | <i>Echinacea pallida</i> |
| Purple Three-awn | <i>Aristida purpurea</i> |
| Red Cedar | <i>Juniperus virginiana</i> |
| Red Elm | <i>Ulmus rubra</i> |
| Red Mulberry | <i>Morus rubra</i> |
| Red Three-awn | <i>Aristida longiseta</i> |
| Rose Verbena | <i>Verbena canadensis</i> |
| Rosinweed | <i>Silphium integrifolium</i> |
| Russian Olive | <i>Elaeagnus angustifolia</i> |
| Russian Thistle | <i>Salsola kali</i> |
| Sand Cherry | <i>Prunus besseyi</i> |
| Sand Sagebrush | <i>Artemisia filifolia</i> |
| Sandbar Willow | <i>Salix interior</i> |
| Sandbur | <i>Cenchrus longispinus</i> |
| Sand Dropseed | <i>Sporobolus cryptandrus</i> |
| Sand Lily | <i>Mentzelia decapetala</i> |
| Scarlet Globe Mallow | <i>Sphaeralcea coccinea</i> |
| Sensitive Briar | <i>Schrankia uncinata</i> |
| Side-oats Grama | <i>Bouteloua curtipendula</i> |
| Single Seeded Croton | <i>Croton monanthogynus</i> |

APPENDIX

In the following list (which is arranged alphabetically by vernacular names) scientific names are given for all plants referred to in text. When authors did not list complete scientific names, species designations could not be assigned; in other instances authors listed only common names that could apply to two or more species, and we, to the best of our ability, have indicated by brackets (in text) the probable vernacular name (with scientific name in the appendix). Most vernacular and scientific names of trees, shrubs, forbs, and a single species of sedge were taken from Barkley (1968), whereas most names of grasses are from Hitchcock (1950).

| | |
|--------------------------|-------------------------------|
| Alfalfa | <i>Medicago sativa</i> |
| American Elm | <i>Ulmus americana</i> |
| Annual Sunflower | <i>Helianthus annuus</i> |
| Ashy Goldenrod | <i>Solidago mollis</i> |
| Bee Flower | <i>Cleome serrulata</i> |
| Big Bluestem | <i>Andropogon gerardi</i> |
| Black Locust | <i>Robinia pseudoacacia</i> |
| Black Walnut | <i>Juglans nigra</i> |
| Bladderpod | <i>Lesquerella ovalifolia</i> |
| Blazing Star | <i>Liatris punctata</i> |
| Blue Grama | <i>Bouteloua gracilis</i> |
| Blue Verbena | <i>Verbena hastata</i> |
| Boxelder | <i>Acer negundo</i> |
| Broomweed | <i>Gutierrezia sarothrae</i> |
| Buffalo Gourd | <i>Cucurbita foetidissima</i> |
| Buffalo Grass | <i>Buchloë dactyloides</i> |
| Canada Wild-rye | <i>Elymus canadensis</i> |
| Catalpa | <i>Catalpa speciosa</i> |
| Choke Cherry | <i>Prunus virginiana</i> |
| Climbing False Buckwheat | <i>Polygonum scandens</i> |
| Cocklebur | <i>Xanthium strumarium</i> |
| Common Hackberry | <i>Celtis occidentalis</i> |
| Coneflower | <i>Lepachys</i> sp. |
| Corn | <i>Zea mays</i> |
| Crabgrass | <i>Digitaria sanguinalis</i> |
| Dalea | <i>Dalea</i> sp. |
| Dandelion | <i>Taraxacum officinale</i> |
| Eastern Cottonwood | <i>Populus deltoides</i> |
| False Bone Set | <i>Kuhnia eupatorioides</i> |
| False Gromwell | <i>Onosmodium molle</i> |
| False Indigo | <i>Amorpha fruticosa</i> |
| Flax | <i>Linum</i> sp. |
| Giant Ragweed | <i>Ambrosia trifida</i> |
| Green Ash | <i>Fraxinus pennsylvanica</i> |
| Green Foxtail | <i>Setaria viridis</i> |
| Hairy Grama | <i>Bouteloua hirsuta</i> |
| Heath Aster | <i>Aster ericoides</i> |

- STANLEY, W. C. 1963. Habits of the red fox in northeastern Kansas. Misc. Publ. Mus. Nat. Hist., Univ. Kansas, 34:1-34.
- SWENK, M. H. 1916. On a new subspecies of porcupine from Nebraska. Univ. Nebraska Studies, 16:115-125.
- TIEMEIER, O. W. 1955. Winter foods of Kansas coyotes. Trans. Kansas Acad. Sci., 58:196-207.
- TIHEN, J. A., AND J. M. SPRAGUE. 1939. Amphibians, reptiles, and mammals of the Meade County State Park. Trans. Kansas Acad. Sci., 42:499-512.
- TIMMONS, F. L. 1942. The dissemination of prickly pear seed by jack rabbits. J. Amer. Soc. Agron., 34:513-520.
- TOMANEK, G. W., AND G. K. HULETT. 1970. Effects of historical droughts on grassland vegetation in central Great Plains. Pp. 203-210, in Pleistocene and Recent environments of the central Great Plains (W. Dort, Jr., and J. K. Jones, Jr., eds.), Univ. Press Kansas, Lawrence, 433 pp.
- VAN GELDER, R. G. 1959. A taxonomic revision of the spotted skunks (genus *Spilogale*). Bull. Amer. Mus. Nat. Hist., 117:229-392.
- VILLA-R., B., AND E. R. HALL. 1947. Subspeciation in pocket gophers of Kansas. Univ. Kansas Publ., Mus. Nat. Hist., 1:217-236.
- WARE, E. R., AND L. F. SMITH. 1939. Woodlands of Kansas. Bull. Kansas Agric. Exp. Sta., 285:1-42.
- WEAVER, J. E., AND F. W. ALBERTSON. 1936. Effects of the great drought on the prairies of Iowa, Nebraska, and Kansas. Ecology, 17:567-639.
- . 1939. Major changes in grassland as a result of continued drought. Bot. Gaz., 100:576-591.
- . 1940. Deterioration of midwestern ranges. Ecology, 21:216-236.
- . 1943. Resurvey of grasses, forbs, and underground plant parts at the end of the great drought. Ecol. Monogr., 13:63-117.
- . 1944. Nature and degree of recovery of grassland from the great drought of 1933 to 1940. Ecol. Monogr., 14:393-479.
- WEAVER, J. E., AND W. E. BRUNER. 1954. Nature and place of transition from true prairie to mixed prairie. Ecology, 35:117-126.
- WHITAKER, H. L. 1939. Fox squirrel utilization of Osage orange in Kansas. J. Wildlife Mgt., 3:117.
- WILEY, R. W. 1971. Activity periods and movements of the eastern woodrat. Southwestern Nat., 16:43-54.
- WOOSTER, L. D. 1931. The present status of certain mammals in western Kansas. Trans. Kansas Acad. Sci., 34:112-113.
- . 1935. Notes on the effects of drought on animal population in western Kansas. Trans. Kansas Acad. Sci., 38:351-352.
- . 1938. An attempt at an ecological evaluation of predators on a mixed prairie area in western Kansas. Trans. Kansas Acad. Sci., 41:387-394.
- . 1939. The effects of drought on rodent population. Turtox News, 17(1):1-2.

Address of authors: *Museum of the High Plains, Fort Hays Kansas State College, Hays, 67601. Received 30 March, accepted 11 September 1974.*

- MARTIN, E. P. 1960. Distribution of native mammals among the communities of the mixed prairie. Fort Hays Studies (n.s.), Sci. Ser., 1:iv+1-26.
- MARTIN, E. P., AND G. F. STERNBERG. 1955. A swift fox, *Vulpes velox velox* (Say), from western Kansas. Trans. Kansas Acad. Sci., 58:345-346.
- MEAD, J. R. 1899a *Felis concolor*. Trans. Kansas Acad. Sci., 16:278-279.
- . 1899b. Some natural-history notes of 1859. Trans. Kansas Acad. Sci., 16:280-281.
- MERRIAM, C. H. 1898. Life zones and crop zones of the United States. U.S. Dept. Agric., Biol. Serv. Bull., 10:1-79.
- MILES, N. A. 1896. Personal recollections and observations of General Nelson A. Miles Werner Co., Chicago, vii+1-591.
- MURIE, O. J. 1951. The elk of North America. The Stackpole Co., Harrisburg, Pa., and Wildlife Mgt. Inst., Washington, D.C., (10)+376 pp.
- PACKARD, R. L. 1956. The tree squirrels of Kansas: ecology and economic importance. Misc. Publ. Mus. Nat. Hist., Univ. Kansas, 11:1-67.
- PATTIE, J. O. 1833. The personal narrative of James O. Pattie, . . . (T. Flint, ed.). E. H. Flint, Cincinnati. Reprinted in 1966 by Univ. Microfilms, Inc., Ann Arbor, xi+13-300.
- PETRYSZYN, Y., AND E. D. FLEHARTY. 1972. Mass and energy of detritus clipped from grassland vegetation by the cotton rat (*Sigmodon hispidus*). J. Mamm., 53:168-175.
- QUEAL, L. M. 1964. Distribution of deer. Processed by Kansas Forestry, Fish and Game Commission, 8 pp.
- QUIMBY, D. C. 1951. The life history and ecology of the jumping mouse, *Zapus hudsonius*. Ecol. Monogr., 21:61-95.
- RAINEY, D. G. 1956. Eastern woodrat, *Neotoma floridana*: life history and ecology. Univ. Kansas Publ., Mus. Nat. Hist., 8:535-646.
- RIEGEL, A. 1941. Some coactions of rabbits and rodents with cactus. Trans. Kansas Acad. Sci., 44:96-103.
- . 1942. Some observations of the food coactions of rabbits in western Kansas during periods of stress. Trans. Kansas Acad. Sci., 45:369-375.
- SCHEFFER, T. H. 1911. The prairie-dog situation in Kansas. Trans. Kansas Acad. Sci., 23:115-118.
- SETZER, H. W. 1949. Subspeciation in the kangaroo rat, *Dipodomys ordii*. Univ. Kansas Publ., Mus. Nat. Hist., 1:473-573.
- SHELFORD, V. E. 1945. The relative merits of the life zone and biome concepts. Wilson Bull., 57:248-252.
- SKINNER, M. F., AND O. C. KAISEN. 1947. The fossil *Bison* of Alaska and preliminary revision of the genus. Bull. Amer. Mus. Nat. Hist., 89:123-256.
- SMITH, J. D. 1964. Systematics of the plains harvest mouse, *Reithrodontomys montanus*. Unpublished M.A. thesis, Univ. Kansas, 42 pp.
- SMITH, J. D., AND T. E. LAWLOR. 1964. Additional records of the armadillo in Kansas. Southwestern Nat., 9:48-49.
- SMITH, R. E. 1958. Natural history of the prairie dog in Kansas. Misc. Publ. Mus. Nat. Hist., Univ. Kansas, 16:1-36.
- STAINS, H. J. 1956. The raccoon in Kansas, natural history, management, and economic importance. Misc. Publ. Mus. Nat. Hist., Univ. Kansas, 10:1-76.
- STAINS, H. J., AND R. H. BAKER. 1958. Furbearers in Kansas: a guide to trapping. Misc. Publ. Mus. Nat. Hist., Univ. Kansas, 18:1-100.

- HOWARD, J. A. 1967. Variation in the big brown bat, *Eptesicus fuscus*, in Kansas. Unpublished M.A. thesis, Univ. Kansas, 37 pp.
- HOWELL, A. H. 1938. Revision of the North American ground squirrels, with a classification of the North American Sciuridae. N. Amer. Fauna, 56:1-256.
- HULETT, G. K., J. H. BROCK, AND J. E. LESTER. 1972. Community structure and function in a remnant Kansas prairie. Proc. Midwest Prairie Conf., 2:104-112.
- JACKSON, H. H. T. 1951. Classification of the races of the coyote. Pp. 227-341, in *The clever coyote* (S.P. Young and H.H.T. Jackson, eds.), The Stackpole Co., Harrisburg, Pa., and Wildlife Mgt. Inst., Washington, D.C., xv+1-411.
- . 1955. The Wisconsin puma. Proc. Biol. Soc. Washington, 68:149-150.
- JANES, D. W., AND H. T. GIER. 1966. Distribution, numbers, and hunting of foxes in Kansas. Trans. Kansas Acad. Sci., 69:23-31.
- JONES, J. K., JR. 1958a. A new bog lemming (genus *Synaptomys*) from Nebraska. Univ. Kansas Publ., Mus. Nat. Hist., 9:385-388.
- . 1958b. The type locality and nomenclatorial status of *Peromyscus maniculatus nebrascensis* (Coues). Proc. Biol. Soc. Washington, 71:107-111.
- . 1960. The hispid cotton rat in Nebraska. J. Mamm., 41:132.
- . 1964. Distribution and taxonomy of mammals of Nebraska. Univ. Kansas Publ., Mus. Nat. Hist., 16:1-356.
- JONES, J. K., JR., AND G. L. CORTNER. 1965. The least weasel, *Mustela nivalis*, in Kansas. Amer. Midland Nat., 73:247.
- JONES, J. K., JR., AND B. MURSALOGLU. 1961. Geographic variation in the harvest mouse, *Reithrodontomys megalotis*, on the central Great Plains and in adjacent regions. Univ. Kansas Publ., Mus. Nat. Hist., 14:9-27.
- JONES, J. K., JR., E. D. FLEHARTY, AND P. B. DUNNIGAN. 1967. The distributional status of bats in Kansas. Misc. Publ. Mus. Nat. Hist., Univ. Kansas, 46:1-33.
- KAUFMAN, D. W., AND E. D. FLEHARTY. 1974. Habitat selection by nine species of rodents in north-central Kansas. Southwestern Nat., 18:443-451.
- KELLOGG, R. 1915. The mammals of Kansas. . . . Unpublished M.A. thesis, Univ. Kansas, 241 pp.
- KRUTZSCH, P. H. 1954. North American jumping mice (genus *Zapus*). Univ. Kansas Publ., Mus. Nat. Hist., 7:349-472.
- LANTZ, D. E. 1905. A list of Kansas mammals. Trans. Kansas Acad. Sci., 19:171-178.
- LEONARD, A. R., AND D. W. BERRY. 1961. Geology and ground-water resources of southern Ellis County and parts of Trego and Rush counties, Kansas. Kansas Geol. Surv. Bull., 149:1-156.
- LITTLE, R. J. 1973. Population status of small mammals in Kansas (muskrats, mink, beaver). Processed by Kansas Forestry, Fish and Game Commission, 16 pp.
- LONG, C. A. 1972. Taxonomic revision of the North American badger, *Taxidea taxus*. J. Mamm., 53:725-759.
- LUEBS, R. E. 1962. Investigations of cropping systems, tillage methods, and cultural practices for dryland farming. . . . Bull. Kansas Agric. Exp. Sta., 449:1-114.

- HAINES, J. M., AND H. T. GIER. 1951. Distribution of microtine rodents in Kansas. *Trans. Kansas Acad. Sci.*, 54:58-62.
- HALL, E. R. 1951a. A synopsis of the North American Lagomorpha. *Univ. Kansas Publ., Mus. Nat. Hist.*, 5:119-202.
- . 1951b. American weasels. *Univ. Kansas Publ., Mus. Nat. Hist.*, 4:1-466.
- . 1955. Handbook of mammals of Kansas. *Misc. Publ. Mus. Nat. Hist., Univ. Kansas*, 7:1-303.
- HALL, E. R., AND E. L. COCKRUM. 1953. A synopsis of the North American microtine rodents. *Univ. Kansas Publ., Mus. Nat. Hist.*, 5:373-498.
- HALL, E. R., AND K. R. KELSON. 1959. The mammals of North America. Ronald Press, New York, 1:xxx+1-546+79; 2:viii+547-1083+79.
- HANSEN, C. M., AND E. D. FLEHARTY. 1974. Structural ecological parameters of a population of *Peromyscus maniculatus* in west-central Kansas. *Southwestern Nat.*, 19:293-303.
- HART, E. B. 1971. Karyology and evolution of the plains pocket gopher, *Geomys bursarius*. Unpublished Ph.D. dissertation, Univ. Oklahoma, ix+1-111.
- HAYS, H. A., AND P. H. IRELAND. 1967. A big free-tailed bat (*Tadarida macrotis*) taken in southeast Kansas. *Southwestern Nat.*, 12:196.
- HENDERSON, F. R. 1960. Beaver in Kansas. *Misc. Publ. Mus. Nat. Hist., Univ. Kansas*, 26:1-85.
- HENDRICKSEN, R. L. 1973. Variation in the plains pocket gopher (*Geomys bursarius*) along a transect across Kansas and eastern Colorado. *Trans. Kansas Acad. Sci.*, 75:322-368.
- HESKET, M. G., AND E. D. FLEHARTY. 1966. Additional records of the least weasel (*Mustela nivalis*) in Kansas. *Trans. Kansas Acad. Sci.*, 68:582-583.
- HIBBARD, C. W. 1933. A revised check list of Kansas Mammals. *Trans. Kansas Acad. Sci.*, 36:230-249.
- HIBBARD, C. W., AND G. C. RINKER. 1942. A new bog-lemming (*Synaptomys*) from Meade County, Kansas. *Univ. Kansas Sci. Bull.*, 28:25-35.
- HILL, W. A. 1938. Historic Hays. *News Publ. Co., Hays*, 1-81.
- HITCHCOCK, A. S. 1950. Manual of the grasses of the United States. *Misc. Publ. U.S. Dept. Agric.*, 200:1-1051.
- HLADEK, K. L., G. K. HULETT, AND G. W. TOMANEK. 1972. The vegetation of remnant shale-limestone prairies in western Kansas. *Southwestern Nat.*, 17:1-10.
- HOFFMANN, R. S., AND J. K. JONES, JR. 1970. Influence of late-glacial and post-glacial events on the distribution of Recent mammals on the northern Great Plains. Pp. 355-394, *in* Pleistocene and Recent environments of the central Great Plains (W. Dort, Jr., and J. K. Jones, Jr., eds.), Univ. Press Kansas, Lawrence, 433 pp.
- HOFFMEISTER, D. F. 1947. Early observations on the elk in Kansas. *Trans. Kansas Acad. Sci.*, 50:75-76.
- HOLLISTER, N. 1911. A systematic synopsis of the muskrats. *N. Amer. Fauna*, 32:1-47.
- . 1914. A systematic account of the grasshopper mice. *Proc. U.S. Nat. Mus.*, 47:427-489.
- . 1916. A systematic account of the prairie-dogs. *N. Amer. Fauna*, 40:1-37.

- FLEHARTY, E. D. 1972. Some aspects of small mammal ecology in a Kansas remnant prairie. Proc. Midwest Prairie Conf., 2:97-103.
- FLEHARTY, E. D., AND J. R. CHOATE. 1973. Bioenergetic strategies of the cotton rat, *Sigmodon hispidus*. J. Mamm., 54:680-692.
- FLEHARTY, E. D., AND J. P. FARNEY. 1965. A second locality record for *Myotis keeni* (Merriam) in Kansas. Trans. Kansas Acad. Sci., 68:200.
- FLEHARTY, E. D., AND M. A. MARES. 1973. Habitat preference and spatial relations of *Sigmodon hispidus* on a remnant prairie in west-central Kansas. Southwestern Nat., 18:21-29.
- FLEHARTY, E. D., AND L. E. OLSON. 1969. Summer food habits of *Microtus ochrogaster* and *Sigmodon hispidus*. J. Mamm., 50:475-486.
- FLEHARTY, E. D., AND D. L. STADEL. 1968. Distribution of *Peromyscus leucopus* (woods mouse) in western Kansas. Trans. Kansas Acad. Sci., 71:231-233.
- FLEHARTY, E. D., J. R. CHOATE, AND M. A. MARES. 1972. Fluctuations in population density of the hispid cotton rat: factors influencing a "crash." Bull. So. California Acad. Sci., 71:132-138.
- FLEHARTY, E. D., M. E. KRAUSE, AND D. P. STINNETT. 1973. Body composition, energy content, and lipid cycles of four species of rodents. J. Mamm., 54:426-438.
- FLY, C. L. 1946. Natural agricultural resource areas of Kansas. Soil conservation in Kansas. Rept. Kansas State Board Agric., 65:126-195.
- FRYDENDALL, M. J. 1961. Occurrence of *Peromyscus leucopus aridulus* in Ellis County, Kansas with some notes on their activities. Trans. Kansas Acad. Sci., 64:36-40.
- . 1969. Rodent populations on four habitats in central Kansas. Trans. Kansas Acad. Sci., 72:213-222.
- GARDNER, A. L. 1973. The systematics of the genus *Didelphis* (Marsupialia: Didelphidae) in North and Middle America. Spec. Publ. The Museum, Texas Tech Univ., 4:1-81.
- GENOWAYS, H. H., AND J. R. CHOATE. 1972. A multivariate analysis of systematic relationships among populations of the short-tailed shrew (genus *Blarina*) in Nebraska. Syst. Zool., 21:106-116.
- GENOWAYS, H. H., AND J. K. JONES, JR. 1972. Mammals from southwestern North Dakota. Occas. Papers The Museum, Texas Tech Univ., 6:1-36.
- GENOWAYS, H. H., AND D. A. SCHLITZER. 1967. Northward dispersal of the hispid cotton rat in Nebraska and Missouri. Trans. Kansas Acad. Sci., 69:356-357.
- GETZ, L. L. 1961. New locality records of some Kansas mammals. J. Mamm., 42:282-283.
- GIER, H. T. 1968. Coyotes in Kansas. Bull. Kansas Agric. Exp. Sta., 393:1-118.
- GOLDMAN, E. A. 1944. Classification of wolves. Part II, xi + 387-507, in The wolves of North America (S.P. Young and E. A. Goldman, eds.), Amer. Wildlife Inst., Washington, D.C., xx + 1-636.
- . 1946. Classification of the races of the puma. Part II, pp. 175-302, in The puma, mysterious American Cat (S.P. Young and E. A. Goldman, eds.), Amer. Wildlife Inst., xiv + 1-358.
- . 1950. Raccoons of North and Middle America. N. Amer. Fauna, 60:vi + 1-153.
- GRISWOLD, S. B. 1942. A study of the woody plants along the streams which cross Ellis County, Kansas. Trans. Kansas Acad. Sci., 45:98-106.

- Peromyscus maniculatus* as recorded by a photographic device. *Southwestern Nat.*, 15:209-216.
- CARTER, F. L. 1939a. A history of the changes in population of certain mammals in western Kansas. Unpublished M.S. thesis, Fort Hays Kansas State College, vi+1-78.
- . 1939b. A study in jackrabbit shifts in range in western Kansas. *Trans. Kansas Acad. Sci.*, 42:431-435.
- CHOATE, J. R. 1970. Systematics and zoogeography of Middle American shrews of the genus *Cryptotis*. *Univ. Kansas Publ., Mus. Nat. Hist.*, 19:195-317.
- CHOATE, J. R., AND E. D. FLEHARTY. 1973. Habitat preference and spatial relations of shrews in a mixed grassland in Kansas. *Southwestern Nat.*, 18:110-112.
- CHOATE, J. R., AND H. H. GENOWAYS. 1967. Notes on some mammals from Nebraska. *Trans. Kansas Acad. Sci.*, 69:238-241.
- CHOATE, J. R., AND D. M. TERRY. 1974. Observations on habitat preference of *Onychomys leucogaster* (Rodentia: Muridae) on the central Great Plains. *Trans. Kansas Acad. Sci.*, 76:263-265.
- CHOATE, J. R., E. D. FLEHARTY, AND R. J. LITTLE. 1974. Status of the spotted skunk, *Spilogale putorius*, in Kansas. *Trans. Kansas Acad. Sci.*, 76:226-233.
- CLEMENTS, F. E. 1920. Plant indicators *Carnegie Inst. Washington Publ.*, 190:xvi+1-388.
- COCKRUM, E. L. 1951. A new pocket mouse (genus *Perognathus*) from Kansas. *Univ. Kansas Publ., Mus. Nat. Hist.*, 5:203-206.
- . 1952. Mammals of Kansas. *Univ. Kansas Publ., Mus. Nat. Hist.*, 7:1-303.
- DALE, K. 1964. Echoes and etchings of early Ellis. Big Mountain Press, Denver, 224 pp.
- DENNEY, R. N. 1952. A summary of North American beaver management, 1946-1948. Processed by Colorado Game and Fish Dept., vii+1-58.
- DETWILER, M. N. 1952. Hays, Kansas, at the nation's heart. *Nat. Geog. Mag.*, 101:461-490.
- DICE, L. R. 1943. The biotic provinces of North America. *Univ. Michigan Press, Ann Arbor*, viii+1-78.
- . 1952. Natural communities. *Univ. Michigan Press, Ann Arbor*, x+1-547.
- DOWNHOWER, J. F., AND E. R. HALL. 1966. The pocket gopher in Kansas. *Misc. Publ. Mus. Nat. Hist., Univ. Kansas*, 44:1-32.
- DUTT, O. D. 1970. Native vegetation on some Ellis County, Kansas soils. Unpublished M.S. thesis, Fort Hays Kansas State College, vi+1-40.
- DYCHE, L. L. 1905. The puma or American lion. *Trans. Kansas Acad. Sci.*, 19:160-163.
- EGOSCUE, H. J. 1960. Laboratory and field studies of the northern grasshopper mouse. *J. Mamm.*, 41:99-110.
- ELY, C. A. 1971. A history and distributional list of Ellis County, Kansas, birds. *Fort Hays Studies (n.s.), Sci. Ser.*, 9:vii+1-115.
- FITCH, H. S., AND L. L. SANDIDGE. 1953. Ecology of the opossum on a natural area in northeastern Kansas. *Univ. Kansas Publ., Mus. Nat. Hist.*, 7:305-338.

- AUSTIN, M. E. 1965. Land resource regions and major land resource areas of the United States. Agric. Handbook, Soil Conserv. Serv., 296:1-82.
- BARR, S. L., E. D. FLEHARTY, AND M. F. ARTMAN. 1975. Utilization of deep burrows and nests by cotton rats in west-central Kansas. Southwestern Nat., 19:440-444.
- BAKER, A. B. 1889. Mammals of western Kansas. Trans. Kansas Acad. Sci., 11:56-58.
- BAKER, R. H. 1971. Nutritional strategies of myomorph rodents in North American grasslands. J. Mamm., 52:800-805.
- BARKLEY, T. M. 1968. A manual of the flowering plants of Kansas. Processed by Kansas State Univ. Endowment Assoc., Manhattan, vi+1-402.
- BASS, N. W. 1926. Geologic investigations in western Kansas, with special reference to oil and gas possibilities; Part 1, Geology of Ellis County. Kansas Geol. Surv. Bull., 11:1-52.
- BEED, W. E. 1936. A preliminary study of the animal ecology of the Niobrara Game Preserve. Bull. Conserv. Surv. Div., Univ. Nebraska, 10:1-33.
- BIDWELL, O. W. 1956. Major soils of Kansas. Kansas Agric. Exp. Sta., Circ. 336:1-16.
- BIRNEY, E. C. 1973. Systematics of three species of woodrats (genus *Neotoma*) in central North America. Misc. Publ. Mus. Nat. Hist., Univ. Kansas, 58:1-173.
- BIRNEY, E. C., AND J. D. RISING. 1968. Notes on distribution and reproduction of some bats from Kansas, with remarks on incidence of rabies. Trans. Kansas Acad. Sci., 70:519-524.
- BIRNEY, E. C., J. K. JONES, JR., AND D. M. MORTIMER. 1971. The yellow-faced pocket gopher, *Pappogeomys castanops*, in Kansas. Trans. Kansas Acad. Sci., 73:368-375.
- BLACK, J. D. 1937. Mammals of Kansas. Kansas State Bd. Agric., 30th biennial report, 35:116-217.
- BRONSON, F. H., AND O. T. TIEMEIER. 1959. The relationship of precipitation and black-tailed jack rabbit populations in Kansas. Ecology, 40:194-198.
- BROWN, H. L. 1940. The distribution of the white-tailed jack rabbit (*Lepus townsendii campanius* Hollister) in Kansas. Trans. Kansas Acad. Sci., 43:385-389.
- . 1945. Evidence of winter breeding of *Peromyscus*. Ecology, 26:308-309.
- . 1946. Rodent activity in a mixed prairie near Hays, Kansas. Trans. Kansas Acad. Sci., 48:448-456.
- . 1947a. Why has the white-tailed jack rabbit (*Lepus townsendii campanius* Hollister) become scarce in Kansas? Trans. Kansas Acad. Sci., 49:455-456.
- . 1947b. Coaction of jack rabbit, cottontail, and vegetation in a mixed prairie. Trans. Kansas Acad. Sci., 50:28-44.
- BRUMWELL, M. J. 1951. An ecological survey of the Fort Leavenworth Military Reservation. Amer. Midland Nat., 45:187-231.
- BUGBEE, R. E., AND A. RIEGEL. 1945. Seasonal food choices of the fox squirrel in western Kansas. Trans. Kansas Acad. Sci., 48:199-203.
- BUNKER, C. D. 1940. The kit fox. Science, 92(2376):35-36.
- CARLEY, C. J., E. D. FLEHARTY, AND M. A. MARES. 1970. Occurrence and activity of *Reithrodontomys megalotis*, *Microtus ochrogaster*, and

specimens housed in the Museum of the High Plains are especially acknowledged. Finally, various aspects of this study were funded indirectly by several small grants for mammalian research from the Faculty Research Fund at Fort Hays Kansas State College.

LITERATURE CITED

- ALBERTSON, F. W. 1937. Ecology of mixed prairie in west central Kansas. *Ecol. Monogr.*, 7:481-547.
- ALBERTSON, F. W., AND G. W. TOMANEK. 1965. Vegetation changes during a 30-year period on grassland communities near Hays, Kansas. *Ecology*, 46:714-720.
- ALBERTSON, F. W., AND J. E. WEAVER. 1942. History of the native vegetation of western Kansas during seven years of continuous drought. *Ecol. Monogr.*, 12:23-51.
- . 1944. Effects of drought, dust, and intensity of grazing on cover and yield of short-grass pastures. *Ecol. Monogr.*, 14:1-29.
- . 1945. Injury and death or recovery of trees in prairie climate. *Ecol. Monogr.*, 15:393-433.
- . 1946. Reduction of ungrazed mixed prairie to short grass as a result of drought and dust. *Ecol. Monogr.*, 16:449-463.
- ALBERTSON, F. W., G. W. TOMANEK, AND A. RIEGEL. 1957. Ecology of drought cycles and grazing intensity on grasslands of central Great Plains. *Ecol. Monogr.*, 27:28-44.
- ALLEN, J. A. 1871. The fauna of the prairies. *Amer. Nat.*, 5:4-9.
- . 1872. Notes of an ornithological reconnoissance of portions of Kansas, Colorado, Wyoming, and Utah. II. List of birds observed in the vicinity of Fort Hays, Kansas, from May 26 to July 3, 1871; with annotations. *Bull. Mus. Comp. Zool.*, 3:131-142.
- . 1874. Notes on the mammals of portions of Kansas, Colorado, Wyoming and Utah. Part I. On the mammals of middle and western Kansas. *Bull. Essex Inst.*, 6:45-52.
- . 1895. List of mammals collected in the Black Hills region of South Dakota and in western Kansas by Mr. Walter W. Granger, with field notes by the collector. *Bull. Amer. Mus. Nat. Hist.*, 7:259-274.
- ANDERSEN, K. W. 1971. Recent records of *Mustela nivalis* from Kansas. *Trans. Kansas Acad. Sci.*, 73:404-406.
- ANDERSEN, K. W., AND E. D. FLEHARTY. 1964. Additional fox records for Kansas. *Trans. Kansas Acad. Sci.*, 67:193-194.
- . 1967. Mammalian distribution within biotic communities of northeastern Jewell County, Kansas. *Fort Hays Studies (n.s.), Sci. Ser.*, 6:v+1-46.
- ANDERSEN, K. W., AND J. K. JONES, JR. 1971. Mammals of northwestern South Dakota. *Univ. Kansas Publ., Mus. Nat. Hist.*, 19:361-393.
- ANDERSON, D. D. 1964. The status of deer in Kansas. *Misc. Publ. Mus. Nat. Hist., Univ. Kansas*, 39:1-36.
- ANDERSON, S., AND B. C. NELSON. 1958. Additional records of mammals of Kansas. *Trans. Kansas Acad. Sci.*, 61:302-312.
- ARMSTRONG, D. M. 1972. Distribution of mammals in Colorado. *Monogr. Mus. Nat. Hist., Univ. Kansas*, 3:x+1-415.

southwest' (*Sylvilagus audubonii*, *Spermophilus spilosoma*, *Papogeomys castanops*, *Vulpes velox*, and *Bassariscus astutus*; "boreal or montane species" (*Synaptomys cooperi*, *Zapus hudsonius*, and *Mustela nivalis*); "deciduous forest species (*Nycticeius humeralis* and *Urocyon cinereoargenteus*); "invader from the south" (*Tadarida macrotis*); and "widespread species" (*Myotis leibii*, *Lasionycteris noctivagans*, *Ursus americanus*, and *Ursus arctos*).

Therefore, Ellis County is situated in a transitional zone that is known to be (or to have been) inhabited by representatives of five different faunal units (nine "steppe species"; five "invaders from the southwest"; ten "deciduous forest species"; three "invaders from the south"; and 23 "widespread species"). The distributional patterns of several species of mammals in this transitional zone have been modified appreciably by the activities of modern man, and those of certain others are subject to abrupt changes resulting from the effects of drought. The only major faunal units represented in the Great Plains (see Hoffmann and Jones, 1970:364-365) that lack representation in Ellis County are the "Great Basin species" and the "boreal and montane species." It is doubtful that the former faunal unit has ever been represented in the county, at least during the Recent Epoch, but the latter possibly was represented by *Zapus hudsonius* and *Synaptomys cooperi* during the Recent Epoch and conceivably is represented by *Mustela nivalis* now.

ACKNOWLEDGMENTS

Drs. G. K. Hulett (Professor of Biology), L. E. Oliva (Professor of History), and R. J. Zakrzewski (Associate Professor of Geology and Director of the Sternberg Memorial Museum), all members of the faculty at Fort Hays Kansas State College, provided helpful comments on the plants, history, and geology, respectively, of Ellis County. Information regarding large mammals was contributed by Messrs. G. L. Carson and R. J. Little (both of the Kansas Forestry, Fish and Game Commission) and by Mr. Carroll Olsen (a fur dealer in WaKeeney, Kansas). In addition to the above mentioned faculty, Drs. G. W. Tomanek of Fort Hays Kansas State College, H. H. Genoways, J. K. Jones, Jr., and D. Northington of Texas Tech University, and R. S. Hoffmann of The University of Kansas, plus three graduate students at Fort Hays Kansas State College (Ms. L. R. Joyce and Messrs. S. L. Baar and D. M. Terry) critically reviewed the manuscript. Some of the photographs were taken (and all were processed) by Mr. L. J. Jackson. The efforts of many past and present undergraduate and graduate students in collecting and preparing

tilocapra americana, and *Bison bison*. All of these except man (which was not treated by Hoffmann and Jones, 1970), and the white-tailed jack rabbit and black-footed ferret (both of which are "steppe species") were regarded by Hoffmann and Jones (1970:364-365) as "widespread species." Finally, the bats known to occur in Ellis County include two species (*Myotis keenii* and *Eptesicus fuscus*, regarded by Hoffmann and Jones, 1970:365, as a "deciduous forest species" and a "widespread species," respectively) that hibernate in the county and three species (*Lasiurus borealis*, *L. cinereus*, and *Tadarida brasiliensis*; a "deciduous forest species," a "widespread species," and an "invader from the south," respectively, see Hoffmann and Jones, 1970:365) that migrate out of the county each winter.

The list of species of unverified occurrence includes two (*Sylvilagus audubonii* and *Vulpes velox*) that are restricted to arid grassland in Kansas, and the distributions of which approach Ellis County from the west by means of the High Plains. One species (*Spermophilus franklinii*) occurs primarily in mesic grasslands farther to the north and east in Kansas, and two species (*Synaptomys cooperi* and *Zapus hudsonius*) occur in Kansas primarily in very wet environments (whether they be forests or marshes); these species might have inhabited Ellis County prior to modification of riparian habitats by man or, perhaps more importantly, prior to the great drought of the 1930's. *Spermophilus spilosoma* occurs in western Kansas primarily in relatively deep (usually sandy) soils, often associated with ephemeral watercourses. Two of the unverified species (*Urocyon cinereoargenteus* and *Ursus americanus*) are strict woodland species, the former presently extending its range westward along riparian habitats toward Ellis County and the latter possibly an infrequent inhabitant of the depauperate riparian communities that existed in Ellis County at the time of settlement of the region by European man (see historical account). Distribution of the remaining terrestrial species of unverified occurrence (*Pappogeomys castanops*, *Perognathus flavescens*, *Ursus arctos*, *Bassariscus astutus*, and *Mustela nivalis*) is (or, in the case of the grizzly bear and ringtail, was) probably restricted more by presence of suitable soil or sites for dens than by vegetation. Hoffmann and Jones (1970:364-365) assigned the species of unverified occurrence in Ellis County to the following major faunal units (those authors did not include the yellow-faced pocket gopher and the ringtail, but we have assigned them to the appropriate faunal unit): "steppe species" (*Spermophilus franklinii*, *Perognathus flavescens*, and *Vulpes velox*); "invaders from the

silky pocket mouse and the plains harvest mouse) seemingly is most common in communities (of either short or tall grasses and forbs) that have been overgrazed or otherwise mismanaged (see discussion in Choate and Terry, 1974). All of the grassland species that are not obligatory with regard to prairie habitats (*Blarina carolinensis*, *Cryptotis parva*, *Dasyopus novemcinctus*, *Reithrodontomys megalotis*, *Sigmodon hispidus*, *Microtus ochrogaster*, *Canis latrans*, and *Odocoileus hemionus*) occasionally occur in riparian woodland. The short-tailed shrew, although often regarded as a woodland species (for example, see Hall, 1955:14), is most abundant in mesic grassland or brushy areas (frequently in "forest-edge" habitats). The least shrew "is most easily caught in large numbers in restricted damp or mesic areas, such as at the borders of streams or lakes, within otherwise relatively arid habitats" (Choate, 1970:255). The western harvest mouse, prairie vole, hispid cotton rat, and probably nine-banded armadillo occur in almost any habitat (including lush riparian communities) that satisfies their particular needs for food and cover.

The grassland species, as listed in this paper, include representatives of five of the seven faunal units on the Great Plains, as described by Hoffmann and Jones (1970:364-365). Four of these species (*Peromyscus maniculatus*, *Canis latrans*, *Taxidea taxus*, and *Odocoileus hemionus*) are among those regarded as "widespread species" (see above). Two (*Blarina carolinensis*, and *Cryptotis parva*), seemingly contradictorily, were regarded as "deciduous forest species"; however, although these shrews are thought to have evolved in, and radiated outward from, the region of North America presently vegetated primarily by deciduous forest, today they are not characteristic inhabitants of forested areas but, rather, of mesic grassland that frequently occurs in and around forested areas. Six species (*Cynomys ludovicianus*, *Spermophilus tridecemlineatus*, *Geomys bursarius*, *Perognathus hispidus*, *Reithrodontomys montanus*, and *Microtus ochrogaster*) are "steppe species," and five (*Lepus californicus*, *Perognathus flavus*, *Dipodomys ordii*, *Reithrodontomys megalotis*, and *Onychomys leucogaster*) doubtlessly invaded the Great Plains from arid regions of the Southwest. Finally, two species (*Dasyopus novemcinctus* and *Sigmodon hispidus*) are Recent immigrants from the south.

Nine species of mammals are known to have occurred in Ellis County at the time of settlement of the region by European man but subsequently were extirpated; these include *Homo sapiens* (subspecies *americanus*), *Lepus townsendii*, *Canis lupus*, *Mustela nigripes*, *Lutra canadensis*, *Felis concolor*, *Cervus elaphus*, *An-*

description of depauperate riparian woodland by J. A. Allen, in historical account). The opossum, the fox squirrel, and perhaps the eastern mole arrived in Ellis County after settlements were established. Finally, one species (*Spilogale putorius*) was regarded by Hoffmann and Jones (1970:364; see discussion on p. 381) as a "steppe species." We concur with this seemingly contradictory designation, but with the following qualifications. The "natural" habitat of the spotted skunk in Ellis County (and probably elsewhere on the Great Plains), in our opinion, consists largely of riparian (albeit relatively arid) communities (either with or without trees). This might be due to peculiar needs for cover or sites for dens, or it might be a response to other, as yet unknown, environmental factors. However, the spotted skunk also inhabits a variety of "commensal" habitats, some of which may be a considerable distance from the nearest riparian situations (see discussion by Choate *et al.*, 1974); therefore, the species obviously is well adapted for survival in a "steppe" environment. Both *Mephitis mephitis* and *Mustela frenata*, which were stated above to show no pronounced preference either for woodland or grassland, were regarded by Hoffmann and Jones (1970:365) as "widespread species."

Of the grassland species (listed above), the black-tailed jack rabbit, black-tailed prairie dog, thirteen-lined ground squirrel, plains pocket gopher, silky pocket mouse, hispid pocket mouse, Ord's kangaroo rat, plains harvest mouse, deer mouse, northern grasshopper mouse, and badger are obligate inhabitants of native prairies and other grasslands in Ellis County. *Lepus californicus*, *Cynomys ludovicianus*, *Spermophilus tridecemlineatus*, *Perognathus flavus*, and *Reithrodontomys montanus* occur primarily on arid (usually short grass) prairies, although the jack rabbit and ground squirrel also make extensive use of croplands and "managed" grasslands (closely mown lawns of various kinds), respectively. The obligatory relationship of *Geomys bursarius*, *Dipodomys ordii*, and *Perognathus hispidus* for grassland environments apparently stems largely from a need for suitably deep, friable soils in which to burrow. Such suitable habitats usually exist in areas of tall or short grasses but sometimes abut with or extend into wooded areas (in which soils often consist of sandy alluvium). The deer mouse occurs in grassland communities of all kinds, at least in Ellis County, so long as those communities are not severely overgrazed. Likewise, the badger is ubiquitous with regard to the kinds of prairie habitats that exist in Ellis County except where those prairie communities are closely underlain with limestone. Finally, the northern grasshopper mouse (and possibly also the

that show no pronounced preference for either woodland or grassland.

Of the woodland species, the Virginia opossum, fox squirrel, beaver, white-footed mouse, porcupine, red fox, raccoon, and mink are obligate inhabitants of wooded areas in Ellis County (although all occasionally cross treeless areas in their wanderings). Reasons for the obligatory relationship with wooded habitats include availability of food (fox squirrel, beaver, and porcupine), and suitable cover or sites for dens (probably all of these species). Of the woodland species that are not obligatory with regard to wooded habitats (eastern mole, eastern cottontail, eastern woodrat, muskrat, spotted skunk, bobcat, and white-tailed deer), all probably occur more commonly in wooded areas than on grasslands in Ellis County because of their peculiar needs for cover, nesting materials, or sites for dens. The muskrat, for example, occurs as commonly in streams where the riparian habitat consists of grasses and sedges as in streams lined by riparian woodland, but the latter presently are more abundant than the former in Ellis County (although this might not have been true prior to intensive settlement of the region by European man — see historical account). Likewise, the eastern mole occurs in western Kansas primarily in deep (usually sandy), moist soils at the border of riparian woodland, probably because suitable soils are most prevalent along water-courses.

The woodland species, as listed in this paper, include representatives of three of the seven faunal units on the Great Plains described by Hoffmann and Jones (1970:364-365; see also discussions by Andersen and Jones, 1971:389-392, and Genoways and Jones, 1972:32-34). Eight of these (*Castor canadensis*, *Ondatra zibethicus*, *Erethizon dorsatum*, *Vulpes vulpes*, *Procyon lotor*, *Mustela vison*, *Felis rufus*, and *Odocoileus virginianus*) are "widespread species" that "are tolerant of a wide range of environmental conditions or have rather specialized requirements that are met in several biotopes" (Hoffmann and Jones, 1970:380). Six species (*Didelphis virginiana*, *Scalopus aquaticus*, *Sylvilagus floridanus*, *Sciurus niger*, *Peromyscus leucopus*, and *Neotoma floridana*) are characteristic of the eastern deciduous forest. Of these, the eastern cottontail and the eastern woodrat (neither of which is an obligate inhabitant of wooded areas, so long as suitable cover and nesting material are available) and, perhaps, the white-footed mouse (which is an obligate inhabitant of the broadly defined woodland habitat but is capable of occupying brushy areas and sparse riparian woodland) were native to Ellis County prior to settlement of the region by European man (see

reported from Cowley and Lyon counties in eastern Kansas (Cockrum, 1952:285; Anderson and Nelson, 1958:309) and conceivably might have occurred as far north and west as Ellis County in the past.

Mustela nivalis Linnaeus. — Jones and Cortner (1965:247) and Heskett and Fleharty (1966:582-583) reported the first specimens of the least weasel to be obtained in Kansas, and Andersen (1971:404-405) summarized data on additional specimens, all of which to that time had been collected in Jewell, Republic, Marshall, and Smith (the second county north and the first east of Ellis) counties along the northern border of the state. We include the least weasel in this list of unverified species on the basis of a specimen that was subsequently (in March 1972) obtained 8 mi. N, 4 mi. E Lincoln, Lincoln County (the second county to the east of Ellis).

DISCUSSION

Various authors (including Beed, 1936, as summarized by Jones, 1964:38; Andersen and Fleharty, 1967:10; and Armstrong, 1972:327-329, in part) have attempted to describe the ecological distributions of mammals in restricted areas of the Great Plains by means of "community-types" (see Dice, 1952:440). However, as noted by Kaufman and Fleharty (1974), the predictive value of these community types is not great because mammals tend to cross community boundaries and form a "continuum" among the different communities. Therefore, we have chosen to follow Genoways and Jones (1972:32) and discuss the ecological distributions of mammals in terms of broadly defined habitats rather than community types. The principal habitats occupied by mammals in Ellis County are woodland and grassland.

Of the 36 species (exclusive of bats) of native mammals that presently occur in Ellis County, we regard 15 (*Didelphis virginiana*, *Scalopus aquaticus*, *Sylvilagus floridanus*, *Sciurus niger*, *Castor canadensis*, *Peromyscus leucopus*, *Neotoma floridana*, *Ondatra zibethicus*, *Erethizon dorsatum*, *Vulpes vulpes*, *Procyon lotor*, *Mustela vison*, *Spilogale putorius*, *Felis rufus*, and *Odocoileus virginianus*) primarily as woodland species, 19 (*Blarina carolinensis*, *Cryptotis parva*, *Dasyurus novemcinctus*, *Lepus californicus*, *Cynomys ludovicianus*, *Spermophilus tridecemlineatus*, *Geomys bursarius*, *Perognathus flavus*, *P. hispidus*, *Dipodomys ordii*, *Reithrodontomys megalotis*, *R. montanus*, *Peromyscus maniculatus*, *Onychomys leucogaster*, *Sigmodon hispidus*, *Microtus ochrogaster*, *Canis latrans*, *Taxidea taxus*, and *Odocoileus hemionus*) as grassland species, and two (*Mustela frenata* and *Mephitis mephitis*) as species

subsequent reports of gray foxes in Clark and Meade counties (in southwestern Kansas — Getz, 1961:283) and in Lincoln County (the second county to the east of Ellis — Andersen and Fleharty, 1964: 193-194) raised the possibility that the species might be expanding its range westward in Kansas. Janes and Gier (1966:25) recorded the species from Osborne County (which borders Ellis County to the northeast) and from Phillips County (the second county to the north of Ellis); these records attest to the continued westward movement of the species into western Kansas. We doubt that the gray fox has yet reached Ellis County, but it should be watched for in the future in riparian habitats along the Saline River, Big Creek, and the Smoky Hill River.

Ursus americanus Pallas. — Records kept at Fort Hays (see historical account) made no reference to bears, but Allen (1874:46) reported that the black bear was "said to be more or less common along the streams [in the vicinity of Fort Hays]. We observed its tracks in June along the Saline." Whether the tracks that Allen saw were those of the black bear or the grizzly bear, and whether he was in Ellis County at the time, remain in doubt. However, it is possible that the species existed in the sparse woodland that lined the banks of streams as far west as the Fort Hays escarpment in Ellis County.

Ursus arctos Linnaeus. — Cockrum (1952:239) described the probable range of the grizzly bear in Kansas as "the western two-thirds of the state; now extinct." The grizzly bear probably was extirpated in Ellis County (if, indeed, it was native to the county) prior to the establishment of Fort Hays. Cockrum (1952:238-239) summarized evidence (Pattie, 1833:31; Kellogg, 1915; also, see above account of *Ursus americanus*) for the former existence of the species in Trego County (the county adjacent to Ellis on the west) and Logan County (the third county to the west of Ellis).

Bassariscus astutus (Lichtenstein). — After spending five weeks of the summer of 1871 at Fort Hays and two weeks of the following winter in "northwestern Kansas," Allen (1874:45) made the following comments: "Bassariscus astutus. Texas Civet Cat. Of occasional occurrence. Although I did not meet with it, an animal was described to me by different persons that so accurately agrees with the Texas civet cat that I have no doubt of its being this species. It is apparently rather rare, however, as none of my informants had seen more than two or three individuals in the region under consideration. The northern boundary of Kansas probably forms its ordinary northern limit of distribution on the plains." Although the ringtail almost certainly does not occur in Ellis County at this time, it has been

mi. E Stafford, Stafford County (Cockrum, 1952:196), and 1/4 mi. S Hunter, Mitchell County (Haines and Gier, 1951:60; Cockrum, 1952:194, 196). As noted by Jones (1964:222), the population in Meade County and another in Dundy County, southwestern Nebraska (see Jones, 1958a), probably represent Pleistocene relicts left behind as the range of the species withdrew to the north and east. Other such populations doubtlessly occur (or occurred), and it is not beyond the realm of possibility that the ephemeral marshes that formerly existed along watercourses in Ellis County might have been inhabited by southern bog lemmings. It is doubtful, however, that the species exists in Ellis County at this time.

Zapus hudsonius (Zimmermann). — References to “*Jaculus hudsonius*” and “Jumping Mouse” in records kept at Fort Hays (see historical account) might have referred to this species. In this regard, Baker (1889:56-57) reported one meadow jumping mouse that he obtained “among willow brush on the bank of a stream” presumably near WaKeeney “along the hundredth meridian between N. latitude 38.30 and 39.30” in adjacent Trego County. It is conceivable that this species, as well as *Synaptomys cooperi* (see above), might have inhabited “low undergrowth usually of grasses or forbs or both, . . . but most frequently in open, moist areas . . . affording moist to semi-aquatic living conditions” (Quimby, 1951:75; Krutzsch, 1954:422) along Big Creek and possibly the Smoky Hill and Saline rivers prior to modification of those environments by man and, perhaps more importantly, prior to the great drought of the 1930’s. It is doubtful that we will ever know with certainty whether *Z. hudsonius* occurred in Ellis County prior to intensive settlement of the region by European man, as the species almost certainly does not occur here at this time.

Vulpes velox (Say). — Allen (1874:45) reported that “these graceful little animals are still more or less abundant [in the vicinity of Fort Hays].” However, whether his observations were made in Ellis County or on the High Plains farther to the west is questionable. The swift fox formerly was thought to have been extirpated in Kansas (Bunker, 1940:35-36; Cockrum, 1952:234-235) but has recently been recorded in almost all counties in the western one-half of the state (see Martin and Sternberg, 1955:345; Anderson and Nelson, 1958:308; Andersen and Fleharty, 1964:193; Janes and Gier, 1966:25). The species almost certainly will be found on open rangeland in Ellis County.

Urocyon cinereoargenteus (Schreber). — Cockrum (1952:236-237) recorded the gray fox only from eastern Kansas. However,

ground squirrel on the basis of a specimen obtained long ago at a place 9 mi. W WaKeeney in adjacent Trego County. The species probably was extirpated in western Kansas early during this century, either as a result of intensive grazing by cattle or by the great drought of the 1930's. More recently, improved conservation practices have increased the amount of tall grass and dense brush (apparently the preferred habitat of the species) available in western Kansas, and the species might be reinvading areas from which it had withdrawn. Evidence for this is available in the form of a specimen found (in July 1970) dead alongside a road on the Kirwin Wildlife Refuge in Phillips County (approximately 40 miles north of Ellis County), an area that previously was not inhabited by the species. It is possible, therefore, that Franklin's ground squirrel might occur, either now or in the future, in suitable ungrazed habitat in Ellis County.

Spermophilus pilosoma Bennett. — The spotted ground squirrel is known in Kansas from several localities to the south and west of Ellis County where "they prefer dry, sandy soil, and are quite common in drifted sand along the rivers" (Cockrum, 1952:126). The locality of record nearest Ellis County is Kinsley, Edwards County (Howell, 1938: 127), only about 50 miles to the south, but we doubt that the species will be found in Ellis County.

Pappogeomys castanops (Baird). — No specimens of the yellow-faced pocket gopher were available from Kansas until 1968, but the species was subsequently recorded at several localities north of the Arkansas River in Finney, Ford, Gray, Hamilton, Hodgeman, and Lane counties (Birney *et al.*, 1971:368). The species, at least in Kansas, occurs primarily in "pastures of native short grasses and adjacent roadside ditches in those areas characterized by loamy soils having calcareous deposits in either surface or subsurface layers" (Birney *et al.*, 1971:369). Whether *P. castanops* might occur in suitable upland soils (if, indeed, any exist) in southwestern Ellis County is conjectural.

Perognathus flavescens Merriam. — Two specimens of the plains pocket mouse were obtained (1 mi. N, 1 mi. E Lucas and 7 1/2 mi. S, 1/2 mi. W Lucas) in eastern Russell County (the county just east of Ellis) in October 1965. Other localities of record in Kansas for this poorly known species are scattered throughout the western half of the state, and it is conceivable that individuals of the species will be trapped in Ellis County.

Synaptomys cooperi Baird. — In central and western Kansas, the only localities of record for the southern bog lemming are 14 mi. SW Meade, Meade County (Hibbard and Rinker, 1942:26), 15 mi. N, 3

SPECIES OF UNVERIFIED OCCURRENCE

The 17 species listed below are not known to occur, or to have formerly occurred, in Ellis County, but additional research may reveal their presence (either present or past).

Myotis leibii (Audubon and Bachman). — The small-footed *Myotis* is presently known in Kansas only from the three counties (Trego, Gove, and Logan) immediately to the west of Ellis (see Jones *et al.*, 1967:9), where they inhabit chalk bluffs and canyons near the floodplain of the Smoky Hill River. Few such habitats exist in Ellis County, but occasional individuals might inhabit bluffs overlooking the Smoky Hill River in the southwestern corner of the county.

Lasionycteris noctivagans (Le Conte). — According to Jones *et al.* (1967:12), the silver-haired bat is "probably state-wide during seasonal migrations, but evidently not resident in Kansas." The locality of record (Jones *et al.*, 1967:13) that is nearest Ellis County is WaKeeney, Trego County (only 15 miles to the west of the county line), and it is possible that the species eventually will be found in Ellis County.

Nycticeius humeralis (Rafinesque). — The evening bat was known in Kansas only from Clay, Douglas, Jewell, and Johnson counties (all in the northeastern quarter of the state) when Jones *et al.* (1967:21-22) reviewed its distribution. However, Birney and Rising (1968:522) subsequently reported the species from Ford County, "approximately 200 miles southwest of the nearest previously reported locality in Kansas." The distribution of this bat in Kansas obviously is not well known, and it is conceivable that the evening bat might be found in Ellis County.

Tadarida macrotis (Gray). — Although Jones *et al.* (1967:28) stated that the big free-tailed bat is "to be looked for in any part of the state," it seems unlikely that it will be found in Ellis County. The species is known in Kansas only from Morton County (the southwesternmost county — Cockrum, 1952:85) and Crawford County (in the southeastern corner of the state — Hays and Ireland, 1967:196).

Sylvilagus audubonii (Baird). — Cockrum (1952:106) examined specimens of the desert cottontail from three localities in Trego County (the county immediately west of Ellis), and included western Ellis County within the hypothetical range of the species. Although no specimens of *S. audubonii* are yet available from Ellis County, we suspect that intensive collecting in short-grass rangeland on the High Plains of western Ellis County will reveal the presence of this species.

Spermophilus franklinii (Sabine). — Cockrum (1952:129-130) included Ellis County within the hypothetical range of Franklin's

eastward of the Colorado boundary, at this season they mostly abandoning this portion of the state for the milder portions of the country to the southward and westward. We observed them in June about Fort Hays in small parties of six to a dozen." The species probably was extirpated in Ellis County soon after the turn of the century, and we know of no specimens that are available from Ellis County.

Bison bison

Bison

The subspecific name *B. b. bison* (Linnaeus) applies to populations of bison that once occurred on the Great Plains (Skinner and Kaisen, 1947:158; see also discussion by Armstrong, 1972:309).

The "buffalo" evidently was extirpated from Ellis County in the short span of 12 years between 1865, when Fort Fletcher was established, and 1877, when Assistant Surgeon H. S. Kilbourne (see records kept at Fort Hays, in historical account) commented on the disappearance of the species. After his visit to Fort Hays and "north-western Kansas," Allen (1874:46-47) wrote:

The great "buffalo country" of the United States is now mainly restricted to Western Kansas and Eastern Colorado, between the Arkansas and Platte Rivers, — a region extending about two hundred miles in a north and south direction and nearly three hundred miles in an easterly and westerly direction, over much of which territory they still range in countless hordes. They are, however, partially migratory, moving eastward in summer and westward in winter. In the northern part of the state their summer range, in 1871, extended eastward from the western boundary of the state to the vicinity of Fort Harker [in Ellsworth County, the second county to the east of Ellis]. In winter their eastern limit scarcely extended east of Ellis [in Ellis County], on the Kansas Pacific Railway, while they ranged westward into Eastern Colorado. These movements of the buffalo are evidently influenced by the climate, the prairies of Kansas west of Ellis being rarely long covered by snow, while to the eastward of this point the snow is much more constant, and the country hence much less favorable for the existence of the buffalo there in winter than it is more to the westward. Every year, however, their range is becoming more circumscribed, owing to the rapid reduction of their numbers by hunters, and, in consequence also of constant persecution, their movements are much more uncertain than formerly. Although the number of buffalo to be met with in this portion of Kansas is still almost beyond conception, the country sometimes seeming alive with them as far as the eye can reach, their diminution is rapid, and at the present rate of destruction a few years will suffice to exterminate them wholly.

All that remains of the hordes of bison that Allen saw in Ellis County is a small herd that is maintained on land that formerly comprised part of the Fort Hays Military Reservation. No specimens of wild bison are available from Ellis County.

species) were estimated to inhabit Ellis County (but see Anderson, 1964:11, who estimated that only 25 to 100 "deer" were present in Ellis County), and the county was included in the region of the state in which "deer" were most numerous (Queal, 1964). Finally, in 1965, a hunting season was established in order to prevent overpopulation. We have examined no specimens of this species from Ellis County.

Odocoileus virginianus

White-tailed Deer

White-tailed deer in Ellis County likely are of mixed parentage, resulting from interbreeding of individuals of at least *O. v. texanus* (Mearns), which were introduced from Texas and Oklahoma (for example, see Tihen and Sprague, 1939:509), with individuals of *O. v. macrourus* (Rafinesque), which were introduced or immigrated from Missouri (Cockrum, 1952:273; see also Anderson, 1964:7-8). Consequently, we do not think assignment of the population inhabiting Ellis County to one or the other subspecies is justified at this time.

The white-tailed deer apparently did not occur in Ellis County at the time of settlement of the region by European man (see records kept at Fort Hays, in historical account; see also Allen, 1874, and Baker, 1889), and has immigrated into the area during the last two or three decades. The species is now common in and around riparian woodlands, and its density is regulated by means of controlled hunting. However, the only museum specimens of the species from Ellis County that we have seen are the skeletal remains of two fawns found in the Antonino city dump, 4 mi. S Antonino.

Antilocapra americana

Pronghorn

Populations of this species that formerly inhabited Ellis County (see Hall and Kelson, 1959:1023) pertained to the subspecies *A. a. americana* (Ord).

The pronghorn was mentioned in each entry of the records kept at Fort Hays (see historical account). The first entry (undated) alluded to the abundance of pronghorn, whereas the third entry (1877) acknowledged its "diminished numbers"; obviously, the species was on the decline. After spending the summer of 1871 in the vicinity of Fort Hays and two weeks of the winter of 1871-1872 in "northwestern Kansas," Allen (1874:48) remarked that the pronghorn was "common in summer as far east as the middle of the state, and formerly ranged much farther eastward. Not observed in winter much to the

The wapiti was common throughout much of Kansas prior to settlement of the region by European man. In a letter to L. L. Dyche (of The University of Kansas), Mr. J. R. Mead (a hunter and naturalist who lived in Wichita) referred to droves of "1000 more or less" and said they were especially numerous in the 1850's and 1860's north of the Smoky Hill River (presumably including Ellis County), where they preferred broken country with timbered draws and streams (Hoffmeister, 1947:75-76). The wapiti probably was one of the "two varieties of the genus *ceruus* [*sic*]" referred to in records kept at Fort Hays (see historical account); after visiting Fort Hays, Allen (1874:48) noted that the "Elk" was "more or less common near the streams, especially on Paradise Creek [in adjacent Russell County], and occurs as far east at least as Fort Harker" in Ellsworth County, the second county to the east of Ellis. The wapiti probably was extirpated in Ellis and surrounding counties before the turn of the century (see Lantz, 1905:172), and no specimen of the species from the county (or anywhere in Kansas, so far as we know) is available in any museum collection.

Odocoileus hemionus

Mule Deer

The subspecific name *O. h. hemionus* (Rafinesque) presently applies to all populations of the mule deer in Kansas (see Hall and Kelson, 1959:1005).

The mule deer [listed as "Cervus Macrotes," "Mule (Blacktail) Deer" in the second entry of records kept at Fort Hays] doubtlessly was one of the "two varieties of the genus *ceruus* [*sic*]" referred to in the fourth entry of these records (see historical account). After visiting Fort Hays, Allen (1874:48) noted that the "Mule Deer" or "Blacktail" was "more or less common along the wooded portions of the streams, especially on the Smoky and the Paradise." Baker (1889:57) noted that, in adjacent Trego County, mule deer were "quite common till within the past few years; now found only occasionally, and in the roughest country." The species probably was extirpated in Ellis County at about that time, and was thought to have "probably entirely disappeared" in Kansas by the turn of the century (Lantz, 1905:172).

The mule deer has again become common in Ellis County, probably resulting at least in part from dispersal of individuals that comprised introduced herds (see Tihen and Sprague, 1939:509; Cockerum, 1952:272; Anderson, 1964:6) but largely from immigration from surrounding states. In 1963, 200 or more deer (including both

in central Kansas in the mid-1800's as "timbered streams and the prairies and hills adjacent." Accordingly, Allen (1871:5) regarded the puma as "rare on the prairies" because of lack of forest shelter.

So far as we are aware, the last specimen of puma ever taken in Kansas was a young male (probably actually a female — see Goldman, 1946:210) that was shot on 15 August 1904 by Messrs. William Applebaugh and J. H. Spratt (both of Hays) just north of Catharine in Ellis County. It weighed approximately 90 pounds, and had recently consumed a jack rabbit. Dyche (1905:162) regarded this puma as a "straggler" in the state; however, although no recent records exist for the species in Kansas, there are numerous reports (a few of which are considered reliable) of sightings of pumas in the state and it is conceivable (albeit improbable) that a few pumas might still exist in relatively remote, rugged rangeland, such as that which exists adjacent to the Saline or Smoky Hill rivers in parts of Ellis and other counties in western Kansas.

Felis rufus

Bobcat

As noted by Armstrong (1972:299), geographic variation over the range of *F. rufus* is in need of thorough study. In our opinion, subspecific designation of the population of bobcats inhabiting Ellis County is not warranted at this time.

Reference to the "American wild cat" in records kept at Fort Hays (see historical account) doubtlessly refer to this species. Allen (1874:45) described the bobcat as "rather frequent" in Ellis County, and noted that it is "occasionally met with on the prairies remote from timber." Bobcats continue to be relatively common, although infrequently seen, in riparian habitats and the adjacent escarpments along the Saline and Smoky Hill rivers, and newspaper accounts periodically report the "bagging" of bobcats on rangeland in Ellis County by coyote hunters. However, a male shot on 8 June 1972 near the Saline River 15 1/2 mi. N, 1/2 mi. E Hays (T. 11S, R. 18W, sec. 15) and an unsexed individual (TTU) trapped (by a professional trapper) on 17 January 1973 at an unspecified locality on the Saline River are the only specimens that we have seen from Ellis County.

Cervus elaphus

Wapiti

Extinct populations of the wapiti in Kansas were referred, at least indirectly, to the subspecies *C. canadensis* [= *elaphus*] *canadensis* by Murie (1951:54).

Records kept at Fort Hays (see historical account) reveal that the river otter was “of casual occurrence” in Ellis County at the time of settlement of the region by European man. After spending the summer of 1871 at Fort Hays and two weeks of the winter of 1871-1872 “in northwestern Kansas” “meeting everywhere with intelligent hunters, some of whom had spent many years in the vicinity of the localities I visited, . . . [and obtaining] from them much valuable information in respect to the occurrence and relative abundance of the larger species . . . ,” Allen (1874:43-44,46) described the abundance of the river otter simply as “occasional along streams.” Extirpation of the species in Ellis County (and elsewhere in Kansas) almost certainly was hastened by overtrapping and destruction of habitat. So far as we know, no specimen of *L. canadensis* from Ellis County is available in any collection.

Felis concolor Mountain Lion

In his review of the subspecies of mountain lions (or pumas, as they were usually referred to on the Great Plains), Goldman (1946) included all of Kansas (see p. 197) within the range of *F. c. hippolestes* Merriam on the basis of two incomplete specimens (one of which — see p. 211 — was the skull of a puma from Catharine, Ellis County) from the state. Jackson (1955:149-150) subsequently erected the name *F. c. schorgeri*, based on only three specimens (including the above-mentioned skull from Ellis County), for extinct populations that formerly occupied approximately the “upper Mississippi Valley and western Great Lakes region.” In our opinion (see also Jones, 1964:300-302, who referred all pumas from Nebraska to *F. c. hippolestes*), the subspecific status of pumas from Kansas is, at best, questionable (and likely will remain that way). However, it seems unrealistic to assume that significant geographic variation ever existed within this wide-ranging species on the plains of Kansas, and that recognition of two subspecies therein (*schorgeri* in Ellis County and *hippolestes* in adjacent Trego County — see Hall and Kelson, 1959:957) is warranted. Therefore, we elect to employ the older subspecific name, *F. c. hippolestes*, for the population that formerly inhabited Ellis County.

Records kept at Fort Hays (see historical account) document the presence of the “Catamount” in Ellis County at the time of settlement of the region by European man; in fact, those records mention (almost unintelligibly) the killing of three individuals in 1873 and 1874. Mead (1899a:278) described the preferred habitat of the puma

Spilogale putorius
Eastern Spotted Skunk

The subspecific name *S. p. interrupta* (Rafinesque) currently applies to all populations of this species in Kansas (see Van Gelder, 1959:251).

Choate *et al.* (1974) recently reviewed the history and status of the spotted skunk (or civet cat, as it is known locally) in Kansas. Based both on the historical record of westward dispersal of the species across Kansas and on the fact that Allen (1874) made no mention of spotted skunks in the report he compiled after spending the summer of 1871 at Fort Hays, it seems reasonable to assume that references to "Pole Cat," "Mephitis Bicolor," and "skunk" in records kept at Fort Hays (see historical account) all pertain to *Mephitis mephitis* rather than *S. putorius*. Thus, the two specimens of *S. putorius* from Ellis County reported by Choate *et al.* (1974) are the only records of existence of the species in the county. Both specimens are adult males (one was found dead on a road near a haystack at the corner of a wheat field, and the other was dug out of its den beneath a haystack in a cluttered barnyard surrounded by fields of sorghum and near a feedlot). Both localities were within 1 1/2 miles of the nearest riparian community.

Discussions with long-time residents of western Kansas leave one with the impression that the spotted skunk recently has become rare. However, as noted by Choate *et al.* (1974:233), "the formerly dense populations with which existing populations are being compared probably were an unnatural condition resulting from the activities of man [primarily from dividing the land into numerous small, almost self-sufficient farms that provided abundant commensal habitat for the species], and the subsequent numerical . . . decline in the species, to a level near or just above that which preceded the increase, was merely a consequence of reversal of human activities" (reduction in number of small farms and concomitant reduction in amount of commensal habitat).

Specimens examined (2). — 1 1/2 mi. S Munjor (T. 14S, R. 18W, sec. 36), 1; 2 1/2 mi. N, 3 1/2 mi. W Catharine (T. 12S, R. 18W, sec. 36), 1.

Lutra canadensis
River Otter

The subspecific name *L. c. interior* (Swenk) presently applies to populations of this species that formerly occurred in Kansas (see Hall and Kelson, 1959:947).

a gradual decrease [in number of badgers] which lasted for ten or fifteen years" (Carter, 1939a). Wooster (1938:387-388) stated that the badger had "become too nearly exterminated to play an important part" in predator-prey relations in Ellis County. However, since that time the species has become one of the commonest predators in upland areas of Ellis County. It seems likely that badgers have benefited considerably from modern agricultural practices and the construction of roads along section lines; the excavations of badgers are noticeably more numerous in roadside ditches adjacent to cultivated fields than in rangeland.

Numerous badgers are found dead along roads in Ellis County each year, and a few are trapped for their fur. Unpublished data (Mr. R. J. Little, personal communication) obtained from the Kansas Forestry, Fish and Game Commission (based on the Kansas Fur Dealers reports of 1967-1970 and 1971-1972 and on the Kansas Fur Trapping and Marketing Survey for 1969-1970) indicate that the density of badgers in Ellis County is "moderate" relative to other areas of the state.

Specimens examined (6). — Yocemento, 1; 2 mi. W Hays (T. 13S, R. 18W, sec. 31), 1; 1 mi. E Victoria, 1; 17 mi. SW Hays [= 5 mi. S, 6 mi. W Antonino?], 1; no specific locality, 2.

Mephitis mephitis

Striped Skunk

Armstrong (1972:289) recognized two subspecies of the striped skunk, *M. m. hudsonica* Richardson in the north and *M. m. varians* (Gray) in the south, in eastern Colorado. Inasmuch as the status of those subspecies is questionable (Armstrong, 1972:292), we elected not to attempt subspecific allocation of the population inhabiting Ellis County.

Records kept at Fort Hays (see historical account) indicate that the "Pole Cat" ("Mephitis Bicolor") was "rather numerous" in Ellis County at the time of settlement of the region by European man. Additionally, Allen (1874:46) regarded the species as "abundant [in the vicinity of Fort Hays]. One of the most common of the smaller mammalia." As noted by Stains and Baker (1958), the species prefers riparian situations and forest-edge habitats; however, the striped skunk can be found almost anywhere in Ellis County because it has adjusted to a commensal existence by utilizing man-made structures as dens. Striped skunks are commonly found dead on roads in Ellis County, and they are occasionally trapped for their fur.

Only one specimen (from an unspecified locality) of *M. mephitis* is presently available from Ellis County.

southwestern Jewell County (approximately 60 miles northeast of Hays). Nevertheless, the species doubtlessly occurred in Ellis County at the time of settlement of the region by European man; although the black-footed ferret was not mentioned in records kept at Fort Hays, Baker (1889:56) commented that "it is generally to be found [in adjacent Trego County] in the larger prairie-dog 'towns,' but is nowhere numerous." The species no longer occurs in Ellis County or, to the best of our knowledge, anywhere in Kansas.

Mustela vison

Mink

The subspecific name currently used for mink in Kansas is *M. v. letifera* Hollister (see Hall and Kelson, 1959:917).

Mink are common around permanent sources of water in Ellis County (see also records kept at Fort Hays, in historical account). Many hundreds of pelts of mink are sold each winter by professional trappers who operate traplines on the Saline River, Big Creek, and the Smoky Hill River, thus making this the most sought-after species of furbearer in Ellis County (Carroll Olsen, personal communication). Based on the Fur Trapping and Marketing Survey for 1969-1970 and on reports gathered from fur dealers in Kansas for the winters of 1967-1968 and 1969-1970, Little (1973) included much of Ellis County within the region of Kansas in which mink presently are most abundant. Mink occasionally venture considerable distances from watercourses or impoundments, as evinced by the fact that a male was shot after being chased up a tree (by a dog belonging to Mr. Robert Pfeifer) about 2 1/2 mi. south of Big Creek; the area surrounding the site of capture was comprised of open pastures containing only a few trees in scattered draws.

Specimens examined (38). — T. 11S, R. 18W, SE 1/4 sec. 12 [16 mi. N, 3 mi. E Hays], 1; 5 mi. W Hays (T. 14S, R. 19W, NW 1/4 sec. 2), 1; no specific locality, 36.

Taxidea taxus

Badger

Long (1972:739) referred all populations of the badger in Kansas to the subspecies *T. t. taxus* (Schreber).

The fact that badgers existed in western Kansas at the time of arrival of European man is well documented (see Baker, 1889, and Mead, 1899*b*), but records kept at Fort Hays (see historical account) suggest that the species was not especially common. Reports by early settlers in western Kansas indicate that "beginning in 1895 there was

wherever adequate concealment for dens and sources of food are available. Two adult males were trapped (one on 15 July 1965, and the other on 7 August 1965) in Sherman live traps (3 by 3 by 9 inches) placed in a remnant of the Mixed Prairie southwest of Hays, and one adult male was found dead on a street near the outskirts of Hays on 28 July 1964. Few long-tailed weasels are sold each year by professional trappers (R. J. Little, personal communication), but the paucity of trapping records likely is not indicative of the abundance of this species. Little is known of the habits or preferred habitats of *M. frenata* in Ellis County.

Specimens examined (3). — Hays, 1; T. 14S, R. 19W, SE 1/4 sec. 1 [1 mi. S, 3 mi. W Hays], 2.

Mustela nigripes

Black-footed Ferret

Mustela nigripes is a monotypic species (see Hall, 1951b:82).

Cockrum (1952:251) listed a specimen in the Carnegie Museum from "near Hays" in his account of black-footed ferrets in Kansas. According to records kept at the Carnegie Museum, the ferret was collected by "Sternberg" and was received from the "University of Nebraska." The specimen (Carnegie Museum cat. no. 21,391) is a mount and is on exhibit.

Records kept in the Sternberg Memorial Museum at Fort Hays Kansas State College indicate that three black-footed ferrets formerly were on exhibit in that museum. Two of these (recorded as being from "Buda, Nebraska") apparently were discarded in 1965. The other ferret was obtained by Mr. Albert Schmidt (no locality given, but home address listed as "Iona, Kansas") and donated to the museum in 1939 as part of the Pauline Schmidt Collection.

In 1943, George F. Sternberg corresponded with personnel at the Carnegie Museum about black-footed ferrets. In a letter dated 23 January 1943, Sternberg noted that "black-footed ferrets are extremely rare around here, but we occasionally get one." On 29 January 1943, Sternberg received a letter from the Carnegie Museum acknowledging receipt of a mounted specimen of *M. nigripes*. At about the same time, a notation was made in the records for the specimen from "Iona, Kansas" indicating that it was "exchanged with Carnegie Museum."

Therefore, it appears likely that the specimen of *M. nigripes* at the Carnegie Museum was not obtained "near Hays." Rather, if it is safe to assume that the home address ("Iona") of the collector was actually Ionia, then the ferret might have been obtained in or around

Kansas State College. On the basis of trapping reports and reliable sight records, we assume that the red fox is now one of the commonest of the large carnivores in Ellis County.

Specimens examined (4). — "S of Catharine," 1; "along Big Creek between Ellis and Hays," 2; 1/2 mi. S, 1 mi. E Hays, 1.

Procyon lotor

Raccoon

The subspecific name *P. l. hirtus* Nelson and Goldman presently applies to populations of this species in Ellis County (see Goldman, 1950:24).

Records kept at Fort Hays (see historical account) indicate that raccoons occurred in Ellis County at the time of settlement of the region by European man. Allen (1874:46) regarded the raccoon as "common along the streams [in the vicinity of Fort Hays], where we frequently observed its tracks."

Ellis County is presently included (albeit at the periphery) within a broad sector of the state in which the relative density of raccoons presently is higher than in other sectors (unpublished data from Kansas Forestry, Fish and Game Commission, R. J. Little, personal communication). Raccoons are omnivorous, feeding on a wide variety of plant and animal materials (see list compiled by Stains and Baker, 1958:54) that are generally associated with low-lying areas along permanent streams. Additionally, raccoons do not ordinarily dig their own dens, but use hollow trees or dens dug by other animals, usually within one-quarter mile of permanent water (Stains and Baker, 1958:53), but sometimes as far as 10 miles from water in areas where water is scarce (Stains, 1956:18). However, in Ellis County the species occurs primarily in riparian communities along the Saline River, Big Creek, the Smoky Hill River, and their tributaries. In such situations, raccoons are commonly seen by local residents and are often killed by vehicular traffic.

Specimens examined (6). — 4 mi. N, 8 1/2 mi. W Hays (T. 13S, R. 19W, sec. 20), 5; no specific locality, 1.

Mustela frenata

Long-tailed Weasel

The subspecific name *M. f. longicauda* Bonaparte presently applies to populations of the long-tailed weasel in western Kansas (see Hall, 1951b:221).

The long-tailed weasel probably is relatively common (see also records kept at Fort Hays, in historical account) in Ellis County

Many of those that remained were killed for "sport" and bounty and, as noted by Mead (1899b:280), "hunters with strychnia finally eliminated the wolves, myself and men killing some 5000 of them. They never molested people." However, Miles (1896:129-130) recounted an instance, in 1870, in which Captain F. D. Baldwin (who was stationed at Fort Harker, in nearby Ellsworth County) was chased on horseback for a distance of about 20 miles by a pack of 50-75 wolves.

When the wolf was finally extirpated in Ellis County is unknown. Lantz (1905:176) reported that the wolf was "still found in a few scattered sections of the state. There is a bounty of five dollars on the large wolves in most of the counties. Last year only three counties were called upon to pay such bounties — Chautauqua, Republic, and Sherman." The last of these is the second county west and first north of Ellis. Carter (1939a) noted that "two wolves were reported killed in Ellsworth county [the second county east of Ellis] in the winter of 1938-39. The writer heard of these reports and traced down the pelt of one, which had been sold, and it was identified as a gray wolf." Therefore, it is conceivable that wolves occurred sporadically in Ellis County after the turn of the century.

Vulpes vulpes

Red Fox

The subspecific status of the red fox in northwestern Kansas is uncertain. Historically (see Hall and Kelson, 1959:856), all populations of this species in Kansas were referred to *V. v. fulva* (Desmarest). However, Jones (1964:255) assigned all specimens from Nebraska to *V. v. regalis* Merriam, whereas Armstrong (1972:261) referred all individuals from Colorado to *V. v. macroura* Baird. For the time being, in our opinion, subspecific designation of specimens from Ellis County is not warranted.

In Ellis County, the red fox occurs in riparian habitats along Big Creek and probably along the Saline and Smoky Hill rivers. The species apparently has only recently immigrated into (or returned to, perhaps following the great drought — see Carter, 1939a) western Kansas (see summary by Janes and Gier, 1966); the first sightings of this species in Ellis County that we know of (but see Stanley, 1963:6) were made during the winter of 1962-1963, and a male red fox was found dead on a road near Big Creek just southeast of Hays in March of 1963 (Andersen and Fleharty, 1964). Since that time, periodic observations have been made on an active den of red foxes located in dense riparian habitat along Big Creek on the campus of Fort Hays

“scalp” that was turned in with evidence that the kill had taken place within the county (Gier, 1968). Such bounties were unwarranted, as it has subsequently been documented (Tiemeier, 1955; Gier, 1968) that coyotes seldom feed on livestock or poultry and that many of the complaints about coyotes probably were the result of activity of a few “renegade” or “killer” coyotes or feral dogs. In Kansas, 80 to 90 per cent of the food consumed by coyotes consists of lagomorphs, carrion, and rodents.

Wooster (1938) tabulated the number of coyotes for which bounties were paid in Ellis County during the years from 1914 to 1932; averages of 338 bounties were paid from 1914 to 1922 and 333 from 1923 to 1932, with a maximum of 541 in 1917. By checking records maintained by the County Clerk, Wooster estimated that the mean litter size for coyotes in Ellis County was 6.14 during spring of 1931. He estimated (p. 392) that, at that time, there were “approximately .5 coyotes per square mile on mixed-prairie land in Ellis County.” Wooster also determined, based on average number of grams of food consumed per day in Ellis County by several different predators, that the coyote was the second most important predator (second only to the Marsh Hawk) on the Mixed Prairie.

Coyotes are probably as abundant as ever in Ellis County, and they are especially popular among those who hunt them for sport and for their pelts.

Specimens examined (6). — 5 mi. N, 1/2 mi. E Ellis, 1; Hays, 1; unspecified locality, 4 (TTU).

Canis lupus Gray Wolf

The subspecific name *C. l. nubilus* Say applies to populations of the gray wolf that formerly occurred in Ellis County (see Goldman, 1944:414).

Records kept at Fort Hays (see historical account) indicate that the gray (or white) wolf was abundant on the plains of Ellis County prior to intensive settlement of the region by European man. However, soon after settlement Allen (1874:45) remarked that the “‘Buffalo Wolf’” was “‘formerly very abundant [in the vicinity of Fort Hays], but during the last few years their numbers have greatly diminished, thousands having been killed for their skins every winter by means of strychnine. Comparatively few now remain.” Mead (1899b) noted that wolves fed almost exclusively on buffalo; thus, it is likely that the extermination of buffalo along the Smoky Hill Trail in Ellis County also contributed to the decline in number of wolves in the region.

example, Cockrum, 1952:218; Jones, 1964:242) seemingly employed the name *E. d. bruneri* primarily for historical reasons, and no one has critically examined geographic variation in the species.

The "yellow-haired porcupine" was included in the list of mammals that occurred in the vicinity of Fort Hays (see historical account), and Allen (1874:52) commented that "a few [porcupines] are reported still to occur on the Paradise [Paradise Creek, in adjacent Russell County]. Formerly more or less frequent on all the wooded streams." However, the skull of an adult female picked up on 23 December 1967 near the Saline River in the southeast quarter of section 12, T. 11S, R. 18W (16 mi. N, 3 mi. E Hays) is the only specimen of this species we have examined from Ellis County. Wooster (1931) reported that a porcupine was captured (but presumably not saved) 10 mi. N Hays (near the North Fork of Big Creek) in the autumn of 1929. Carter (1939a) stated that "on December 22, 1939, a porcupine was captured by two highway patrolmen west of Hays." Two more recent visual records [the first on 30 November 1972 along the Smoky Hill River in the northern half of section 28, T. 15S, R. 16W (1/2 mi. N Schoenchen) and the other in June 1973 at a place 3 1/2 mi. S, 2 mi. W Ellis (T. 13S, R. 20W, sec. 30) by employees of the Kansas Forestry, Fish and Game Commission (B. Hlavachick and George Carson, personal communication)] confirm the continuing presence of the species in Ellis County. Doubtlessly, other porcupines will be found in riparian woodlands in Ellis County.

Canis latrans

Coyote

Populations of the coyote on the Great Plains are referable (see Jackson, 1951:255) to the subspecies *C. l. latrans* Say.

The coyote received considerable attention in records kept at Fort Hays (see historical account), in which it was sometimes referred to as the "small yellow wolf" or "prairie wolf." As the environment of Ellis County and other areas of the Great Plains became increasingly altered by the activities of European settlers, occasional coyotes responded by utilizing introduced sources of food; thus, the species came to be regarded as a "pest" and was increasingly persecuted. Allen (1874:45) stated that the coyote was "still quite common [in the vicinity of Fort Hays], but far less so than they were a few years ago. While their dismal cries are still familiar sounds on the plains of the western part of the state, especially in the winter, hunters with their destructive poisons have reduced their numbers till comparatively few remain." In 1877 a law was enacted by which the Kansas Legislature authorized the counties to pay \$1.00 for each coyote

diet of *M. ochrogaster*, Brown (1946) stated that prairie voles feed on western wheatgrass, little barley, buffalo grass, blue grama, side-oats grama, and western ragweed.

Population densities of *M. ochrogaster* also fluctuate from year to year, frequently as the result of variation in climate. During the great drought, Black (1937:202) stated the opinion that the species was "on the verge of extinction in western Kansas." Wooster (1939; see also Tomanek and Hulett, 1970:210) estimated that Ellis County had been inhabited by an average of three prairie voles per acre in 1933, whereas during the drought years of 1935-1939 "not a meadow mouse nor a sign of one has been seen . . . on the prairie in this county." However, Martin (1960) believed that at least a few prairie voles persisted in Ellis County during the drought; he recorded crude densities as high as 7.5 per acre and a maximal ecological density of 21.7 for the period October 1952 to August 1958. Fleharty (1972) reported maximal crude and ecological densities of 3 and 25 per acre, respectively, during the period April 1965 to February 1969.

A female caught on 16 March 1965 contained four embryos that measured 25 in crown-rump length, and another trapped on 8 October 1971 contained six embryos measuring 17.

Specimens examined (109). — 17 mi. N, 7 mi. W Hays, 3; 15 mi. N, 4 mi. W Hays, 3; 16 mi. N, 1 mi. W Hays [= 15 mi. N, 1 mi. W Hays], 2; 6 1/2 mi. N Ellis, 3; 6 mi. N Ellis, 1; 6 mi. N, 1/2 mi. W Hays, 1; 5 mi. N, 1/4 mi. W Hays, 1; 1 3/4 mi. W Ellis, 1; 3 mi. E Ellis, 1; 4 mi. N, 1 mi. W Hays, 2; T. 13S, R. 18W, SW 1/4 sec. 9 [4 mi. N, 1 mi. W Hays], 1; 4 mi. N, 1/2 mi. W Hays, 16; 4 mi. N, 1/4 mi. W Hays, 7; 3 1/2 mi. N, 1 mi. W Hays, 2; 3 mi. N Hays, 1; 2 mi. N, 3 mi. E Hays, 1; 1 1/2 mi. N, 5 mi. E Hays, 6; 1/2 mi. N, 1 mi. E Hays, 1; T. 13S, R. 19W, SE 1/4 sec. 36 [3 mi. W Hays], 3; 2 mi. W Hays, 4; T. 14S, R. 18W, NE 1/4 sec. 5 [1 mi. W Hays], 9; Hays, 2; 1/2 mi. S, 3 mi. W Hays, 1; 1/4 mi. S, 1 mi. W Hays [= 1/2 mi. S, 1 mi. W Hays], 11; T. 14S, R. 20W, NE 1/4 sec. 9 [5 1/2 mi. S, 1 mi. E Ellis], 1; 1 mi. S, 6 mi. W Hays, 10; 1 mi. S, 2 mi. W Hays [= 1 mi. S, 3 mi. W Hays (T. 14S, R. 19W, SE 1/4 sec. 1)], 3; 1 mi. S, 1/2 mi. E Hays, 1; 1 1/2 mi. SW Hays, 1; 1 1/2 mi. SE Hays, 1; "1/2 mi. E Hays Experiment Station" [= 1 1/2 mi. S, 1 mi. E Hays], 2; 2 mi. S, 2 mi. W Hays, 2; 2 mi. S, 1 1/2 mi. W Hays, 2; 2 mi. S Hays, 1; 2 1/2 mi. SW Hays, 1; T. 15S, R. 19W, NE 1/4 sec. 27 [4 mi. S, 1 mi. W Antonino], 1.

Additional records. — Hays; 1/2 mi. S, 4 mi. W Hays (Cockrum, 1952:203).

Erethizon dorsatum

Porcupine

Use of the subspecific name *E. d. bruneri* Swenk for populations of the porcupine in Kansas apparently stems from Hibbard's (1933:245) casual adoption of the name ("*E. epixanthum bruneri*") proposed by Swenk (1916:117) for porcupines from western Nebraska. Subsequent authors of faunal studies pertaining to the Great Plains (for

Microtus ochrogaster

Prairie Vole

The subspecific name commonly used (see Hall and Cockrum, 1953:446) for populations of this species in northwestern Kansas is *M. o. haydenii* (Baird). This name is tentatively employed for prairie voles in Ellis County pending completion of a review of geographic variation in the species.

References to "Arvicolor hipana" and "Bank Mouse" in records kept at Fort Hays (see historical account) possibly refer to this species. The prairie vole occurs throughout Ellis County in a variety of habitats. Being primarily diurnal in habits (Carley *et al.*, 1970), the species prefers areas where dense, grassy cover and at least an inch of mulch enable the construction of runways that afford protection from aerial predators. On a remnant of the Mixed Prairie southwest of Hays, the preferred habitats of *M. ochrogaster* are communities dominated by buffalo grass, side-oats grama, and Hooker's dropseed (and containing abundant western wheatgrass) in winter and spring, by big bluestem in summer, and by big and little bluestem and side-oats grama in autumn (Fleharty, 1972). In other studies conducted on the same remnant grassland and in an adjacent pasture, Brown (1946) and Martin (1960) also demonstrated a marked preference by *M. ochrogaster* for vegetative communities in which western wheatgrass is prevalent. However, western wheatgrass probably influences abundance more than distribution because it is a cool season grass that affords plentiful food in late autumn and early spring when most other grasses are dormant; in the absence of western wheatgrass, prairie voles occupy practically all habitats that satisfy their requirements for food, cover, and mulch (for example, see Kaufman and Fleharty, 1974), but their population densities might not be so great.

On the remnant of the Mixed Prairie, population densities of *M. ochrogaster* are greater in spring and summer than in autumn and winter (Fleharty, 1972). Martin (1960) and Frydendall (1969) thought that these seasonal fluctuations in density were the result of interspecific competition with hispid cotton rats (*Sigmodon hispidus*). On the basis of examination of stomach contents, Fleharty and Olson (1969) determined that tall dropseed, Mexican fireweed, blue grama, Japanese brome, pale dock, and crabgrass are among the most palatable foods of *M. ochrogaster* in Ellis County during the summer months; they suggested that, although prairie voles and hispid cotton rats consume many of the same foods, competition between them probably is for space rather than food. In another study (based on examination of food caches found in Ellis County) of the

Hips of prairie rose and seeds of smooth sumac, ill-scented sumac, and choke cherry, together with a few seeds of small soapweed and sandy lily, comprised the food items found in an excavated nest (Brown, 1946).

A female obtained on 24 June 1971 contained four embryos that measured 55 in crown-rump length.

Specimens examined (27). — T. 11S, R. 18W, SE 1/4 sec. 12 [16 mi. N, 3 mi. E Hays], 1; 16 mi. N, 1 mi. W Hays [= 15 mi. N, 1 mi. W Hays], 3; T. 11S, R. 18W, sec. 16 [15 1/2 mi. N, 1/2 mi. W Hays], 4; 13 mi. N, 1 mi. W Hays, 1; T. 11S, R. 18W, SE 1/4 sec. 28 [13 mi. N Hays], 2; 2 mi. N, 2 mi. E Yocemento, 4; 2 mi. N, 4 mi. E Yocemento, 1; 3 1/2 mi. N, 1 1/2 mi. E Hays, 1; T. 13S, R. 18W, NW 1/4 sec. 31 [1 mi. N, 3 mi. W Hays], 4; 2 mi. S Hays, 1; T. 15S, R. 20W, NW 1/4 sec. 11 [1 mi. S, 7 mi. W Antonino], 2; T. 15S, R. 19W, SW 1/4 sec. 16 [3 mi. S, 3 mi. W Antonino], 2; no specific locality, 1.

Additional records. — 16 mi. N Hays (Birney, 1973:14); Hays; 1/2 mi. S, 3 1/2 mi. W Hays (Cockrum, 1952:189); 7 mi. S, 10 mi. W Hays (Birney, 1973:14).

Ondatra zibethicus

Muskrat

Based on the revision by Hollister (1911), muskrats from most of the Great Plains are assigned to the subspecies *O. z. cinnamominus* Hollister.

Records kept at Fort Hays (see historical account) document the occurrence of this species in Ellis County at the time of settlement of the region by European man. Allen (1874:49) noted simply that the muskrat was "occasional along the streams" in the vicinity of Fort Hays.

In Ellis County, muskrats are abundant wherever permanent bodies of water exist. These large microtine rodents are frequently observed swimming in Big Creek (on or near the campus of Fort Hays Kansas State College) and in Rohr-Jacobs Lake (T. 14S, R. 20W, sec. 2), and considerable numbers are trapped each winter by professional trappers along the Saline River, Big Creek, and the Smoky Hill River.

Little (1973) summarized data from reports of fur dealers in Kansas for the trapping seasons of 1967-1968 and 1969-1970, and found that an average of 10.7 muskrats per trapper were trapped in Ellis County in those years. Trappers in only eight counties in Kansas had better average success than those in Ellis County; therefore, Ellis County was regarded as an area of moderate to high muskrat density.

Specimens examined (8). — Hays, 5; no specific locality, 3.

Hays, 5; Hays, 4; 3/4 mi. E Hays, 6; 1 mi. S, 6 mi. W Hays, 1; 1 mi. S, 3 mi. W Hays, 3; 1 mi. S, 2 mi. W Hays, 4; 1 mi. S, 1 mi. W Hays, 3; 1 mi. S, 1/2 mi. W Hays, 4; "1/2 mi. E Buffalo Hills Trailer Park" [= 1 mi. S, 1 1/2 mi. E Hays (T. 14S, R. 18W, N 1/2 sec. 11)], 1; 1 1/2 mi. S Hays, 1; 1 mi. S, 1/2 mi. E Victoria [= 1/2 mi. S, 1/2 mi. E Victoria], 3; 2 mi. S, 3 1/4 mi. W Antonino, 1.

Additional record. — "Near Hays" (Cockrum, 1952:186) [= 1 1/2 mi. SW Hays (Martin, 1960:2, 17)].

Neotoma floridana

Eastern Woodrat

Birney (1973) determined that the appropriate subspecific name for the eastern woodrat in Ellis County is *N. f. campestris* J. A. Allen.

References to "Mus" and "Wood Rat" in records kept at Fort Hays (see historical account) probably pertain to this species. Allen (1874:49) commented that the woodrat was "apparently common along the timbered portions of the streams. A complete skeleton was found on the banks of Big Creek, near Fort Hays."

Woodrats occur in most areas of Ellis County where suitable materials are available for construction of nests. In wooded areas, nests are constructed at the bases of trees or from 2 to 10 feet above the ground in the branches of trees (Birney, 1973:17; for a more detailed description, see Rainey, 1956). Where trees are sparse, nests frequently are located around outcrops of rock, at the bases of limestone breaksites, or in quarries remote from the nearest timber (Birney, 1973:17; Wiley, 1971). Brown (1946) noted that a nest located in an old quarry surrounded by prairie (but within one mile of a wooded draw) was constructed of twigs of choke cherry, smooth sumac, common hackberry, American elm, ill-scented sumac, sandy lily, broomweed, manyflower scurfpea, Maximilian's sunflower, Russian thistle, and horseweed.

Birney (1973:150) assumed that "[*N. floridana*] *campestris* exists in relatively small and semi-isolated populations that occupy discontinuous areas of suitable habitat," and that "such a pattern probably results from inability of these woodrats to permanently occupy shortgrass prairie between river systems, rock outcrops, and stands of trees" (p. 16). However, Wiley (1971:50) recorded movements of more than 4350 feet by female rats and of approximately 2475 feet by males, thus it seems likely that woodrats have the potential to disperse to and occupy most of the suitable habitats that exist in Ellis County. Such dispersal must be accomplished entirely at night; woodrats in Ellis County do not become active until approximately 30 minutes before dark, are most active before midnight, and cease activity about 30 minutes before sunrise (Wiley, 1971).

breeding in autumn coupled with predation and prolonged periods of sub-freezing weather in winter. However, Baar *et al.* (1974) described deep burrow systems in which some cotton rats probably avoid extreme winter temperatures.

"Crashes" in density of hispid cotton rats in Ellis County occurred during the winters of 1952-1953 and 1957-1958 (Martin, 1960), in late winter and early spring of 1960 (Frydendall, 1969), possibly prior to spring of 1965, and during the winter of 1968-1969 (Fleharty *et al.*, 1972). Both Martin (1960) and Frydendall (1969) postulated that various aspects of winter weather are responsible for periodic decimation of populations. Fleharty *et al.* (1972) augmented this hypothesis by demonstrating that severe winter weather acts primarily to accelerate seasonal declines in population density by causing starvation of animals (especially those that are heavily parasitized) that lack sufficient energy reserves (largely in the form of stored lipids — see Fleharty *et al.*, 1973) to withstand protracted periods in which foraging is restricted.

Sigmodon hispidus is generally regarded as a herbivorous species (Baker, 1971) that supplements its diet with occasional seeds and insects. Fleharty and Olson (1969) observed that preferred summer foods of this species include wheat, Mexican fireweed, tall dropseed, Japanese brome, pale dock, and cocklebur; several of these foods also are preferred by another herbivorous rodent (the prairie vole, *Microtus ochrogaster*) in Ellis County (see account of that species). When foraging, hispid cotton rats clip off vegetation near the base and successively up the stem so that they can gain access to the nutritious head; in so doing, cotton rats are responsible for the accumulation of piles of clippings where they feed. By examining those piles of clippings, Petryszyn and Fleharty (1972) estimated that grasses (primarily big and little bluestem and side-oats grama) comprise 54 per cent, western ragweed and Mexican fireweed 40 per cent, and annual sunflower 6 per cent of the vegetation clipped by *S. hispidus* on a remnant of the Mixed Prairie in Ellis County.

At the latitude of Ellis County, some individuals in certain years breed in every month although most reproduction occurs in summer and autumn. The average size for litters is 6.7 (Fleharty and Choate, 1973). A female trapped on 17 September 1971 contained seven embryos that measured 35 in crown-rump length.

Specimens examined (68). — T. 11S, R. 18W, SE 1/4 sec. 12 [16 mi. N, 3 mi. E Hays], 1; 8 mi. N Hays (T. 12S, R. 18W, N 1/2 sec. 27), 11 (TTU); 5 mi. N Hays, 2; 4 mi. N, 1/2 mi. W Hays, 1; 4 mi. N Hays, 1; 2 mi. N Hays, 1; 2 mi. N, 2 mi. E Hays, 1; 1 mi. N, 3 mi. W Hays, 1; 1 mi. N Hays, 1; 1 mi. N, 2 mi. E Hays, 1; 1/2 mi. N, 1 mi. E Hays, 4; 3 mi. W Hays, 1; 2 mi. W Hays, 2; 3/4 mi. W Hays, 4; 1/2 mi. W

The hispid cotton rat is an immigrant Neotropical species that has dispersed northward onto the southern and central Great Plains in Recent time. In western Kansas, the species was not known from as far north as Ellis County until October 1949 (Cockrum, 1952:185). Since then, specimens of *S. hispidus* have been recorded from as far north as two counties in southeastern and south-central Nebraska (Jones, 1960; Choate and Genoways, 1967; Genoways and Schlitter, 1967), and the species has become common in Ellis County wherever dense vegetation in relatively mesic areas provides sufficient ground cover, food, and nesting materials (for example, see Fleharty and Mares, 1973).

On a remnant of the Mixed Prairie southwest of Hays, Martin (1960) noted that hispid cotton rats occur primarily in relatively mesic western wheatgrass and weedy communities, but avoid relatively arid upland areas supporting stands of either big bluestem alone or "mixed grass" in summer or of little bluestem alone in all seasons. In a study conducted on the same remnant, Fleharty and Mares (1973) demonstrated that hispid cotton rats prefer relatively mesic, lowland communities dominated by big bluestem, by buffalo grass, side-oats grama, and Hooker's dropseed (and containing abundant western wheatgrass), and by big bluestem, Mexican fireweed, and annual sunflower in all seasons, and that they avoid relatively arid, upland communities dominated by big and little bluestem and side-oats grama. In addition, they found that an upland community (but with deep mulch) dominated by buffalo grass, side-oats grama, and tall dropseed is utilized extensively in winter (when high population density causes emigration of individuals from preferred habitats) and spring, but is significantly avoided in summer and autumn.

Pronounced seasonal fluctuations and periodic "crashes" in population density of cotton rats in Ellis County have been well documented. Annually, population density ranges from highest in autumn to lowest in spring or summer (Fleharty *et al.*, 1972; see also Martin, 1960, and Frydendall, 1969). During periods of peak abundance (usually in October or November), hispid cotton rats have been sighted or killed in gardens, window wells, and garages in Hays. During such periods, Martin (1960) recorded crude densities of five to seven rats per acre and ecological densities as high as 14 per acre, whereas Fleharty *et al.* (1972) estimated maximal crude and ecological densities to be eight and 26 rats per acre, respectively. During periods of low density, on the other hand, few cotton rats can be trapped, even in preferred habitats. Fleharty *et al.* (1972) proposed that the annual decline in population density results from cessation of

bluestem as dominants. Choate and Terry (1974:265) suggested that one of the preferred habitats of *O. leucogaster* on the central Great Plains might be communities in disclimax. In those situations, "high productivity of early successional species results in an abundant supply of both plant and animal foods, and bare patches of sandy soil, lacking mulch (Kaufman and Fleharty, 1974) but partially sheltered by forbs (especially small soapweed, sand sagebrush, and plains prickly pear), afford space for dusting (see Egoscue, 1960:101), feeding, and construction of dens. Seral communities such as these doubtlessly were widespread on the Great Plains before the arrival of European man as a result of periodic floods, prairie fires, and grazing and trampling by bison. Today, such areas are most prevalent in roadside ditches and in poorly managed pastures."

The series of seven grasshopper mice listed below from 15 mi. N, 4 mi. W Hays was obtained in the relatively arid, lowland community described in the account of *Reithrodontomys montanus*. Two females, one obtained on 3 June 1965 and the other on 20 June 1965, contained four embryos that measured 24 and 12 in crown-rump length, respectively.

Specimens examined (82). — 17 mi. N, 4 mi. W Hays, 1; T. 11S, R. 18W, SE 1/4 sec. 12 [16 mi. N, 3 mi. E Hays], 1; T. 11S, R. 20W, sec. 13 [15 1/2 mi. N, 9 1/2 mi. W Hays], 1; T. 11S, R. 19W, SE 1/4 sec. 18 [15 mi. N, 8 mi. W Hays], 2; T. 11S, R. 19W, SW 1/4 sec. 17 [15 mi. N, 8 mi. W Hays], 2; 15 mi. N, 4 mi. W Hays, 7; T. 11S, R. 17W, NE 1/4 sec. 27 [14 mi. N, 7 mi. E Hays], 3; T. 11S, R. 19W, SW 1/4 sec. 27 [13 mi. N, 6 mi. W Hays], 2; 6 1/2 mi. N Ellis, 1; T. 12S, R. 19W, SW 1/4 sec. 5 [11 mi. N, 8 mi. W Hays], 6; 6 mi. N, 1/2 mi. W Hays, 1; 4 mi. N, 4 1/2 mi. W Hays, 1; 4 mi. N, 1 mi. W Hays, 1; 4 mi. N, 1/2 mi. W Hays, 3; 4 mi. N, 1/4 mi. W Hays, 8; 4 mi. N Hays, 1; 3 1/2 mi. N, 1 mi. W Hays, 5; 3 1/2 mi. N, 1 mi. E Hays, 2; 3 mi. N, 1/2 mi. E Hays, 1; 2 mi. S Ellis, 2; 1/2 mi. N, 1 mi. E Hays, 1; 3 mi. W Hays, 2; 1/4 mi. S, 1 mi. W Hays [= 1/2 mi. S, 1 mi. W Hays], 8; T. 14S, R. 19W, SW 1/4 sec. 1 [1 mi. S, 4 mi. W Hays], 1; 1 mi. S, 2 mi. W Hays, 3; 1 mi. S, 1/2 mi. W Hays, 1; 1/2 mi. N Antonino, 2; T. 15S, R. 20W, NW 1/4 sec. 11 [1 mi. S, 7 mi. W Antonino], 2; T. 15S, R. 20W, NE 1/4 sec. 11 [1 mi. S, 6 mi. W Antonino], 1; T. 15S, R. 16W, SW 1/4 sec. 14 [2 1/4 mi. N, 4 1/2 mi. E Pfeifer], 3; T. 15S, R. 16W, SW 1/4 sec. 24 [1 1/4 mi. N, 5 1/2 mi. E Pfeifer], 3; 5 mi. S Antonino, 3; 7 1/2 mi. S Munjor, 1.

Additional records. — Ellis (Hollister, 1914:441; Cockrum, 1952:162); 4 mi. N, 3 mi. E Hays (Cockrum, 1952:162).

Sigmodon hispidus

Hispid Cotton Rat

The subspecific name *S. h. texianus* (Audubon and Bachman) is in common use for populations of this species in western Kansas (see comments on *S. h. alfredi* Goldman and Gardner by Armstrong, 1972:215).

Hays, 10; 1/2 mi. S, 3 mi. W Hays, 3; 1 mi. S, 2 mi. W Hays [= 1 mi. S, 3 mi. W Hays (T. 14S, R. 19W, SE 1/4 sec. 1)], 14; T. 14S, R. 18W, SE 1/4 sec. 6 [1 mi. S, 2 mi. W Hays], 3; 2 mi. S, 1/2 mi. E Hays (T. 14S, R. 18W, SE 1/4 sec. 10), 6 (TTU); T. 14S, R. 20W, NW 1/4 sec. 10 [5 1/2 mi. S, 1 mi. E Ellis], 9; 1 mi. S, 1/2 mi. W Hays, 8; T. 14S, R. 18W, sec. 10 [1 1/2 mi. S, 1/2 mi. E Hays], 1; 2 mi. SE Hays, 1; 1 1/2 mi. S, 2 mi. E Hays, 6; "Custer Island" [= 2 mi. S, 1/2 mi. E Hays (T. 14S, R. 18W, S 1/2 sec. 10)], 1; 2 mi. S, 1 1/2 mi. W Hays, 10; 2 mi. S, 1 mi. W Hays, 7; 1 mi. S, 1/2 mi. E Victoria [= 1/2 mi. S, 1/2 mi. E Victoria], 3; 2 mi. N, 3 mi. E Antonino, 4; 1 mi. N Antonino, 4; 1/2 mi. N Antonino, 3; T. 15S, R. 20W, NW 1/4 sec. 3 [8 mi. W Antonino], 2; T. 14S, R. 19W, SE 1/4 sec. 35 [Antonino], 1; 1/4 mi. S Antonino, 1; 11 mi. S, 1/2 mi. E Ellis, 2; 1/2 mi. S Antonino, 1; T. 15S, R. 20W, NW 1/4 sec. 11 [1 mi. S, 7 mi. W Antonino], 1; T. 15S, R. 20W, NE 1/4 sec. 11 [1 mi. S, 6 mi. W Antonino], 15; 7 mi. S, 9 mi. W Hays, 3; 2 mi. S, 3 1/4 mi. W Antonino, 2; T. 15S, R. 19W, SW 1/4 sec. 16 [3 mi. S, 3 mi. W Antonino], 16; T. 15S, R. 16W, SW 1/4 sec. 14 [2 1/4 mi. N, 5 mi. E Pfeifer], 1; T. 15S, R. 16W, SW 1/4 sec. 24 [1 1/4 mi. N, 5 1/2 mi. E Pfeifer], 2; T. 15S, R. 19W, NE 1/4 sec. 27 [4 mi. S, 1 mi. W Antonino], 12; 5 mi. S, 5 mi. W Antonino, 3; T. 15S, R. 19W, NW 1/4 sec. 35 [5 mi. S, 1 mi. W Antonino], 1; 5 mi. S Antonino, 3; T. 15S, R. 19W, NE 1/4 sec. 35 [5 mi. S Antonino], 3; T. 15S, R. 19W, SE 1/4 sec. 35 [6 mi. S Antonino], 2.

Additional record. — 1/2 mi. S, 3 1/2 mi. W Hays (Cockrum, 1952:174).

Onychomys leucogaster Northern Grasshopper Mouse

Based on the revision by Hollister (1914), grasshopper mice from western Kansas historically have been referred to the subspecies *O. l. arcticeps* Rhodes. However, the line separating *O. l. arcticeps* from the more easterly *O. l. breviauritus* Hollister bisects eastern Ellis County (Cockrum, 1952:162, cited a marginal record for *arcticeps* as 4 mi. N, 3 mi. E Hays). Pending a more thorough investigation of variation among populations of grasshopper mice on the Great Plains, we prefer not to arbitrarily assign specimens from Ellis County to one or the other, or both, subspecies.

Although it is not considered rare, the northern grasshopper mouse is seldom taken in quantity in Ellis County. Martin (1960) captured 19 individuals a total of 42 times in a live trap study conducted on a remnant of the Mixed Prairie southwest of Hays over a period of almost six years, and in a similar study we trapped 28 individuals a total of 100 times in 47 months. Our unpublished data indicate that grasshopper mice were obtained most often in two communities, one dominated by little bluestem, big bluestem, and side-oats grama and the other by buffalo grass, side-oats grama, and tall dropseed. In nearby Lincoln County, Kaufman and Fleharty (1974) did not catch enough individuals of this species to justify statistical determination of habitat preference, but most of their specimens were trapped in an ungrazed prairie with sandy soil and with tall dropseed and little

deer mice per acre in areas of short grass and prickly pear; Martin (1960) recorded a maximum crude density of 9 per acre on his entire study area and ecological densities as high as 30 per acre in favored habitats; Hansen and Fleharty (1974) found maximal monthly crude and maximal seasonal ecological densities of 7 and 8 per acre, respectively.

Brown (1945, 1946) reported that 57, 5, 4, and 35 per cent of the female deer mice captured in Ellis County in September, December, January, and March, respectively, were pregnant; from these data, he assumed that deer mice breed throughout the year at the latitude of Ellis County. Fleharty and Hansen (unpublished data) demonstrated that reproduction is at its peak in October, but found no evidence of breeding in January, February, July, or August. Probably some individuals in certain habitats are reproductive in every month, at least when a number of years encompassing variations in climatic conditions are considered.

Size of litters of deer mice was reported by Brown (1946) to range from 2 to 5 with a mean of 3.6. A female trapped on 21 May 1966 contained five embryos that measured 12 in crown-rump length, and another mouse caught on 9 June 1966 contained five embryos that measured 15.

Specimens examined (362). — 17 mi. N, 7 mi. W Hays, 1; T. 11S, R. 19W, SE 1/4 sec. 4 [17 mi. N, 6 mi. W Hays], 1; T. 11S, R. 20W, sec. 13 [15 1/2 mi. N, 9 1/2 mi. W Hays], 2; T. 11S, R. 17W, sec. 14 [15 1/2 mi. N, 7 1/2 mi. E Hays], 1; T. 11S, R. 19W, NW 1/4 sec. 19 [15 mi. N, 9 mi. W Hays], 3; T. 11S, R. 19W, SE 1/4 sec. 18 [15 mi. N, 8 mi. W Hays], 7; T. 11S, R. 19W, SW 1/4 sec. 17 [15 mi. N, 8 mi. W Hays], 1; 15 mi. N, 7 mi. W Hays (T. 11S, R. 19W, SW 1/4 sec. 16), 3 (TTU); 15 mi. N, 4 mi. W Hays, 20; 16 mi. N, 1 mi. W Hays [= 15 mi. N, 1 mi. W Hays], 9; T. 11S, R. 17W, SE 1/4 sec. 22 [14 mi. N, 7 mi. E Hays], 7; T. 11S, R. 17W, NE 1/4 sec. 27 [14 mi. N, 7 mi. E Hays], 4; T. 11S, R. 19W, SW 1/4 sec. 27 [13 mi. N, 6 mi. W Hays], 4; T. 11S, R. 19W, SE 1/4 sec. 27 [13 mi. N, 5 mi. W Hays], 1; 13 mi. N, 1 mi. W Hays, 1; T. 11S, R. 18W, SE 1/4 sec. 28 [13 mi. N Hays], 2; T. 12S, R. 19W, NE 1/4 sec. 5 [12 mi. N, 7 mi. W Hays], 1; T. 12S, R. 18W, sec. 4 [11 1/2 mi. N, 1/2 mi. W Hays], 2; T. 12S, R. 19W, SW 1/4 sec. 5 [11 mi. N, 8 mi. W Hays], 5; 6 1/2 mi. N Ellis, 1; 6 mi. N Ellis, 5; T. 12S, R. 19W, NE 1/4 sec. 14 [10 mi. N, 4 mi. W Hays], 4; 8 mi. N Hays (T. 12S, R. 18W, N 1/2 sec. 27), 7 (TTU); 6 mi. N, 1/2 mi. W Hays, 4; 6 mi. N Hays, 1; T. 13S, R. 18W, NW 1/4 sec. 3 [6 mi. N Hays], 1; 1 mi. N, 2 mi. W Ellis, 1; 5 mi. N, 3 mi. E Hays (T. 13S, R. 17W, SW 1/4 sec. 6), 1 (TTU); Ellis, 3; 4 mi. N, 1 mi. W Hays, 3; 4 mi. N, 1/2 mi. W Hays, 12; 4 mi. N, 1/4 mi. W Hays, 10; 4 mi. N Hays, 7; 3 1/2 mi. N, 1 mi. W Hays, 6; T. 13S, R. 18W, sec. 13 [3 1/2 mi. N, 2 1/2 mi. E Hays], 1; 3 mi. N Hays, 1; 2 mi. N Hays, 2; 2 mi. N, 3 mi. E Hays, 1; 2 mi. N, 3 1/2 mi. E Hays, 2; T. 13S, R. 18W, sec. 30 [1 1/2 mi. N, 2 1/2 mi. W Hays], 1; 1 mi. N, 1 mi. W Hays, 1; "College Pasture" [= 3-4 mi. W Hays], 3; 2 mi. W Hays, 20; T. 13S, R. 18W, SE 1/4 sec. 31 [2 mi. W Hays], 4; T. 14S, R. 18W, NE 1/4 sec. 6 [2 mi. W Hays], 4; T. 13S, R. 18W, SE 1/4 sec. 32 [1 mi. W Hays], 5; T. 14S, R. 18W, NE 1/4 sec. 5 [1 mi. W Hays], 5; 1/2 mi. W Hays, 1; Hays, 2; 2 mi. E Hays, 4; 1/4 mi. S, 1 mi. W

Peromyscus maniculatus

Deer Mouse

We follow Jones (1958b:110) in use of the subspecific name *P. m. luteus* Osgood for populations of this species in western Kansas.

The deer mouse presently is the most abundant species of mammal in Ellis County, and occurs commonly in all native habitats in the county except densely wooded riparian situations and severely overgrazed prairies. On a remnant of the Mixed Prairie southwest of Hays, Martin (1960) noted that *P. maniculatus* occurs in all vegetative communities but is most abundant in an area supporting a dense stand of little bluestem. Hansen and Fleharty (1974), in another study conducted on the same remnant, supported Martin's observation but determined that *P. maniculatus* prefers a community dominated by big and little bluestem and side-oats grama and generally avoids an area that supports a seral community of annual sunflowers and Mexican fireweed. In adjacent Russell County, Kaufman and Fleharty (1974) noted that deer mice occurred in all grassland habitats that were sampled, but avoided a wooded riparian community; the mice attained their greatest abundance in tall grass habitats dominated by big and little bluestem, side-oats grama, and tall dropseed. In addition, Brown (1946) observed that *P. maniculatus* occurs in areas of both natural vegetation and artificial revegetation.

Examination of caches of stored seeds and of fecal pellets (Brown, 1946) revealed that at least seven species of grass and 17 of forbs are consumed by deer mice in Ellis County. Of these, seeds of annual sunflower, buffalo grass, and cactus (probably prickly pear) are most extensively utilized. In addition, evidence from excavated burrows showed that the diet includes crickets, beetles, moths, spiders, millipedes, and grasshoppers; in fact, studies conducted in the laboratory revealed that deer mice sometimes prefer insects to seeds of native grasses (Brown, 1946). Finally, Riegel (1941) and Brown (1946) reported that, during periods of cold weather, deer mice frequently remove and eat seeds contained within droppings of pheasants, black-tailed jack rabbits (*Lepus californicus*), and cattle.

Population density of *P. maniculatus* fluctuates on a seasonal basis and varies among different habitats. Hansen and Fleharty (1974) reported that populations are most dense in Ellis County from mid-autumn until early winter (October through December), decline from mid-winter until early spring (January through March), increase slightly from mid-spring until early summer (April through June), and decline from mid-summer until early autumn (July through September). Riegel (1941) reported population densities of 10-20

false buckwheat, November goldenrod, horseweed, buffalo gourd, rosinweed, and Pennsylvania smartweed); and grasses and sedges (Japanese brome, Canada wild-rye, Mexican muhly, western wheatgrass, green foxtail, heavy sedge, and switchgrass). Additionally, brushpiles and rotting logs were present at every locality where Frydendall collected specimens of *P. leucopus* in the county.

In adjacent Russell and Osborne counties, Kaufman and Fleharty (1974) determined that *P. leucopus* was the most abundant species of mammal in two riparian communities (dominated by Virginia wild-rye, green ash, and American elm, and by Japanese brome, American elm, and green ash) in which the extent of canopy cover averaged 96 and 68 per cent, respectively. The only other vegetative community in which Kaufman and Fleharty trapped *P. leucopus* was a tall grass habitat comprised chiefly of big and little bluestem and side-oats grama; however, sites of capture in that community were located within 30 meters of a ravine that supported a dense growth of trees and shrubs.

A female trapped on 18 December 1965 contained three embryos that measured 10 in crown-rump length, and another obtained on 23 September 1967 contained five embryos that measured 11.

Specimens examined (186). — 18 mi. N Hays, 1; T. 11S, R. 18W, SE 1/4 sec. 12 [16 mi. N, 3 mi. E Hays], 15; T. 11S, R. 17W, SW 1/4 sec. 8 [16 mi. N, 4 mi. E Hays], 12; 15 mi. N, 7 mi. W Hays (T. 11S, R. 19W, SW 1/4 sec. 16), 4 (TTU); 16 mi. N, 1 mi. W Hays [= 15 mi. N, 1 mi. W Hays], 9; 13 mi. N, 1 mi. W Hays, 4; T. 11S, R. 18W, SE 1/4 sec. 28 [13 mi. N Hays], 1; T. 12S, R. 19W, NE 1/4 sec. 14 [10 mi. N, 4 mi. W Hays], 1; 8 mi. N Hays (T. 12S, R. 18W, N 1/2 sec. 27), 9 (TTU); 6 3/10 mi. N Hays, 9; 6 mi. N, 1/2 mi. W Hays, 5; 5 mi. N Hays, 3; 5 mi. N, 3 mi. E Hays (T. 13S, R. 17W, SW 1/4 sec. 6), 6 (TTU); Ellis, 2; 4 mi. N, 1 mi. W Hays, 1; 4 mi. N, 1/2 mi. W Hays, 3; 4 mi. N Hays, 14; 3 1/2 mi. N, 1 mi. W Hays, 2; 2 mi. N, 2 mi. E Hays, 3; 2 mi. N, 3 1/2 mi. E Hays, 2; 1 mi. N, 2 mi. E Hays, 5; 2 mi. W Hays, 1; Hays, 8; 1/2 mi. E Hays, 1; 1/2 mi. S, 1 mi. E Hays, 3; 1/2 mi. S, 2 mi. E Hays, 10; "T. 15S, R. 19W, Relict Area" [= 1 mi. S, 3 mi. W Hays (T. 14S, R. 19W, SE 1/4 sec. 1)], 1; 1 mi. SE Hays, 1; 1 mi. S, 1/2 mi. E Hays, 1; 1 mi. S, 2 mi. E Hays, 2; 1 1/2 mi. S Hays, 1; T. 14S, R. 18W, sec. 10 [1 1/2 mi. S, 1/2 mi. E Hays], 8; 1 1/2 mi. S, 1 mi. E Hays, 1; 2 mi. SW Hays, 1; 1 mi. S, 1/2 mi. E Victoria, 1; 2 mi. N, 3 mi. E Antonino, 2; 1 mi. N Antonino, 1; 11 mi. S, 1/2 mi. E Ellis, 5; T. 15S, R. 20W, NW 1/4 sec. 11 [1 mi. S, 7 mi. W Antonino], 2; T. 15S, R. 20W, NE 1/4 sec. 11 [1 mi. S, 6 mi. W Antonino], 4; 2 mi. S, 1/2 mi. E Hays (T. 14S, R. 18W, SE 1/4 sec. 10), 4 (TTU); T. 15S, R. 19W, SW 1/4 sec. 16 [3 mi. S, 3 mi. W Antonino], 2; T. 15S, R. 16W, SW 1/4 sec. 24 [1 1/4 mi. N, 5 1/2 mi. E Pfeifer], 1; T. 15S, R. 19W, NW 1/4 sec. 27 [4 mi. S, 2 mi. W Antonino], 2; T. 15S, R. 19W, NE 1/4 sec. 27 [4 mi. S, 1 mi. W Antonino], 2; 10 1/2 mi. S, 3 mi. W Hays, 9; 5 mi. S, 5 mi. W Antonino, 1.

Additional records. — 15 mi. N Hays; 13 mi. N Yocemento; "near Fort Hays Kansas State College"; 12 mi. S Ellis; 3 mi. W Schoenchen (Frydendall, 1961:36-38).

Specimens examined (33). — T. 11S, R. 17W, SW 1/4 sec. 8 [16 mi. N, 4 mi. E Hays], 1; T. 11S, R. 19W, SE 1/4 sec. 18 [15 mi. N, 8 mi. W Hays], 2; 15 mi. N, 4 mi. W Hays, 15; T. 11S, R. 17W, NE 1/4 sec. 27 [14 mi. N, 7 mi. E Hays], 1; T. 11S, R. 18W, SE 1/4 sec. 28 [13 mi. N Hays], 1; T. 12S, R. 19W, SW 1/4 sec. 5 [11 mi. N, 8 mi. W Hays], 7; 2 mi. N Hays, 1; 2 mi. W Hays, 1; Hays, 1; 2 mi. SW Hays, 2; 5 mi. SW Antonino, 1.

Additional record. — 1/2 mi. S, 4 mi. W Hays (Cockrum, 1952:169).

Peromyscus leucopus

White-footed Mouse

Fleharty and Stadel (1968:232) tentatively assigned populations of this species in Ellis County to the subspecies *P. l. aridulus* Osgood.

Allen (1874:49) reported that "a single specimen [of the "whitefooted mouse," "*Hesperomys leucopus*, var. *sonoriensis*"] was picked up dead in the yard at our quarters at Fort Hays. Probably more or less common." However, so far as we know *P. leucopus* was not recorded again in Ellis County for nearly a century (Frydendall, 1961). It is not known if the species occurred in the county during the first half of this century; these mice might simply have been overlooked by previous researchers in the county (most of whom were concerned largely with the biology of plants and animals of the prairie and might not have trapped in wooded areas), or the range of the species might have included Ellis County prior to the 1930's only to have withdrawn eastward during the ensuing drought. Whatever the case, at the time of Frydendall's (1961) study the species was thought to be almost exclusively restricted in Ellis County to riparian woodland along the Saline River, Big Creek, and the Smoky Hill River. At the present time, the distribution of *P. leucopus* in Ellis County is associated with the distribution of timber claims, shelter belts, and naturally wooded areas along the major watercourses and their tributaries. However, when populations are at their peak, occasional individuals are trapped at some distance from trees or suitably brushy habitats; for example, a few specimens have been obtained at various times on a remnant of the Mixed Prairie southwest of Hays although this area is approximately one mile from the nearest riparian habitat along Big Creek.

Frydendall (1961) provided lengthy descriptions of habitats occupied by *P. leucopus* in Ellis County. In every instance these were streambank associations in which the vegetation was comprised of three prominent strata: trees (American elm, honey locust, plains cottonwood, boxelder, green ash, sandbar willow, and red mulberry); tall forbs and brush (annual sunflower, wild grape, Mexican fireweed, giant ragweed, pale dock, mapleleaf goosefoot, climbing

Hays (T. 14S, R. 19W, SE 1/4 sec. 1)], 9; 1 mi. S, 1 mi. W Hays, 2; 1 mi. S Hays, 2; 1 1/2 mi. S, 2 mi. W Hays, 2; 1 1/2 mi. SE Hays, 1; 2 mi. S, 1 1/2 mi. W Hays, 16; 2 mi. S, 1 mi. W Hays, 1; "Custer Island" [= 2 mi. S, 1/2 mi. E Hays (T. 14S, R. 18W, S 1/2 sec. 10)], 2; 1 mi. S, 1/2 mi. E Victoria [= 1 1/2 mi. S, 1/2 mi. E Victoria], 1; 2 mi. N, 3 mi. E Antonino, 2; 1 mi. N, 1/2 mi. W Antonino, 1; 1 mi. N Antonino, 3; 11 mi. S, 1/2 mi. E Ellis, 1; 2 mi. S, 3 1/4 mi. W Antonino, 1; 2 mi. S, 1 mi. W Antonino, 1; T. 15S, R. 19W, SW 1/4 sec. 16 [3 mi. S, 3 mi. W Antonino], 1; T. 15S, R. 19W, NW 1/4 sec. 27 [4 mi. S, 2 mi. W Antonino], 2; 5 mi. S Antonino, 2; T. 15S, R. 19W, NE 1/4 sec. 35 [5 mi. S Antonino], 2.

Additional records. — 1/2 mi. S, 4 mi. W Hays; 1/2 mi. S, 3 1/2 mi. W Hays (Cockrum, 1952:166).

Reithrodontomys montanus

Plains Harvest Mouse

Armstrong (1972:188) summarized Smith's (1964:19) tentative conclusions regarding the status of *R. m. albescens* Cary. That subspecific name presently applies for populations of this species in Ellis County, but *R. m. montanus* (Baird) would become the valid name in the event that the two taxa are judged to be inseparable.

The plains harvest mouse seems to be uncommon in Ellis County. Martin (1960) caught only one during a live trap study conducted from October 1952 until August 1958; Frydendall (1969) did not trap any of these mice during the period July of 1959 through April of 1961; and we caught only three on a grid of live traps operated from April 1965 through February 1969. However, all three of these studies were conducted at least in part on a remnant of the Mixed Prairie that was protected from grazing, and possibly none of the habitats represented was among those preferred by *R. montanus*.

The 15 plains harvest mice listed below from 15 mi. N, 4 mi. W Hays were collected in a relatively arid, lowland community along a fencerow between an abandoned field that was in an early stage of succession and an overgrazed pasture. The soil was dry, sandy alluvium deposited by the Saline River, and the fencerow was lined with mounds of wind-blown dust. Dominant grasses were blue grama, buffalo grass, side-oats grama, tall dropseed, western wheatgrass, and green foxtail, and dominant forbs included western ragweed, wavyleaf thistle, prickly pear, skeletonweed, tallbread scurfpea, small soapweed, and pigweed. On relatively arid upland sites in adjacent Russell County, Kaufman and Fleharty (1974) determined that *R. montanus* prefers short grass communities (dominated by blue grama, sand dropseed, and buffalo grass) and oldfields (in early seral stages wherein red three-awn and green foxtail are dominant).

A female trapped on 11 October 1966 contained five embryos that measured 22 in crown-rump length.

Unpublished data resulting from a study conducted on a remnant of the Mixed Prairie southwest of Hays indicate that western harvest mice demonstrate a marked preference in winter and spring for an upland community dominated by buffalo grass, side-oats grama, and tall dropseed, and avoid another upland community dominated by big and little bluestem and side-oats grama; in summer and autumn no preference is exhibited for any particular habitat, but in autumn a weedy community dominated by big blue stem, Mexican fireweed, and annual sunflower is avoided. In adjacent Russell County, Kaufman and Fleharty (1974) discovered that the relative abundance of this species does not differ in short grass, tall grass, and riparian habitats, but that it is probably most common in relatively mesic grassland or riparian communities characterized by lush vegetation.

Population density of *R. megalotis* in Ellis County is greatest in winter or spring and least in autumn (Fleharty, 1972). Martin (1960) recorded maximal crude and ecological densities of eight and 18 western harvest mice per acre, whereas Fleharty (1972) reported corresponding densities of five and 10.

After examining food caches and fecal pellets, Brown (1946) reported that western harvest mice in Ellis County feed on grasshoppers, Indian grass, seeds of buffalo grass and switchgrass, and flower heads of "brown weed" [= broomweed?], ironweed, snow-on-the-mountain, and Maximilian's sunflower. In late winter and early spring, Martin (1960) often observed these mice to climb "tall weeds" to obtain their seeds.

Brown (1946) noted that at least some females of this species are gravid in Ellis County in all months except December and January, but our unpublished data indicate that at least some individuals are reproductively active in every month of the year. Females trapped on 11 June 1965, 9 July 1965, 9 June 1966, and 10 June 1966 each contained four embryos with crown rump lengths of 23, 17, 8, and 4, respectively.

Specimens examined (164). — T. 11 S, R. 18 W, SE 1/4 sec. 12 [16 mi. N, 3 mi. E Hays], 33; T. 11 S, R. 19 W, SE 1/4 sec. 18 [15 mi. N, 8 mi. W Hays], 1; 15 mi. N, 4 mi. W Hays, 1; 16 mi. N, 1 mi. W Hays [= 15 mi. N, 1 mi. W Hays], 4; T. 11 S, R. 18 W, SE 1/4 sec. 28 [13 mi. N Hays], 1; T. 12 S, R. 19 W, SW 1/4 sec. 5 [11 mi. N, 8 mi. W Hays], 3; T. 12 S, R. 19 W, NE 1/4 sec. 14 [10 mi. N, 4 mi. W Hays], 19; T. 12 S, R. 19 W, SE 1/4 sec. 14 [9 mi. N, 4 mi. W Hays], 6; 6 mi. N, 1/2 mi. W Hays, 2; 5 mi. N, 3 mi. E Hays (T. 13 S, R. 17 W, SW 1/4 sec. 6), 1 (TTU); 1 3/4 mi. W Ellis, 1; 4 mi. N, 1 mi. W Hays, 3; 4 mi. N, 1/2 mi. W Hays, 1; 4 mi. N, 1/4 mi. W Hays, 3; 4 mi. N Hays, 7; 2 mi. N, 3 mi. E Hays, 5; 1 mi. N, 2 mi. W Hays, 2; 1 mi. N, 2 mi. E Hays, 1; 2 mi. W Hays, 5; T. 14 S, R. 18 W, NE 1/4 sec. 6 [2 mi. W Hays], 2; T. 14 S, R. 18 W, NE 1/4 sec. 5 [1 mi. W Hays], 7; 1/2 mi. W Hays, 1; Hays, 1; 1/4 mi. S, 1 mi. W Hays, 1; 1 mi. S, 6 mi. W Hays, 1; 1 mi. S, 2 mi. W Hays [= 1 mi. S, 3 mi. W

that the beaver was "still quite frequent along the timbered portions of the streams" in the vicinity of Fort Hays.

The beaver presently is a common resident of permanent streams and other bodies of water (such as Rohr-Jacobs Lake, T. 14S, R. 20W, sec. 2) in Ellis County. Although seldom seen by local residents, beaver are abundant in Big Creek on the campus of Fort Hays Kansas State College, and felled saplings and other signs are numerous elsewhere along Big Creek and on both the Saline and Smoky Hill rivers.

The most comprehensive study to date of beaver in Kansas was that of Henderson (1960), who selected Ellis and Douglas counties (the latter in eastern Kansas) for intensive investigation. In Ellis County, he found 24, 26, and 75 colonies of beaver on the Saline River, Big Creek, and the Smoky Hill River, respectively, and eight additional colonies on minor creeks. He estimated (p. 14) that there were "at least 175 colonies of beaver in Ellis County or a little more than one colony per mile of suitable stream." If there is an average of five beaver per colony, as suggested by Denny (1952), this places the resident population of beaver in Ellis County at about 875. Henderson (1960:14) pointed out that there were more beaver in Ellis County than in Douglas County because the preferred foods (for example, willow and cottonwood trees) are more common along streams in western Kansas than farther to the east. Based on reports of fur dealers in Kansas for the years 1967-1969 and 1969-1970 and on the Kansas Fur Trapping and Marketing Survey of 1969-1970, Little (1973) included Ellis County within the section of Kansas in which beaver are most abundant.

Specimens examined (4). — Hays, 1; 15 mi. SW Hays [= 3 mi. S, 4 mi. W Antonino?], 1; no specific locality, 2.

Reithrodontomys megalotis

Western Harvest Mouse

The subspecific name *R. m. dychei* J. A. Allen currently applies to populations of the western harvest mouse in northwestern Kansas (see Jones and Mursaloğlu, 1961:17).

In Ellis County, the western harvest mouse occurs in a variety of habitats that support dense stands of herbaceous vegetation. Martin (1960) noted that the species exhibits a preference for weedy communities and generally avoids open stands of little bluestem. Fryden-dall (1969) commented on the high density of *R. megalotis* in a moderately grazed pasture that contained western wheatgrass, Canada wild-rye, switchgrass, plains bristlegrass, and blue grama.

luteolus (Goldman) with the qualifications (p. 180) that "distinction between *D. o. luteolus* and *D. o. richardsoni* . . . is tenuous at best," and "assignment of individual specimens to subspecies generally is arbitrary." Pending further study, we tentatively assign specimens from Ellis County to *D. o. richardsoni*.

The Ord kangaroo rat is commonest in areas of Ellis County where ground cover is sparse and sandy soil facilitates burrowing and dusting. Such areas exist on the floodplains of the Saline and Smoky Hill rivers, whence most of the specimens listed below were obtained. Additionally, kangaroo rats inhabit roadside ditches (sometimes rank with vegetation but usually adjacent to fallow fields or other places where the vegetation is broken by patches of bare, sandy soil), where abrupt banks facilitate construction of burrows.

Fourteen burrows of kangaroo rats were excavated at a place 4 1/2 mi. S Antonino during autumn of 1972. Main tunnels and escape openings of those burrows averaged 9 cm. in diameter, nests averaged 17-18 cm., and storage chambers 16-17 cm. Nest chambers were centrally located, had only one entrance, and were situated almost one meter below the surface of the ground. Seeds of green foxtail and sandbur (which had been extracted from their spiny exocarps) have been removed from the pouches of kangaroo rats, and presumably are among the foods commonly eaten by this species in Ellis County.

A female caught on 28 September 1971 contained three embryos that measured 5 in crown-rump length, and another obtained on 14 October 1967 contained two embryos that measured 30.

Specimens examined (42). — T. 11S, R. 18W, SE 1/4 sec. 12 [16 mi. N, 3 mi. E Hays], 2; T. 11S, R. 17W, SW 1/4 sec. 8 [16 mi. N, 4 mi. E Hays], 1; 15 mi. N, 4 mi. W Hays, 6; 7 mi. N Ellis, 1; 6 1/2 mi. N Ellis, 4; 6 mi. S, 3 3/4 mi. W Hays, 1; T. 15S, R. 20W, NW 1/4 sec. 3 [8 mi. W Antonino], 2; 7 mi. S, 9 mi. W Hays, 1; T. 15S, R. 20W, NW 1/4 sec. 11 [1 mi. S, 7 mi. W Antonino], 7; T. 15S, R. 20W, NE 1/4 sec. 11 [1 mi. S, 6 mi. W Antonino], 4; 3 mi. S, 6 mi. W Antonino, 1; 3 mi. S, 5 1/4 mi. W Antonino, 1; 3 mi. S, 4 mi. W Antonino, 9; 5 mi. S, 5 mi. W Antonino, 1; 7 1/2 mi. S Munjor, 1.

Additional records. — 12 mi. N, 3 mi. W Hays; Ellis (Cockrum, 1952:154).

Castor canadensis

Beaver

The subspecific name *C. c. missouriensis* V. Bailey is thought to apply to populations of beaver in Kansas (Hibbard, 1933:241; Black, 1937:185-186; see also discussion by Cockrum, 1952:156-157).

Records kept at Fort Hays (see historical account) document the presence of the beaver in Ellis County at the time of settlement of the region by European man. Additionally, Allen (1874:49) commented

mice occur in both tall and short grass habitats without exhibiting any marked preference; riparian communities, however, are devoid of this species.

Unpublished data suggest that hispid pocket mice are most abundant in autumn when crude and ecological densities on a mature prairie in Ellis County averaged 1.3 and 5.6 per acre, respectively. The species is relatively inactive above ground in winter; Hall (1955:111) even went so far as to state that this species "is never found active above-ground in winter and the presumption is that it hibernates." The veracity of this presumption remains unproven, and occasional authors (for example, Martin, 1960:19; Jones, 1964:173-174) have commented on individuals captured in winter. However, from 1965 through 1969, during which a live trap grid located southwest of Hays was operated on the first 14 days of each month, no hispid pocket mice were caught later than 9 December or earlier than 3 April. Perhaps individuals of this species are active below ground throughout winter, but seldom venture above ground during periods of cold weather.

Food items removed from pouches of *P. hispidus* and reported by Brown (1946) included bee flower, snow-on-the-mountain, western ragweed, false gromwell, manyflower scurfpea, pitcher sage, single seeded croton, sensitive briar, and Texas croton.

Specimens examined (39). — T. 11S, R. 17 W, SW 1/4 sec. 8 [16 mi. N, 4 mi. E Hays], 1; 15 mi. N, 4 mi. W Hays, 1; 16 mi. N, 1 mi. W Hays [= 15 mi. N, 1 mi. W Hays], 2; 14 3/4 mi. N Hays, 1; T. 11S, R. 17W, NE 1/4 sec. 27 [14 mi. N, 7 mi. E Hays], 3; T. 12S, R. 19W, SW 1/4 sec. 5 [11 mi. N, 8 mi. W Hays], 2; 8 mi. N Hays (T. 12S, R. 18W, N 1/2 sec. 27), 2 (TTU); 3 mi. N Hays, 4; 3 mi. N, 3 mi. E Hays, 1; 1 mi. N, 2 mi. W Hays, 1; 1/2 mi. N, 5 mi. E Hays, 2; 2 mi. W Hays, 2; 3/4 mi. E Hays, 1; 2 mi. S, 1 1/2 mi. W Hays (on some labels), or 1 mi. S, 2 mi. W Hays (on others) [both = 1 mi. S, 3 mi. W Hays (T. 14S, R. 19W, SE 1/4 sec. 1)], 5; T. 14S, R. 18W, SE 1/4 sec. 6 [1 mi. S, 2 mi. W Hays], 1; 1 1/2 mi. S, 2 mi. W Hays, 1; 1 1/2 mi. S, 2 mi. E Hays, 1; 2 mi. S, 1/2 mi. E Hays (T. 14S, R. 18W, S 1/2 sec. 10), 2; 2 mi. S, 2 mi. W Hays, 1; T. 15S, R. 20W, NW 1/4 sec. 3 [8 mi. W Antonino], 1; T. 15S, R. 20W, NE 1/4 sec. 11 [1 mi. S, 6 mi. W Antonino], 1; 2 mi. S, 3 1/4 mi. W Antonino, 1; 3 1/2 mi. S, 1 mi. W Antonino, 1; 7 1/2 mi. S Munjor, 1.

Additional records. — Ellis; Hays; "Ft. Hays State College (1/4 mi. W Dairy Barns)" (Cockrum, 1952:150).

Dipodomys ordii Ord's Kangaroo Rat

Historically (see Setzer, 1949:512), specimens of Ord's kangaroo rat from western Kansas have been referred to the subspecies *D. o. richardsoni* (J. A. Allen). However, Armstrong (1972:177) identified specimens from northeastern Colorado (south to about the latitude of Ellis County) as representatives of the subspecies *D. ordii*

Specimens examined (32). — 16 mi. N, 1 mi. W Hays [= 15 mi. N, 1 mi. W Hays], 2; 1 mi. N, 3 mi. E Ellis [= 1 1/2 mi. N, 3 mi. E Ellis], 1; 1/2 mi. N, 4 mi. E Ellis, 2; 3 mi. E Ellis, 1; 3/4 mi. W Yocemento, 14; 1/2 mi. N, 6 mi. W Hays, 1; 8 1/2 mi. W Hays, 1; 8 mi. W Hays, 2; 6 mi. W Hays, 3; T. 15S, R. 20W, NE 1/4sec. 11 [1 mi. S, 6 mi. W Antonino], 2; T. 15S, R. 19W, SW 1/4 sec. 16 [3 mi. S, 3 mi. W Antonino], 3.

Additional record. — "Hays State College Campus, Hays" (Cockrum, 1952:141).

Perognathus flavus Silky Pocket Mouse

The subspecific name *P. f. bunkerii* Cockrum presently applies to populations of the silky pocket mouse in western Kansas (see Cockrum, 1951:205-206).

A female (weight 6.3) trapped on 28 June 1965 in the southeast quarter of section 28, T. 11S, R. 18W (13 mi. N Hays) provides the only record for the silky pocket mouse in Ellis County. The site of capture, which is the easternmost record for the species in northern Kansas, was on hilly open range where the soil generally was rocky, shallow, and underlain with limestone. Dominant plants were blue grama and broomweed, and subdominants included wild sage, buffalo grass, side-oats grama, and little bluestem.

Perognathus hispidus Hispid Pocket Mouse

Two subspecies of *Perognathus hispidus* (*P. h. paradoxus* Merriam in the west and *P. h. spilotus* Merriam in the east) currently are recognized as occurring in Kansas. As mapped by Cockrum (1952:149), the line separating these two passes through Russell County (the county just east of Ellis), but the geographic and taxonomic relationships of the taxa are poorly defined. Therefore, we have not attempted to assign specimens from Ellis County to one or the other of these nominal subspecies.

Hispid pocket mice inhabit prairie situations throughout Ellis County, especially in sandy soils, but nowhere do they seem abundant. The species is well adapted to arid conditions, and increased markedly in abundance during the first years of the great drought of the 1930's (Wooster, 1939). Ongoing research on a remnant of the Mixed Prairie southwest of Hays has revealed that the species prefers habitats dominated by big and little bluestem and side-oats grama in all seasons except autumn, when it seemingly prefers a community dominated by big bluestem alone. In nearby Russell and Lincoln counties, Kaufman and Fleharty (1974) determined that hispid pocket

(for example, see Hart, 1971), available data (Hendricksen, 1973) indicate that the subspecific name *G. b. lutescens* Merriam probably applies to populations in Ellis County.

References to "Thomomys rufescens" and "Gopher" in records kept at Fort Hays (see historical account) doubtlessly pertain to this species. Allen (1874:49) commented that "a gopher (some species of *Geomys* or *Thomomys*) was more or less common in the moist bottom lands near the streams [in the vicinity of Fort Hays], but none were captured."

The distribution of the plains pocket gopher in Ellis County corresponds closely to the distribution of moderately deep, friable soils. Such soils are most common on the sandy floodplains of the Saline River, Big Creek, the Smoky Hill River, and their major tributaries, and it is from these places that almost all of the specimens listed below were obtained. Additionally, gophers inhabit roadside ditches and other places where the depth and nature of the soil have been modified by man. Gophers have been collected in fields of alfalfa, wheat (usually in spring or autumn and often only near the borders), and sudan grass, as well as in prairie communities dominated by buffalo grass and blue grama.

Burrows of the plains pocket gopher frequently contain clippings of grass and other vegetation removed from the surface of the ground, and fecal pellets often are associated with these clippings. However, most food items probably are obtained from beneath the surface of the ground; tubers and roots of alfalfa, sudan grass, and dandelion are occasionally found in cheek pouches of gophers trapped in Ellis County.

At the latitude of northwestern Kansas, activity of gophers at the surface of the ground (as evinced by the presence of fresh mounds) declines markedly with the onset of winter (for example, see Downhower and Hall, 1966:17). It seems likely that the routine activities of gophers during such periods are confined beneath the frozen surface of the ground, and that they continue their excavations by filling old chambers with dirt removed from new passages. However, even during protracted periods of cold weather, new mounds continue to be thrown up at places in Ellis County where the earth is moderately damp and remains unfrozen.

Other species of small mammals occasionally utilize burrow systems of the plains pocket gopher in Ellis County, as shown by the fact that ground squirrels (*Spermophilus tridecemlineatus*) and pocket mice (*Perognathus hispidus*) have been caught in Macabee traps set in burrows leading from fresh mounds.

Two females trapped on 24 October 1971 appeared to be lactating.

The thirteen-lined ground squirrel prefers short grass or overgrazed mid-height prairies and, in Ellis County, frequently occurs on schoolyards, golf courses, lawns, and in parks and closely mown roadside ditches. In addition to places where short grasses predominate, Brown (1946) reported that *S. tridecemlineatus* prefers natural or artificial revegetation to areas of big bluestem or either grazed or ungrazed little bluestem.

Riegel (1941) noted that thirteen-lined ground squirrels consume seeds of prickly pear and assist in their propagation by burying them. On the basis of materials found in excavated burrows, Brown (1946) postulated that the principal foods of this species in Ellis County are burs and crowns of buffalo grass, stems and seeds of little barley, and bulbs of wild onion; other foods include crowns of blue grama, seeds of plains prickly pear, roots of blazing star, underground stems of western ragweed, and grasshoppers, crickets, beetles, and spiders. In addition, individuals of this species frequently are seen feeding on other ground squirrels that have been killed on roads.

In Ellis County, thirteen-lined ground squirrels usually retire to their burrows in mid-October and do not emerge fully from hibernation until March or April. The latest and earliest recorded dates of activity were given by Brown (1946) as 21 October and 5 March, respectively, and none of the specimens listed below was trapped between those dates. Reproduction of this species in Ellis County takes place in April, and litters are born during the last half of May (a female trapped on 2 May 1964 contained 11 embryos that measured 9 in crown-rump length). Unpublished data indicate that, with the advent of hot, dry summer weather, cool season plants become dormant and most adult thirteen-lined ground squirrels go into estivation. Young of the year remain active throughout summer, and are often rejoined by adults during early autumn.

Specimens examined (35). — T. 11S, R. 19W, SW 1/4 sec. 17 [15 mi. N, 8 mi. W Hays], 4; T. 11S, R. 18W, SE 1/4 sec. 28 [13 mi. N Hays], 1; T. 12S, R. 19W, SW 1/4 sec. 5 [6 1/2 mi. N, 5 mi. E Ellis], 2; 1/2 mi. N, 5 mi. W Hays, 1; Hays, 22; T. 14S, R. 19W, SW 1/4 sec. 1 [1 mi. S, 4 mi. W Hays], 1; T. 14S, R. 18W, SE 1/4 sec. 5 [1 mi. S, 1 mi. W Hays], 1; 1 1/2 mi. S, 2 mi. W Hays, 1; 1 1/2 mi. S Hays, 2.

Additional records. — Ellis; Hays (Howell, 1938:114); 1/4 mi. S, 3 mi. W Hays (Cockrum, 1952:125).

Geomys bursarius

Plains Pocket Gopher

Villa-R. and Hall (1947) recognized five subspecies of the plains pocket gopher in Kansas. Although the status of those taxa is in doubt