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ECOLOGY OF THE BLACK-FOOTED FERRET AND  
THE BLACK-TAILED PRAIRIE DOG

BY

ROBERT G. SHEETS

A thesis submitted  
in partial fulfillment of the requirements for the  
degree Master of Science, Major in  
Wildlife Biology, South Dakota  
State University

1970

ECOLOGY OF THE BLACK-FOOTED FERRET AND  
THE BLACK-TAILED PRAIRIE DOG

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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ECOLOGY OF THE BLACK-FOOTED FERRET AND  
THE BLACK-TAILED PRAIRIE DOG

Abstract

ROBERT G. SHEETS

Research involving the black-footed ferret (Mustela nigripes) and black-tailed prairie dog (Cynomys ludovicianus) was conducted during 1968 and 1969.

Eighteen prairie dog burrows were excavated in 1968 and 1969. Burrow systems ranged from 13 to 109 feet long and 3 to 14 feet deep. Fifteen of the burrows exhibited dome-shaped entrances leading to a gradually descending passageway which made an abrupt vertical ascent to a crater-shaped entrance. Nest chambers were found in 6 burrows. Earthen plugs created by prairie dogs in burrows after ferret departure ranged from 9 to 33 feet long. Eighty-two ferret scats were recovered. Animal remains found in ferret scats were mouse (86 percent) and prairie dog (14 percent). Mouse remains occurred in 32 percent of the scats in 1968 on a town which had four young ferrets and 9 percent in 1969 with one young ferret on the town. Rabbit hair was recovered from the intestine of one roadkilled ferret.

Although prairie dog activity appeared to peak at 8:00 a.m. and 8:00 p.m. during the last two weeks of July, least variation among counts occurred in mid afternoon. Counts throughout the summer of 1969 indicated optimum censusing conditions existed on a still, overcast afternoon within a temperature range of 74 to 76°F. Five to 41

counts were required to detect changes of 10 percent in population with a probability of 0.95 under these optimum conditions.

The number of prairie dogs on a town with five ferrets in 1968 and two in 1969 decreased 16 percent from 1968 to 1969 while counts on three other towns increased 19, 42 and 28 percent. One ferret was reported seen one morning in 1968 on the town that increased 28 percent. The town decreasing in prairie dog population differed significantly ( $P < 0.01$ ) in population change from the others.

Prairie dogs were observed creating curved trough-like formations on their mounds that could be confused with earthen trenches created by ferrets. Unlike the prairie dog troughs, ferret trenches were usually straight and often extended off the burrow mound.

Two ferrets were captured with snares and three were live trapped for ear marking by notches and tags; live trapping proved more convenient. Both markings were readily observable at a distance of 30 yards with aid of 7x50 binoculars.

## INTRODUCTION

The first recorded sighting of the black-footed ferret was made by John J. Audubon in 1851 (Audubon 1851). Since then ferrets have been sighted infrequently in black-tailed prairie dog towns in western South Dakota (Henderson et al. 1969). In 1964 the South Dakota Cooperative Wildlife Research Unit began research on the ferret (Henderson et al. 1969, Hillman 1968) which is continued in this study.

It has been assumed prairie dogs constitute the entire diet of ferrets since ferrets are most often found in prairie dog towns. Hillman (1968) examined two ferret scats and found only prairie dog remains. Henderson et al. (1969) stated that prairie dog was the main food of the ferret, but noted other material was also utilized. Ferret scats are seldom found above ground and presumably defecation occurs in the burrow system (Hillman 1968).

The effect of ferrets on prairie dog populations is presently unknown and information involving changing prairie dog numbers in dog towns with and without ferrets can be obtained only when reliable prairie dog censusing techniques are developed.

Research involving the black-footed ferret and black-tailed prairie dog was conducted in western South Dakota in the summers of 1968 and 1969. The objectives were to study food habits of the ferret, develop a technique for censusing prairie dogs, and initiate a study of movements of the ferret.

## STUDY AREA DESCRIPTION

Four prairie dog towns (Carr West, Carr East, Carr South and Rasmussen) were studied in Mellette County, South Dakota. Three of the towns were within the drainage system of Pine Creek while the fourth (Rasmussen) was located in marginal badlands terrain. Sizes of the towns ranged from 22 to 107 acres (Figures 1, 2, 3 and 4).

Soils are stream deposited alluvium, tertiary sandstones and siltstones, and Pierre shale. Soils are solidized solonetz with a thin friable surface layer underlain by a dense, dispersed clay layer. The grayish brown clay, silt loams, and sandy loam soils are well to excessively drained (Westin et al. 1959).

Two of the four towns were located on bench-like plateaus along Pine Creek while the others were on upland prairie. The towns located near Pine Creek had highest burrow density occurring at the base of adjacent hillsides. Although burrow occurrence was quite uniform on the two upland prairie dog towns, active burrows were widely spaced. Burrow construction was expanding up 25 to 30° slopes bordering the northwest edge of the Carr East town while a 35 to 45° slope apparently inhibited expansion on the northwest edge of the Carr South town.

Spacing of prairie dog burrows was quite uniform throughout each town, except for the Carr West town. Completely barren crests on knolls, outwash beds filled with conglomerate rocks, and periodically flooded grassways contained few, if any, burrows on that town.

Prior to this study a single ferret was sighted on the Carr West town in 1965 and a litter of five ferrets and their mother were there

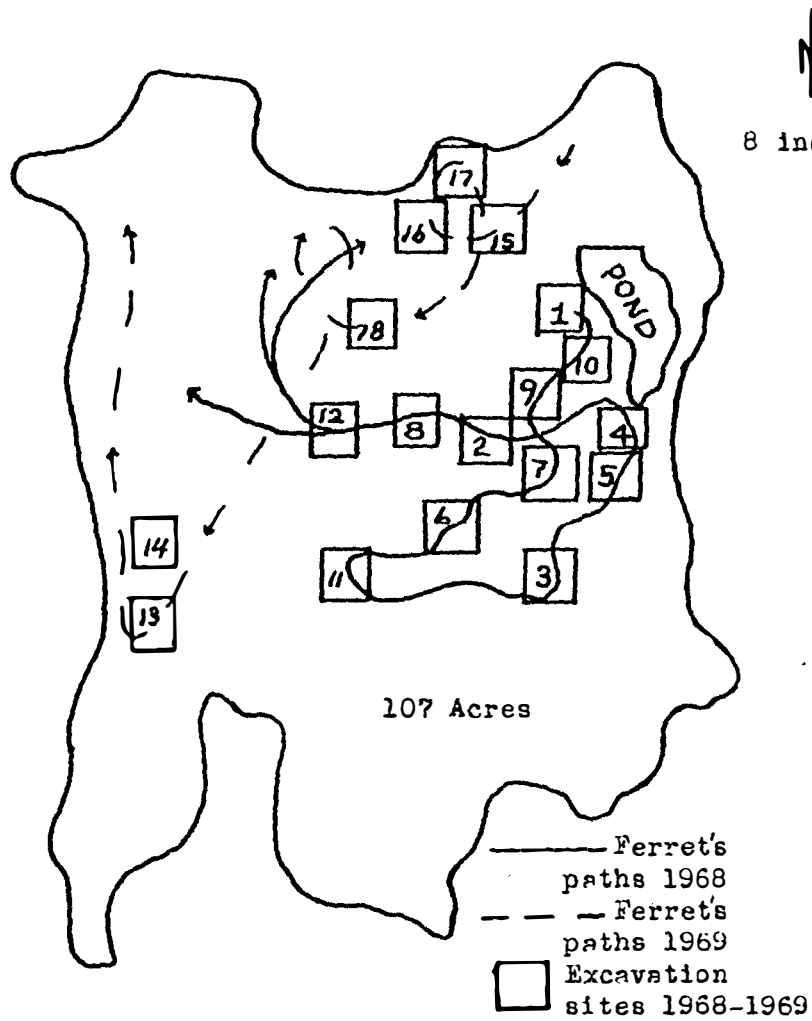


Figure 1. Carr West town

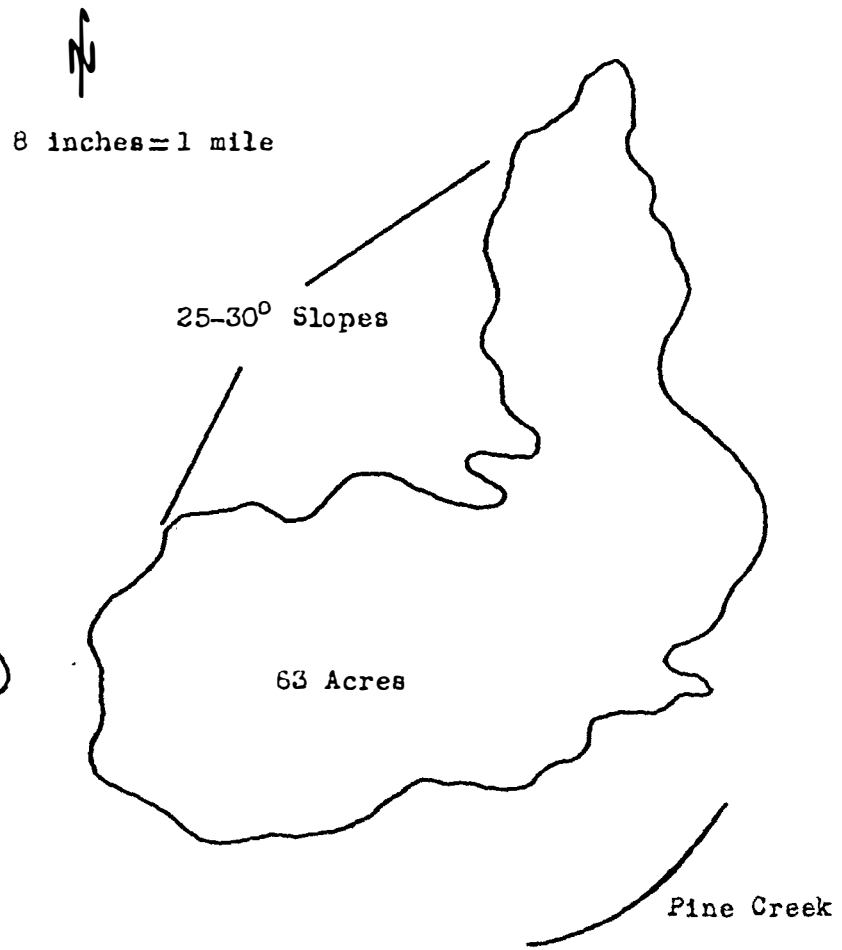


Figure 2. Carr East town

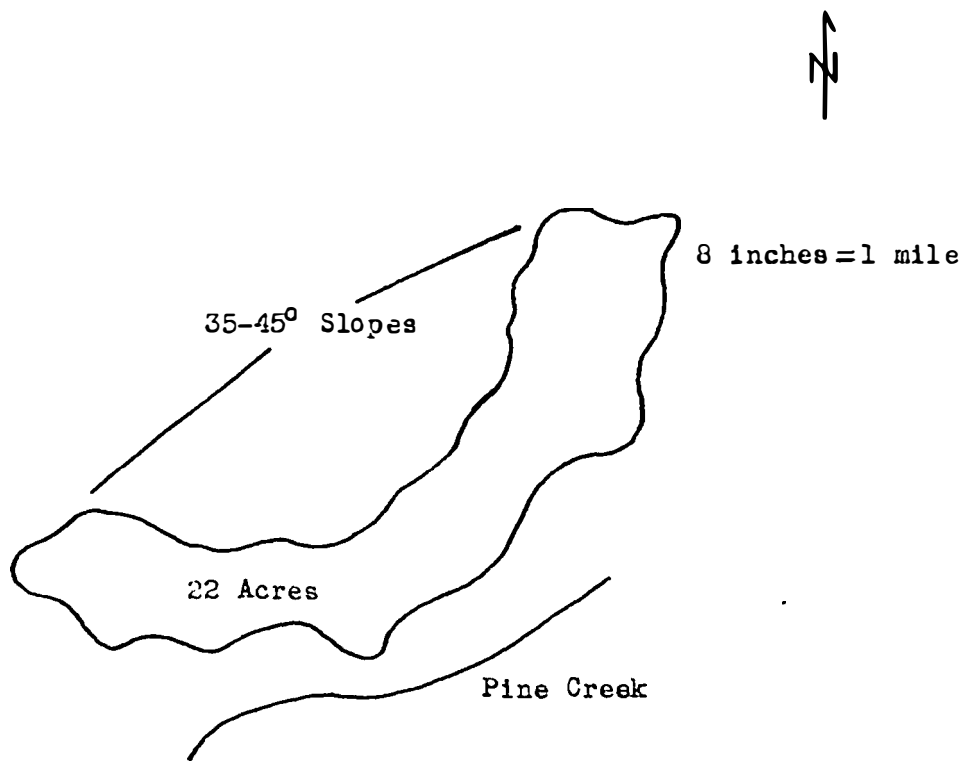


Figure 3. Carr South town

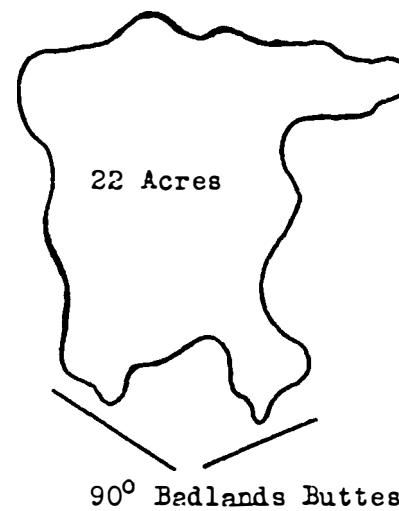


Figure 4. Rasmussen town

in 1966 (Hillman 1968). During this study five ferrets occupied the Carr West town in the summer of 1968 and two in 1969. The Carr East town, approximately 4 miles down the Pine Creek drainage system from the Carr West town, had 5 ferrets the summer of 1967; however, no ferrets were sighted on this town during either summer of this study.

The Carr South town has not been known to support a litter of ferrets although it does lie adjacent to a branch of the same creek drainage and a single ferret was observed on it one morning in 1967 (Henderson et al. 1969). The Rasmussen town had a single ferret reported on it one morning in the summer of 1968 by the landowner's son. It was the only town of the four that received periodic shooting pressure.

Vegetation in the area of the towns consisted of mixed shortgrass prairie species. Each of the four towns was periodically grazed by cattle.

## METHODS AND MATERIALS

Two techniques were utilized to estimate numbers of prairie dogs. Total counts were made by driving over each town and stopping at various vantage points for observation. Random plots (100 x 100 feet) were also established on each town to obtain population indices.

Location of plots was determined from photos by randomly choosing coordinates to achieve a 7 percent sample of each town. Large rocks painted white were used to mark each corner of the 28 plots on the Carr West town, 17 plots on the Carr East town and 6 plots on the Carr South town. Stakes were used to mark plot corners of the 6 plots on the Rasmussen town. This made it possible to observe plots from a distance great enough so that prairie dogs were not disturbed. It was necessary to wait 15 to 20 minutes before prairie dogs within 100 yards of an observer resumed normal activity and 0 to 5 minutes when prairie dogs were from 100 to 300 yards.

Time, temperature, cloud cover and wind velocity were recorded when each count was made so the effects of these variables could be analyzed. Statistical limits were designed to detect a 10 percent variation from the mean with 95 percent probability. Only the counts of the Carr West and Carr East towns were analyzed, since more counts were made on those towns.

Total and active burrows were counted on each plot. An inactive burrow was identified by vegetation growing in or over the burrow entrance and a lack of fresh prairie dog droppings and footprints.



Four of the pre-established plots on the Carr East and Carr West towns were chosen for counting prairie dogs above ground at different times of the day in late July, 1969. Plots (one low, two medium, and one high density) were chosen on each town based on previous plot count averages. Sixty-two prairie dogs were trapped and stained with picric acid and Rhodamine B stain. Thirty-four of these were residents of the 8 chosen plots. Changes in numbers of marked prairie dogs on or off the plots and unmarked prairie dogs above ground on each plot were recorded at 1-minute intervals during a 10-minute period. Each of 4 plots was counted hourly from sunrise to sunset. A spy blind was constructed on one town while a pickup vehicle was used on the other. Each town was counted on alternate days over a 12 day period from the same vantage point located no closer than 150 yards from the nearest of any of the four plots.

Prairie dog burrows which ferrets used in 1968 and 1969 were excavated to recover ferret scats and measure burrows. Two lines of measurement were established in the form of coordinates, one perpendicular to the direction of the burrow's entrance and the other traveling along the left side of the digging. Variations of one foot or more in the burrow passageway were recorded as excavation proceeded and later plotted to scale on graph paper. Excavation was by backhoe tractor, (Figure 5) and by hand. The burrow was cleaned by hand about 2 feet ahead of the digging.

Ferret scats were dried, and contents were separated and weighed to the nearest 0.01 g. Identification of hair found in scats was based on relative size, texture and color using reference collections.

Two of four ferret litter mates were manually snared in 1968 using 1/8 inch nylon rope placed 3 to 5 inches below the burrow entrance. A spike driven into the mound vertically with the snare rope around it prevented a "v" occurring in the loop when the snare was drawn. A tubular live trap, designed for insertion into a burrow 4 to 6 inches in diameter, was constructed to trap 3 other ferrets (Figure 7). The inside of the trap was lined with a cork impregnated plastic substance (known in the plumbing trade as "No-Drip Tape") that was later dusted with fine dirt to simulate a natural burrow. One end of the tube was blocked with a 1/2-inch thick plexiglass window. A sliding wire mechanism was used to drop a door behind the ferret once he had entered. The three ferrets trapped were either observed in or seen to enter a burrow immediately prior to placing the trap.

Scientific names of mammals, insects and plants are according to Hall and Kelson (1959), Ross (1965) and Hitchcock (1950), respectively.

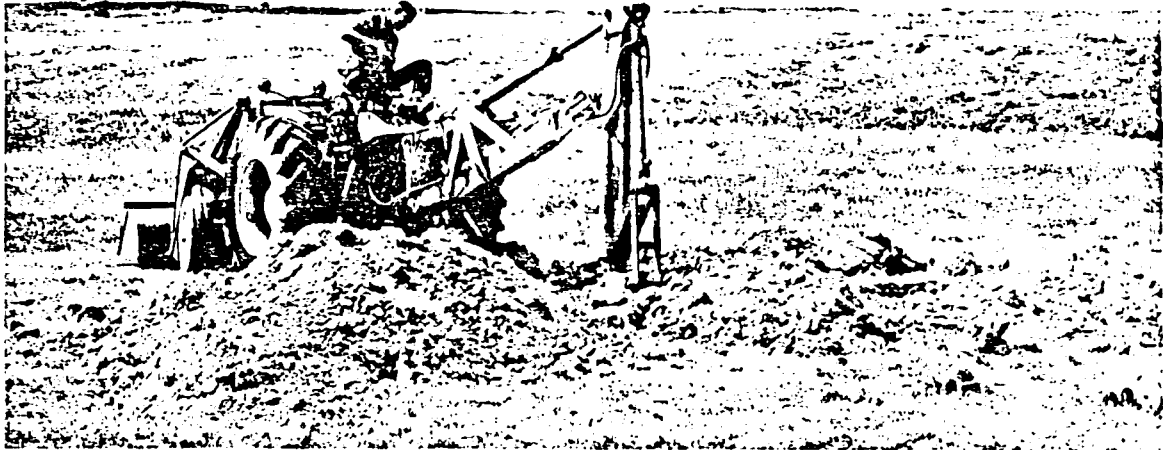


Figure 5. Backhoe used to remove overburden from prairie dog burrows.

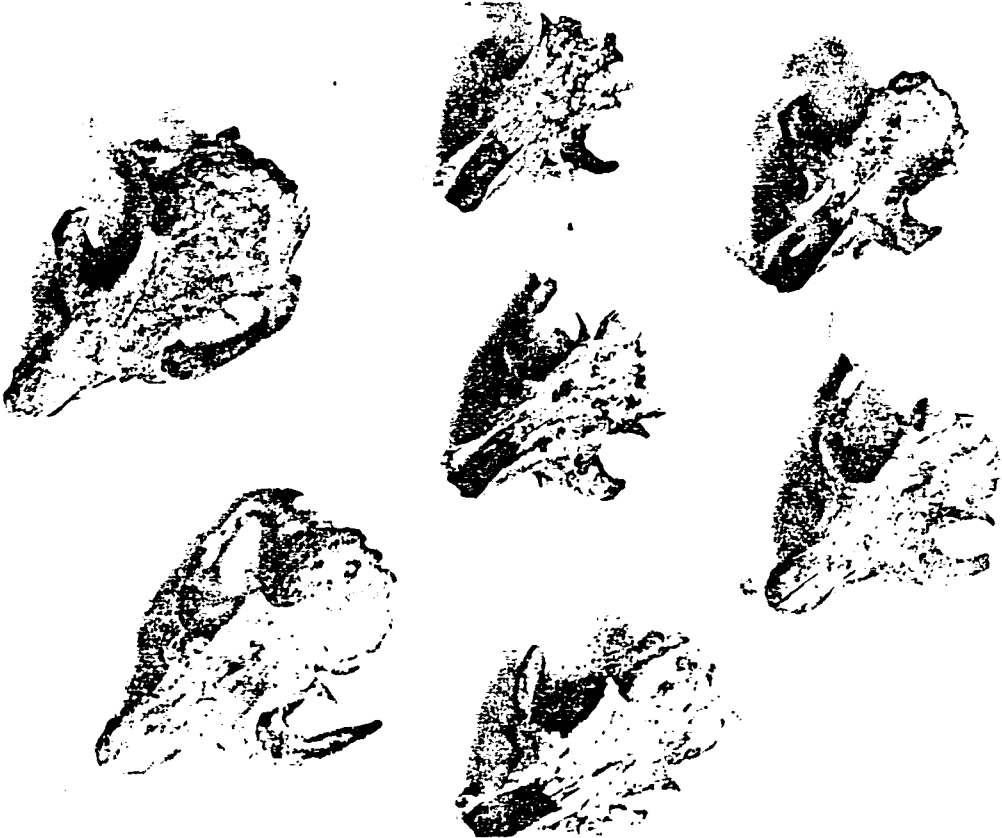


Figure 6. The rear portion was often missing from prairie dog skulls recovered from burrows and ferret tooth marks were evident.

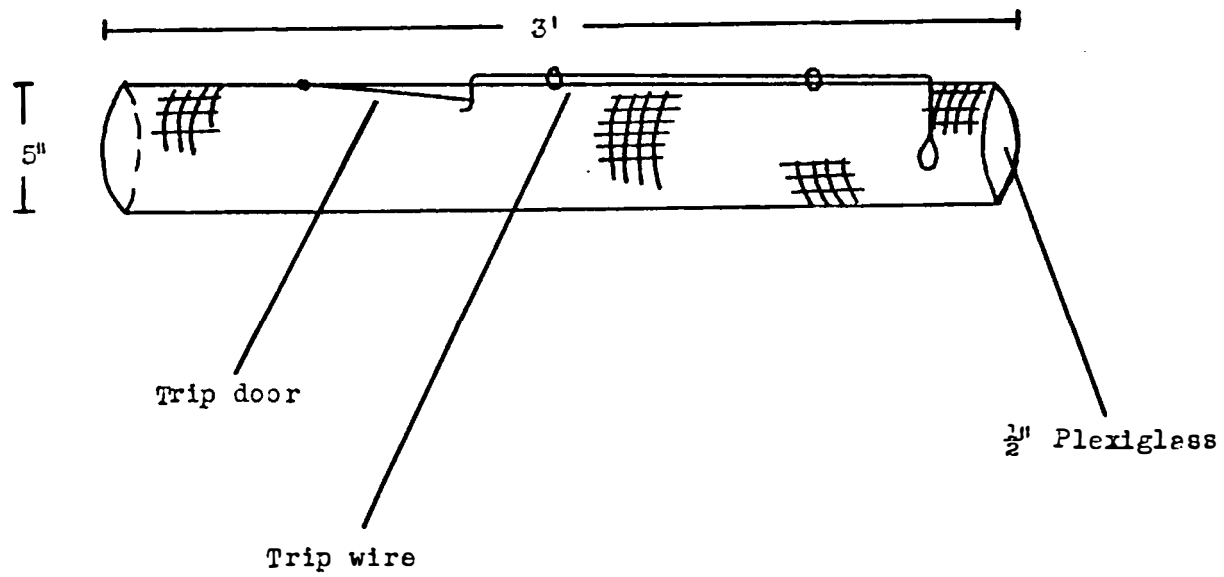


Figure 7. Diagram of tubular live-trap used to capture ferrets.

## RESULTS

Excavation of Prairie Dog Burrows

Six burrow systems previously occupied by ferrets were excavated in 1968 and 12 in 1969 (Figure 1). They ranged from 4 to 14 feet deep and 13 to 109 feet long (Table 1). All had one or more dome-shaped mounds at one entrance which typically sloped 15 to 20° and which at some point made an abrupt vertical ascent to another opening. Sixteen of the systems had at least one crater-shaped mound at the top of the vertical passageway. A typical burrow derived from general configuration common to 15 of the 18 systems is shown in Figure 8. Smith (1958) stated that the prairie dog excavates its burrow beginning at the dome-shaped entrance and finishes by digging upwards to the crater-shaped mound. All dome-shaped mounds consisted of subsoil material while crater-shaped mounds consisted of compacted surface soil mixed with grass.

Shallow depressions of 2 to 3 inches were found in the burrow floor at most branches and were partially filled with compacted prairie dog pellets. The floor of passage ways were strewn with prairie dog pellets and chips of cow manure. Many chips appeared torn open and the grass seeds exposed were presumably a source of food. Jillson (1871) and Wilcomb (1954) likewise found cattle manure in prairie dog burrow systems.

Burrow passages were 4 to 5 inches in diameter with areas of 2 to 10 inches wide occurring where the main burrow branched. Excavation site 17 contained an enlargement, 12 inches in diameter, 3 feet directly below a crater-shaped entrance. Scheffer (1947) mentioned

Table 1. Description of prairie dog burrows excavated on the Carr West town, 1968-1969.

Burrow Number	Total Passage (feet)	Burrow Depth (feet)	Length of Plug (feet)	Number of Entrances	Number of Nests	Days of Known Ferret Inhabitation	Number of Ferret Scats
1	43	6	12	2	0	3	8
2	62	9	10	2	2	3	8
3	59	4	33	2	0	4	39
4	13	3	0	1	0	1	0
*5	14	14	0	1	0	5	0
*6	19	5	19	1	0	2	0
7	43	7	11	2	1	1	0
8	109	8	21	3	1	1	0
9	33	4	0	2	0	1	0
10	24	7	0	2	1	1	0
11	44	6	12	2	0	1	5
12	39	7	28	3	0	1	0
13	31	5	0	2	0	1	0
14	58	6	0	2	0	0	0
15	48	7	6	2	0	4	8
16	42	8	4	2	0	2	0
17	51	10	0	2	1	8	11
18	42	10	9	2	0	4	3

\* Incomplete excavation

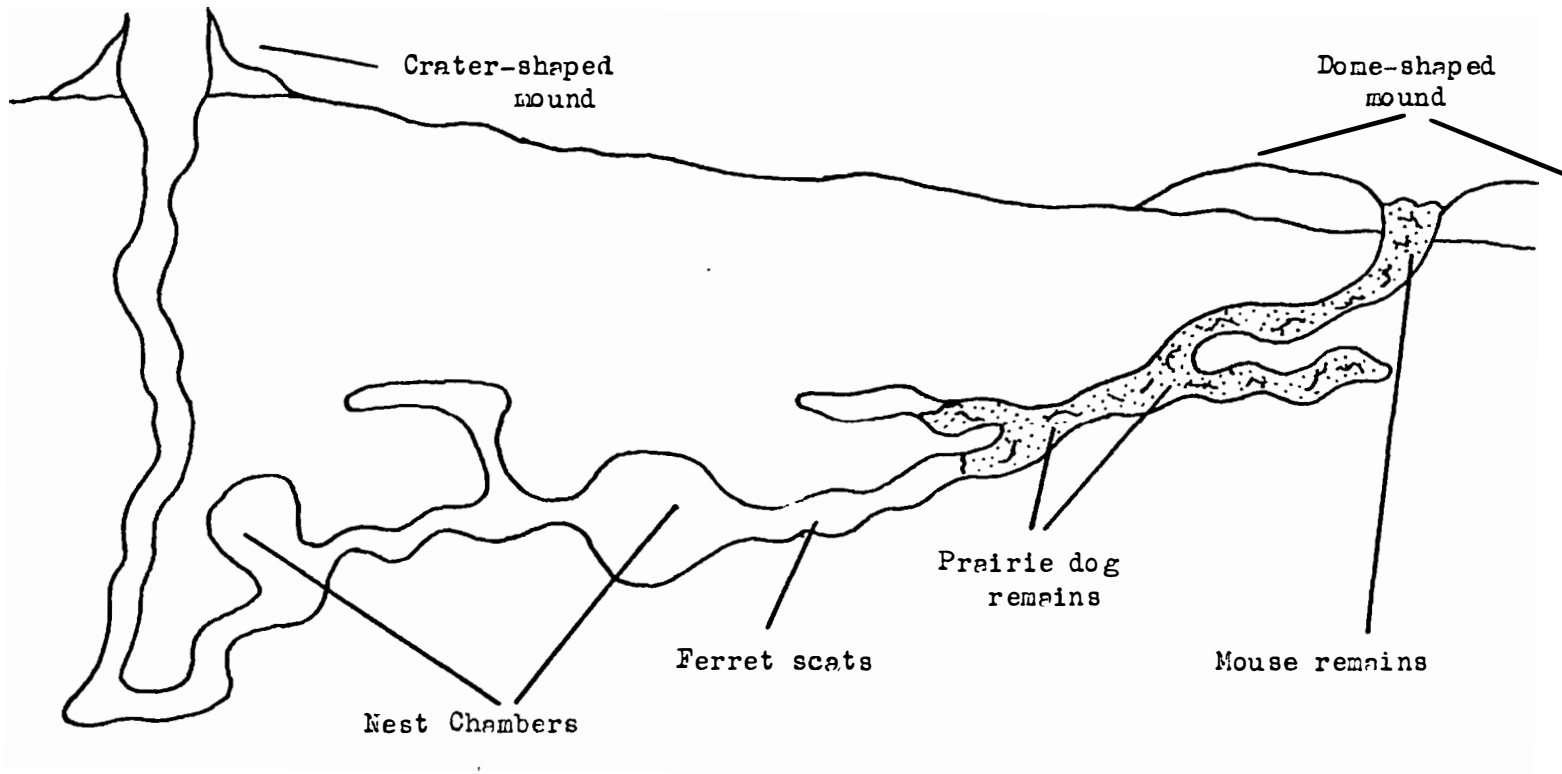


Figure 8. A side view of a typical prairie dog burrow.

finding such areas and termed them "turning bays", areas in which prairie dogs could wait for above ground danger to pass. Side pockets or nest chambers were found in 9 of the systems. Although most side pockets were empty, two found at Site 1 were filled with loose, fine-textured black soil mixed with grass seeds, stolons and roots. Earthen plugs were found in 11 of the systems. Wilcomb (1954) stated that plugs are created to alter the burrow design. Smith (1958) indicated plugging is a sanitary measure or a way of eliminating undesired objects. Remains of prairie dogs, mice and ferret scats were found in several plugs created by prairie dogs following temporary ferret inhabitation. Prairie dog remains consisted of the skull connected to the body hide at the nape of the neck. Skeletal structure and viscera were absent except that the feet were intact. Several individual prairie dog legs found were eaten to the bone as far as the metatarsals with the remainder of the foot intact. The rear portion of the cranial vault was missing on ten prairie dog skulls. Tooth puncture marks were evident on several of the skulls (Figure 6). Mouse remains varied from whole body to bits of fur and bone.

Most ferret scats recovered from excavations were 1 to 3 inches long and approximately  $\frac{1}{4}$  inch in diameter. They were dark brown to black with hair exposed on the surface and were frequently covered with a greater amount of white or yellow mold than were prairie dog pellets.

A variety of arthropods was found throughout the systems. Black widow spiders (Latrodectus sp.) were found at the entrance of many



burrows. Several families of centipedes (Subclass: Chilopoda) were also retrieved. Insects found throughout most burrows included larvae of darkling beetles (Tenebrionidae), ground beetles (Carabidae), dung beetles (Scarabidae) and flesh flies (Calliphoridae). Adult specimens included cave crickets (Gryllidae), hister beetles (Histeridae), scavenger beetles (Staphylinidae) and dung flies (Sphaeroceridae). Wilcomb (1954) found most of these insect families in burrow systems in central Oklahoma.

Six nest chambers were found in five burrows. They were elliptical in shape, ranging from 12 to 18 inches at their widest point and were approximately 10 inches high. A mat of dry grass approximately 2 inches thick covered the floor and extended part way up the walls in five of the six nests found. One contained small amounts of decayed lining indicating it had been abandoned. Grass in the nest lining included buffalo grass (Bachloe dactyloides), prairie threeawn (Aristida longiseta), sixweeks fescue (Festuca octoflora) and Cheat grass (Bromus tectorum). All linings contained prairie dog pellets and were infested with adult and immature forms of the flea, Ovisocrostis hirsutus.

#### Ferret Food Habits

The mother and four young ferrets under observation during the summer of 1968 occupied 10 different burrows for two or more consecutive nights from July until the litter dispersed in late August. Six of these burrows were excavated in August, 1968, and in June, 1969,

and 60 scats were recovered. Four burrows occupied by a mother and one young ferret from July 25 to August 26, 1969 were also excavated and 22 scats were recovered.

Hair and bone fragments of prairie dogs and mice were the only mammalian remains found in ferret scats both years (Table 2). Prairie dog occurred in 91 percent of all scats and made up 86 percent of the animal matter. Mouse remains occurred in 26 percent of the scats and made up 14 percent of the animal matter.

Prairie dogs occurred in 90 percent of the scats recovered from burrows occupied in 1968 and mice in 32 percent. Prairie dog occurred in 95 percent and mice in 9 percent in 1969. Mice occurred in only about one-fourth as many scats in 1969 when the litter contained a single young compared to 1968 when the litter contained four young.

Of the scat material (37.4 g.) separated in 1968, 47 percent was animal matter and the remainder vegetation and miscellaneous material. Of the animal matter, 83 percent was prairie dog and 17 percent mouse. Scat material separated in 1969 (14.2 g.) was 50 percent animal matter. Of the animal matter, 92 percent was prairie dog and the rest mouse remains. Mouse remains were not identified to species; however 40 deer mice (Peromyscus maniculatus), 3 northern grasshopper mice (Onychomys leucogaster), 3 house mice (Mus musculus), 2 prairie voles (Microtus ochrogaster) and 2 thirteen-lined ground squirrels (Citellus tridecemlineatus) were captured during a snap trap survey in 1968 (200 trap nights) and 1969 (1000 trap nights). One roadkilled male ferret found 3 miles from the nearest prairie dog town in 1967 had

Table 2. Composition of ferret scats removed from prairie dog burrows, 1968-69.

	1968			1969			Both Years		
	(60 scats)			(22 scats)			(82 scats)		
	Grams	Percent Frequency	Percent Weight	Grams	Percent Frequency	Percent Weight	Grams	Percent Frequency	Percent Weight
Mouse	2.98	31.6	8.0	.58	9.0	4.1	3.56	25.6	6.8
Bone	.47	21.6	1.3	.22	9.0	1.6	.69	18.3	1.3
Hair	2.51	26.6	6.7	.36	9.0	2.5	2.87	21.9	5.5
Prairie Dog	14.78	90.0	39.4	6.47	95.4	45.6	21.25	91.5	41.2
Bone	4.44	71.6	11.8	1.37	50.0	9.6	5.81	78.1	11.3
Hair	10.34	88.3	27.6	5.10	95.4	36.0	15.44	90.2	29.9
Plant Material	1.94	40.0	5.2	2.54	77.2	17.9	4.43	50.0	8.7
Miscellaneous*	<u>17.74</u>	71.6	<u>47.4</u>	<u>4.59</u>	63.60	<u>32.4</u>	<u>22.33</u>	69.5	<u>43.3</u>
Total	37.44		100.0	14.18		100.0	51.62		100.0

\* Includes soil which adhered to scats.

rabbit hair in its intestinal tract. The gastrointestinal tract of another female roadkilled ferret collected in 1968 was empty.

#### Prairie Dog Social Behavior

Two male prairie dogs, an adult and young, were dyed with picric acid and transplanted from the north to the west end of the Carr East town, a distance of approximately 500 yards. The adult had defended a territory at the trapping site and the young was trapped within that territory. Two days later the adult had returned to the trapping site while the young remained in the vicinity of its release the remainder of the summer.

Males within each territory frequently gave a territorial call throughout the day. They were the first to appear, 10 to 15 minutes after sunrise, and the last to descend, occasionally as much as 20 minutes after sundown. Marked adult males gave a territorial call which was repeated by surrounding neighbors including young. During June and July the young frequently toppled over when imitating the yip but became more proficient as the summer progressed.

Young prairie dogs often appeared to seek attention from adults. Some adults repelled this attention by brushing the young away or running away themselves. On occasion the young rolled onto their back at the feet of an adult and pawed at the adult until the adult drew its nose through the young's belly hair, similar to behavior mentioned by King (1955). On one occasion an adult continued to groom the hair on the young's back when the young rolled onto its belly.

Although intolerance toward the young was observed in adults, it is not known if it caused expansion of the town. Adults were frequently seen at the perimeter of the towns digging new burrows during August. However, marked adults observed at the edge of a town made frequent returns to their previous territory.

When prairie dogs passed through an area where ferrets were located, they would raise their head and back hair and erect their tail. They stood as high as possible and moved very slowly through the area. They occasionally approached the burrow inhabited by a ferret or snake slowly and darted backwards repeatedly. Hillman (1968) described prairie dogs following and antagonizing ferrets.

Hillman (1968) reported that a trench on a prairie dog mound was strong indication of a ferret's presence. Two trenches which did not extend off the mound were found on the Carr East town in July, 1969. Continued observation revealed that prairie dogs evenly distributed earth brought to the surface by pushing it with their noses to form a curved trough or trench around the mound. Several ferrets were observed to make trenches on the Carr West town which were all straight and often extended off the burrow mound.

#### Observations of ferret behavior

A litter of four ferrets and the mother were first observed on the Carr West town on July 15, 1968. The young were approximately three-fourths adult size and were reluctant to leave their burrow. The adult female moved the young from one burrow to another at 2 to 3 day intervals. They moved in single-file formation, with the first

tugged away from the burrow by the mother. After the first one left the burrow, the others followed. This behavior is similar to that described by Hillman (1968). Eye reflection of the young appeared to be a pale blue while the adult female's eyes reflected a darker and richer blue. The color difference became less noticeable as young matured.

Ferrets often emitted a low, abruptly-ending hissing noise when approached by an observer. This changed to a sharp chatter if a hand or any object passed near the burrow entrance. Progulske (1969) indicated similar calls from a captive ferret.

On August 2, one young was seen moving with the mother while the other three remained at a burrow. They continued as a family unit until August 17 when each young was observed in a separate burrow. At first they were separated by about 20 yards; however, on September 4 each member was in a different part of the town. Thereafter two were occasionally observed in the same burrow throughout the night. Observations ended September 6, 1968.

From June 1968 to August 1969 total prairie dog counts and projected sample plot counts averaged on the Carr West town indicated a 16 percent decrease in the prairie dog population (Table 3). Five ferrets were found on this town the summer of 1968 and 2 ferrets the following summer. Prairie dog numbers on the other towns increased 19 percent, 42 percent and 28 percent. One ferret was reported seen one morning in 1968 on the town that increased 28 percent. The population trend on the Carr West town from June 1968 through August 1969

Table 3. Counts of prairie dogs on the four towns obtained from total and projected plot counts, 1968-69.

	Carr West (107 acres)		Carr East (63.8 acres)		Carr South (22.3 acres)		Rasmussen (22.5 acres)	
	<u>1968</u>	<u>1969</u>	<u>1968</u>	<u>1969</u>	<u>1968</u>	<u>1969</u>	<u>1968</u>	<u>1969</u>
Average total count	242.2	218.3	240.8	354.3	84.8	130.8	81.1	104.0
Average projected plot count	458.5	360.8	448.5	477.0	154.2	298.5	112.0	171.0
Average No. of prairie dogs/acre by total count	2.26	2.04	3.76	5.53	3.86	5.94	3.68	4.62
Average No. of prairie dogs/acre by plot count	4.28	3.37	7.45	10.68	6.91	13.54	4.97	7.60

Table 4. Estimated number of burrows based upon plot counts, 1968-69.

	Carr West		Carr East		Carr South		Rasmussen	
	<u>1968</u>	<u>1969</u>	<u>1968</u>	<u>1969</u>	<u>1968</u>	<u>1969</u>	<u>1968</u>	<u>1969</u>
Total burrows/acre	1.72	1.71	1.58	2.00	1.18	2.55	1.82	1.64
Active burrows/acre	0.747	0.775	1.14	1.25	0.86	1.84	1.08	0.57

differed significantly ( $P < 0.01$ ) from the trends of the other three towns during the same period using chi-square analysis with 3 degrees of freedom. Changes in numbers of total burrows or active burrows (Table 4) were not correlated with changes in prairie dog numbers on these towns.

On July 25, 1969, an adult female and single young male were seen on the Carr West town. Both appeared equal in size. Individual identification was possible only after watching their behavior. The mother was occasionally seen pulling the young out of the burrow by the nape of its neck. In addition, the young was often seen playing about the burrow while the mother remained upright in the burrow entrance surveying the dog town. As the summer progressed, the young appeared to become larger than its mother but remained with her. By the end of August they were frequently seen in separate burrows but were usually within 20 yards of one another. Figure 1 illustrates movement of ferret litters during both summers.

#### Prairie Dog Surveys

Results of the 12-day survey indicated greatest percentages of marked individuals and total numbers above ground at 8:00 a.m. and 8:00 p.m. during the last half of July (Tables 5 and 6). The average of marked dogs from the 8 plots revealed a maximum of 63 percent and a minimum of 29 percent marked individuals were above ground during daylight hours (Figure 9).

Analysis of random plot counts showed the optimum censusing period



Table 5. Carr East town counts obtained from 12 day census of four plots and shown as averages of 10 one minute counts.

Time	Plot 1 (5)*		Plot 2 (5)		Plot 3 (4)		Plot 4 (4)	
	Marked	Total	Marked	Total	Marked	Total	Marked	Total
a.m.								
7:00	0.60**	1.30***	0.80	1.24	2.00	4.38	3.20	6.44
8:00	2.40	4.74	3.00	3.55	2.88	5.44	3.80	7.84
9:00	2.80	4.65	2.28	3.13	2.53	5.53	3.50	6.57
10:00	1.53	3.57	2.35	2.70	2.30	4.75	2.33	4.87
11:00	2.00	2.98	1.83	2.67	1.93	4.72	3.03	5.93
12:00	1.87	2.78	2.17	2.32	2.10	4.90	2.38	5.20
p.m.								
1:00	2.00	3.28	1.33	2.00	1.73	3.68	2.03	4.43
2:00	1.17	2.12	1.67	2.17	1.50	3.62	1.62	4.88
3:00	1.00	2.60	1.23	1.97	1.22	2.67	1.80	4.30
4:00	1.30	2.32	1.33	1.33	1.37	3.03	1.90	3.75
5:00	1.00	1.67	1.17	1.40	1.50	3.10	2.20	4.23
6:00	1.03	2.77	1.50	2.50	1.32	3.53	2.45	6.28
7:00	2.08	6.56	2.00	3.20	2.00	4.43	2.93	7.32
8:00	2.53	4.90	2.67	3.58	3.17	6.35	3.50	7.85
9:00	2.60	4.80	2.40	3.80	2.14	2.92	0.00	0.40

\* Number of marked prairie dogs.

\*\* Marked prairie dogs were counted both on and off the plot.

\*\*\* Unmarked prairie dogs counted on the plot only and marked both on and off the plot.

Table 6. Carr West town counts obtained from 12 day census of four plots and shown as averages of 10 one minute counts.

Time	Plot 1 (6)*		Plot 2 (1)		Plot 3 (3)		Plot 4 (6)	
	Marked	Total	Marked	Total	Marked	Total	Marked	Total
a.m.								
7:00	1.90**	2.75***	0.05	1.05	1.13	2.25	2.05	4.30
8:00	3.25	8.90	0.50	1.50	1.95	3.70	3.00	7.15
9:00	2.95	7.38	0.86	1.30	1.50	3.48	2.12	5.20
10:00	2.23	5.40	0.67	1.65	1.75	3.85	2.20	4.96
11:00	1.75	4.36	0.67	1.33	1.61	2.45	2.70	5.08
12:00	2.00	3.16	0.16	0.55	0.85	2.03	2.11	4.91
p.m.								
1:00	2.00	3.78	0.33	0.50	1.50	2.48	2.33	4.83
2:00	1.33	2.47	0.57	0.83	1.26	2.15	2.50	3.96
3:00	1.55	2.80	0.17	0.62	1.00	1.33	2.00	3.68
4:00	1.40	3.60	0.17	0.17	1.28	1.95	2.00	3.80
5:00	1.50	2.83	0.05	0.05	1.17	1.83	2.25	3.75
6:00	1.93	3.47	0.83	1.00	1.33	1.78	2.30	5.08
7:00	2.35	4.97	0.50	1.02	1.63	2.85	3.13	5.80
8:00	2.80	6.35	0.83	1.83	2.43	3.52	3.65	5.85
9:00	2.88	5.94	1.00	1.80	1.02	1.92	0.15	0.30

\* Number of marked prairie dogs.

\*\* Marked prairie dogs were counted both on and off the plot.

\*\*\* Unmarked prairie dogs counted on the plot only and marked both on and off the plot.

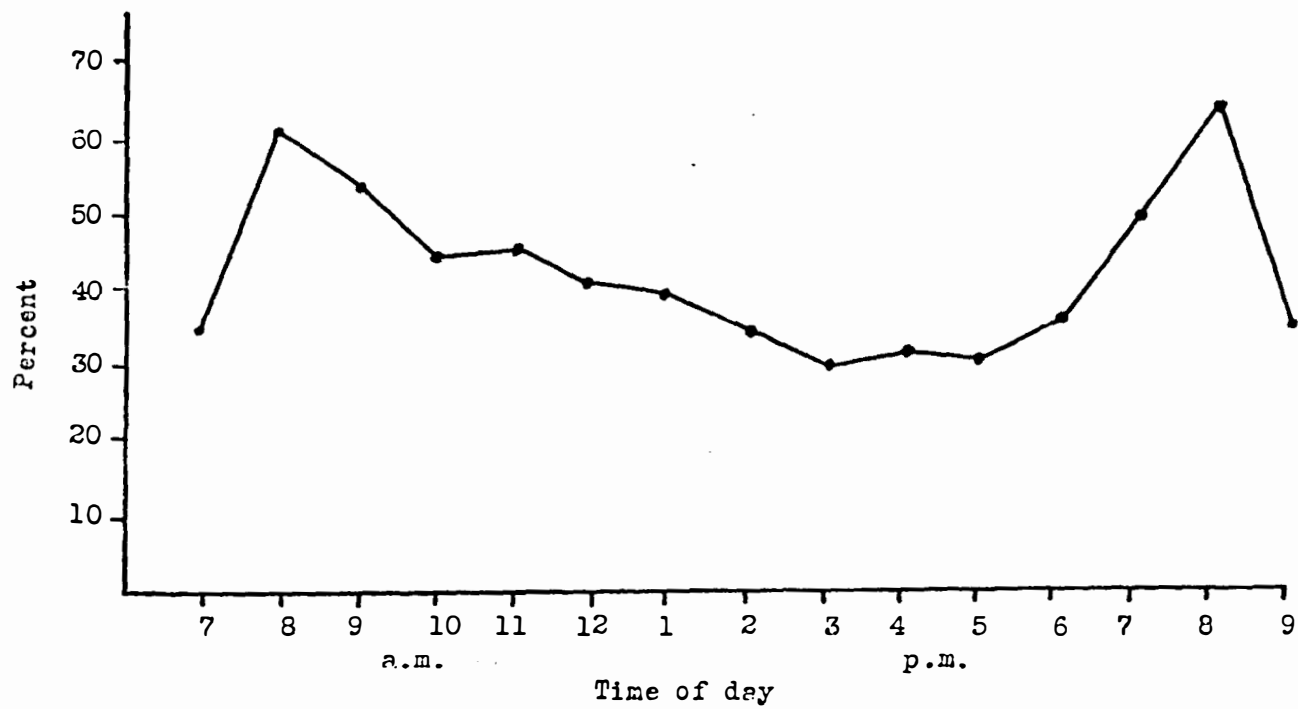


Figure 9. Percent of marked prairie dogs above ground during daylight hours derived from 12 day census.

was an overcast afternoon with a temperature of 74 to 76° F with wind from 0 to 10 m.p.h. Not as many counts of the town were needed on the Carr West town with 28 plots as on the Carr East town with 17 plots (Table 7). Number of counts needed to obtain estimates within 10 percent of the mean at the 95 percent level of probability on the Carr East and West towns, respectively, was: 35 and 17 between 12 and 6 p.m., 33 and 8 with temperature from 74 to 76° F., and 41 and 15 with winds 0 to 10 m.p.h. No data were available under overcast skies on the Carr East town, but 5 counts were needed on the Carr West town.

#### Trapping and Marking Ferrets

Two litter mates were snared on the Carr West town in August, 1968. A notch was snipped in their left ear with surgical scissors dipped in alcohol. Beginning at capture, both animals maintained an excited state and chattered until released. Rapid panting accompanied by slight urination and musk emission occurred with both ferrets. The animals were most at ease if held by the nape of the neck in mid-air where no footing could be attained. Once their feet contacted a surface they proceeded to writhe and struggle. Holding time from capture to release was about 3 minutes.

Both marked ferrets were with the litter the following morning. The ear notches were observed at a distance of 30 yards with the aid of 7x50 binoculars.

In October of 1968 a single unmarked ferret was observed on the Carr West town. The live trap was inserted approximately 8 inches into the ferret-occupied burrow and what appeared to be the adult female was

Table 7. Number of prairie dog counts needed to obtain estimates within 10 percent of the mean at the 95 percent level of probability.

	East Town		West Town	
	Number of Counts Made	Number of Counts Needed	Number of Counts Made	Number of Counts Needed
<b>Time</b>				
8-12 a.m.	6	42	8	19
12-6 p.m.*	5	35	8	17
6-9 p.m.	5	45	7	35
<b>Temperature</b>				
-70F	4	75	4	70
71-73	4	50	5	12
74-76*	5	35	5	8
77-79	0	--	0	--
80-82	0	--	5	45
83-85	3	60	4	65
86-88	0	--	3	60
89-91	6	42	5	6
92-94	0	--	0	--
95+	5	40	4	10
<b>Cloud Cover</b>				
Clear	10	45	16	25
Partly Cloudy	6	46	5	12
Overcast*	0	0	5	5
<b>Wind</b>				
0-10 m.p.h.*	13	41	17	15
10-20 m.p.h.	4	50	5	25
20+ m.p.h.	6	60	5	65

\* Indicates lowest number of counts needed in each category or optimum counting conditions.

captured (Figure 10). Her left ear was pulled through the mesh of the trap and notched with scissors. The animal was released immediately.

On August 20, 1969, a young male was trapped on the Carr West town. A 3/8-inch red plastic disc was attached to a small metal strip tag (No. 4) and placed in the left ear. A metal strip tag (No. 1) with no attached disc was placed in the right ear (Figure 11). The ferret exhibited a dark mid-ventral streak and small testes swelling just anterior to the anus. Slight salivation, urination and defecation occurred while the animal was in the trap. Once released, it made a rapid dash to a nearby burrow. The following day the animal was observed with the disc tag missing and a small tear in one ear while the other tag was in place.

On August 22, 1969, an adult female was live-trapped on a prairie dog town 23 miles northeast of the Carr West town. She was seen to leave a burrow containing at least one other ferret, presumed to be young, and enter a nearby burrow. She was caught about 2 minutes after the trap was set in that burrow. A metal strip tag (No. 5) was placed in the right ear. Tag No. 6 with orange disc attached was placed in the left ear. A restraining cone was used on this occasion making tag placement easier. A distinct dark medial streak was evident between each row of nipples. Her entire pelage was much darker than any ferrets trapped previously. Her nipples were calloused, hard and dried with much hair worn off the base of each, indicating she had been suckled. After release she dashed to the burrow containing the other ferret. Several days later Donald K. Fortenbery, Biologist for the

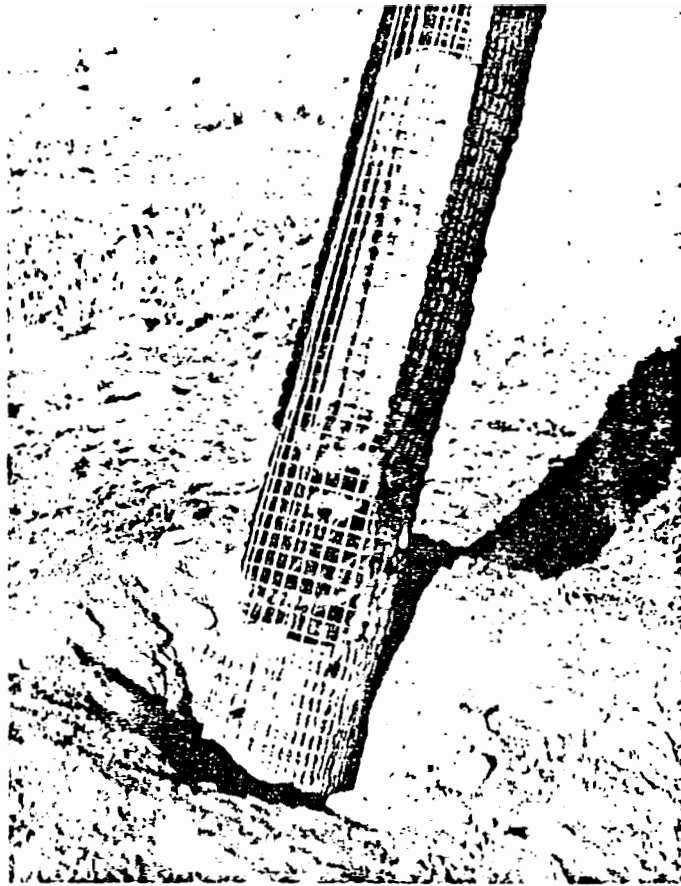


Figure 10. Ferret in live-trap immediately after capture.

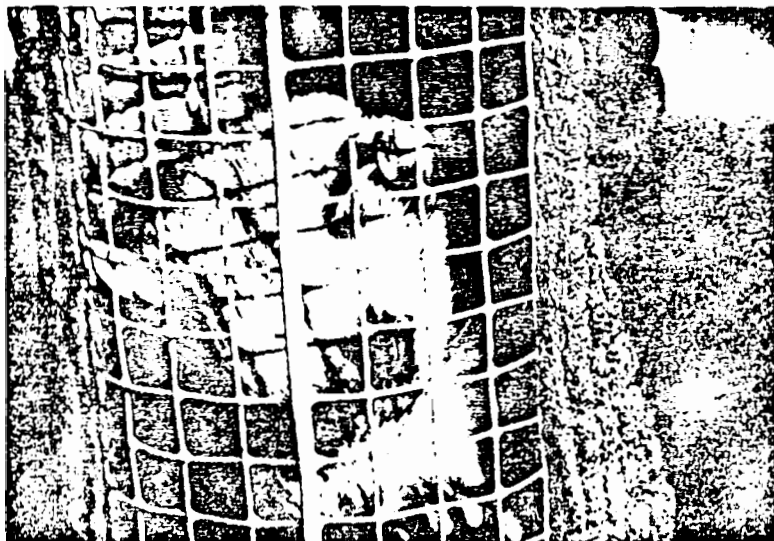


Figure 11. Ferret in trap with ear tag and colored disc attached.

Bureau of Sport Fisheries and Wildlife, reported a group of 4 ferrets on this same prairie dog town, but he could not determine whether any were marked.



## CONCLUSIONS

Prairie dog burrows ranged from 13 to 109 feet long and 3 to 14 feet deep. Fifteen of the 18 systems exhibited a dome-shaped entrance leading to a gradually descending passageway which made an abrupt vertical ascent to a second crater-shaped entrance. Nest chambers were found in six of the systems. Earthen plugs created by prairie dogs in burrows following ferret departure ranged from 9 to 33 feet long. Remains of mice and prairie dogs and ferret scats were found in these plugs. The rear portion of the cranial vault was missing on ten prairie dog skulls.

Prairie dogs appear to be the primary food source for the ferret. Although other animal species were present on the prairie dog town, prairie dog (86 percent) and mice (14 percent) constituted all mammalian remains identified from 62 ferret scats recovered from prairie dog burrows.

Highest counts of prairie dogs were obtained at 8:00 a.m. and 8:00 p.m. during a 12-day census in late July 1969. However, analysis of projected plot counts made from June to August showed lowest variation in numbers of prairie dogs above ground occurring on an overcast afternoon, with temperature ranging from 74 to 76°F and winds 0 to 10 m.p.h. Number of counts needed for estimates within 10 percent of the mean at 95 percent probability under these environmental conditions ranged from 5 to 17 on the Carr West town where 28 plots were used and from 33 to 41 on the Carr East town when 17 plots were used.

The effect of black-footed ferrets upon prairie dog numbers on

the Carr West town may be related to the 16 percent average decrease in population from June 1968 through August 1969. This decline differed significantly when compared to trends of three other towns.

A tubular live-trap made marking easier than snaring since ferrets captured in it remained calm and could be marked and tagged while held within the trap or attached restraining cone. Notches and tags in the ear could be seen with the aid of binoculars at 30 yards.

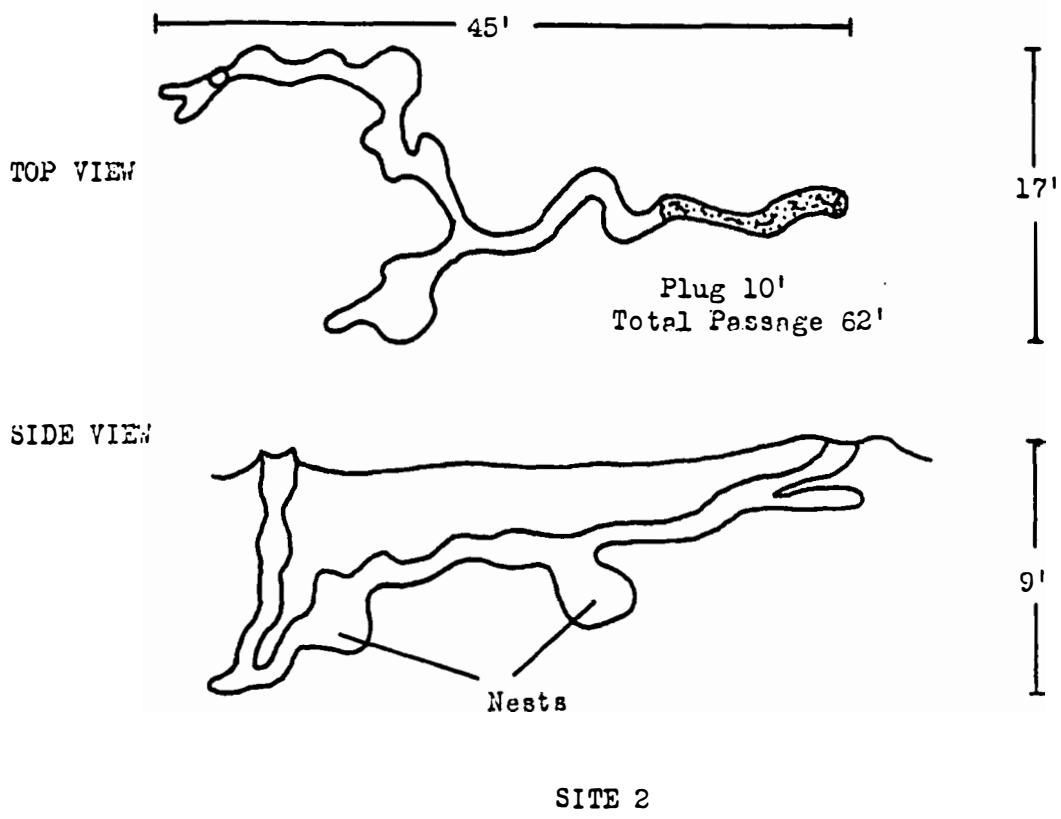
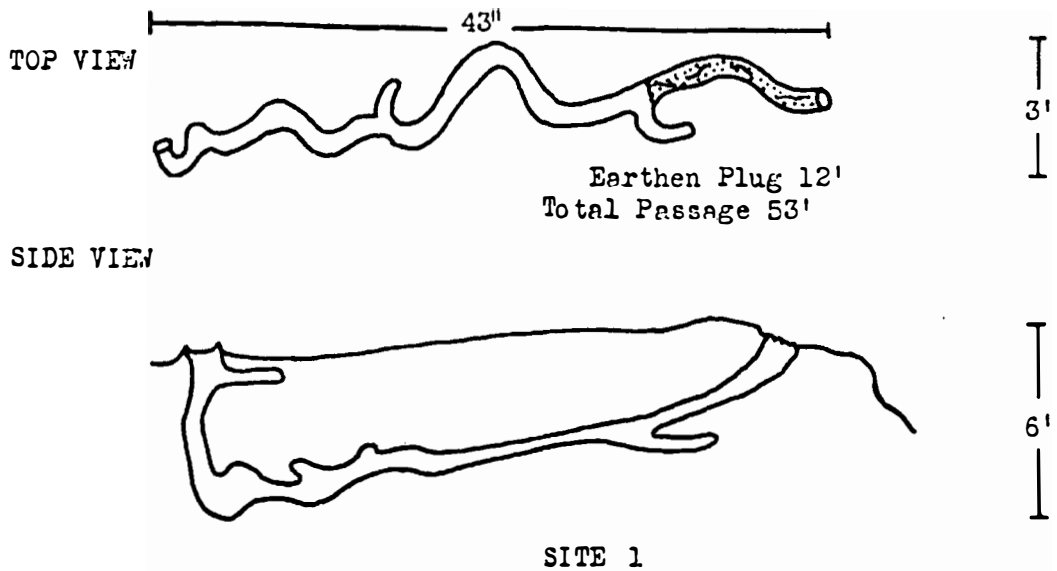
Occurrence of a trench by a prairie dog burrow is considered a sign that ferrets occupy a prairie dog town. Care must be exercised in identifying these structures however, since prairie dogs also push dirt from their burrows and form a curved trough with their nose and forefeet. These usually do not extend beyond the burrow mound while trenches made by ferrets often extend beyond the edge of the mound and are typically straight.

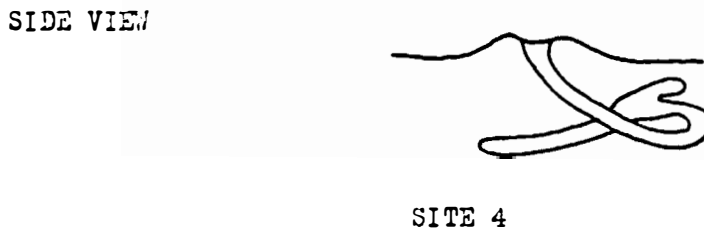
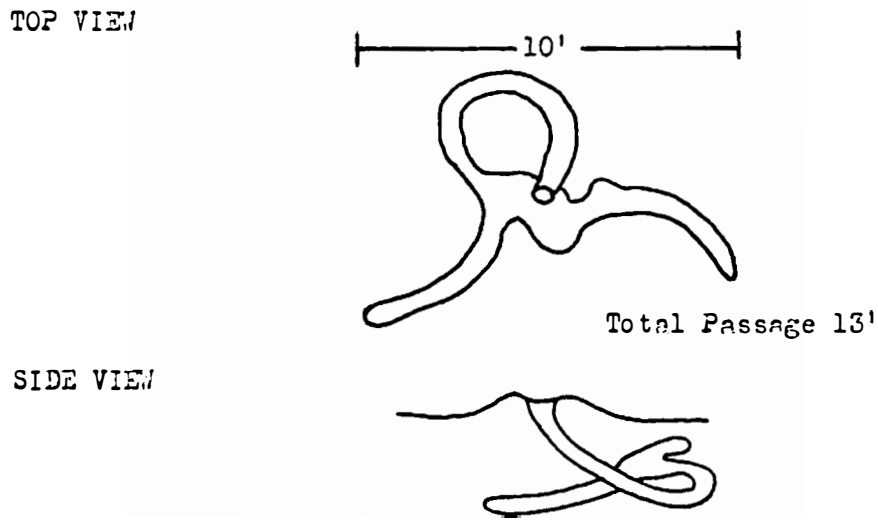
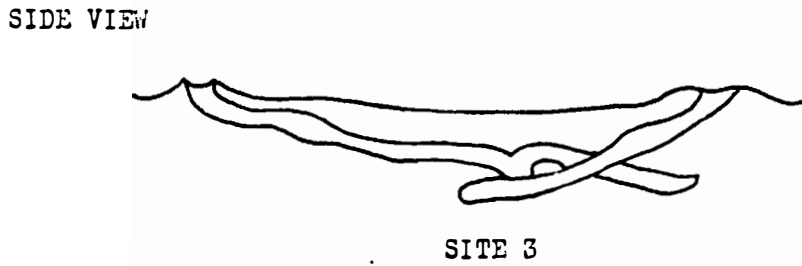
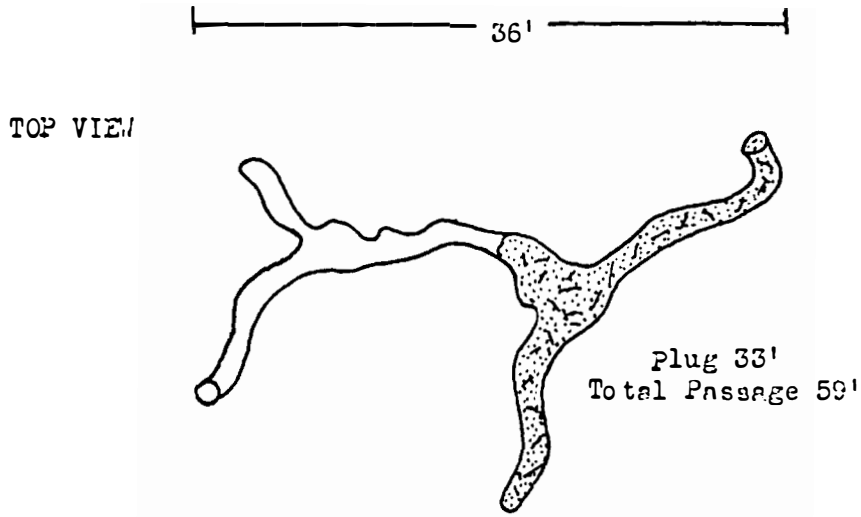
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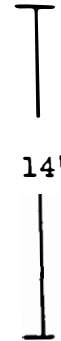
APPENDIX

Appendix Figure A. Excavation Sites 1 - 18.





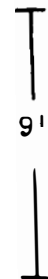
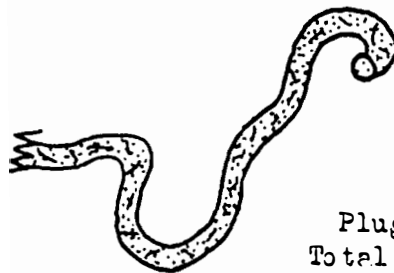
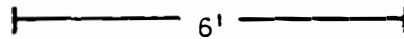
SIDE VIEW



Total Passage 14'

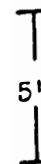
SITE 5

TOP VIEW

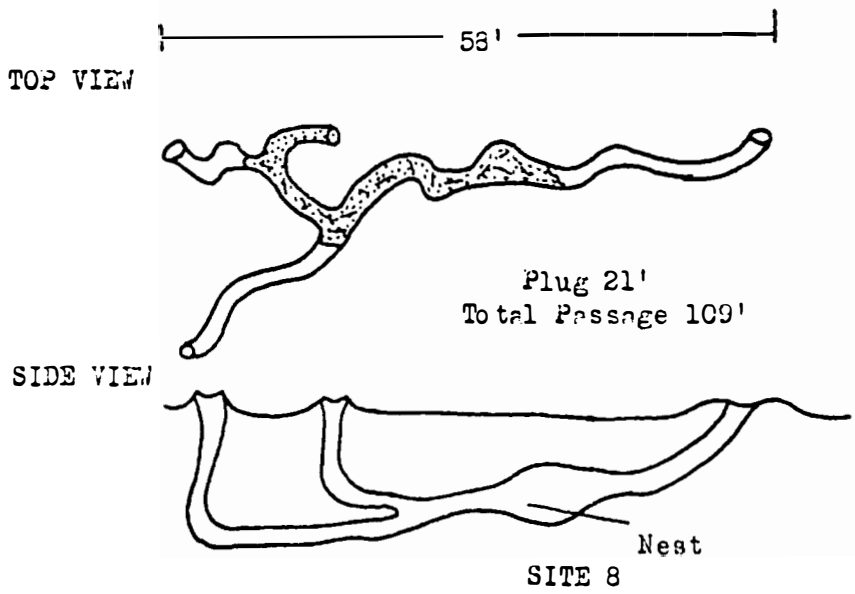
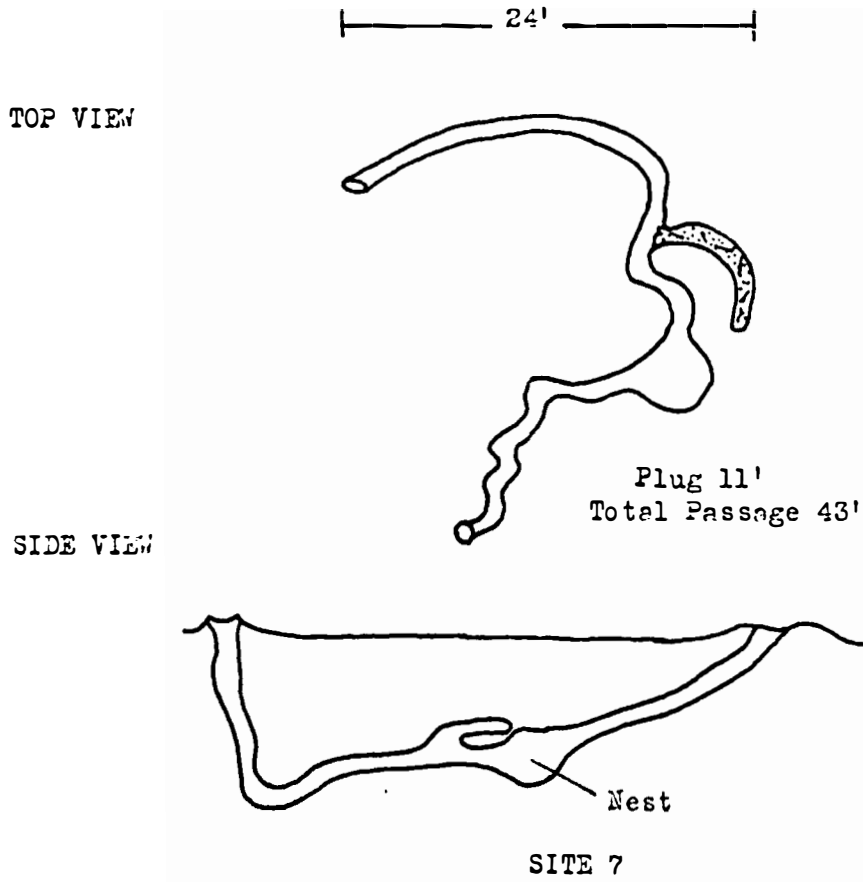


Plug 19'  
Total Passage 19'

SIDE VIEW



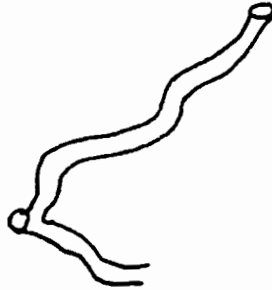
SITE 6





TOP VIEW

20'



Total Passage 33'

22'

SIDE VIEW



4'

SITE 9

TOP VIEW

21'



Total Passage 24'

7'

SIDE VIEW



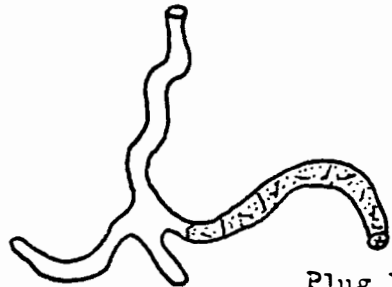
Nest

7'

SITE 10

TOP VIEW

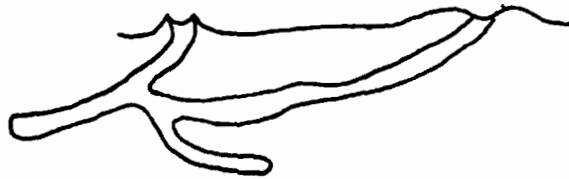
21'



Plug 12'  
Total Passage 44'

21'

SIDE VIEW

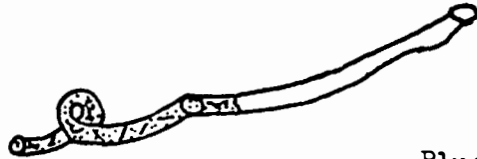


6'

SITE 11

TOP VIEW

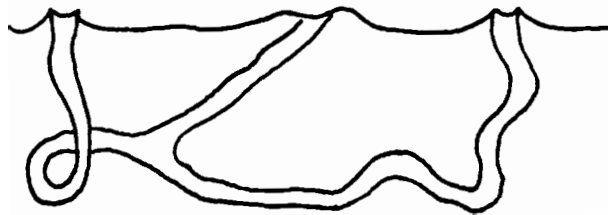
32'



Plug 28'  
Total Passage 39'

9'

SIDE VIEW

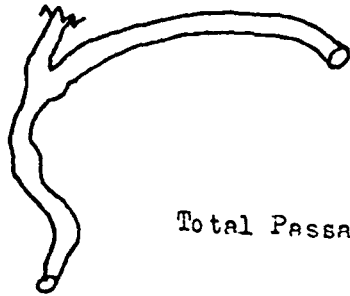


7'

SITE 12

TOP VIEW

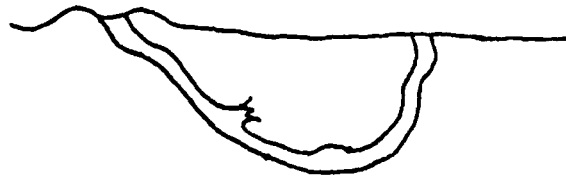
16'



Total Passage 31'

SIDE VIEW

18'

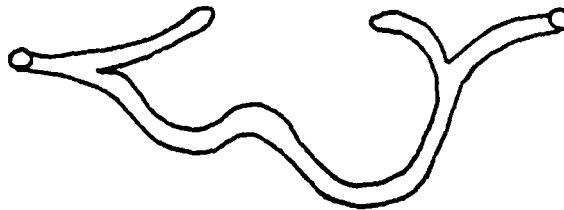


5'

SITE 13

TOP VIEW

24'



Total Passage 58'

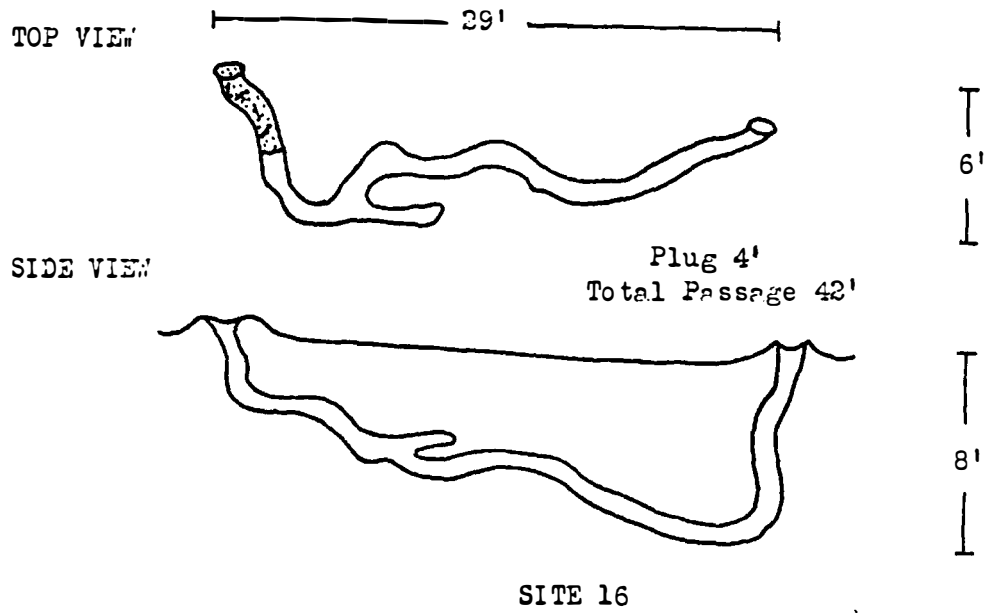
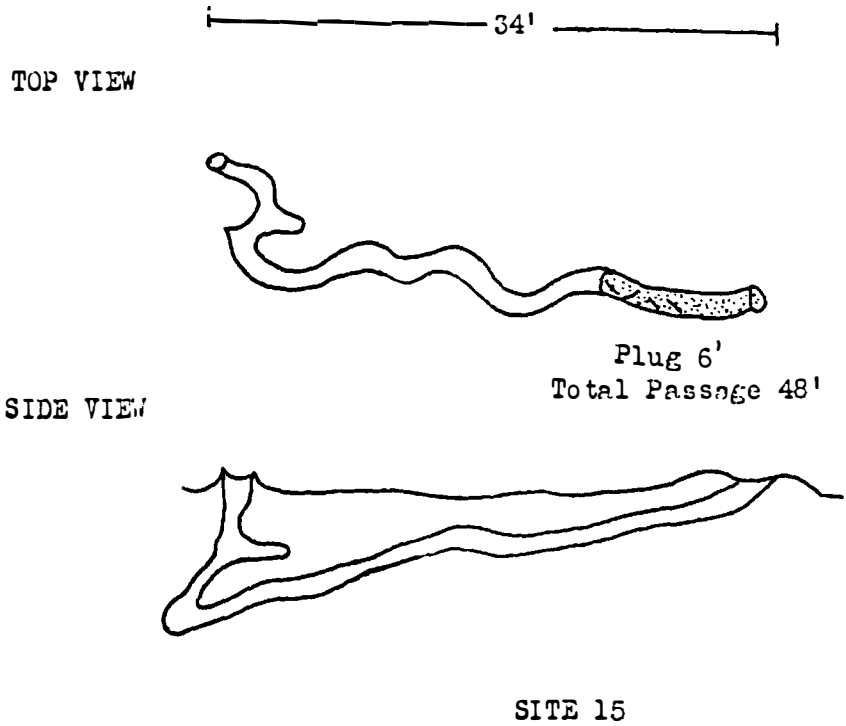
SIDE VIEW

11'



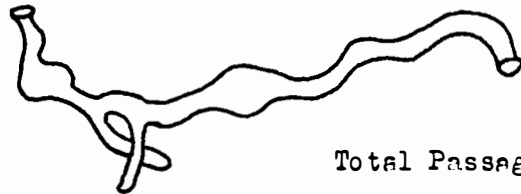
6'

SITE 14



37'

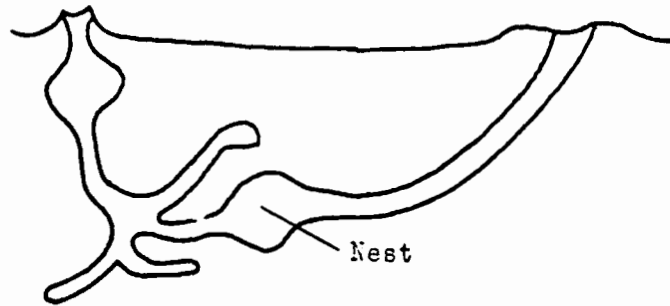
TOP VIEW



Total Passage 51'

8'

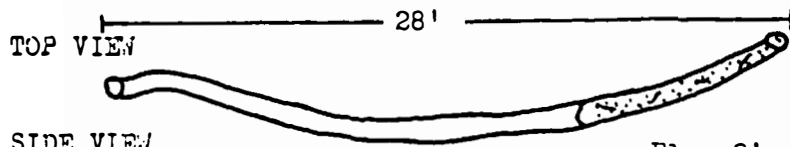
SIDE VIEW



Nest

10'

SITE 17



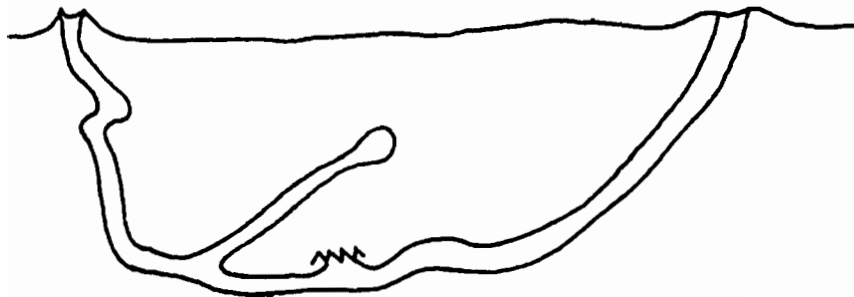
TOP VIEW

28'

SIDE VIEW

Plug 9'  
Total Passage 42'

4'



10'

SITE 18