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MAMMALS OF LOST MAPLES STATE NATURAL AREA, TEXAS

BRADY K. MCGEE AND RICHARD W. MANNING

Lost Maples State Natural Area, (hereafter SNA), is located 8 km north of Vanderpool, and covers approximately 880 ha along the Sabinal River in Bandera and Real counties. These counties are located in south-central Texas on the Edwards Plateau. The land was purchased from private owners in 1973-1974, by the Texas Parks and Wildlife Department, but was not opened to the public until September 1979. The ranch had been overgrazed by livestock and exotic game animals (axis deer, *Cervus axis*; fallow deer, *Cervus dama*; and mouflon sheep, *Ovis musimon*). Intensive grazing has had a deleterious effect on wildlife communities here and elsewhere (Grant et al., 1982; Bich et al., 1995). Today the area is a nature preserve with limited public access.

Mammals of SNA have not been studied in detail or documented fully. However, studies have been done on mammals occurring on the Edwards Plateau (Goetze, 1998), including Bandera and Real counties. Other studies have shown that the Edwards Plateau is an ecological region with relatively low mammalian diversity (Goetze et al., 1996).

The purposes of this study at Lost Maples SNA were: 1) to obtain baseline inventory data and document information on the presence, distribution, relative abundance, natural history and taxonomic status of mammals in the area; 2) to determine habitat affinity of small mammals relative to the dominant vegetation types of the area; 3) to establish permanent survey lines for small mammals so that information can be used for long-term ecological and biological monitoring; 4) to determine population density using a mark-recapture technique with small mammals along the permanent survey lines; and 5) to assess the impact that human visitors may have on native mammalian fauna.

METHODS AND MATERIALS

Mammal Sampling.—Data were collected monthly from September 1998 through August 1999. All trap lines and permanent transects were referenced on the Universal Transverse Mercator (UTM) coordinate system using a hand-held Global Positioning System (GPS) unit. Thirteen permanent survey lines were established in six habitat types and their point of origin was marked with a 1 m long piece of rebar. A 30 cm long piece of rebar was placed next to the 1 m long piece to indicate the direction of the line. An alumi-

num tag (.025" thick, 2 3/4" long x 1" wide, # 79182, Forestry Suppliers, Inc., Jackson, MS) was affixed to the rebar. Each tag was engraved with "mammal point" and the habitat acronym for each habitat type (see description of habitats). Voucher specimens were collected, prepared as standard skin and skull preparations and are housed in the mammal collection of the Natural Science Research Laboratory of the Museum of Texas Tech University.

Sherman live-traps were used to capture most small-bodied, ground-foraging species. Fifty Sherman traps were placed along a transect at about 10 m intervals in most habitat types. Grids, used to capture mammals for mark-recapture studies, consisted of two lines 20 m apart with 50 traps per line and two traps per station. Traps were set and baited with oatmeal in the afternoon. The following morning, traps were checked and captured mammals identified. Trap lines were not left in the same area for more than two consecutive nights (Manning and Geluso, 1989).

Once the 13 permanent survey lines were established, selected habitat types were used to determine population density estimates. This was done using a mark-recapture technique where small mammals captured on the first trapping night were ear-tagged and released (# 1005-1, self-piercing - 1 monel ear tags, National Band and Tag Co., Newport, KY). All traps were picked up the second morning and any mammals caught were recorded as marked or unmarked.

For medium sized mammals, Tomahawk live traps were selectively placed in different areas and baited with sardines or other types of bait such as cat food (Frels et al., 1996).

Mist nets were used to capture bats. Nets usually were set up in areas of the park which contained a permanent or semi-permanent source of water. Other areas netted included beneath dense canopies or areas near permanent light sources where bats were seen catching insects. Sampling began after dusk and continued until some time before dawn when there was minimal wind (Frels et al., 1996).

Scent stations were set up in four different habitat types in order to determine presence of predatory mammals such as coyotes, foxes, and bobcats. Fatty acid tablets (USDA Pocatello Supply Depot, Pocatello, ID) were placed in the center of a 1 m diameter circle filled with sand. The sand was moistened prior to monitoring the stations so mammal tracks could be more easily identified. Scent stations were utilized for two consecutive nights during three separate sampling intervals between June and August, 1999.

Data were collected on all types of mammalian sign in all habitats, including the presence of fecal material, tracks, porcupine workings, and feral hog workings. Visual observations were made on large mammals and additional information was obtained from park personnel.

Common and scientific names of mammals follow Hall (1981) and Manning and Jones (1998). Linear measurements are in millimeters (mm) and mass in grams (g). Introduced or non-native species are marked with an asterisk (*).

Data Analysis.—The relative abundance of rodent species was expressed for each habitat type as number of individuals of each species captured per 100 trap nights (Manning and Geluso, 1989). Only mammals collected along permanent line transects were used in the analysis of habitat affinities. Animals captured by other methods or in other areas were not included in the habitat affinity analysis because of the nonrandomness of collecting and unequal catchability. Relative abundance data were used to calculate rodent species diversity and species composition between habitat types. Raw data were used to calculate species richness.

A modified Lincoln-Petersen index was used to calculate a population density estimate ($\hat{n}$) from the mark-recapture study in selected habitat types (Chapman, 1951):

$$\hat{n} = (n_1 + 1)(n_2 + 1) / (m_2 + 1) - 1$$

where:

$\hat{n}$ = population density estimate
n_1 = animals caught at period one, marked and released
n_2 = animals captured the second night
m_2 = the number of marked animals in second capture.

The program PETERSEN was used to estimate population size from the mark-recapture study (Krebs, 1995). This program computes population estimates with 95% confidence.

Because sample sizes varied between habitat types, species richness values equaling the total number of species encountered were not suitable for comparing communities (Krebs, 1989). Therefore, rarefaction analysis was used to determine species richness values for each habitat type. This method uses the number of species and individuals of each species to estimate the theoretical species richness for a given sample size. By setting the sample size of each community equal (n = 10), comparable richness values were derived. Richness values increase with increasing diversity in communities. The program RAREFACT was used to calculate species richness (Krebs, 1995). Other studies have shown this method to be satisfactory for comparing species richness among communities sampled at different intensities (James and Rathbun, 1981).

Species diversity was calculated by the program DIVERS (Krebs, 1995). This program uses the Shannon-Wiener index to calculate species diversity. As the number of species in a community increases, the index value increases. Species diversity will be zero if all individuals belong to one species. However, if given two communities with an equal number of individuals and species, the community with the most individuals belonging to the same species would have a lower value than the community with equal numbers of individuals for each species (Krebs, 1989).

Vegetation Sampling.—The line-intercept method was used to describe and compare habitat types along the 13 permanent survey lines (Frels et al., 1996). From these data, percent cover and dominance were calculated for plant species, and percent bare ground was determined at each site. Vegetation sampling was conducted during June 1998 to allow for comparison of different habitat types within one season (Nudds, 1977). A line transect, 100 m in length, was extended from a fixed point in each permanent survey plot. All woody species that intercepted the entire line were recorded, along with their intercept lengths. For non-woody species, the first and last 10 m of the line were used to identify species and record their intercept lengths.

Description of Habitats

The Edwards Plateau natural region consists of three subregions: Live Oak-Mesquite Savanna, Balcones Canyonlands, and Lampasas Cut Plain. Lost Maples SNA is located within the Balcones Canyonlands subregion, which is an area of rugged terrain along the southern edges of the Edwards Plateau. Characteristic vegetation of this subregion consists of a scrub forest of Ashe juniper (*Juniperus ashei*), plateau live oak (*Quercus fusiformis*), Texas oak (*Quercus buckleyi*), and Texas persimmon (*Diospyros texana*) (LBJ School of Public Affairs, 1978).

The park contains many examples of "typical" Edwards Plateau flora. There are steep, rugged limestone canyons, springs, plateau grasslands, wooded slopes, and clear streams. The most notable floristic component found in the park is the relictual mesic bigtooth maple (*Acer grandidentatum*).

Lost Maples SNA consists of three major soil types. One type is the Orif-Karnes association which is on long, narrow, frequently flooded bottom lands parallel to and in the stream channels of rivers. This area contains many native grasses or is improved pasture. The area is usually too gravelly and the flood hazard is too severe for many plant species. The other two soil types are Tarrant-Rock outcrop, undulating and steep. Undulating areas have slopes that range from one to eight percent but are mainly four to six percent with exposed fractured limestone. The climax plant community here is a mixture of little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*) and others, as well as shin oak (*Quercus sinuata*), live oak, sumac (*Rhus* sp.) and other browse plants. Steep areas have slopes that range from about 20-40% which are composed of limestone cobblestone. Steep areas support a mixture of little bluestem, sideoats grama, and other grasses as well as forbs, low shrubs, and oak trees (Hensell et al., 1977).

In 1976, The Texas Parks and Wildlife Department conducted an initial vegetation inventory of

Lost Maples SNA. Eight habitat types were identified based on vegetation composition and structure (Anonymous, 1976). These habitat types are listed in Table 1.

On-site analysis performed during the early stages of this study yielded a slight difference in some of the plant communities inventoried by Texas Parks and Wildlife. Based upon the physiognomy of the vegetation and species composition in an area large enough to put a trap line or grid, six habitat types were detected. These six habitat types are represented by 13 permanent survey lines established during the coarse of the study. A description of these habitats and their subdivisions follows.

Eastern Gamagrass (EG).—A habitat type occurring along the edges of the Sabinal River. This area frequently is flooded after only a few inches of rainfall. This habitat type is characterized by one dominant plant, eastern gamagrass (*Tripsacum dactyloides*). This is a tall bunch grass with stems rising 1.5-3 m in height and forming 100% ground cover. This area frequently is burned during the winter months.

Bigtooth Maple-Oak Association (BMO).—A habitat type found on some steep canyons in the central part of the SNA. This association is dominated by bigtooth maple, Lacey oak (*Quercus laceyi*) and Texas oak (*Quercus buckleyi*). A 94.6% canopy cover was measured on this site. There is a substantial amount of leaf litter along with limestone outcrops and cobblestone. No grassy ground cover was noted at this site.

Texas Wintergrass-King Ranch Bluestem Association (TWKR).—An anthropogenic habitat type found in Orif-Karnes soil association. This flat area is only about 10 m above the Sabinal River so it is probably flooded every 100-500 years. It also is burned every 2-5 years to prevent the invasion of woody plant species. Dominant vegetation includes Texas wintergrass (*Stipa leucotricha*) and the introduced King ranch bluestem (*Bothriochloa ischaemum*). No woody vegetation was sampled in this habitat type and there is less than 42% bare ground.

Ashe Juniper (AJ).—A habitat type occurring mainly on the flat to gently sloping hilltops. Soils are extremely shallow with many areas of limestone outcrops. There are three permanent survey lines in this type of habitat composed of dense strands of Ashe juniper. No grass understory or ground cover exists in these areas due to the realitively shallow soil, dense Ashe juniper canopy and limestone outcrops.

AJ-1.—This permanent survey line contains 48.6% ground cover by Ashe juniper, 1.6% by mountain laurel (*Sophora secundiflora*) and 49.8% bare ground. No other plants occurred along transects at this site.

AJ-2.—This site contains no species other than Ashe juniper with a 52.3% ground cover.

AJ-3.—This site is composed mainly of Ashe juniper with 57.3% ground cover. The only other species noted at this site was Lacey oak which had a 12.1% ground cover.

Upland-Cleared-Burned Area (UCBA).—A managed habitat type found on some of the hilltops. Ashe juniper has been removed and this habitat type is burned every two years to prevent further invasion of woody species. The soils here are similar to the Ashe juniper habitat type with limestone outcrops. This habitat contains many species of fire adapted grasses and shrubs.

UCBA-1.—The dominant grasses at this site are Texas wintergrass and purple threeawn (*Aristida purpurea*) which have a ground cover of 20.5% and 10.5%, respectively. Other grasses include old field threeawn (*Aristida oligantha*) and King ranch bluestem with a combined ground cover of 3.25%. Mountain laurel and persimmon were the only woody species in this area, and they had a ground cover estimate of 7% and 1.7%, respectively. Bare ground constitutes 57.05% at this site.

UCBA-2.—This site contains many species of grasses and woody plants. The dominant grasses are Texas wintergrass, curleymesquite (*Hilaria belangeri*) and purple threeawn. Dominant woody vegetation consists of Texas persimmon and mountain laurel. In this area, bare ground constitutes up to 43.65% of the total.

Table 1. Major plant communities identified at Lost Maples SNA by the Texas Parks and Wildlife Department. A class description, conditions and percent of Lost Maples State Natural Area represented are given for each habitat type (Anonymous, 1976).

Major Plant Communities	Vegetation Class	Vegetation Condition	Percent of Area Represented
Ashe Juniper-Oak	evergreen woodland	good	43.7
Lacey Oak	deciduous forest	excellent	33.1
Little Blustem-Indiangrass	tall grassland	poor	10.1
Bigtooth Maple-Oak	deciduous woodland	excellent	3.4
Texas Oak	deciduous woodland	good	1.6
Bald Cypress-Sycamore	deciduous woodland	fair	1.4
Woody/Herb/Non-native-Native	deciduous shrubland	fair	3.2
Herb/Non-native-Native	old field	poor	0.7
	open water		0.4
	development		2.3

UCBA-3.—At this site, Texas wintergrass and King ranch bluestem are the dominant grasses with a ground cover of 30.25% and 13.75%, respectively. Dominant woody species are mountain laurel and agarita (*Berberis trifoliolata*) with a ground cover of 5.1% and 2.6%, respectively. Bare ground is estimated at 44.3%

Lacey Oak-Ashe Juniper Association (LOAJ).—This habitat type is found along the steep canyons throughout most of the SNA. Soils are extremely shallow with many limestone outcrops and cobblestone. Dominant vegetation consists of Lacey oak and Ashe juniper, which measured 90-100% canopy cover. This habitat type also contains an understory of shrubs, large amounts of leaf litter but no grasses. Four permanent survey lines were established in this habitat type, which represents the major habitat type at Lost Maples SNA.

LOAJ-1.—This site has a 62.9% ground cover of Lacey oak and 34% of Ashe juniper. Other species include Texas oak, walnut (*Juglans* sp.) and Mexican buckeye (*Ungnadia speciosa*). There is a 100% canopy cover at this site.

LOAJ-2.—This site has a 78.6% ground cover of Lacey oak and 15.5% of Ashe juniper. Bigtooth maple, Mexican buckeye and mountain laurel were the only other species sampled and they had a ground cover of 11.6%, 2.8% and 2.6%, respectively. Estimated canopy cover was 100%.

LOAJ-3.—This site has a 55.4% ground cover of Lacey oak and 35.1% of Ashe juniper. No other species were sampled at this site. Bare ground constituted 9.5%.

LOAJ-4.—This site contained only three species with more than 100% canopy cover (due to canopy overlap). Lacey oak has a 86.5% ground cover, while Ashe juniper and mountain laurel have 26.1% and 16%, respectively.

Table 2. The following mammalian species are reported in the literature as having a current or historical distribution within or bordering Lost Maples State Natural Area (Davis and Schmidly, 1994). The presence of a mammalian species is denoted by an X. V = verified species; P = possible occurrence; E = extirpated species; Geographic Distribution: SW = statewide; TP = Trans-Pecos; PC = Plains Country including the High Plains, Rolling Plains, Cross Timbers area and Edwards Plateau; RGP = Rio Grande Plains encompasses the South Texas Brushlands; ET = East Texas region includes the Pineywoods, Central Texas Woodlands, Blackland Prairies and Coastal Prairies and Marshes; EM = east of 100th meridian. Non-native mammals are not included in the geographic distribution.

Species	Common Name	V	P	E	Geographic Distribution
Didelphis virginiana	Virgina Opossum	X			SW
Cryptotis parva	Least Shrew		X		EM
Notiosorex crawfordi	Desert Shrew		X		TP, PC, RGP
Scalopus aquaticus	Eastern Mole		X		EM
Mormoops megalophylla	Ghost-faced Bat		X		TP, PC, RGP
Myotis velifer	Cave Myotis	X			TP, PC, RGP
Lasionycteris noctivagans	Silver-haired Bat		X		SW
Pipistrellus hesperus	Western Pipistrelle		X		TP, PC
Pipistrellus subflavus	Eastern Pipistrelle	X			EM
Lasiurus borealis	Eastern Red Bat	X			SW
Lasiurus cinereus	Hoary Bat		X		SW
Antrozous pallidus	Pallid Bat	X			TP, PC, RGP
Tadarida brasiliensis	Brazilian Free-tailed Bat	X			SW
Nycticeius humeralis	Evening Bat		X		EM
Plecotus townsendii	Townsend's Big-eared Bat		X		TP, PC
Nyctinomops macrotis	Big Free-tailed Bat		X		TP, PC, RGP
Dasypus novemcinctus	Nine-banded Armadillo	X			EM
Sylvilagus aquaticus	Swamp Rabbit		X		ET
Sylvilagus audubonii	Desert Cottontail		X		TP, PC, RGP
Sylvilagus floridanus	Eastern Cottontail	X			SW
Lepus californicus	Black-tailed Jackrabbit	X			SW
Spermophilus mexicanus	Mexican Ground Squirrel		X		TP, PC, RGP
Spermophilus variegatus	Rock Squirrel	X			TP, PC
Cynomys ludovicianus	Black-tailed Prairie Dog		X		TP, PC
Sciurus niger	Eastern Fox Squirrel	X			EM
Thomomys bottae	Botta's Pocket Gopher		X		TP, PC
Geomys texensis	Llano Pocket Gopher		X		PC
Perognathus merriami	Merriam's Pocket Mouse		X		TP, PC, RGP
Chaetodipus hispidus	Hispid Pocket Mouse		X		SW
Castor canadensis	American Beaver		X		SW
Reithrodontomys fulvescens	Fulvous Harvest Mouse		X		SW
Reithrodontomys montanus	Plains Harvest Mouse		X		TP, PC
Peromyscus attwateri	Texas Mouse		X		PC
Peromyscus leucopus	White-footed Mouse		X		SW
Peromyscus maniculatus	Deer Mouse	X			SW
Peromyscus pectoralis	White-ankled Mouse	X			TP, PC
Baiomys taylori	Northern Pygmy Mouse	X			EM
Sigmodon hispidus	Hispid Cotton Rat	X			SW
Neotoma albigula	White-throated Woodrat		X		TP, PC
Neotoma floridana	Eastern Woodrat		X		EM
Neotoma micropus	Southern Plains Woodrat		X		TP, PC, RGP
*Rattus norvegicus**	Norway Rat		X		

Table 2. (cont.)

Species	Common Name	V	P	E	Geographic Distribution
*Mus musculus**	House Mouse		X		
Microtus pinetorum	Woodland Vole		X		EM
Erethizon dorsatum	Porcupine	X			TP, PC
*Myocastor coypus**	Nutria	X			
Canis latrans	Coyote	X			SW
Canis lupus	Gray Wolf			X	TP, PC, RGP
Canis rufus	Red Wolf			X	EM
*Vulpes vulpes**	Red Fox		X		
Urocyon cinereoargenteus	Gray Fox	X			SW
Ursus americanus	Black Bear			X	SW
Bassariscus astutus	Ringtail	X			SW
Procyon lotor	Common Raccoon	X			SW
Nasua narica	White-nosed Coati			X	RGP
Mustela frenata	Long-tailed Weasel		X		TS
Mustela vison	Mink			X	EM
Taxidea taxus	American Badger		X		TP, RC, RGP
Spilogale gracilis	Western Spotted Skunk		X		TP, PC, RGP
Spilogale putorius	Eastern Spotted Skunk		X		EM
Mephitis mephitis	Striped Skunk	X			SW
Conepatus mesoleucus	Hog-nosed Skunk	X			TP, PC, RGP
Puma concolor	Mountain Lion	X			SW
Leopardus pardalis	Ocelot			X	RGP
Lynx rufus	Bobcat	X			SW
*Sus scrofa**	Feral Pig	X			
Pecari tajacu	Collared Peccary			X	TP, PC, RGP
*Cervus axis**	Axis Deer	X			
*Cervus nippon**	Sika Deer	X			
Odocoileus virginianus	White-tailed Deer	X			SW
Antilocarpa americana	Pronghorn			X	TP, PC, RGP
*Ovis ammon**	Four-horned Sheep	X			
*Ovis musimon**	Mouflon Sheep	X			
*Ammotragus lervia**	Auodad or Barbary Sheep	X			

*Exotic or introduced species

Results and Discussion

Relative Abundance.—In this study, we verified the presence of 32 mammalian species and herein report eight extirpated species and 34 species of possible occurrence within Lost Maples SNA (Table 2). A total of 6,250 Sherman trap-nights was used to document small rodent species along the permanent line transects. A total of 595 *Peromyscus pectoralis*, 36 *Sigmodon hispidus*, and 2 *Baiomys taylori* were captured along the permanent line transects during the study. Of the three small rodent species collected from the permanent line transects, only one species (*Baiomys taylori*) was unique to the Upland-Cleared-Burned Area (UCBA-1). All three species of rodents were found there. Two species occurred in two habitat types, while only one species occurred in the remaining 10 permanent line transects (Table 3).

Table 3. Results of a live-trap study on the Lost Maples SNA. Numbers indicate individuals captured per 100 trap nights. Numbers in parentheses indicate total number of animals captured. Abbreviations used are as follows: EG = eastern gamagrass; BMO = bigtooth maple-oak association; TWKR = Texas wintergrass-King ranch bluestem association; AJ = Ashe juniper; UCBA = upland-cleared-burned area; LOAJ = Lacey oak-ashe juniper association.

	HABITAT TYPES												
Species	EG	BMO	TWKR	AJ1	AJ2	AJ3	UCBA1	UCBA2	UCBA3	LOAJ1	LOAJ2	LOAJ3	LOAJ4
P. pectoralis (595)	9.4	14.9	11.0	19.0	13.6	10.8	4.4	10.7	4.8	12.4	6.8	8.6	3.8
S. hispidus (36)	1.7		2.3				0.1						
B. taylori (2)							0.2						
Total	11.1	14.9	13.3	19.0	13.6	10.8	4.7	10.7	4.8	12.4	6.8	8.6	3.8

Table 4. Population density estimates of Peromyscus pectoralis *for selected habitat types determined from mark-recapture studies. A modified Lincoln-Petersen (LP) index was used to calculate the number of* P. pectoralis *per hectare (Chapman, 1951). Population size also was estimated (with 95% confidence limits) using the program PETERSEN (PP) (Krebs, 1995). LCL = lower confidence limit; UCL = upper confidence limit; TWKR = Texas wintergrass-King ranch bluestem association; AJ = Ashe juniper; LOAJ = Lacey oak-Ashe juniper association; UCBA = upland-cleared-burned area.*

	HABITAT TYPES			
Date of Trapping	TWKR	AJ-2	LOAJ-4	UCBA-1
9-11 October 1998				
LP	44.9			
PP	44.2			
(LCL)	(34.89)			
(UCL)	(66.30)			
2-4 April 1999				
LP		11.9	7.0	
PP		11.57	4.0	
(LCL)		(9.30)	(0.87)	
(UCL)		(25.78)	(7.00)	
16-18 April 1999				
LP	11.0			16.3
PP	9.0			13.0
(LCL)	(4.19)			(6.2)
(UCL)	(594.1)			(143.8)
9-11 August 1999				
LP	9.0			5.0
PP	5.0			4.0
(LCL)	(1.33)			(2.34)
(UCL)	(9.00)			(37.92)

Peromyscus pectoralis was the dominant species along all line transects. Ashe juniper 1 had the highest total abundance of small rodents (19.0 individuals captured/100 trap nights), whereas Lacey oak-Ashe juniper 4 association had the lowest total abundance (3.8 individuals captured/100 trap nights). Species occurrence and relative abundance by habitat type are presented in Table 3.

Species Richness.—Species richness was compared at permanent line transects. The highest species richness (1.8619) was in the Texas wintergrass-King ranch bluestem grassland. The eastern gamagrass and upland-cleared-burned area 1 ranked second and third in species richness with values of 1.8544 and 1.5967, respectively. The remaining permanent survey lines had low species richness with values of 1.0000 because only one rodent species was collected at each of these 10 sites. Species richness was highest in habitats that are managed by periodic burning.

Species Diversity.—Species diversity for each habitat type ranged from 0 to 0.668. The most diverse habitat was in the Texas wintergrass-King ranch bluestem grassland. The trend for rodent species diversity was the same as species richness. The eastern gamagrass and upland-cleared-burned area 1 ranked second and third in species diversity. Only one species was found in the remaining habitat types which had species diversity values of 0. Species diversity also was highest in habitats that are frequently burned.

Comparison of Habitat Types.—Eastern gamagrass was one of only three permanent line transects which contained more than one species of rodent. Both *P. pectoralis* and *S. hispidus* were found in this dense grassland with a total abundance of 11.1 individuals captured per 100 trap nights (Table 3). This habitat had 100% ground cover but no diversity in food plants which probably limited the suitability of this habitat for other rodent species.

The bigtooth maple-oak association had only one rodent species (*P. pectoralis)* with an abundance value of 14.9 individuals per 100 trap nights (Table 3). Because of the substantial amount of leaf litter along with limestone outcrops, cobblestone, and no grassy ground cover, this area provides a limited habitat, presumably unacceptable to most rodent species.

The Texas wintergrass-King ranch bluestem grassland represented a very small area of the park. It had the highest species richness and diversity, even though only two species (*P. pectoralis* and *S. hispidus*) occurred there (Table 3). This ecotone lies near the base of deciduous woodland slopes and adjacent to linear riparian communities. This habitat also was selected for a mark-recapture study which showed a tremendous decrease in number of *P. pectoralis*, 44.2 - 44.9 per ha in October 1998 to 5.0 - 9.0 per ha in August 1999 (Table 4). Grass species sampled at this site accounted for 52% ground cover. Because of this limited diversity in food plants and relatively little ground cover, this habitat may not have been adequate for other rodent species. Also, this area was heavily infested with imported red fire ants. When fire ant activity increased, fewer rodents were captured. This could have contributed to the population decrease seen in the mark-recapture study.

The Ashe juniper habitat type had the highest abundance values, even though only one species (*P. pectoralis*) was found at all three permanent line transects (Table 3). A mark-recapture study was conducted 2-4 April 1999 along line transect Ashe juniper habitat type which yielded an estimated population size for *P. pectoralis* between 11.57 and 11.9 animals per ha (Table 4).

Upland-cleared-burned area 1 also had a somewhat limited rodent community. This was the only habitat where all three species of rodents were found. However, rodents were collected in relatively low numbers. In addition, this is the only habitat in which *B. taylori* occurred (Table 3). As with all areas where a mark-recapture study was conducted, this site showed a decrease in *P. pectoralis* population size of 13.0 - 16.3 per ha (in April, 1999) to 4.0 - 5.0 per ha (in August 1999) (Table 4). Only one rodent species (*P. pectoralis*) was found in upland-cleared-burned areas 2 and 3. Relative abundance values were 10.7 and 4.8 individuals captured per 100 trap nights, for these two areas, respectively. The upland-cleared-burned habitat areas are a managed habitat type found on some of the hilltops. Because this habitat type contains many fire adapted species of grasses and shrubs, there is adequate ground cover and a variety of food plants which provides a suitable habitat for multiple rodent species. Nevertheless, relative abundance of rodent

species were low, probably because of the large number of red fire ants encountered along the permanent line transects in this habitat type.

Four permanent line transects were established in the Lacey oak-Ashe juniper habitat type. Only one rodent species (*P. pectoralis*) was found at all four transects with relatively low abundance (Table 3). A mark-recapture study was conducted along transect Lacey oak-Ashe juniper 4 in April, 1999, which showed an estimated *P. pectoralis* population size of 4.0 - 7.0 individuals per ha (Table 4). This habitat type is similar to the bigtooth maple-oak association because there is a substantial amount of leaf litter along with limestone outcrops, cobblestone and no grassy ground cover.

ACCOUNTS OF SPECIES

The following 32 accounts of species inhabiting Lost Maples SNA are based on mammals collected or observed during this study. Additional information is presented from appropriate scientific literature. The arrangement of taxa and nomenclature follows Manning and Jones (1998). Habitat preference at Lost Maples SNA is included in each species account.

Didelphis virginiana virginiana
Kerr, 1792
Virginia Opossum

The opossum was neither collected nor observed during the course of this study. Park personnel have observed this marsupial in previous years scavenging trash cans near the campground. Opossums occupy a variety of habitats, including riparian areas, deciduous woodlands, grassy valleys, oldfields, prairies, and savannah areas on the Edwards Plateau (Goetze, 1998).

Myotis velifer incautus
(J. A. Allen, 1896)
Cave Myotis

Four cave myotis were caught in mist nets during the study. This bat also had a night roost in the maintenance barn. Generally, the cave myotis is associated with limestone formations and canyon areas on the Edwards Plateau (Goetze, 1998). This species is a colonial, cave dwelling bat that may roost in rock crevices, old buildings, under bridges, and even in abandoned cliff swallow nests (Davis and Schmidly, 1994). This is a new record for Bandera County.

Pipistrellus subflavus subflavus
(F. Cuvier, 1832)
Eastern Pipistrelle

Only one eastern pipistrelle was caught in a mist net over the Sabinal River during our study. This species frequently was observed at twilight flying above the tree canopy. These small bats are known to have daytime retreats in caves, crevices of cliffs, buildings, and other man-made structures offering concealment (Davis and Schmidly, 1994). The eastern pipistrelle appears to be a forest-edge species, inhabiting areas of relatively open tree canopy (Goetze, 1998).

Lasiurus borealis
(Müller, 1776)
Eastern Red Bat

The eastern red bat was a common species of bat observed in Lost Maples SNA. Preferred habitats of the red bat on the Edwards Plateau are riverine and riparian areas where they roost in tree foliage (Goetze, 1998). It is possible that some red bats observed were migrating, because they are known to frequent Mexico during winter months (Davis and Schmidly, 1994).

Antrozous pallidus pallidus
(Le Conte, 1856)
Pallid Bat

One pallid bat was caught near midnight on 10 August 1999. We observed pallid bats using the covered picnic tables as evening roosts. Pallid bats are known to inhabit rocky areas, usually near a source of water (Goetze, 1998). Pallid bats may roost in other areas such as caves, mine tunnels, attics of houses, under the eaves of barns, behind signs, in hollow trees and in abandoned adobe buildings (Davis and Schmidly, 1994). This is a new record for Bandera County.

Tadarida brasiliensis mexicana
(Saussure, 1860)
Brazilian Free-tailed Bat

The Brazilian free-tailed bat was the most frequently caught bat at Lost Maples SNA. Seven were caught in mist nets during our study. Most were netted along the Sabinal River near the maintenance barn. A single individual was captured under dense canopy cover along Can Creek. This species occupied a man-made bat house on the south side of the maintenance building, especially during spring and autumn migration. A few bats over-wintered during the winter months of 1998. The Brazilian free-tailed bat often roosts in large numbers in caves, but also utilizes hollow trees, rock crevices, buildings, culverts, bridges and cave swallow nests (Goetze, 1998).

Dasypus novemcinctus mexicanus
Peters, 1864
Nine-banded Armadillo

The nine-banded armadillo was found throughout Lost Maples SNA in all habitat types. It was one of the most common mammals observed in the park. Armadillos are known to occupy a variety of habitats throughout the Edwards Plateau, including stream and river-side habitats, grassy meadows, wooded uplands and rocky, juniper areas. However, all permanent habitats must have soil deep enough for the excavation of a burrow (Goetze, 1998). This is a new record for Bandera County.

Sylvilagus floridanus chapmani
(J. A. Allen, 1899)
Eastern Cottontail

Cottontails were observed primarily in the upland-cleared-burned areas. Occasionally, they were found in grassland areas along waterways. However, none was observed along the steep, rugged canyonlands. Other areas in which eastern cottontails reside include old fields, grassy valleys, upland woods, agricultural areas, edge habitats, mesquite grasslands and creosote scrub (Goetze, 1998). This is a new record for Bandera County.

Lepus californicus merriami
Mearns, 1896
Black-tailed Jackrabbit

Jackrabbits were observed only in the upland-cleared-burned areas on hilltops where there was a mixture of shrubs and grasses. They were relatively uncommon because they were restricted to these small areas of the SNA. Black-tailed jackrabbits are known to prefer areas of limited brush and sparse vegetation usually no more than one meter in height. They typically avoid areas of dense, tall vegetation or riparian areas where visibility is reduced (Goetze, 1998).

Spermophilus variegatus buckleyi
Slack, 1861
Rock Squirrel

The rock squirrel was observed in the steep, rugged canyonlands where there were areas of limestone outcrops and cobblestone. There usually was a dense tree canopy, little underbrush, and no grasses in these areas. Rock squirrels also frequented the bird feeder located outside the park office. They nearly always seek refuge and den in rocky areas such as cliffs, canyon walls, boulder piles, and fills along highways (Davis and Schmidly, 1994).

Sciurus niger limitus
Baird, 1855
Eastern Fox Squirrel

Eastern fox squirrels were common in riparian habitats along the Sabinal River and its tributaries. They frequently were seen foraging at the bird feeder outside the park office. Commonly, the largest populations of fox squirrels are supported by forests of mixed trees in a variety of habitats (Davis and Schmidly, 1994).

Peromyscus maniculatus pallescens
J. A. Allen, 1896
Deer Mouse

The only deer mouse taken at Lost Maples SNA was caught in a camper-trailer and given to us by a park guest. The guest had spent the previous week at Falcon Lake State Park, so it is not known, with absolute certainty, whether the mouse came from Lost Maples or somewhere else. These mice normally occupy a variety of habitats, but frequently are trapped in lowland, grassy valleys on the Edwards Plateau. This mouse may be found inhabiting fields, abandoned buildings and living as a commensal of humans in some areas (Goetze, 1998). This is a new record for Bandera County.

Peromyscus pectoralis laceianus
Bailey, 1906
White-ankled Mouse

The white-ankled mouse was the most abundant rodent on the property in all habitat types. This mouse was caught in the maintenance barn, an abandoned house, and storage sheds. The white-ankled mouse is known for inhabiting steep slopes and rocky ledges on the Edwards Plateau, but often is found in persimmon-shin oak and juniper-oak associations. It is less likely to be found in areas lacking rocky cover and rarely found in grassy, valley areas (Goetze, 1998).

Baiomys taylori taylori
(Thomas, 1897)
Northern Pygmy Mouse

Only two pygmy mice were captured in 7,000 trap-nights during the year long study. Both mice were taken in an upland-cleared-burned area. These mice frequently inhabit grassy areas, and they commonly are found in old fields and pastures (Davis and Schmidly, 1994). This is a new record for Bandera County.

Sigmodon hispidus texianus
(Audubon and Bachman, 1853)
Hispid Cotton Rat

The hispid cotton rat was caught in the Texas wintergrass-King ranch bluestem association, eastern gamagrass and in one upland-cleared-burned area. Hispid cotton rats prefer tall-grass areas that offer both a protective canopy cover and adequate food supply (Davis and Schmidly, 1994).

Erethizon dorsatum epixanthum
Brandt, 1835
Porcupine

Only two porcupines were observed during the course of our study. Both were sighted along densly wooded canyonlands. One large, mature animal was observed near a large limestone boulder. The other, an immature animal, was seen on the branch of a Texas oak tree. Porcupines prefer habitats of mixed hardwood and softwood trees throughout their range (Goetze, 1998).

Myocastor coypus *
Nutria

Nutrias were common at the ponds of Lost Maples SNA. One immature individual was collected

as a voucher specimen. Nutrias may cause damage to the man-made impoundments which form the ponds of Lost Maples SNA. Dens usually are constructed in mud banks along watercourses, lakes, and streams on the Edwards Plateau (Goetze, 1998).

Canis latrans texensis
Bailey, 1905
Coyote

Coyotes occupy wooded uplands, riparian areas, juniper scrub areas, rocky slope habitats, cropland habitats, savanna and prairie habitats on the Edwards Plateau (Goetze, 1998; Davis and Schmidly, 1994)). None was seen on the SNA, however their scat was found along roadways on hilltops.

Urocyon cinereoargenteus scottii
Mearns, 1891
Common Gray Fox

One juvenile gray fox was seen while spotlighting in a riparian area near the main campground. Gray foxes are more commonly found in the vicinity of rocky slopes, woodland-farmland edge habitats and mesquite pastures on the Edwards Plateau (Goetze, 1998).

Bassariscus astutus flavus
Rhoads, 1894
Ringtail

Only one ringtail was caught in a Tomahawk trap along a rock bluff adjacent to the Sabinal River. Ringtails live in a variety of habitats within their range, but they have a preference for rocky areas such as rock piles, stone fences, and canyon walls (Davis and Schmidly, 1994).

Procyon lotor fuscipes
Mearns, 1914
Common Raccoon

Raccoons were numerous at the SNA, especially around the main campground where there were plenty of food scraps left by campers. Raccoons were observed in every habitat of the park. Their preferred habitat on the Edwards Plateau includes riparian areas, mesic upland wooded areas, cultivated and abandoned farmlands, and in many cases, around human habitations (Goetze, 1998). This is a new record for Bandera County.

Mephitis mephitis varians
Gray, 1837
Striped Skunk

This mustelid is common throughout all regions of Texas. This species was not observed on the property, but was noted as road kills along the highways outside the park. Striped skunks generally inhabit wooded or brushy areas and their associated farmlands. Rocky outcrops are favored refuge sites, but they also will seek out burrows of foxes, armadillos, and other animals (Davis and Schmidly, 1994).

Conepatus mesoleucus mearnsi
Merriam, 1902
Common Hog-nosed Skunk

The hog-nosed skunk is another species that was observed as road killed outside the park, but was not seen on the property. These skunks usually prefer habitats in more xeric areas of rocky uplands and slopes. Unlike the striped skunk, hog-nosed skunks seldom are found around human habitations (Goetze, 1998).

Puma concolor stanleyana
Goldman, 1938
Mountain Lion

A mountain lion was observed by two different hunters in the same area at two different times in January, 1999. An official report of the sighting was filed with the Texas Parks and Wildlife Department. The animal was seen along Can Creek in a Lacey oak-Ashe juniper association. On the Edwards Plateau, mountain lions prefer rocky, precipitous canyons, escarpments, rimrocks, or dense brush (Goetze, 1998; Davis and Schmidly, 1994).

Lynx rufus texensis
J. A. Allen, 1895
Bobcat

Although the bobcat was not observed during our study, park personnel verified their occurrence at Lost Maples SNA in the past. Bobcats occupy a variety of habitats, but they have a decided preference for rocky canyons or outcrops when such areas are available. In areas with few rocks, bobcats resort to thickets for protection and dens sites (Davis and Schmidly, 1994).

Sus scrofa *
Feral Pig

There were many wallows and other sign left by feral pigs throughout the park. Feral pigs occasionally are struck by automobiles, and one individual was seen dead on the roadway immediately south of Lost Maples SNA. Common habitats of feral pigs on the Edwards Plateau are upland wooded areas, riparian areas, and the margins of agricultural lands (Goetze, 1998).

Cervus axis *
Axis Deer

A hunter harvested an axis deer during January, 1999, at Lost Maples SNA. Free-ranging axis deer were seen along the highways near the SNA. Axis deer generally avoid rough terrain, while inhabiting grasslands and open woodlands (Goetze, 1998).

Cervus nippon *
Sika Deer

Sika deer, especially females, often were seen feeding in upland-cleared-burned areas of the SNA. Their preferred habitats on the Edwards Plateau are upland woods and edge habitats along streams (Goetze, 1998).

Odocoileus virginianus texana
(Mearns, 1898)
White-tailed Deer

White-tailed deer are common on Lost Maples SNA. They were observed in all habitat types, but most frequently were seen in the upland-cleared-burned areas or in a riparian community. Two skulls were salvaged at Lost Maples SNA. These are new records for Bandera County.

Ovis ammon *
Four-horned Sheep

Four-horned sheep, sometimes known as Max Lotham sheep, are a selectively bred exotic that yields only about 10% four-horned offspring (Mungall and Sheffield, 1994). Two males were observed in August in a Lacey oak-Ashe juniper association.

Ovis musimon *
Mouflon Sheep

Mouflon sheep have become well established on the property. They most often are found along the steep canyonlands and pastures during morning and afternoon grazing. At midday they are known to lounge in shaded areas (Mungall and Sheffield, 1994).

***Ammotragus lervia* ***
Auodad or Barbary Sheep

Auodad, also known as barbary sheep, were not as abundant as mouflon sheep. Similar to the mouflon, they were seen feeding in the upland-cleared-burned areas and occupying steep canyonlands or cedar hilltops. On the Edwards Plateau, these sheep usually occupy steep, rocky terrain (Goetze, 1998).

Species of Postulated Occurence

The following 34 accounts of mammalian species were reported in the literature as having a distribution within or bordering Lost Maples SNA (Davis and Schmidly, 1994), but were not collected or observed during this study. These mammals may be found within Lost Maples SNA with further census activities.

Cryptotis parva parva
(Say, 1823)
Least Shrew

The distribution of this shrew includes the eastern part of Bandera County. A record is available from Bexar County. Least shrews are likely to be found in areas of dense grasses, riparian, and wooded areas where leaf litter covers the soils (Goetze, 1998). They probably are excluded from Lost Maples SNA because of unsuitable edaphic conditions.

Notiosorex crawfordi crawfordi
(Coues, 1877)
Desert Shrew

The desert shrew may occur in a variety of habitats including semidesert scrub and other xerophytic vegetation. Records are available from the adjacent counties of Bexar, Kerr, and Medina (Goetze, 1998).

Scalopus aquaticus alleni
Baker, 1951
Eastern Mole

The distribution of the eastern mole extends through the eastern half of Bandera County, but not within Lost Maples SNA. This mole could occur within Lost Maples SNA in loamy, well-drained soils. Such areas include river and stream valleys with deep soils. The closest known record of occurrence is in Bexar County (Goetze, 1998).

Mormoops megalophylla megalophylla
(Peters, 1864)
Ghost-faced Bat

Ghost-faced bats inhabit caves on the southern Edwards Plateau (Goetze, 1998). These bats also may roost in buildings. The nearest known records of occurrence are from Bexar, Kinney, Medina, and Uvalde counties (Davis and Schmidly, 1994).

Lasionycteris noctivagans
Le Conte, 1831
Silver-haired Bat

Silver-haired bats utilize trees as roosting sites. This bat may also roost in buildings, rock crevices, caves, and mines. A record from Bandera County is available (Goetze, 1998). This bat is to be looked for during spring and autumn migration.

Pipistrellus hesperus maximus
Hatfield, 1936
Western Pipistrelle

The western pipstrelle occurs on the western portion of the Edwards Plateau. The nearest species records come from Uvalde and Edwards counties. The western pipistrelle usually roosts in rocky habitats, within burrows and buildings. Night roosts may include trees, bushes, buildings, and other locations within a foraging area (Goetze, 1998).

Lasiurus cinereus cinereus
(Palisot de Beauvois, 1796)
Hoary Bat

The hoary bat ranges over all of Texas, but few records exist from the Edwards Plateau region. Records are available from the counties surrounding Bandera, including Bexar, Kerr, Comal, Blanco, and Kimble. These bats are found in riparian areas, wooded uplands, juniper scrub, and other habitats on the Edwards Plateau (Goetze, 1998). Like the silver-haired bat, this species is likely to occur here during spring and autumn migration.

Nycticeius humeralis humeralis
(Rafinesque, 1818)
Evening Bat

Evening bats frequent forested areas and watercourses, and utilize hollow trees as roosting sites. They use attics of houses and other man-made structures when natural sites are not available. Records are available from Bandera, as well as the adjacent counties of Kerr and Real (Davis and Scmidly, 1994).

Plecotus townsendii pallescens
(Miller, 1897)
Townsend's Big-eared Bat

Townsend's big-eared bat is not restricted to specific vegetative associations throughout its range. Its distribution is correlated with rocky country. The nearest records to Lost Maples SNA are from Kimble and Edwards counties (Goetze, 1998).

Nyctinomops macrotis
(Gray, 1839)
Big Free-tailed Bat

This species roosts in caves, along rocky cliffs, and in buildings. Its distribution covers the western and southern edges of the Edwards Plateau. However, there is no record of this bat from the region. The nearest records are from Brewster and Lubbock counties (Goetze, 1998).

Sylvilagus aquaticus
(Bachman, 1837)
Swamp Rabbit

The swamp rabbit is found primarily in eastern parts of the Edwards Plateau. Specimens are available from Bexar, Medina, Kerr and Comal counties. Swamp rabbits are restricted to swamps, river bottoms, and lowland areas throughout their range (Goetze, 1998).

Sylvilagus audubonii parvulus
(J. A. Allen, 1904)
Desert Cottontail

The desert cottontail ranges throughtout the western portions of the Edwards Plateau. Records closest to Lost Maples SNA are from Edwards, Kerr, and Val Verde counties. The desert cottontail occurs in arid habitats and may be found in oldfield habitats, mesquite pastureland, and other brushy areas (Goetze, 1998).

Spermophilus mexicanus parvidens
Mearns, 1896
Mexican Ground Squirrel

The Mexican ground squirrel occurs throughout the Edwards Plateau in level grasslands associated with mesquite, creosote, and cactus. They may also be found inhabiting overgrazed pasturelands. This species is the most common ground squirrel residing on the Edwards Plateau. Records near Lost Maples are available from Kerr and Medina counties (Davis and Schmidly, 1994).

Cynomys ludovicianus ludovicianus
(Ord, 1815)
Black-tailed Prairie Dog

The black-tailed prairie dog's distribution includes the eastern half of Bandera County. The nearest record to Lost Maples SNA is from Bexar County. Black-tailed prairie dogs once were common in plains

grassland areas throughout its range. Deep soils and open, grassy areas are the preferred habitats (Goetze, 1998). Due to the limited availability of these areas, this species is not likely to be found at Lost Maples SNA.

Thomomys bottae confinalis
Goldman, 1936
Botta's Pocket Gopher

Pocket gophers are not likely to be found within Lost Maples SNA because they are limited in distribution by the presence of suitable soils. These pocket gophers are found along riparian areas and areas of cultivated land on the Edwards Plateau. The nearest records are from Kerr, Edwards, and Uvalde counties (Goetze, 1998).

Geomys texensis texensis
Smolen, Pitts, and Bickham, 1993
Llano Pocket Gopher

The distribution of the Llano pocket gopher extends through the eastern half of Bandera County. The closest records are available from Medina and Uvalde counties. This species may be found inhabiting valley areas and fluvial soils at the margins of rivers and streams. Shallow coarse soils generally are avoided (Goetze, 1998).

Perognathus merriami merriami
J. A. Allen, 1892
Merriams's Pocket Mouse

Merriam's pocket mouse is known to occur in rocky habitats with interspersed midgrass species, such as sideoats grama. They also may be found in grassland valley habitats on the Edwards Plateau. Habitats with dense ground cover usually are avoided. This species is known from Bandera County (Goetze, 1998).

Chaetodipus hispidus hispidus
(Baird, 1858)
Hispid Pocket Mouse

The hispid pocket mouse is found in a variety of dry, grassland habitats. This pocket mouse is an inhabitant of mesic valleys, watercourse vegetation, rocky, juniper habitats, and pasturelands throughout the Edwards Plateau. The nearest records are from Bexar, Kerr, Edwards, and Kinney counties (Goetze, 1998).

Castor canadensis texensis
Bailey, 1905
American Beaver

Beavers are restricted to areas near permanent water. They commonly occur in large rivers, impoundments, and large lakes with relatively stable water levels. The closest record of occurrence of beavers are from the adjacent counties of Real and Bexar (Goetze, 1998).

Reithrodontomys fulvescens laceyi
J. A. Allen, 1896
Fulvous Harvest Mouse

The fulvous harvest mouse favors weedy and overgrown habitats. Grassy areas, possibly including rock outcrops, cactus, and brush are commonly utilized habitats. The nearest records to Lost Maples SNA are from Bexar and Kerr counties (Goetze, 1998).

Reithrodontomys montanus griseus
Bailey, 1905
Plains Harvest Mouse

These mice prefer grassy and weedy habitats. Other suitable habitats include hayfields, moderately grazed pastures, brushy habitats, riparian areas and abandoned fields. The plains harvest mouse has been reported from the adjacent counties of Bexar and Kerr (Goetze, 1998).

Peromyscus attwateri
(J. A. Allen, 1893)
Texas Mouse

The Texas mouse most often is found inhabiting juniper covered slopes on the Edwards Plateau. Level, grassy areas and meadows generally are avoided. The Texas mouse ranges through most of the southern counties of the Edwards Plateau, including Bandera (Goetze, 1998).

Peromyscus leucopus texanus
(Woodhouse, 1853)
White-footed Mouse

On the Edwards Plateau, the white-footed mouse is associated with level, brushy pasture lands. Generally, it is not trapped in rocky, broken terrain. Records nearest to Lost Maples SNA are from Bexar, Kendall, Kerr, Real, and Uvalde counties (Goetze, 1998).

Neotoma albigula albigula
Hartley, 1894
White-throated Woodrat

The white-throated woodrat occurs in a variety of habitats on the Edwards Plateau including rocky slopes, juniper, sagebrush, and other arid-land vegetation. Nearby records are available from Edwards, Kerr, and Uvalde counties (Goetze, 1998).

Neotoma floridana attwateri
Mearns, 1897
Eastern Woodrat

The woodrat is limited to mesic, upland habitats and riparian areas on the Edwards Plateau. Records are available from Edwards, Kerr, and Bexar counties (Davis and Schmidly, 1994).

Neotoma micropus micropus
Baird, 1855
Southern Plains Woodrat

The southern plains woodrat primarily is found in valley pastures and around watercourses throughout most of the Edwards Plateau. Records near Lost Maples SNA are from Bexar, Kerr, and Uvalde counties (Goetze, 1998).

Rattus norvegicus *
Norway Rat

The Norway rat is common in urban environments throughout most of Texas. They are sometimes found in and around human habitations in rural areas (Manning and Jones, 1998). Records exist from Kerr and Bexar counties (Goetze, 1998).

Mus musculus *
House Mouse

The house mouse is common in and around human habitations throughout the Edwards Plateau. Feral populations also exist in weedy, overgrown areas. Records exist for Blanco, Coke, Comal, Runnels, and Tom Green counties in the region (Goetze, 1998).

Microtus pinetorum auricularis
Bailey, 1898
Woodland Vole

This species is known from the Edwards Plateau from only a few specimens collected in Kerr and Gillespie counties. Well drained soils, with a thick ground cover of leaf litter, grassy areas and old brush piles are favored habitats on the Edwards Plateau. The woodland vole may now be extirpated from this region (Goetze, 1998).

***Vulpes vulpes fulva* ***
(Desmarest, 1820)
Red Fox

The red fox has a distribution that ranges through the eastern half of Bandera County. Nearby records exist for Kerr, Kimble, Bexar, and Comal counties. This fox may be found in oak-juniper upland, edge habitats, intermixed cropland-woods, rolling farmlands, brushy areas, and pastureland habitats on the Edwards Plateau (Goetze, 1998).

Mustela frenata texensis
Hall, 1936
Long-tailed Weasel

Long-tailed weasels occupy a variety of habitats, but may be more common in riparian areas and in upland or wooded habitats on the Edwards Plateau. Specimens are known from Bexar, Gillespie, and Kerr counties (Goetze, 1998).

Taxidea taxus berlandieri
Baird, 1858
American Badger

Badgers usually are found in open habitats and grasslands. Heavily wooded areas and areas with shallow, rocky soils usually are avoided. The badger's range covers the entire Edwards Plateau. The nearest record to Lost Maples SNA is from Kerr County (Goetze, 1998).

Spilogale gracilis leucoparia
Merriam, 1890
Western Spotted Skunk

Spotted skunks often are found in rocky areas, but may also occur in the vicinity of farmsteads, old fields, upland woods, and canyon drainages. Records exist from Bexar, Kendall, Kerr, and Uvalde counties (Goetze, 1998).

Spilogale putorius interrupta
(Rafinesque, 1820)
Eastern Spotted Skunk

The eastern spotted skunk's distribution borders Lost Maples SNA. Records exist from the surrounding counties of Kerr, Kendall, Bexar, and Medina. This skunk usually is found in wooded areas, tall-grass prairies, and rocky areas (Davis and Schmidly, 1994).

Conclusions

Lost Maples SNA has a history of overgrazing which resulted in deleterious effects on wildlife communities. When the property was acquired nearly 30 years ago, intensive grazing by livestock and exotic game animals had removed virtually all vegetation below one meter in height (David Riskind, personal communication). Currently, the park is in a state of recovery. Even though livestock and most exotic game animals have been removed for some time, habitat types are not diverse. Vegetation is essential for all animals because mixtures of plant species provide food, cover, and in some circumstances, water. Because of low vegetative diversity within Lost Maples SNA, there is a low mammalian diversity.

Peromyscus pectoralis was the most abundant rodent in all habitats sampled throughout Lost Maples SNA. From our population density estimates, *P. pectoralis* population numbers fluctuated by season and habitat (Table 4). The highest numbers of white-ankled mice have been reported in habitats with woody vegetation and steep rocky slopes on the Edwards Plateau (Baccus and Horton, 1984). This habitat represents the majority of Lost Maples SNA.

The two other rodent species taken along permanent line transects, *S. hispidus* and *B. taylori,* exhibited an affinity for upland and lowland grassy areas. Both mice commonly are found in grassy habitats that offer protective canopy cover and adequate food supply (Davis and Schmidly, 1994).

Grasslands within Lost Maples SNA represent isolated, biogeographic islands. Even though grasslands represent the smallest area of the park, they are the most diverse in plant and animal species. However, there is a low rodent diversity at Lost Maples SNA.

Throughout the study, one of the main contributing factors to low rodent abundance might be attributed to imported red fire ants. They were especially common in grassland areas where there was some soil. These introduced pests not only removed bait from traps, but killed small rodents that had been captured. They are aggressive and may remove or prevent the establishment of many vulnerable mammalian species (Allen et al., 1994).

With the continual recovery of vegetation from prior degradation, future mammalian research should be conducted along the same permanent line transects in Lost Maples SNA. Differences in species composition, relative abundance, and distribution should be monitored. Future research can be used as an indicator of habitat quality and to ascertain if management practices are improving biodiversity of native flora and fauna.

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Addresses of Authors:

BRIAN K. MCGEE

Department of Biology
Southwest Texas State University
San Marcos, Texas 78666

RICHARD W. MANNING

Department of Biology
Southwest Texas State University
San Marcos, Texas 78666
e-mail: rm11@swt.edu

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It was through the efforts of Horn Professor J Knox Jones, as director of Academic Publications, that Texas Tech University initiated several publications series including the Occasional Papers of the Museum. This and future editions in the series are a memorial to his dedication to excellence in academic publications. Professor Jones enjoyed editing scientific publications and served the scientific community as an editor for the Journal of Mammalogy, Evolution, The Texas Journal of Science, Occasional Papers of the Museum, and Special Publications of the Museum. It is with special fondness that we remember Dr. J Knox Jones.

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