Small mammal abundance and distribution in the Missouri River Breaks, Montana
by Robert Garst Trout

A thesis submitted in partial fulfillment of MASTER OF SCIENCE in Zoology
Montana State University

Abstract:
Objectives of this study were to obtain seasonal population indices for small rodents in major vegetation types, to estimate home range size, density, turnover rate, and seasonal population changes of small rodents in two vegetation types, to obtain population indices for leporids, and to obtain quantitative measurements of vegetation types sampled for small mammals. Field work for this study of small mammal abundance and distribution in the Missouri River breaks, northeastern Fergus County, Montana, was conducted on a full time basis from,April through September, 1976, and from June through August, 1977. Methods used were snap-trap lines, j live trap grids, headlight surveys, pellet group counts, and a toe ! point method of measuring vegetation. Peromyscus maniculatus was s the most abundant and widely distributed small mammal trapped. There] were few significant differences in the mean number of captures of P. maniculatus per 100 trap nights among vegetation types within : trap periods due to the wide variation in this index among lines ' within a vegetation type. Indices for the Artemesia tridentata- Agropyron Smithii, Pinus ponderosa-Juniperus scopulorum3 Sarcobatus ' \ vermiculatus-Agropyron Smithii, Artemesia tridentata-Agropyron smithii- ' Agropyron Spicatum, Pseudotsuga menziesii—Juniperus scopulorum, and : Artemesia cana-Agropyron smithii vegetation types for all trap periods \ combined were 3.27, 2.29, 6.48, 2.20, 3.22, and 3.72, respectively.

Population indices for P. maniculatus were low in early summer but I increased by late summer. A late summer decline in breeding activity was observed. Density estimates of P. maniculatus on the Artr-Agsm : and Save-Agsm live trap grids ranged from 1.18/ha-3.29/ha and 1.16/ha- I 3.87/ha, respectively. No significant differences were found among the average home range sizes of .39 ha, .26 ha, .11 ha, and .35 ha I for adult males, adult females, juvenile males, and juvenile females, ' respectively. Turnover of P. maniculatus had a direct relationship i with the length of the interval between trapping series. Other species ; trapped were Onychomys leucogaster, Spermophilus tridecemlineatus, Eutamias minimus, Zapus princeps, Lagurus Curtatus, Dipodomys Ordii, \ and Microtus sp. Leporid indices were similar in 1976 and 1977 and • showed an increase from early to late summer. The Arca-Agsm and Save-Agsm vegetation types had the highest concentrations of leporids.

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ABSTRACT

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Introduction

The importance of small mammals to coyotes as a food source has been documented (Hawthorne 1972; Korschgen 1972; Sperry 1941; Stoddart and Wagner 1972); thus, the abundance of small mammals as alternative prey species is an important consideration in an investigation of coyote-deer interactions (Leopold 1933). This study of the abundance and distribution of small mammals is part of a larger project initiated by the Montana Department of Fish and Game in January, 1976, to examine the relationships between coyotes and deer. Although information on abundance and distribution of small mammals in northern plains habitats is available (Birney 1974; Cada 1968; Dusek and McCann 1974; French and Grant 1974; Lampe, et al. 1974; Maxwell and Brown 1968; Pefaur and Hoffmann1975), baseline information on small mammal populations was needed in the specific study area where the Department of Fish and Game project was located. The study area was located in a portion of the Missouri River breaks and adjacent prairie, northeastern Fergus County, Montana. Censusing of small mammals by snap-trapping, live trapping, and road surveys was begun in April, 1976, and was conducted on a full time basis through September, 1976, and from June through August, 1977.

Specific objectives in this study were fourfold: (1) to obtain seasonal population indices of small rodents for the major vegetation types found in the study area; (2) to estimate home range size, density, turnover rate, and seasonal population changes of small rodents in two

vegetation types; (3) to obtain population indices for leporids in relation to month, year, and vegetation type; (4) to describe the vegetation in the vegetation types sampled for small rodents.

STUDY AREA

The study area, in northeastern Fergus County, Montana was bounded on the north by the Missouri River, on the east by the Fergus-Petroleum county line, on the south by Crooked Creek, and on the west by Highway 191. It had an approximately 517 km^2 (200 mi^2).

Topography of the area has been influenced by the Missouri River. The terrain near the river is rough with intermittent streams forming a pattern of deep coulees interspersed with flat-topped ridges. The southern portion of the area is not as rugged, with undulating hills and little change in elevation. Height above sea level in the area ranges from approximately 701 m (2250 ft) on the river to approximately 966 m (3,100 ft) on the southern edge.

The soils, as described by Gieserker (1938), are primarily clay loams of the Lismas and Pierre Series derived from the Bearpaw Formation. These "gumbo" soils are alkaline and relatively impermeable to water, but become very heavy when wet.

The semi-arid climate is characterized by extremes in temperature and low amounts of rainfall. Records from the Roy 8 NE weather station (Climatological Data, 1975, 1976, 1977) show average temperature of $-8^{o}C$ ($17^{o}F$) for January and $21^{o}C$ ($70^{o}F$) for July (Table 1). Precipitation, falling mostly in the spring and summer, was high in 1975 and near the 29 year mean in 1976 and in 1977 through August. The number of days with snow cover of seven centimeters or more from November, 1976, through April, 1977, averaged 12 days a month.

Table 1. Monthly precipitation totals and days per month with seven cm snow cover for 1975, 1976, and 1977 through August and the 29 year means for monthly precipitation totals and average monthly temperature. These data were recorded at the National Oceanic and Atmospheric Administration Weather Station, Roy 8 NE. (Precipitation is given in centimeters and temperature in degrees Celsius.)

	29 Year Mean		1975		1976		1977	
Month	Precip.	Temp.	Precip.	# Days with seven cm Snow Cover	Precip.	# Days with seven cm Snow Cover	Precip.	# Days with seven cm Snow Cover
Jan.	1.14	-8.27	2.08	2	.33	9	3.12	31
Feb.	1.02	-4.77	.51	17	1.70	1	.51	9
Mar.	1.47	-1.38	2.03	20	1.06	8	5.26	4
Apr.	2.69	6.27	8.81	10	2.84	1	.51	5
May	6.35	11.83	8.05	0	2.54	0	6.76	0
June	8.45	15.94	11.86	0	9.80	0	4.01	0
July	3.86	20.83	7.72	0	2.97	0	5.97	0
Aug.	3.27	19.88	7.26	0	2.56	0	6.15	0
Sept.	2.97	13.77	.99	0	2.87	0		
Oct.	1.93	8.44	3.47	0	1.72	0		
Nov.	1.24	.22	2.99	7	1.57	6		
Dec.	.93	-4.94	1.29	17	.40	7		
Total	35.32		57.06	73	30.36	32	32.29*	49*

* Totals from January-August.

The vegetation of the area reflects the soil and climate of the region. The ridge-tops of the breaks, and the plains to the south, are shrub-grasslands dominated by *Artemesia tridentata* (Big Sagebrush) and *Agropyron smithii* (Western Wheatgrass). The slopes in the breaks are timbered, either with *Pseudotsuga menziesii* (Douglas Fir) or *Pinus ponderosa* (Ponderosa Pine) (Mackie 1970).

Livestock grazing on the area was begun in the 1800's by large cattle companies and continued to the early 1900's. At that time, homesteaders settled the area and attempted to raise small grains. In the 1920's and again in the 1930's drought conditions led to the abandonment of cultivation and grazing again became the major land use (Gieserker, et al. 1953).

METHODS

Snap-trap index lines were the primary method used to examine the abundance and distribution of small mammals on the study area. Live trapping was used to supplement the snap-trapping. Headlight surveys and pellet group counts were used to obtain information on leporid populations. The vegetation of the live trap and snap-trap sites was described with quantitative measurements.

Snap-Trapping

Snap-trap index lines consisted of 20 stations placed 15 m apart with two traps per station. Victor Rat Traps were used exclusively. A mixture of one half moist rolled oats and one half peanut butter was used for bait. Lines were set out in the late afternoon or evening. They were checked and rebaited the following two mornings, then picked up the third. Traps were left operational during the day to be available to diurnal mammals.

Vegetation types to be sampled for small mammals were classified after a review of Mackie's (1970) vegetational description and a period of field reconnaissance. The term vegetation type refers to the actual vegetation on a site. One to four stands in each selected vegetation type were sampled with a snap-trap index line during each trap period.

Sites trapped in 1976 were trapped again in 1977. The sample size was increased in 1977 by trapping several additional sites in each vegetation type. Total number of different sites trapped in each vegetation type are shown in Table 2. Homogeneity of the vegetation

Table 2. The number of sites sampled for small mammals with a snap-trap line in each vegetation type in each trapping period and the total number of sites trapped for each vegetation type.

Vegetation Type	Trap Period[1] I	II	III	IV	V	Total Number of Sites
Pinus ponderosa-Juniperus scopulorum (Pipo-Jusc)	3	3	*	4	4	8
Artemesia tridentata-Agropyron smithii (Artr-Agsm)	3	3	2	4	4	10
Sarcobatus vermiculatus-Agropyron smithii (Save-Agsm)	3	3	*	4	4	8
Artemesia tridentata-Agropyron smithii-Agropyron spicatum (Artr-Agsm-Agsp)	3	3	*	4	4	8
Pseudotsuga menziesii-Juniperus scopulorum (Psme-Jusc)	2	1	*	2	2	4
Artemesia cana-Agropyron smithii (Arca-Agsm)	*	*	3	4	3	10
Populus sargentii-Symphoricarpos occidentalis (Posa-Syoc)	3	3	*	*	*	6
Upland Swales	3	*	*	*	*	3
Agricultural Edges	3	3	*	*	*	6
Total	23	19	5	22	21	63

1 Dates for trap period were: I, May 5-June 6, 1976; II June 28-August 10, 1976; III, April 16-18, 1977; IV, June 22-July 8, 1977; V, August 23-September 5, 1977.

* Indicates no sampling during trap period.

between stands within a given type was tested by comparing the frequency of occurrence of selected plant taxa at each stand sampled. Sites trapped are shown in Figure 1.

During the course of the study there were five snap-trapping periods: Trap Period I, May 6-June 5, 1976; Trap Period II, June 28-August 10, 1976; Trap Period III, April 16-18, 1977; Trap Period IV, June 22-July 8, 1977; Trap Period V, August 25-September 5, 1977.

An index of abundance, the number of captures per 100 trap nights, was calculated for each line for *Peromyscus maniculatus* Wagner (deer mouse). This calculation was based on 120 trap nights per line. In 1977 this index was also calculated using 120 trap nights minus the number of snapped or baitless traps (Schladweiler 1976). Mean number of captures per 100 trap nights for *P. maniculatus* was calculated for each vegetation type within a trap period, each trap period, and each vegetation type through all trap periods. Analyses of variance were performed on the data and the means were compared. Data recorded for species other than *P. maniculatus* were species, site, and date captured.

Two age classes, adult and juvenile, were recognized for *P. maniculatus*. Reproductive tracts of *P. maniculatus* were examined. Females considered to be in reproductive condition were those with embryos or placental scars. Males with testes lengths of 8 mm or greater were classified as being in reproductive condition (Sheppe 1963).

Live Trapping

A 15 X 15 live trap grid was placed in an *Artemesia tridentata*-

Key to Map Symbols

A Artr-Agsm Live Trap Grid
B Save-Agsm Live Trap Grid

a Artr-Agsm Snap-Trap Sites
b Save-Agsm Snap-Trap Sites
c Pipo-Jusc Snap-Trap Sites
d Artr-Agsm-Agsp-Snap-Trap Sites
e Psme-Jusc Snap-Trap Sites
f Arca-Agsm Snap-Trap Sites
g Posa-Syoc Snap-Trap Sites
h Agricultural Edge Snap-Trap Sites
i Upland Swales Snap-Trap Sites

Figure 1. Map of study area showing snap-trap lines and live trap grid sites. Scale: .756cm = 1 mi.