A SEARCH FOR BLACK-FOOTED FERRETS IN THE OKLAHOMA PANHANDLE AND ADJACENT AREA AND AN ECOLOGICAL STUDY OF BLACK-TAILED PRAIRIE DOGS IN TEXAS COUNTY, OKLAHOMA

By

FREDERICK DALE HASSIEN II

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IN TEXAS COUNTY,
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Thesis Approved:

James C Lewis
Thesis Adviser

Bryan P. Glass

Jeff Powell

A N Purdom
Dean of the Graduate College

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CHAPTER I

INTRODUCTION

Among the animals that have become extinct in the past 2000 years, approximately one half have disappeared during the last 73 years (Milne and Milne 1971). The black-footed ferret has been listed in the Federal Register as an endangered species since 1966 (U. S. Department of Interior 1966).

The ferret's original range (Fortenbery 1969:4) (Fig. 1)

> . . . corresponded very closely with that of the prairie dog, extending from the entire Great Plains of southern Canada to the Staked Plains of Texas, and from roughly the one-hundredth meridian to somewhere west of the Continental Divide.

Cahalane (1954) found in 1953 the ferret's reported distribution had diminished considerably from its original range.

The only ferrets definitely known to exist today are in western South Dakota (Fig. 1) where a relatively large number of black-tailed prairie dog towns still occur. Approximately 66 sightings of ferrets have been reported in Mellette County, South Dakota, by biologists and students, since 1964. Sixty-four of these sightings were reported by Linder et al. (1972).

Sightings of ferrets and their signs are still reported frequently throughout much of the ferret's original range (Arvey and Glass 1950, Fichter and Jones 1952, Jones and Loomis 1953, Hershkovitz 1965, Henderson et al. 1969, LeDioyt 1970, Linder et al. 1972, Lewis 1973,

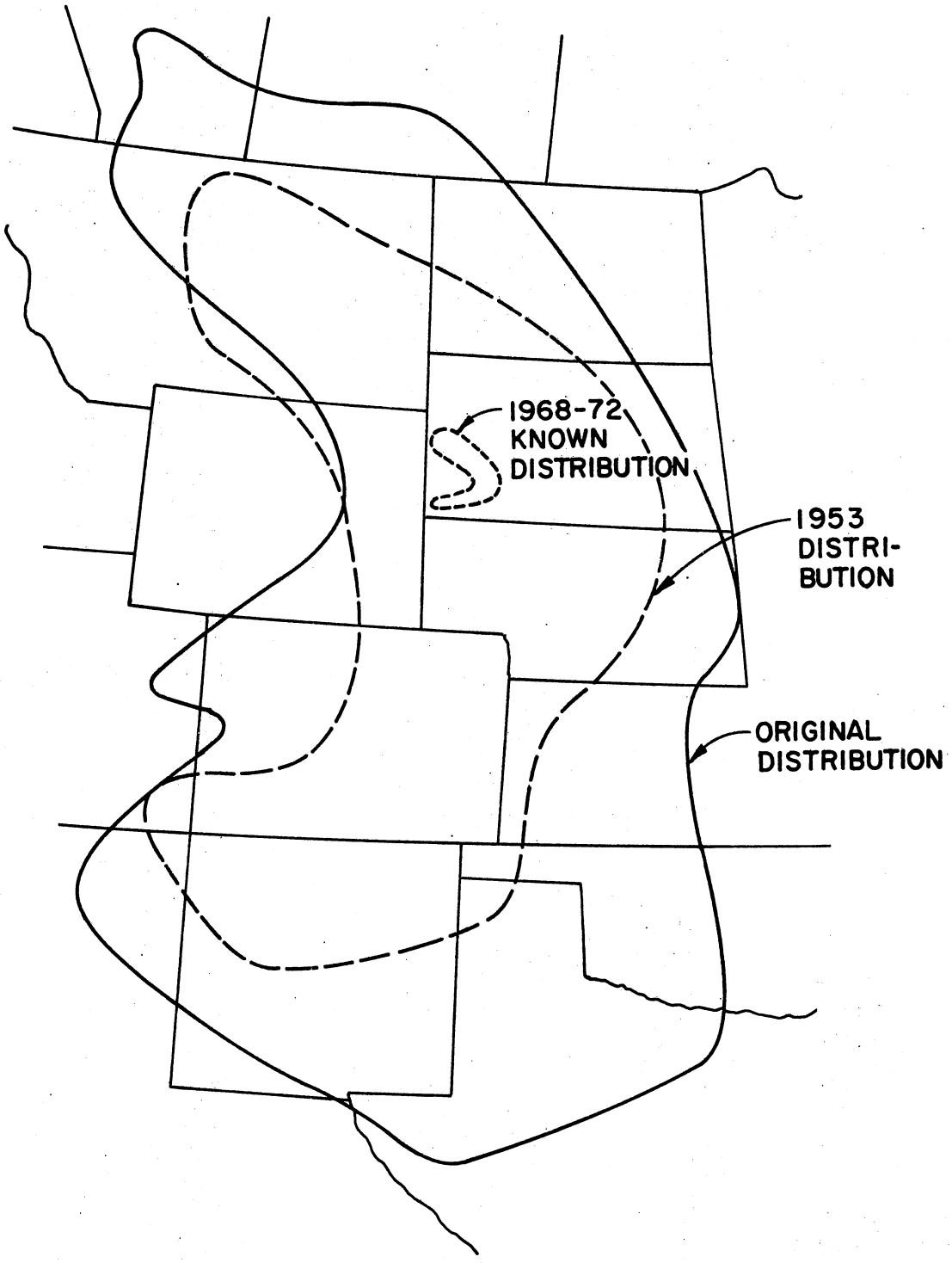

Fig. 1. Original and 1953 distribution of the black-footed ferret (Cahalane 1954) and known distribution 1968-1972 (Linder et al. 1972)

Clark 1974a, Clark 1974b, Lewis and Hassien 1974, Grondahl 1974, Yannone 1974). Most of these reports occurred in North and South Dakota, Nebraska, Wyoming, Kansas, and Oklahoma.

A knowledge of the critical factors that determine the distribution of a species is essential for restoration of an endangered species. An animal's distribution is primarily governed by the presence or absence of suitable habitat (Burt 1938). Any study of an endangered species should, therefore, include a study of its remaining suitable habitat.

Ferrets are dependent upon prairie dogs as their main food while rearing their young and they use prairie dog burrows for shelter (Henderson et al. 1969, Hillman 1968, Sheets et al. 1972). It is, therefore, essential to understand the ecology of prairie dogs and the attitudes of people toward prairie dogs, before any sound judgments can be made about management or restoration of ferrets. Research published on the ecology of prairie dog towns in South Dakota (Hillman 1968, Linder et al. 1972, Sheets 1970) where ferrets still occur provided a basis for defining suitable habitat where ferrets might be restocked within their original range.

The objectives of this study are to determine (1) if black-footed ferrets still existed in a portion of their original range and (2) if suitable habitat for black-footed ferrets still exists within the Oklahoma Panhandle. The survey for black-footed ferrets was conducted in the Oklahoma Panhandle and 10 adjacent counties in Kansas, Texas, and Colorado. The analysis of potential ferret habitat involved an ecological study of the black-tailed prairie dog in Texas County, Oklahoma. The objectives of studying prairie dogs were to determine (1) the number and approximate size of prairie dog towns in the area and (2) any

differences between dog towns and adjacent rangeland in plant species composition and soil nutrients that may have been caused by prairie dogs.

CHAPTER II

DESCRIPTION OF THE STUDY AREA

Surveys for ferrets were conducted in Beaver, Texas, and Cimarron Counties of the Oklahoma Panhandle; Powers and Baca Counties, Colorado; Morton, Stevens, and Stewart Counties, Kansas; Dallam, Sherman, Hansford, Ochiltree, and Lipscomb Counties, Texas (Fig. 2). Each county supports a relatively large population of prairie dogs.

The study area is located within the Great Plains Province (Austin 1965) and consists primarily of rangeland and cropland. Soils in this area are subject to extreme wind and water erosion, especially after cultivation. Wheat and grain sorghum are the principal crops and cattle are the major grazing animals. Much of the vegetation is of the steppe type with gramas (Bouteloua spp.) and buffalo grass (Buchloe dactyloides) the major species.

The average annual precipitation is approximately 500 mm but ranges from 380 to 890 mm. Most of the rain falls from early spring to fall but is erratic. One-third of the annual precipitation may fall during one rain storm. Average annual temperatures are 10 to 15 C. The frost-free period ranges from 185 to 200 days (Austin 1965).

Wind is an important factor in this area. Part of nearly every day is windy, reaching maximum velocity in the afternoon and sometimes diminishing at night. The annual average wind velocity in Cimarron County, Oklahoma is 9.7 km per hour at 0800 and 25.7 km per hour at 1500

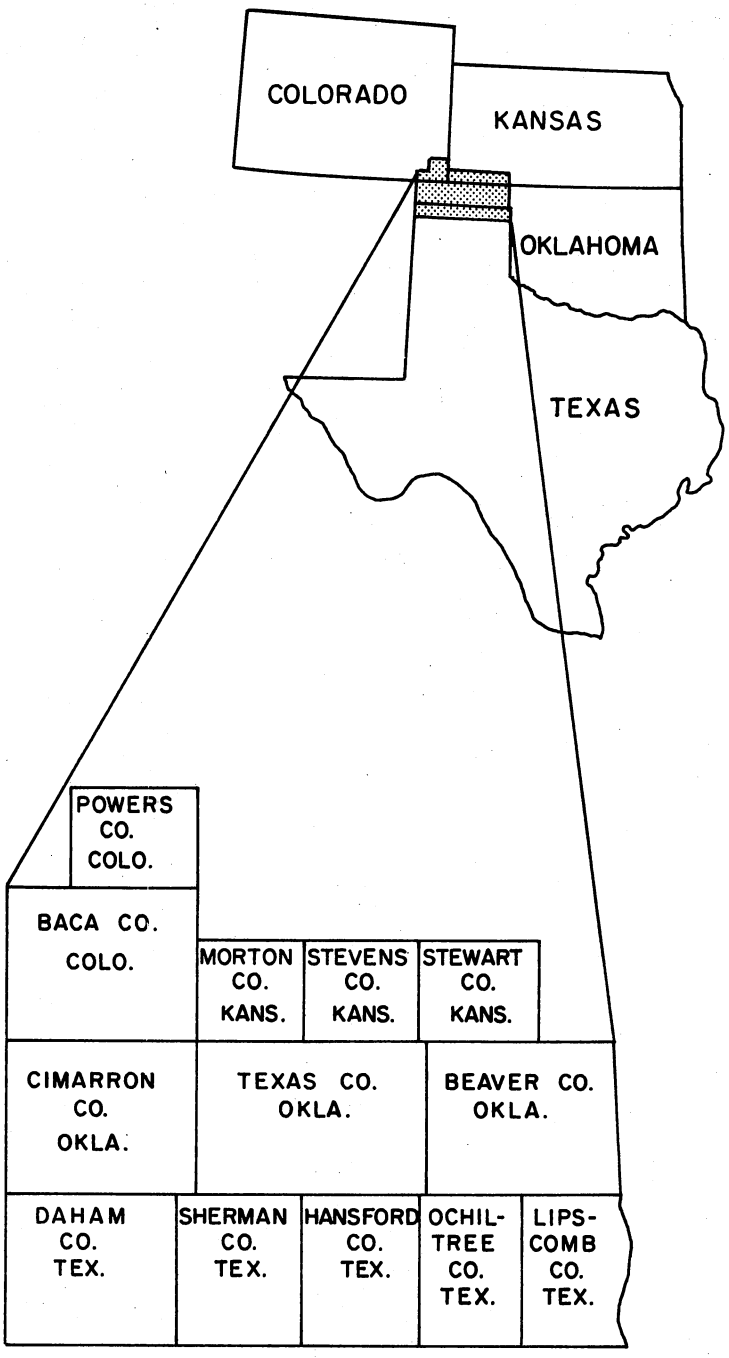

Fig. 2. The study area

(Murphy et al. 1960).

Research on the ecology of prairie dogs was conducted in Texas County, Oklahoma, which is approximately the central county of the 13 county study area. About two-thirds of the county consists of upland plains that are nearly level; the rest is mainly eroded, rough breaks, and narrow flood plains. The elevation is 1155 m on the western border and 790 m on the eastern edge of the county. Vegetation in Texas County is mainly the steppe type with grama and buffalo grass prominent on the fine textured soils; sandsage (Artemisia filifolia), yucca (Yucca glauca), and mid-grasses are prominent on the coarse textured soils.

CHAPTER III

METHODS

Ferret Survey

Prairie dog towns were located in the study area by using aerial photographs (J. C. Lewis personal communication, L. K. Cheathum 1974) of a scale 1:20000 and by interviewing local residents, hunters, and personnel of state and federal agencies. News releases were published in local newspapers, requesting the reader to inform the author of locations of prairie dog towns. Some prairie dog towns were located by checking areas heavily utilized by cattle. These areas often contained prairie dog towns. Many of the prairie dog towns were surveyed for black-footed ferrets and ferret-like signs.

A program was devised to inform the public of the research, to promote public awareness of the ferrets' dependence on prairie dogs, and to solicit their aid in locating ferrets. Business cards with a sketch of a ferret and its' description on the front, and with the author's name, address, and telephone number on the back, were given to all persons interviewed. Articles describing the ferret were published in 38 newspapers, and two radio broadcasts were recorded and transmitted. Speeches on ecosystems, the ecology of prairie dogs, and the black-footed ferret were presented to 12 schools and 7 organizations (Elks, Kiwanis, Businessmens Assoc., local farmer groups, 4-H). A 10 min

film about the black-footed ferret was also shown during these presentations. Training sessions on techniques of surveying for ferrets were also given to U. S. Forest Service personnel. During the latter part of the research, a $100 reward was offered to the first person providing information leading to the discovery and verification of a black-footed ferret in the Oklahoma Panhandle or within a 240 km radius from the Panhandle (Appendix A). The reward poster was published in 21 newspapers and posted at 64 grain elevators and farm supply stores.

All persons reporting ferret sightings were interviewed in order to better judge the accuracy of their reports. A description of the animal was first obtained from the observers; then they were shown study skins of the long-tail ("bridled") weasel (Mustela frenata), a species relatively common in the study area that might be mistaken for a ferret. If the observers said the weasel was not the animal they saw, they were then asked how the animal they saw differed from the specimen. If their description fitted that of a ferret the observers were then shown a faded, taxidermy mount of a black-footed ferret. Those observers who said the taxidermy mount was the same size of the animal they saw, and who gave proper details about the colors, markings, and behavior of the ferret, were assumed to have seen a ferret.

Field surveys were made on prairie dog towns during the summer, and winter ~~of 1972~~ to 1974 and ~~the~~ fall of 1973. The surveys in which the author participated, were conducted 6 July to 16 August, 1972, ~~June~~ to 31 August, 1973 and during parts of June and July 1974. Observations were made in fall from 1 September to 31 October, 1973. Most of the nighttime observations occurred during the summer~~s~~ of 1972 and 1973. Surveys during winter occurred in November and December 1972 and from

November 1973 to March 1974. The towns were surveyed, some as frequently as six times over a 3 yr period, by J. C. Lewis, H. L. Anderson, K. O. Butts or the author. During the early part of this research, field surveys consisted of walking or driving an automobile through the prairie dog towns, examining most of the burrows and watching for ferrets and ferret-like signs. During the latter part of the research a trail bike was used to facilitate these surveys.

Signs currently recognized by Henderson et al. (1969), Hillman (1968), C. Hillman (personal communication 1973), Fortenbery (1972), and Sheets (1970) as indications of ferret presence are:

1. Unusual behavior of prairie dogs: Prairie dogs will sit at a burrow entrance and watch a ferret. A prairie dog will cautiously approach a burrow inhabited by a ferret and quickly dart backward. Prairie dogs residing in a part of a town occupied by ferrets are more apt to be nervous and will readily enter their burrows.
2. Stringers: A mound of soil 15 to 20 cm wide, 5 to 8 cm deep, and from 0.3 to 3.5 m long with a groove in the center created by the ferret's body as it moves out of the burrow with a load of dirt. The stringer is formed when the ferret digs out of a plugged burrow or modifies the burrow.
3. Tracks: Similar to mink (Mustela vison) or weasel tracks. The paired foot prints are separated 35 to 43 cm when the ferret is bounding and 15 to 20 cm when walking. During summer the soil is generally too hard for track impressions to show, therefore, tracks are most often observed after a snowfall. Blowing snow will often obliterate tracks.

4. Scats: Usually dark brown to black, approximately 6 mm in diameter, 25 to 100 mm long and full of hair. Scats are seldom found on the ground surface because the ferrets normally defecate in the burrow.
5. Plugged burrows: These plugs indicate that a ferret might be present, especially if there are five to ten plugged burrows within a 30 m radius. At daybreak the female ferrets may plug the entrances to burrows containing her young. She removes the plugs at dusk. Prairie dogs will plug, with dirt, burrows that contain ferrets or other animals. Badgers (Taxidea taxus) will also plug burrows (Knopf and Balph 1969, personal observations by Lewis).
6. Flies: Flies are often found in the entrance of burrows used by ferrets. They are attracted by the remains of prairie dogs killed in burrows by ferrets.
7. Musk odor: This odor is sometimes detected at the entrance of burrows occupied by ferrets.
8. Prairie dog young:adult ratios: Predation by ferrets may reduce the number of young prairie dogs in a town during late spring and early summer and produce a low young:adult ratio.

Prairie dog towns that had ferret-like signs, were observed for three to five nights. A 100-watt aircraft landing light was shined back and forth across the prairie dog town for 10 min of each hour. The observer would look for the green reflection of the ferret's eyes (Henderson et al. 1969). During night observations a tubular live-trap (Sheets 1970) was placed in some of the prairie dog burrows that had ferret-like signs.

Summer is the best time to observe ferrets because the young are active above ground (Henderson et al. 1969, Hillman 1968, Sheets 1970).

Therefore, the most intensive field surveys were conducted in June, July, August, and September of 1972 and 1973. During the winter, when snow covered the ground, prairie dog towns were also surveyed for ferrets and ferret-like signs. Prairie dog towns, where ferret-like signs had been found during the summer, received especially intensive scrutiny during the winter months. Winter is a good season to conduct searches for ferrets and their sign (Henderson et al. 1969).

Original Occupied Southern Range

All major museums in the United States, and most museums in Oklahoma and bordering states (New Mexico, Texas, Arkansas, Missouri, Kansas, Lousisiana) were asked for information about any specimens they might have of black-footed ferrets. A literature survey was conducted to locate reports of specimens taken in the southern portion of the ferret's original range. These efforts were designed to better delineate the habitat originally occupied by ferrets in Oklahoma and adjacent states.

Ecology of Prairie Dogs

The percentage of rangeland in an area is an important factor in determining remaining suitable habitat for the prairie dog and the black-footed ferret. Kinds of land were determined for Morton County, Kansas which contains 44,516 ha of national grassland and for Texas County, Oklahoma which contains no national grasslands. Kinds of land were determined by reviewing published literature on land planning and conservation needs and by interviewing county agents and personnel of the Agricultural Stabilization and Conservation Service and Soil

Conservation Service. The percentage of rangeland remaining in each county was determined and the likelihood the remaining rangeland might be converted to cropland was evaluated.

The approximate number of prairie dog towns per township was determined in Texas County. These data were then compared with the size and number of prairie dog towns found in Mellette County, South Dakota (Linder et al. 1972) in suitable ferret habitat.

The locations of prairie dog towns found in Texas County, Oklahoma during the ferret survey were marked on a county map and assigned a number. Five of these towns were selected for intensive study, with five restrictions placed on the selection of these towns. The restrictions were designed to (1) reduce bias in sampling vegetation and soils between the prairie dog towns and the adjacent land containing no prairie dogs (referred to as adjacent range throughout this thesis), (2) ensure that any town sampled was large enough to permit adequate sampling of vegetation, and (3) provide data on vegetation differences between soil types. Restrictions placed on the selection were:

1. Size: Each town had to be larger than 0.4 ha to provide adequate sample size.
2. Adjoining range: To provide adequate sample size the adjacent range had to cover at least 0.4 ha and be on the same soil series as the dog town.
3. Fencing: The adjacent range could not be fenced apart from the prairie dog town. This restriction reduced bias caused by unequal stocking rate of livestock.
4. Age: The town had to be at least four years old. This time span should provide enough time for changes in the plant community to

occur because prairie dogs were present.

5. Soil series: Each town was selected on a different soil series. This selection was designed to provide data on differences in vegetation response to prairie dog activity on different soil series.

The selected soil series were Mansker-Potter complex (Mp), Otero-Vona fine sandy loam (Ov), Mansker clay loam (MaB), Dalhart fine sandy loam (DaA), and Delhart loamy fine sand (DsB) (Table 1) (USDA 1970). The study unit included a prairie dog town and a portion of the adjacent range. The nearest boundary of the adjacent range was a minimum of 30 m from the prairie dog town, fences, or roads. This reduced the chance for bias caused by sampling vegetation and soil near areas disturbed by grazing prairie dogs, road and fence construction, and wind erosion.

Visual estimates of the size of 85 prairie dog towns in Texas County were made during searches for ferrets. Fences were generally present along half-section and quarter-section lines and served as reference points to help estimate size of the towns. To determine the accuracy of the estimation, the size of the five prairie dog towns selected for intensive study were estimated before they were measured with a calibrated measuring wheel. Each town was marked off in large quadrilaterals and triangles using twine as boundaries of the geometric figures. The measuring wheel was pushed along the boundaries of each geometric figure and the length of each side measured. The area of each geometric figure was then computed.

Burrows on the outer edge of each prairie dog town showing evidence of recent use delineated the borders of each town. Borders were

Table 1. Description of the five major soil series found on prairie dog towns in Texas County, Oklahoma

Soil Series and Texture	Topography	Slope (%)	Parent Material	Solum Depth (Cm)	Sub-Soil	Wind Erosion Potential
Mansker-Potter Complex clay loam and loam	Breaks and ridges of rough broken uplands	2-5	Calcareous clay, silt, and sand	30-102	Hard caliche and deep granular clay	High
Otero-Vona fine sandy loam	Strongly sloping areas and along drainage	1-6	Sandy loam	107	Sandy loam	High
Mansker clay loam	Gently sloping near breaks and strongly sloping in breaks	0-3	Strongly calcareous moderate fine sediments	122	Hard caliche overlain by clay loam and caliche mix	High
Dalhart fine sandy loam	Level to gently sloping uplands	0-1	Windblown sand	76	Sandy clay loam	Moderate
Dalhart loamy fine sand	Nearly level uplands	0-3	Windblown sand	76	Sandy clay loam	High

traversed using a compass and measured with the measuring wheel. These towns and portions of the adjacent range were mapped and an overlay grid, representing plots of 5 x 30 m, was used to locate sample plots on the map. The grid was numbered vertically and horizontally and placed over a map of each prairie dog town and adjacent range. A table of random numbers was used to randomly select the starting point of each transect and to determine the direction the transects lay.

Vegetation and Ground Cover Sampling

Adequate sampling intensity for analysis of vegetation was determined for each sampling unit by using the equation described by DeVos and Mosby (1971:158).

$$n = (s^2t^2)/d^2$$

The initial goal for statistical confidence was to take enough samples to provide an estimate within 20% ($\pm$ 10%) of the mean of the parameters sampled with a 90% level of confidence. All data collected by random sampling was subjected to an analysis of variance test (Sokal and Rohlf 1973).

Vegetation and ground cover on the prairie dog towns and adjoining ranges were sampled using the Inclinded Ten-Pin Point Frame method described by Stoddart and Smith (1955). A cable 0.32 cm x 30 m was stretched down the center of each randomly selected plot. The frame was placed across this cable at 3 m intervals. The pins were lowered to the ground and all hits recorded. A total of 58 transects were run, 29 on each site with a total of 5798 hits recorded.

If a pin touched bare ground it was recorded as Bare Ground Prairie Dog (BGP), Bare Ground Natural (BGN), Bare Ground Ant (BGA), or Bare

Ground Other (BGO). Rocks were recorded as RCK. Litter or animal dung was recorded as Litter (LIT). Only those pins touching the basal portion of a plant (root crowns at ground level) were recorded as hits on vegetation (VEG).

Percent ground cover and species composition were determined on each site. The plant species nearest each point was recorded to determine species composition. The vegetation was recorded by species or genus and then grouped into 12 categories according to their desirability (Ernest Snook, personal communication 1974) as forage for livestock (Appendices B and C). An abundant species was coded separately as well as being included in the appropriate category. The 12 categories were: Desirable Grasses, Less Desirable Grasses, Least Desirable Grasses, Desirable Annual Forbs, Less Desirable Annual Forbs, Least Desirable Annual Forbs, Desirable Perennial Forbs, Less Desirable Perennial Forbs, Least Desirable Perennial Forbs, Less Desirable Woody Plants, Least Desirably Woody Plants, and Desirable Forbs. Ground cover and species composition of the prairie dog towns were later compared with that found on the adjacent ranges, which were consisdered as controls.

Nomenclature of the forbs and woody plants follows that of Waterfall (1972) for scientific names and Darrow et al. (1966) for common names. Nomenclature of the grasses follows Hitchcock (1971). All species found during the study are listed in Appendix C. Examples of most species are in research vouchers in the Oklahoma State University Herbarium.

Burrow Counts

Burrows and the average distance between them were counted in each vegetation study transect on the prairie dog towns. All burrows with at

least 50% of the burrow within the transect were counted. This information was used in an attempt to estimate the total burrows on each town. On three towns all burrows were counted and distances between the burrows were paced. Total count for each of the three towns was compared with the estimated number of burrows for these towns.

Cattle Use of Sites

An estimate of cattle use of the prairie dog towns and the adjacent ranges was made using a count of cattle droppings (Overton 1971). Droppings were counted in 29, 5 x 30 m plots used for each site. The average number of droppings per hectare for each site was tested by analysis of variance for statistically significant differences between sites.

Soil Sampling

Soil samples were taken with a steel tube 2.5 cm in diameter and 1 m long driven into the soil to a depth of 30 cm. A total of 90 samples were taken, 9 on each prairie dog town and 9 on each adjoining range. Soil samples were taken in sets of three. The first set was in the center of the sampling site (prairie dog town or adjacent range). The other two sets were taken on azimuths of 90° and 220° halfway between the first sample set and the border of the sampling site. The three samples per set were combined into one sample for analyses, providing a total of 30 samples for analyses (15 on prairie dog towns and 15 on adjacent ranges).

Soil samples were analyzed by the Oklahoma State University, Department of Agronomy, Soil and Water Testing Laboratory, for organic

matter, pH, and extractable phosphorus, potassium, magnesium, calcium, and sodium (Buckman and Brady 1970). Chemical composition of the soils of prairie dog towns was compared arithmetically and by analysis of variance with chemical content in soils of the adjacent ranges.

Range Condition

The range condition of the five prairie dog towns and adjacent ranges was determined from the transect data using the method described by Dyksterhuis (1949).

The Soil Conservation Service Range Site Descriptions for Texas County were used to determine the response-to-grazing category (decreaser, increaser, invader) of each species and the percentage expected in climax condition. E. Snook, State Range Conservationest, Soil Conservation Service, categorized all plants not listed in the Range Site Descriptions. All increasers not listed were assigned a 5% maximum allowed (expected) in the climax condition.

Questionnaires

Two questionnaires were designed to determine the attitudes of local residents toward prairie dogs (Appendices D and E). The Student Questionnaire was distributed to students of junior and senior high schools prior to the investigator's speeches on ecosystems, prairie dogs, and the black-footed ferret. The questionnaire was completed and collected prior to the speech. Verbal directions for filling out question numbers 7, 8, 9, and 10 were necessary to increase the probability that the forms would be completed properly. This questionnaire provided

information about the students' knowledge of and attitudes toward prairie dogs.

The Voting Residents' Questionnaire was sent to 5% of the voting residents of the three counties of the Oklahoma Panhandle. Each letter included instructions for completing the questionnaire, an explanation of the need for the questionnaire, and a self-addressed, stamped envelope for its return. Three weeks after the first mailing a follow-up questionnaire was sent to all those who did not return the initial form. Each questionnaire had two parts, one to provide information about the attitudes of land managers the other for persons who were not managers. The returned questionnaires were placed in two categories, i.e., Land Managers and Non-managers.

Population Estimate

A population estimate was made on an isolated portion of one prairie dog town by trapping and marking seven prairie dogs, and then observing them during their periods of peak activity. Prior to estimating the population, it was necessary to tentatively select effective traps, trap placement, marking materials, and marking techniques.

Steel traps with padded jaws, dome-shaped wire traps, recommended by R. G. Sheets (personal communication) and a "drift" trap were used in an attempt to capture prairie dogs. The selection of traps was based on capture success, construction time, time required to set up the traps, and efficiency in a one-man operation.

R. G. Sheets, Biologist, Iowa Department Conservation (personal communication 1973) tested several types of padding on the jaws of steel traps, but the application of these paddings was slow. The author

used surgical rubber tubing with a 5 mm wall thickness, cut into 90 to 100 mm sections. The jaws of 30, number-one, steel traps were removed, one end of each was dipped in glycerin, the rubber tubing was slipped on the jaws, and they were reinstalled in their mounts.

Traps were placed within the burrows and at varying distances from the burrow entrances. A 7 x 7 cm piece of cloth was placed over each trap pan to prevent dirt from clogging the trigger mechanism. A shallow hole, deep enough to hide the trap, was dug and the trap was placed in the hole. The trap was then covered with a thin layer of dirt.

Three dome traps were constructed using a 2.5 x 5 cm welded wire on the bottom and chicken-wire on the top. The traps were 0.6 x 0.9 x 0.6 m in size. A swinging trap door, 15 x 15 cm, was positioned in the center of the bottom of the trap. The prairie dog mound was leveled, and the trap was set on top of the burrow. The prairie dog, when leaving the burrow, would theoretically enter through the swinging trap door and be captured.

The "drift" trap (Fig. 3) was constructed of 30 m of 1.2 m high, chicken wire fence, formed in a "V". The fence had three, 10.2 cm inside diameter, polyvinyl chloride (PVC) plastic sewer pipes inserted along the bottom. One pipe was placed at the apex of the "V". The other two pipes were placed 10 m down the fence, one on each side of the apex of the "V". The plastic pipes had plexiglass doors designed to swing open into traps, 0.6 x 0.6 x 0.6 m in size, placed on the opposite side of the fence. The plexiglass doors were attached to the pipes by hinges. Plastic pipes, 20 to 40 cm long, with plexiglass doors which allowed the prairie dogs to exit but not enter, were placed in all burrows within the "V" formed by the chicken-wire fence. Each piece of

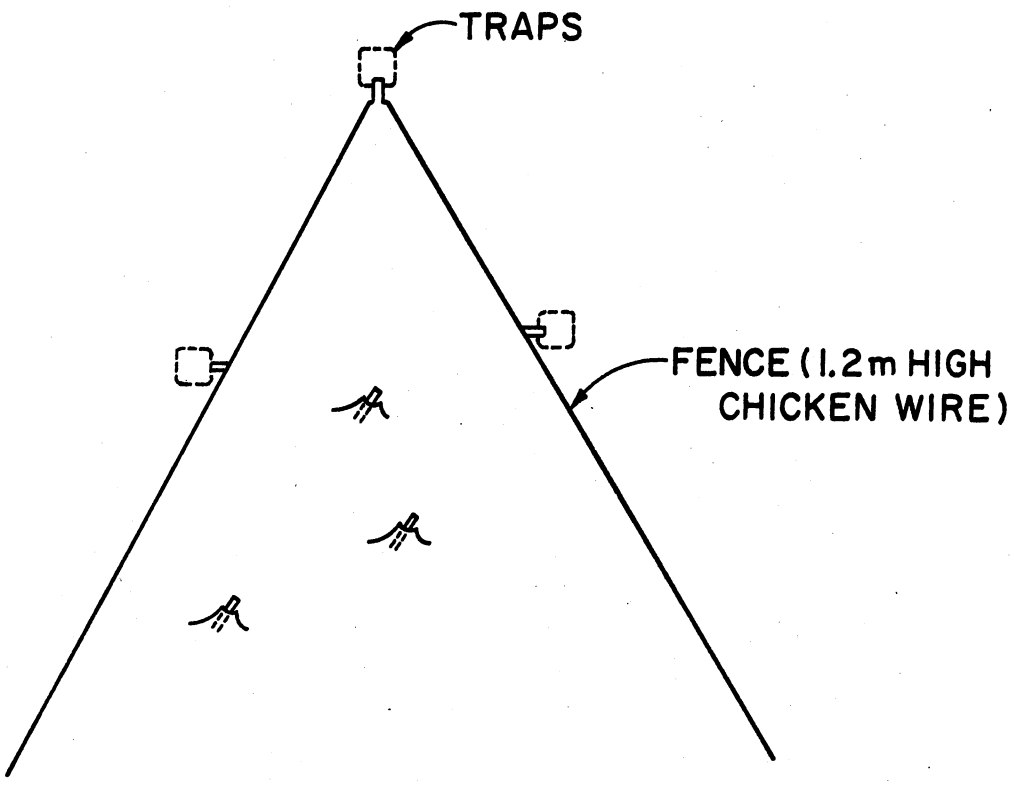

Fig. 3. "Drift" trap with three plastic pipes inserted along the bottom of the fence and others placed in prairie dog burrows

pipe was scored on the inside with a knife to provide traction for the feet of the prairie dogs. When the prairie dogs were outside their burrows, they were chased toward the apex of the trap and theoretically would be captured when they entered the PVC pipes.

Marking Materials and Techniques

During preliminary testing, six prairie dogs were dyed with one of four dyes: human hair dye, picric acid, clothing dye, or Rhodamine B. Picric acid, Rhodamine B and hair dye were mixed with 20% by volume, hydrogen peroxide. Clothing dye was mixed with water. The dyes were applied with either a cotton swab, an atomizer, or a plastic squeeze bottle and the animals released immediately.

As a result of the first experiments, other prairie dogs were kept in captivity for further tests on the permanency of the dye, the transfer of the dye to unmarked animals, and the affect of dyes on the health of marked animals. Prairie dogs live in burrows and they use soil to clean their fur. Therefore, pens for the captive prairie dogs included a simulated burrow where the prairie dogs were in contact with the soil. The captive prairie dogs were fed alfalfa hay, wheat seedlings, commercial rabbit food, and bird seed.

Two series of tests were conducted to determine drying time of dyes, one on a cloudy day with little wind (0 to 9 km per hour) and the second on a sunny, windy day (9 to 25 km per hour) day. All marking and drying trials were conducted outdoors, above ground. The prairie dogs were marked and allowed to dry from 2 to 3 hr. The second experiment was conducted under normal weather conditions for February and March.

Due to hibernation and reduced activities of some of the prairie dogs exposed to the extreme weather conditions, the prairie dogs involved in the latter half of the second test were housed in a small shed. During this series of tests, the least preferred dye and marking techniques were eliminated and the remaining marking techniques were combined. After the prairie dogs were marked and dry, they were caged with an unmarked prairie dog for 30 days.

Prairie dogs for the population study were trapped, marked, and released after the preferred traps, marking techniques, and dyes had been determined. A portion of a prairie dog town was observed for two days from 0800 to 1200 and from 1500 to 1800. During the first 10 min of each hour the prairie dogs above ground were counted. The percentage of marked prairie dogs was used as an indicator of the total population of this portion of the prairie dog town.

The census technique is similar to that of Sheets (1970), however, Sheets attempted to determine population numbers by marking a grid within a prairie dog town and counting the number of prairie dogs in the grid. Sheets experienced difficulty in keeping track of the marked prairie dogs as they crossed the grid boundaries. The author used a portion of a prairie dog town that was separated from the rest of the town by a dirt road and in which a ward (King 1952) existed. The residents of the ward drove all intruding prairie dogs out of this area.

CHAPTER IV

RESULTS AND DISCUSSION

Ferret Survey

Field surveys for ferrets and ferret-like signs were conducted, by J. C. Lewis, H. L. Anderson, K. O. Butts, or the author, on approximately 300 prairie dog towns between 1970 and 1974.

The time spent surveying prairie dog towns for ferret-like signs was considerably reduced after the purchase of a trail bike. The author was able to survey a 180 ha prairie dog town in approximately the same time it took to survey a 30 ha town by walking.

Observations were made at night by J. C. Lewis, C. N. Hillman, and the author for a total of 840 hr during the three summer and two winter surveys. During the night observations approximately 174 trap hours were attempted.

Eighty-six prairie dog towns were surveyed during the winter and 74 hr of night time observation were accomplished. No trapping was attempted during the winter.

Ferret-like signs were found in all counties of the research area except in Ochiltree and Lipscomb Counties, Texas. The ferret-like signs found consisted of: stringers of dirt (Fig. 4); prairie dog skulls with small tooth punctures in the parietal bone or with the occipital bones broken (Fig. 5) as described by Hillman (1968); numerous

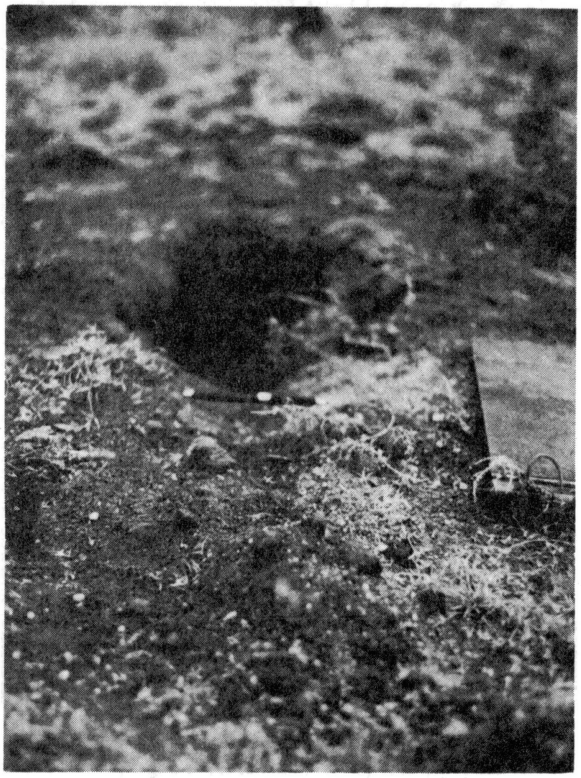

Fig. 4. Two views of one of the many ferret-like stringers found during the survey

plugged burrows in a small area; plugged burrows that had been dug out from the inside (Fig. 6); and tracks that were very similar to that of the long-tailed weasel, but larger.

Ferret-like tracks were found in two locations where possible ferret sightings had occurred. In both cases, the animals ran across the road from a field into an irrigation ditch and then into crops. Plaster casts were made of the tracks and shown to C. N. Hillman, Research Biologist, studying black-footed ferrets for the U. S. Fish and Wildlife Service, Dr. R. C. Erickson, U. S. Fish and Wildlife Service, and Dr. F. R. Henderson, Kansas State University. Positive identification of the animal that made the tracks was not possible.

Conrad Hillman visited the Oklahoma Panhandle and southeastern Colorado in 1973 and found ferret-like signs. Hillman seemed optimistic that ferrets would eventually be found in this area.

Approximately 200 persons who thought they may have seen a black-footed ferret were interviewed. Of these reports, 82 may be authentic sightings (67 of these sightings were reported by Lewis and Hassien 1974). These observers gave relatively accurate descriptions of size, color patterns and behavior traits of a ferret and the observers identified the mounted ferret specimen as the animal they saw. All of these reports were received prior to the time the $100 reward was offered or before the observer had any knowledge of the reward. In 58 of the 82 possible authentic sightings the observers saw the ferret (?) only briefly or they could not remember all of the details of the sighting and these 58 are, therefore, not listed. The remaining 118 sightings, not considered authentic, were probably racoons (Procyon lotor), masked weasels, domestic cats, and two sightings may have been

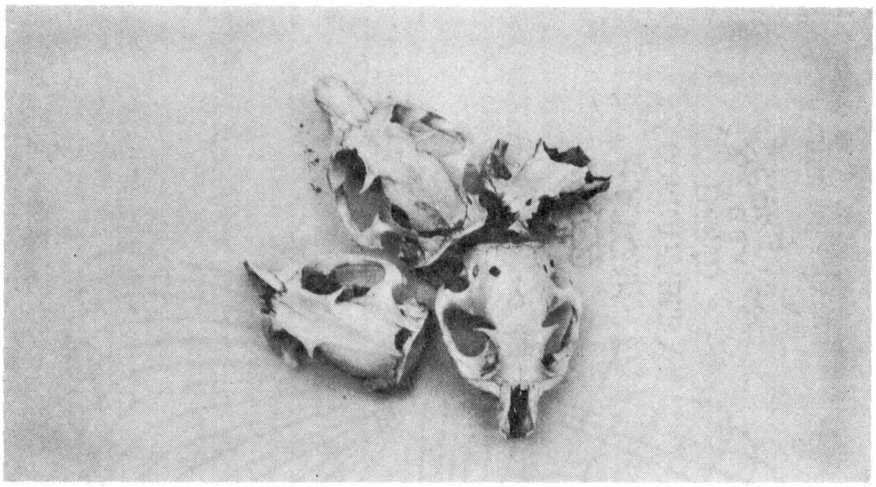

Fig. 5. Prairie dog skulls with small tooth punctures in the parietal bone or with the occipital bones broken

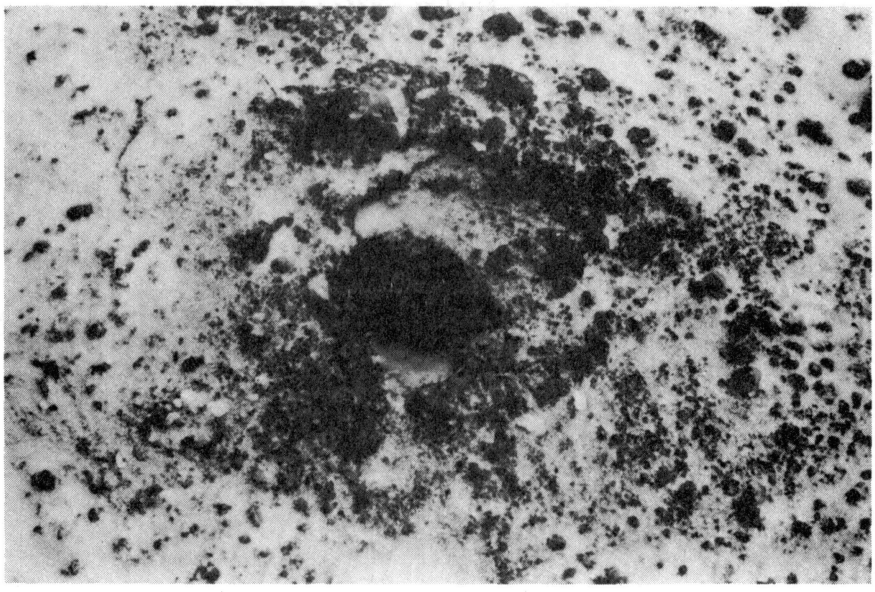

Fig. 6. Plugged burrow dug out from the inside

ring-tailed cats (Bassariscus astutus).

Nineteen observers (Table 2) reported sighting a total of 24 ferrets and these were considered fairly reliable because of the accuracy of the descriptions. Seventeen of these sightings were made by competent observers or in locations where ferret-like signs had been found by the author.

Six ferrets were reported killed or found dead in Oklahoma since 1967, but their carcasses were not preserved by the observer.

Fourteen of the 24 ferrets reported observed were on or within 1.5 km of a prairie dog town. This close proximity to prairie dog towns was considered significant by the author because of the reported dependency of the ferret on prairie dogs and because Hillman and Linder (1974) reported that most of the road kills occurred within 0.8 km of prairie dog towns. The other reported sightings occurred in road ditches, cultivated crop borders, old buildings, irrigation pipe, grain sheds, and around grain elevators. Because of the cover and abundant food supply, each of these locations contains rodents which may serve as an alternate food source for ferrets.

Most of the probable sightings occurred in Morton County, Kansas and Texas County, Oklahoma. The larger number of probable sightings from these two counties may have been due to the author expending more effort in these locations and may not reflect a possible localized population of ferrets.

After completing the program designed to inform the public of the possible presence of black-footed ferrets in the study area, the problem of determining the accuracy of observers' reports became increasingly difficult. Occasionally, the description given, accurately described a

Table 2. Probable ferret sightings reported 1964 to 15 May, 1974, Oklahoma Panhandle and adjoining counties of adjacent states

State and County	Date Sighted	Observer	Number Seen	Location (section, township, range)	Comments
COLORADO:					
Baca	1964	E. Miller, Ranger U. S. Forest Service	3	31-34S-44W	One adult, two young, in dog town
KANSAS:					
Morton	7-28-73	L. Smith, Mailman	1	36-34S-42W	Crossed county road
Morton[1]	3-17-70	S. Adams, Ranger U. S. Forest Service	1	34-34S-42W	Seen from 7 m in dog town
Morton[1]	1- 1-71	S. Adams	1	34-34S-42W	Observed with 20X scope at 30 m on dog town
Morton[1]	4-15-74	S. Adams	1	33-34S-42W	Seen crossing road
Morton	7-31-71	R. Smith	1	21-33S-43W	Seen from 2 m in sandy rangeland
Mead	7- 6-73	F. Marrs	1	13 km N. Mead	Seen crossing road

Table 2 (Continued)

State and County	Date Sighted	Observer	Number Seen	Location (section, township, range)	Comments
TEXAS:					
Sherman[1]	Summer 1972	J. Jackson	4 (3 occasions)	10 km N. Stratford	Around old granary
Sherman[1]	Winter 1972	J. Lavake	1	10 km N. Stratford	Around old granary
OKLAHOMA:					
Texas	1967	G. Briles	1	13-3N-19E	Seen entering burrow
Texas	July 1969	R. Wells	1	1-3N-12E	Cornered at house by dog
Texas[1]	Fall 1970	B. Carder	1	5-5N-12E	Seen along road
Texas	Fall 1970	C. Treece	1	7-2N-10E	In road ditch
Texas	Aug. 1971	Grinstead	1	19-5N-11E	Killed one in barn
Texas	Nov. 1971	B. Fisher, Biology teacher	1	30-5N-11E	Found dead by school
Texas	May 1973	M. Elliot	1	23-2N-9E	In irrigation pipe
Texas	Aug. 1973	R. Ralston	1	23-4N-13E	In irrigation pipe

Table 2 (Continued)

State and County	Date Sighted	Observer	Number Seen	Location (section, township, range)	Comments
OKLAHOMA:					
Texas[1]	Aug. 1973	L. J. Russel	1	30-1N-10E	Seen along road
Cimarron	Aug. 1971	S. Crier	1	18-2N-9E	Crossing road

[1]Denotes location where ferret-like signs were found in the vicinity where the ferret was reported sighted.

ferret, but proved to be some other animal. The use of the ferret and weasel museum specimens proved to be a valuable tool in identifying the animal observed, but was not fool proof. On two occasions the author received reports that ferrets had been sighted, one in a burrow the other in an old barn. The observers were immediately interviewed. They gave an accurate description of a ferret and picked out the ferret specimen. The author then went to the locations where the sightings had occurred. A young badger was observed in the burrow and a domestic cat was found in the barn at the location described by the observers.

The information program designed to alert the public to the possible presence of ferrets was responsible for approximately 25% of the reported sightings. The author became aware of the other reported sightings as a result of interviews with land-managers, hunters, and local residents, and from prior research by J. C. Lewis, K. O. Butts, and H. L. Anderson.

Despite considerable effort to locate ferrets, by personnel of the Oklahoma Cooperative Wildlife Research Unit and the author, ferrets were not observed and their presence in the study area could not be confirmed. The numerous ferret-like sign found in most counties of the study areas and the very accurate description of the ferret by 19 observers (Table 2) indicates that a small number of ferrets may still exist in the study area.

Original Occupied Southern Range

Correspondence with museums and a literature survey indicated that approximately 65 ferret specimens or remains have been collected from

the states of Kansas, Colorado, Texas, Oklahoma, and New Mexico (~~Table 3~~) since the 1870's. Stuart and Christensen (1974, ~~Table 3~~) reported six additional ferret specimens from New Mexico but the present locations of the specimens were not given. Henderson and Little (1974, Table 3) reported three museum specimens or substantiated reports of ferrets from Kansas. Neither the locations of the specimens nor the dates of collection or sighting were given. Consequently, the two Wallace County, Kansas specimens may duplicate two reported by Henderson and Little (1974). Torres (1974) reported two specimens in a private collection taken from Meeker, Colorado (Rio Blanco County) and one located in the University of Colorado Museum. Collection dates were not recorded for these latter specimens, thus one of the two Larimer County, Colorado specimens in the University of Colorado Museum may be a duplicate of the Larimer County specimen reported by Torres (1974).

Basically, the specimens (~~Table~~ 3) confirm the original range boundaries as reported by Cahalane (1954, Fig. 1).

Ecology of Prairie Dogs

Kinds of Land

Much of the land in Texas County, Oklahoma and Morton County, Kansas is cropland. Most of the land suitable for cultivation has been plowed and much of the rangeland not suitable for cultivation has also been plowed (C. Haverkamp, SCS, personal communication, 1973).

Texas County, Oklahoma consists of almost 532,500 ha. Approximately 528,400 ha are in private holdings, 3700 ha are in the Optima National Wildlife Refuge, and the remaining area is occupied by roads

Table 3. Museum specimens collected from the states of Kansas, Colorado, Texas, Oklahoma, and New Mexico[1]

State	County	Date of Collection	Specimen Number	Museum
Kansas	Banner	1891	25358/32771	USNM
Kansas	Banner	1891	83992	USNM
Kansas	Banner	1891	83993	USNM
Kansas	Banner	1891	83994	USNM
Kansas	Dickenson	1890		U. Kans
Kansas	Ellis		CM 21391	Carnegie
Kansas	Ft. Wallace		22929/12299	USNM
Kansas	Grove	1890	22539/30066	USNM
Kansas	Grove	1890	32538/30065	USNM
Kansas	Hamilton	1933		U. Kans
Kansas	Hamilton	1935		U. Kans
Kansas	Hamilton	1935		U. Kans
Kansas	Kingman	1890		U. Kans
Kansas	Lincoln	1930		U. Kans
Kansas	Logan	1901	110772	USNM
Kansas	Salina	1904	UC 895	U. Colo
Kansas	Sheridan[2]			
Kansas	Smith[2]			
Kansas	Trego	1884	188450	USNM
Kansas	Trego	1886	15470/22311	USNM
Kansas	Trego	1886	188451	USNM
Kansas	Trego	1887	188452	USNM
Kansas	Trego	1887	188453	USNM

Table 3 (Continued)

State	County	Date of Collection	Specimen Number	Museum
Kansas	Trego	1887	188454	USNM
Kansas	Trego	1887	188455	USNM
Kansas	Trego	1889	188456	USNM
Kansas	Trego	1889	188457	USNM
Kansas	Trego	1889	22357/30064	USNM
Kansas	Trego	1891	19262/35376	USNM
Kansas	Trego	1891	19263/35016	USNM
Kansas	Trego	1891	19294/35017	USNM
Kansas	Trego	1891	19295/35018	USNM
Kansas	Trego		15470	USNM
Kansas	Trego		19538	USNM
Kansas	Trego		22427/15471	USNM
Kansas	Trego		34977	USNM
Kansas	Wallace	1915	199737	USNM
Kansas	Wallace[2]			
Colorado	Adams	1914	1208	DMNH
Colorado	Adams	1914	1558	DMNH
Colorado	Adams	1916	1883	DMNH
Colorado	Adams	1916	1684	DMNH
Colorado	Adams	1930	4322	DMNH
Colorado	Baca	1905	10659	U. Colo
Colorado	Baca	1924	2024	DMNH
Colorado	Baca	1924	2247	DMNH
Colorado	Baca	1928	2371	DMNH

Table 3 (Continued)

State	County	Date of Collection	Specimen Number	Museum
Colorado	Buena Vista	1943	930	DMNH
Colorado	Costilla	1942	140397	AMNH
Colorado	Denver	1939	3640	DMNH
Colorado	Denver		3703	DMNH
Colorado	El Paso	1878	24412	AMNH
Colorado	El Paso	1905	10660	U. Colo
Colorado	Greasewood	1937	3206	DMNH
Colorado	Larimer	1887	8640	ANS
Colorado	Larimer	1887	8641	ANS
Colorado	Larimer	1909	U. C. #59	U. Colo
Colorado	Larimer[3]			U. Colo
Colorado	Larimer	1913		CSU
Colorado	Middle Park	1888	653	DMNH
Colorado	Moffat	1941	CM 19392	Carnegie
Colorado	Moffat	1941	CM 20627	Carnegie
Colorado	Moffat	1942	CM 20628	Carnegie
Colorado	Park	1926	247073	USNM
Colorado	Rio Blanco[3]			Private
Colorado	Rio Blanco[3]			Private
Colorado	Rio Grande	1919	234118	USNM
Colorado	Semper	1915	5792	DMNH
Colorado	Simpson	1915	41994	AMNH
Colorado	Teller	1905	10658	U. Colo
Colorado	Weld	1910	UC 232	U. Colo

Table 3 (Continued)

State	County	Date of Collection	Specimen Number	Museum
Colorado	Weld	1922	265540	USNM
Colorado	Weld	1923	1897	DMNH
Colorado	Weld	1923	1987	DMNH
Texas	Childress	1894	65061	USNM
Texas	Cook	1886	188459	USNM
Texas	Gainesville		15018	USNM
Texas	Pecos	1904	11842	ANS
Texas	Seymour		12143	ANS
Oklahoma	Woods		858	N. W. State Coll.
Oklahoma	Cleveland	1928	8846	U. Okla
Oklahoma	Texas	1927		OSU
Oklahoma	Cimarron	1923	243787	USNM
New Mexico	Bluewater	1918	231363	USNM
New Mexico	Catron[4]	1918		
New Mexico	Gallup	1934	251453	USNM
New Mexico	Guadalupe[4]	1903		
New Mexico	Magdolena	1918	230773	USNM
New Mexico	McKinley[4]	1918		
New Mexico	Mt. Taylor	1918	228789	USNM
New Mexico	Picacho	1929	14509	ANS
New Mexico	Santa Fe	1930		U. Kans
New Mexico	Socorro[4]	1915		
New Mexico	Valencia[4]	1918		

Table 3 (Continued)

State	County	Date of Collection	Specimen Number	Museum
New Mexico	Valencia[4]	1937		

[1]USNM--U. S. National Museum-Washington
DMNH--Denver Museum of Natural History-Denver
U. Colo--University of Colorado Museum-Boulder
U. Kans--University of Kansas Museum-Lawrence
Carnegie--Carnegie Museum-Pittsburgh
ANS--The Academy of Natural Sciences-Philadelphia
AMNH--The American Museum of Natural History-New York
CSU--Colorado State University Museum-Fort Collins
N. W. State Coll.--N. W. State College-Alva, Oklahoma
U. Okla--Oklahoma University-Norman
OSU--Oklahoma State University-Stillwater

[2]Reported by Henderson and Little 1974

[3]Reported by Torres 1974

[4]Reported by Stuart and Christensen 1974

or in city and state ownership. Fifty-nine percent (312,700 ha) of Texas County is cropland and only 37% (198,600 ha) is rangeland. Approximately 81% (161,600 ha) of the rangeland is in the same land capability classes as 60% of the cropland (Table 4) (USDA 1970).

More of the rangeland is being converted to cropland as new agricultural technology and seed varieties become available. High prices for crops also increase the probability that some of the range will be cultivated in the next 15 years. Cheatham (1974:82) stated ". . . it was obvious when the census was complete that more [prairie dog] colonies had been lost to plowing for agricultural purposes, than to any other single cause." Increased conversion of rangeland to

cultivated land will further reduce the natural habitat of the prairie dog in Texas County and therefore, reduce the number of prairie dog towns available for ferret occupancy.

Table 4. Kinds of land and land capability sub-classes in Texas County, Oklahoma

Land Capability Sub-Classes	Percent (%)	Cropland		Rangeland (%)
		Dryland (%)	Irrigated (%)	
IIIe	28.6	20.2	5.4	2.4
IVe	10.0	2.9	0.2	6.6
VIe	17.7	1.7	0.05	15.9
VIIe	0.5	0.01		0.5
IIIw	0.2	0.1		0.07
Vw	1.2	0.2		1.0
VIIs	5.6	0.1		5.5
IIIc	35.3	23.6	5.3	6.0
Totals	99.1	48.9	10.9	38.0

The conversion of rangeland to cropland was small in the last decade but much of the Conservation Reserve (Soil Bank) land is now being plowed (Texas County ASCS, personal communications, 1973). The Conservation Reserve is classified as cropland by the ASCS and was not listed as rangeland even though the perennial grass vegetation is not subjected to cropping practices.

Morton County, Kansas consists of about 187,800 ha. Approximately 76% (143,200 ha) is in private ownership; the rest is under local, state and federal government control. The local and state government land consists of municipal areas, roads, and 65 ha of cropland. The federal land, the Cimarron National Grasslands, contains 44,500 ha of reclaimed land which is primarily seeded native vegetation. Intensive management for multiple use is being practiced on these lands. Of the 53,300 ha of rangeland remaining in Morton County, only 8,700 ha (16%) are privately owned and approximately 50% of this is adjacent to the National Grasslands. Only 11 prairie dog towns occur on the Cimarron National Grasslands and they contain approximately 120 ha, less than 0.3% of the total area.

The conversion of native grassland to cultivated crops was insignificant in the last decade (C. Haverkamp, SCS, personal communication, 1973) because most of the suitable land is already under cultivation. The Conservation Reserve Land seeded with perennial grasses in 1956-1960 is also being plowed. During 1956-1960, 13,500 ha were under contract to SCS and reseeded with grass. Today all but approximately 2,300 ha have been recultivated (M. Turner, County Executive Director, ASCS, personal communication, 1973).

Location of Prairie Dog Towns

Ten days were spent locating possible prairie dog towns from aerial photographs. Ten more days were spent locating prairie dog towns by interviewing land owners. Forty-six apparent prairie dog towns were located by viewing old aerial photographs. These were checked in the field; 12 were existing towns, five others were

unoccupied, two were ant colonies, one was a pocket gopher colony, and the rest were either fields plowed within the last decade or pastures that no longer contained prairie dogs. A total of 32 prairie dog towns were located in 10 days by interviewing land owners and hunters.

Better success probably would have been obtained if recent photographs were available. Cheatham (1974) used newer (1963 to 1973) photographs of a scale 1:7920 and reported 80% accuracy in determining locations of prairie dog towns in Perry County, Texas.

The aerial photographs for Texas County, Oklahoma were taken in 1960 and were of limited value in locating existing towns. Texas County is heavily cultivated and many of the prairie dog towns located on the old aerial photographs (scale 1:20000) do not exist today. It was also difficult to distinguish prairie dog towns from ant mounds and pocket gopher colonies. J. C. Lewis (personal communication) states that some ant colonies can be distinguished on photographs of a scale larger than 1:20000 because of the more systematic spacing of the ant mounds.

The existence of 123 prairie dog towns in Texas County, Oklahoma was verified (~~Fig. 7~~). Twenty-four other towns were reported but not verified. Considering the accuracy of the previous reports of dog towns by local residents the author believes these reports are valid. This indicates that the 123 prairie dog towns found by the author are less than 80% of the total prairie dog towns existing in Texas County and would put the estimated total at approximately 150 towns.

The most successful method of locating prairie dog towns was by interviewing land owners with prairie dogs on their land and by interviewing persons who hunted prairie dogs. These persons were able to accurately direct the author to other prairie dog towns. The author

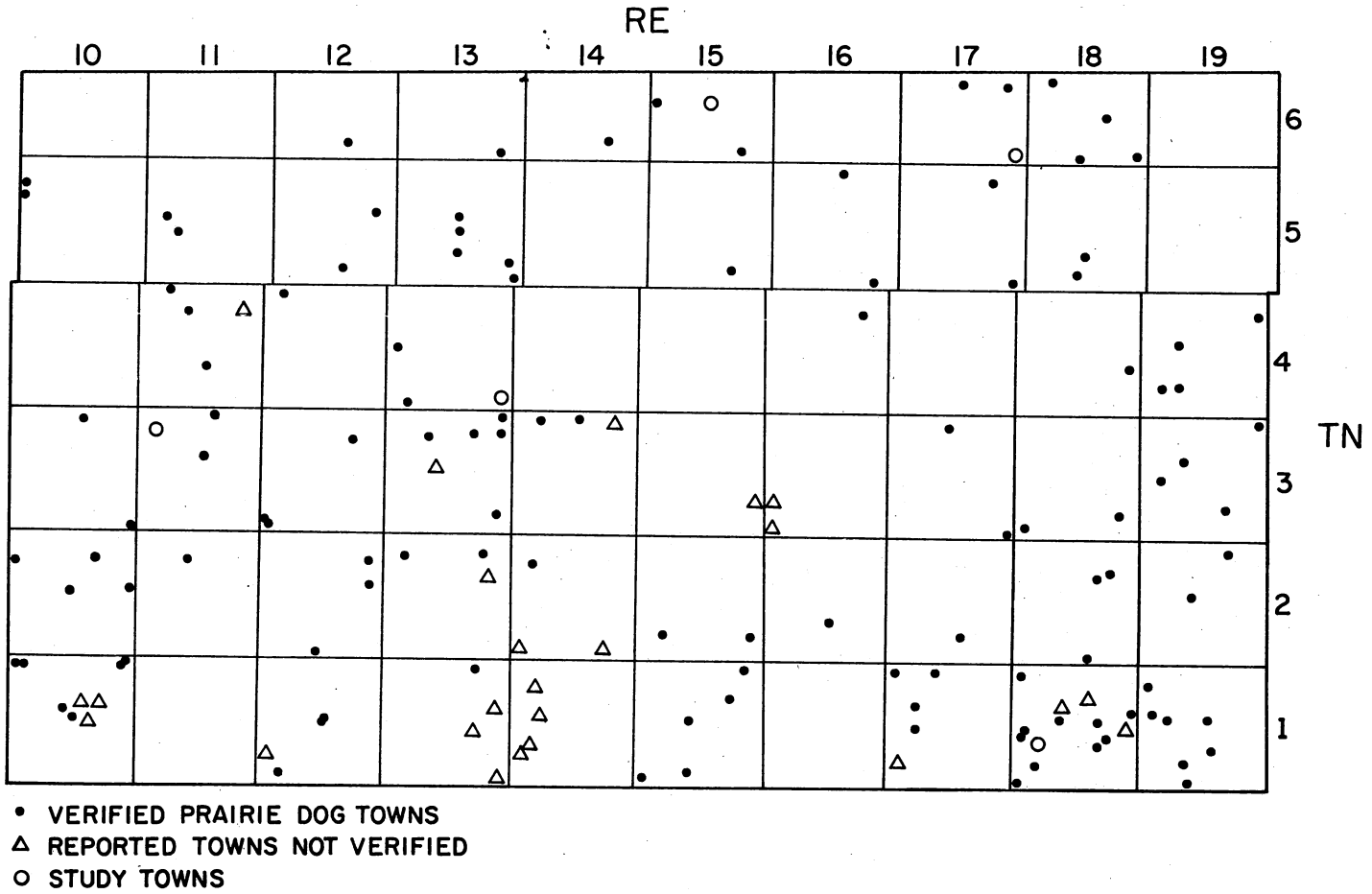

Fig. 7. Distribution of prairie dog towns in Texas County, Oklahoma

believes the second most effective method for locating prairie dog towns is interviewing county agents and animal control personnel of the U. S. Fish and Wildlife Service. The use of the old aerial photographs, and newspaper articles requesting locations of prairie dog towns, was satisfactory only for a cursory survey and not for an intensive study of town locations.

Of the 123 prairie dog towns verified in Texas County, 38 were surveyed for ferrets prior to initiating the prairie dog study and estimates of size were not recorded by the author.

Visual estimates were made of the size of 85 prairie dog towns in Texas County. The average size of these towns was 14 ha and the size ranged from 0.2 to 122 ha. The sizes of the five prairie dog towns used in the intensive ecological study were estimated prior to measuring them. These estimates were approximately 95% accurate. Two towns were overestimated by an average of 2.8% and 3 towns were under-estimated by an average of 4%.

The average size of 85 prairie dog towns was larger than the average size of the five towns selected for intensive study. This difference was expected due to the restrictions placed on the dog towns selected for the study.

Using the average size of 14 ha for the 85 towns the estimated hectares covered by the 123 verified prairie dog towns in Texas County is approximately 1722 ha or 0.32% of the total area of the county. The maximum number of prairie dog towns found in one township was 11. Linder et al. (1972) found 151 prairie dog towns in Mellette County, South Dakota, totaling approximately 1284 ha. The average size of the

towns was 8.5 ha with a range of 0.4 to 56 ha. Approximately 0.38% of Mellette County's total area (338,260 ha) contains prairie dogs.

The distribution of prairie dog towns in Texas County, Oklahoma is similar to the distribution of prairie dog towns in Mellette County, South Dakota (Linder et al. 1972). Both counties show a clumped distribution but with a few prairie dog towns dispersed throughout. The clumping affect is more noticable in Mellette County. The total number of verified towns in Texas County is less than that found by Linder et al. (1972) in South Dakota but the total hectares is similar. The larger average size of the prairie dog towns in Texas County may make up for the small difference in spacing of the prairie dog towns. Linder et al. (1972) reported ferrets on a 25 and a 43 ha town in an area that contained only a small number of prairie dog towns.

Tables 5 and 6 give some ecological characteristics of each of the five prairie dog towns selected for the intensive study. Very light to no hunting pressure was recorded on these towns. Each of these towns had been poisoned one or more times, prior to this study, for control of prairie dogs. Two towns were poisoned in the spring of 1974. A large percentage of the prairie dogs were killed but the landowners did not eliminate the survivors by fumigating their burrows. When no follow-up fumigation occurs the towns usually rebuild their propulations within a few years. Light hunting pressure is typical for most prairie dog towns in Texas County except those close to the small urban areas and a few hunted heavily by unusually avid shooting enthusiasts. Henderson (personal communication 1972) feels that some ferrets may have been killed by people shooting prairie dogs. Most of the hunters the author interviewed were very interested in ferrets and said they would not

Table 5. Soil series, location, physical description, age and estimates of hunting pressures at the intensively studied prairie dog towns

Soil Series	Legal Description (Section, Township, Range)	Physical Description	Age of Town (yr)	Estimate of Hunting Pressure
Mp[1]	SE¼SW¼ S36, T4N, R13E	adjacent to drainage	6	very light
Ov	NE¼NE¼ S30, T1N, R18E	in valley and on lower slopes	15	none
MaB	SW¼NW¼ S8, T3N, R11E	long flat buffalo grass pasture adjacent to corral	7	very light
DaA	NW¼SW¼ S21, T6N, R15E	small pasture surrounded by crops	15	very light
DsB	SW¼NW¼ S36, T6N, R17E	bottom of swale between sand dunes	6	very light

[1]Mansker-Potter Complex (Mp), Otero-Vona Fine Sandy Loam (Ov), Mansker Clay Loam (MaB), Dalhart Fine Sandy Loam (DaA), Dalhart Loamy Fine Sand (DsB)

Table 6. Soil series, date of last poisoning, estimated populations of prairie dogs, number of burrows, maximum gradient, size of the intensively studied prairie dog towns and size of the adjacent pasture, 1974

Series	Date of Last Poisoning	Relative Density of Prairie Dogs per Hectare	Number of Burrows per Hectare	Maximum Gradient (%)	Dog Town Size (Hectares)	Pasture Size (Hectares)
Mp	March 1974	very low (1-5)	50	5	1.54	480
Ov	1964	moderate (10-20)		4	3.06	1200
MaB	1972	moderate (10-20)		4	5.8	940
DaA	1960	moderate (10-20)	66	1	1.34	80
DsB	April 1974	very low (1-5)	31	2	1.01	250

shoot one.

Potential habitat for ferrets in Oklahoma changes rapidly because prairie dogs are continuously eradicated by poisoning or moving in response to cultivation. Tyler (1968) reported that in 1966-1967 the hectares of prairie dog towns in Oklahoma were less than 50% of those present in 1960. Butts (1973) observed an 8% decrease in total hectares and a 30% reduction in the number of towns over a 3-year period. Recent research in Texas County (Lewis and Hassien 1974) shows a 240% increase in hectares of prairie dog towns over that reported by Tyler (1968). Some of this increase could be accounted for by the normal productivity of prairie dogs in the six years between the surveys. Much of the increase may also be explained by differences between techniques used by Tyler (1968) and the author to locate dog towns.

To provide a brief history of prairie dog control in Oklahoma the Wildlife Services Division, U. S. Fish and Wildlife Service, provided data on hectares of prairie dog towns treated for control of prairie dog since 1952 (Lewis and Hassien 1974). This data includes only control work they conducted. Some landowners control their prairie dog towns using strychnine-treated grain, consequently the total hectares treated annually in Oklahoma is unknown but greater than that reported by the Wildlife Services Division. Control was generally achieved using 1080 or strychnine-treated grain and gas cartridges. The total area treated in 1957 was 15160 ha. Hectares treated since then have gradually declined. More than 2469 ha were treated by federal employees the year after Tyler (1968) completed his survey that indicated less than 4041 ha of prairie dog towns remained in Oklahoma (Lewis and Hassien 1974).

Poisoning of prairie dog towns by the federal agency ceased in 1972 following the Presidential Executive Order of 8 February, 1972 which restricted use of chemical toxicants on federal lands and in federal programs on private lands. In February 1973 the Wildlife Services Division again began selling strychnine-treated grain at cost and providing demonstrations of control techniques for landowners.

Ted Smith, Agricultural Extension Agent, Texas County, Oklahoma in cooperation with the Wildlife Services Division, U. S. Fish and Wildlife Service, promoted a meeting of landowners in February 1973, to demonstrate prairie dog poisoning techniques. Invitations were sent to 350 landowners, informing them of the demonstration (Ted Smith, personal communication); 40 attended the meeting. Poisoning permits were signed by Rangers of the Oklahoma Department of Wildlife Conservation without checking any prairie dog towns for ferrets. Wildlife Services Division personnel then sold approximately 907 kg of strychnine-treated oats or enough to treat 1615 ha of prairie dog towns at the recommended dose of 0.56 kg per ha (Berkeley Peterson, personal communication 1973).

Most of the prairie dog towns in Texas County, especially those near cultivated crops, have been poisoned at least once. Poisoning of prairie dog towns appears to be sporadic and occasionally influenced by campaigns by agricultural agencies to eradicate the prairie dog. Poisoning by landowners is generally not organized and most often not fully successful (personal observation). Most landowners claimed they do not have the time to poison the prairie dogs and complained about the U. S. Fish and Wildlife Service not continuing the poisoning program. Some landowners had bought poisoned grain from the Federal agency six to ten months before the interview but had not used it.

Occasionally commercial pest control firms will travel through the area and poison prairie dogs for a fee. There is no restriction on the type of poison or the amount used by these people. This type of poisoning could be more deterimental to ferrets than a federally financed program, using a selective pesticide to control only the size and the expansion of prairie dog towns. A regulated federal control program, combined with good range management, could provide a stable population of prairie dogs and result in suitable habitat for ferrets.

Burrow Counts

The size of the prairie dog towns measured for area varied from 1.0 to 1.5 ha (Table 7). The total burrow counts for the three smaller dog towns and the computed burrow density showed a lower density on the Dalhart loamy fine sand than those on the finer textured soils. Koford (1958) stated most dog towns have an average density of 50-100 burrows per hectare. Although no firm conclusions can be drawn from the limited number of dog towns studied, the looseness of the Dalhart loamy fine sand surface soil may have discouraged burrowing compared to that on more stable soils.

The distance actually measured between burrows on the three dog towns averaged 12.7 m apart and ranged from 9.9 m to 16.6 m. These distances are similar to the 13.7 m figure reported by Koford (1958).

Attempts to estimate burrow density and distance between burrows by counting burrows within the transects and measuring the distances between them proved unsatisfactory. A comparison of actual burrow counts and estimates on the three dog towns showed an overestimation factor varying from 1.3 on the Dalhart loamy fine sand to 2.7 on the

Mansker-Potter Complex. The average distance between burrows within the transects was less than the average distance between burrows as measured over the whole town.

Table 7. Burrow counts and measurements of distances (m) between burrows in the intensively studied prairie dog towns

	Soil Series				
	Mp[1]	Ov	MaB	DaA	DsB
Dog Town Hectares	1.54	3.06	5.8	1.34	1.01
Total Burrows	77			89	31
Burrows per Hectare	50			66	31
Average Distance Between Burrows (m)	9.9			11.5	16.6
Number of Transects	5	3	5	11	5
Area Covered by Transects (%)	4.9	1.5	1.3	12.3	7.4
Burrows in Transects	10	2	9	24	3
Estimated Burrow Density (burrows/ha)	133	43	120	146	41
Average Distance Between Burrows in Transects (m)	6.5		4.0	7.64	13.9

[1]Mansker-Potter Complex (Mp), Otero-Vona Fine Sandy Loam (Ov), Mansker Clay Loam (MaB), Dalhart Fine Sandy Loam (DaA), Dalhart Loamy Fine Sand (DsB).

The distribution of burrows within a prairie dog town is usually not uniform because prairie dogs form coteries (small social groups)

(King 1952) and respond to abundant supplies of food in localized areas (Koford 1958). This concentration of burrows in localized areas would effectively bias the results unless very large samples were taken.

Cattle Use of Sites

The average number of cattle droppings per hectare was about 30% greater ($P < .02$) on prairie dog towns (1600/ha) than on adjacent rangeland (1200/ha); however, the difference was not consistent for all soil series (Table 8). A significant ($P < .02$) soil series x site interaction resulted from a slightly lower number of droppings on the Mansker clay loam dog town and almost twice as many droppings per hectare on the Otero-Vona fine sandy loam dog town as on the adjacent rangeland. The other three towns each had a 20-30% increase in droppings.

Table 8. Cattle droppings per hectare on rangeland (R) and prairie dog towns (T) on five soil series

Mansker-Potter Complex		Otero-Vona Fine Sandy Loam		Mansker Clay Loam		Dalhart Fine Sandy Loam		Dalhart Loamy Fine Sand		Average	
R	T	R	T	R	T	R	T	R	T	R	T
1700	2000	1600	3100	1400	1200	500	600	900	1200	1200	1600

The average density of droppings differed significantly ($P < .01$) on different series or "series locations," but the possible reasons for the differences were many and undetermined. Density of droppings on

the rangeland on Mansker-Potter, Otero-Vona, and Mansker soils were similar and much greater than that on each of the two Dalhart soils.

Unless degradation of feces is slower on prairie dog towns than on adjacent rangeland, these data indicate cattle spend more time or at least defecate more frequently on prairie dog towns than on adjacent rangeland. Dog towns may be used as bed grounds or cattle may move through dog towns more often to graze the shorter vegetation (to be discussed later).

Soil Chemical Composition

The average concentrations of organic matter and extractable phosphorus, potassium, and calcium were all greater ($P < .05$) in surface soil samples from dog towns than in those from adjacent rangeland (~~Table 9~~). Differences in these parameters as well as pH and extractable magnesium and sodium because of soil series was significant at the 5% level (~~Table 10~~). Values for all parameters in soil samples from the same set were very consistent and the corresponding coefficients of variation were generally less than 10% of the mean. Apparently the differences in soil chemical composition caused by prairie dog activity had become relatively uniform in the four or more years the dog towns had been in existence.

Differences in soil chemical composition caused by soil series x site interaction was significant at the 10% level or less for all parameters except calcium. The increase in calcium concentration in dog town soil samples was consistent for all series.

The relatively large increase in organic matter in soil from the Dalhart loamy fine sand dog town was apparently caused by a litter

Table 9. Chemical composition of soil samples (0-12 cm) from prairie dog towns and adjacent rangeland on five soil series

Site	Soil Series Mp[1]	Ov	MaB	DaA	DsB	Average
			Organic Matter (%)			
Range	0.7	2.9	0.7	0.6	0.8	1.2
Town	0.7	2.4	0.8	0.6	2.3	1.4
Average	0.7	2.6	0.7	0.6	1.6	1.2
			Phosphorus (ppm PO_4)			
Range	4	2	13	45	19	17
Town	3	3	3	57	36	21
Average	3	3	8	51	27	19
			Potassium (ppm K_2O)			
Range	190	130	350	350	180	240
Town	230	180	350	400	360	310
Average	210	150	350	380	270	270
			Calcium (ppm)			
Range	3300	2800	3600	1400	1200	2500
Town	3400	2900	3900	1900	1700	2800
Average	3350	2850	3750	1650	1450	2650
			Magnesium (ppm)			
Range	100	110	330	160	120	160
Town	90	100	220	170	190	150
Average	90	110	270	170	150	160

Table 9 (Continued)

Site	Soil Series					Average
	Mp[1]	Ov	MaB	DaA	DsB	
			Sodium (ppm)			
Range	35	45	40	40	40	40
Town	35	50	55	30	45	45
Average	35	50	45	35	45	40
			pH			
Range	8.1	8.3	7.8	7.1	7.6	7.8
Town	8.0	8.3	8.0	7.1	7.5	7.8
Average	8.1	8.3	7.9	7.1	7.6	7.8

[1]Mansker-Potter Complex (Mp), Otero-Vona Fine Sandy Loam (Ov), Mansker Clay Loam (MaB), Dalhart Fine Sandy Loam (DaA), Dalhart Loamy Fine Sand (DsB).

Table 10. Probability levels for chemical components of surface (0-12 cm) soil samples from prairie dog towns and adjacent rangeland on five soil series

Soil Components	Soil Series	Site	Soil Series x Site Interaction
Organic Matter	$P < .01$	$P < .01$	$P < .01$
Phosphorus	$P < .01$	$P < .01$	$P < .01$
Potassium	$P < .01$	$P < .01$	$P < .01$
Calcium	$P < .01$	$P < .03$	$P < .75$
Magnesium	$P < .01$	$P < .50$	$P < .01$
Sodium	$P < .05$	$P < .50$	$P < .10$
pH	$P < .01$	$P < .75$	$P < .10$

accumulation from annual forbs. A similar increase in Buchloe dactyloides would also increase organic matter on this sandy soil. Prairie dogs, while burrowing and digging for roots, incorporate the surface litter into the soil and increase the organic matter content. No explanation is apparent why the organic matter was decreased in the Otero-Vona dog town soil samples. Additional research should be conducted to determine if prairie dog activity consistently decreases the organic matter content in soil with an inherently high organic matter content. It may be that some unique, but unknown factor, related to the Oter-Vona dog town location caused the significant decrease in organic matter.

The greatest increase in phosphorus and potassium in dog town soil samples also occurred on the Dalhart loamy fine sand. Even though burrow density was relatively low on the Dalhart loamy fine sand series, the effect of prairie dog activity on surface soil chemical composition was most pronounced at this location. The effects of prairie dog activity on soil chemical composition were similar for both Dalhart soils. Difference in effects of prairie dog activity on soil chemical composition is apparently caused by a combination of many factors, including surface and subsoil physical and chemical properties, plant species composition and litter, age of the town and the depth and degree of soil disturbance by prairie dogs.

Vegetation

Species composition of all species encountered on the transects and the composition of vegetative groups (Desirable Grasses, etc.) for the five soil series are shown in Table 11. Probability levels for the

Table 11. Plant species composition (%) for prairie dog towns (T) and adjacent rangeland (R) for five soil series.

Species	Soil Series											
	Mp[1]		Ov		MaB		DaA		DsB		Average	
	R	T	R	T	R	T	R	T	R	T	R	T
Buchloe dactyloides	72	93	24	70	99	93	15	26	1	59	42	68
Bouteloua curtipendula	3		25						47		15	
Bouteloua gracilis	9	3	21	18		4		t[2]	21	2	10	6
Sporbolus cryptandrus	3	—	7	t	—	—	20	15	7	4	7	4
Total Desirable Grasses	87	96	77	88	99	97	35	41	76	65	74	78
Bouteloua hirsuta	3		11			t			1		3	t
Chloris verticillata	—	—	1	—	—	—	23	17	1	2	5	4
Total Less Desirable Grasses	3	0	12	0	0	t	23	17	3	2	8	4
Aristida spp.			2		t	1	4	t	1	1	2	t
Aristida longiseta	3	1	1	t		1	23	5	t	8	5	1
Erioneuron pilosum	3		3								1	
Muhlenbergia spp.	2			8		t					t	2

Table 11 (Continued)

Species	Soil Series											
	Mp[1]		Ov		MaB		DaA		DsB		Average	
	R	T	R	T	R	T	R	T	R	T	R	T
Schedonnardus paniculatus	—	—	t	—	—	—	2	9	t	t	t	2
Total Least Desirable Grasses	8	1	7	8	t	2	29	15	1	10	8	5
Kochia scoparia	—	—	—	—	—	—	—	24	—	—	—	5
Total Desirable Annual Forbs	0	0	0	0	0	0	1	24	0	0	0	5
Artemisia ludoviciana							3			7	1	2
Heterotheca latifolia	—	—	—	—	—	—	—	—	14	3	3	1
Total Less Desirable Perennial Forbs	0	2	0	0	0	0	3	0	17	14	5	4
Total Least Desirable Perennial Forbs	1	0	2	0	0	0	5	0	0	3	0	0
Miscellaneous Species	1	t	1	2	t	t	5	t	t	4	t	t

[1]Mansker-Potter Complex (Mp), Otero-Vona Fine Sandy Loam (Ov), Mansker Clay Loam (MaB), Dalhart Fine Sandy Loam (DaA), Dalhart Loamy Fine Sand (DsB).

[2]< 1%.

vegetative groups and for species abundant in localized areas are shown in Table 12.

Buchloe dactyloides was found on all ranges and prairie dog towns and was more frequent ($P < .01$) on prairie dog towns on all soil series except the Mansker Clay Loam (Tables 7 & 8). Mansker clay loam has a finer textured surface soil and is more xeric than the other four soils. Buchloe dactyloides was least abundant on the Dalhart loamy fine sand range. The greater increases in Buchloe dactyloides occurred on the coarser textured soils. Buchloe dactyloides was the most common species in the Desirable Grass group. Differences in frequency of Total Desirable Grasses on different soils was significant at the 1% level, but the effects of soil differences may have been compounded by concurrent differences in grazing pressure, topography and other undetermined factors. On each soil, however, the taller desirable grasses were reduced or eliminated either directly or indirectly by prairie dog activity. Whether prairie dogs preferred taller grasses for food or cut them down for better visibility or both was not determined. When the increase in Buchloe dactyloides was combined with the decrease in taller desirable grasses, the average difference in Total Desirable Grasses because of prairie dog activity was small.

The influence of prairie dogs on the Less Desirable Grasses was significant at the 6% level. Bouteloua hirsuta was virtually eliminated on three dog towns. Bouteloua hirsuta was encountered in trace (< 1%) amounts on the dog town of the Mansker Clay Loam and also occurred in small amounts on the adjacent range but, no encounters occurred. Chloris verticillata was eliminated on the dog town of the Oter-Vona series and slightly reduced on the Dalhart Fine Sandy Loam. Because of

Table 12. Probability levels for plant species composition and species groups found on prairie dog towns and adjacent rangeland on five soil series

Species and Species Groups	Source of Variation		
	Soil Series	Site	Soil Series x Site Interaction
Bouteloua curtipendula	P < .01	P < .01	P < .01
Desirable Grass	P < .01	P < .46	P < .12
Chloris verticillata	P < .01	P < .53	P < .59
Less Desirable Grass	P < .01	P < .06	P < .54
Least Desirable Grass	P < .01	P < .53	P < .04
Kochia scoparia	P < .01	P < .07	P < .01
Desirable Annual Forb	P < .01	P < .07	P < .01
Less Desirable Annual Forb	P < .13	P < .12	P < .13
Least Desirable Annual Forb	P < .05	P < .10	P < .02
Desirable Forb Perennial	P < .03	P < .46	P < .09
Artemisia ludoviciana	P < .01	P < .24	P < .01
Heterotheca latifolia	P < .01	P < .05	P < .01
Less Desirable Forb Perennial	P < .01	P < .28	P < .39
Least Desirable Forb Perennial	P < .01	P < .13	P < .01
Less Desirable Woody	P < .04	P < .92	P < .06
Least Desirable Woody	P < .54	P < .74	P < .22
Desirable Forbs	P < .01	P < .08	P < .02

the inconsistency of occurrence of different less desirable grass species, only the effect of prairie dog activity on Bouteloua hirsuta was considered to be both ecologically and statistically significant.

The Least Desirable Grasses group showed a significant ($P < .04$) interaction between soils and sites due to both order of magnitude beteeen soils and a reversal of trend between sites on the Dalhart Fine Sandy Loam and the Dalhart Loamy Fine Sand. The interaction in this vegetation group was largely due to Aristida longiseta and Schedonnardus paniculatus (Table 8). Aristida longiseta was greatly reduced by prairie dogs on the Dalhart fine sandy loam, but greatly increased on the Dalhart loamy fine sand. Schedonnardus paniculatus was rare on Dalhart loamy fine sand, but was increased from 2% to 9% on Dalhart fine sandy loam dog towns. Both species are warm season perennial grasses with stems 2-3 dm tall. As a group few generalities can be made about the response of Least Desirable Grasses to prairie dog activity because of the apparent differences in ecological relationships for the individual species.

The effects of the prairie dogs on the vegetation composition varied with soil series, but prairie dogs tended to eliminate the taller vegetation on all soil series. The exceptions to this statement were the annual forbs. These annuals apparently flourish in the disturbed soils of the prairie dog towns, but were most often grazed down by the prairie dogs. One example, Kochia scoparia on the Dalhart fine sandy loam, was grazed low on the prairie dog town, but was over one meter tall and very rank on the boundaries of the town. This stand of Kochia on the boundaries had virtually out-competed all other species of vegetation.

Ground Cover

Percent bare ground caused by prairie dog digging varied from 5% and 15% on relatively coarse textured soils to 24-27% on the finer textured soils (Table 13). This was also directly related to estimated burrow density (Table 7) as expected.

Percent bare ground not caused by prairie dogs was consistently lower on dog towns than on adjacent rangeland. Although prairie dogs caused a significant amount of bare ground, the area between mounds had a more complete cover of litter or vegetation than did the rangeland. Therefore, when total bare ground was compared on all dog towns and adjacent rangeland, the significance of direct soil disturbance by prairie dogs was reduced. Differences in litter cover caused by a soil series x site interaction ($P < .02$) were consequently opposite in effect to differences in total bare ground. On the two coarse textured soils with relatively low burrow density, the percent total bare ground was lower and the percent litter cover higher on the dog towns than on the adjacent rangeland. In contrast, on the three finer textured soils with relatively high burrow density, the percent total bare ground was higher and the percent litter cover lower on the dog towns than on the adjacent rangeland.

The range in total bare ground on rangeland varied from 23% to 54%, whereas, the range in total bare ground on dog towns was about half that on rangeland and varied from 33% to 49%. In general for the soil series studied prairie dog activity tended to reduce the variation in ground cover and create a more similar ground cover for all soil series.

The differences in plant density or vegetation cover were small and inconsistent for both sites and soil series. The Mansker soils had a

Table 13. Kinds of ground cover (%) and probability levels for prairie dog towns (T) and adjacent rangeland (R) on five soil series.

Ground Cover	Soil Series												Probability		
	Mp[1]		Ov		MaB		DaA		DsB		Average		Soil Series	Site	Soil Series x Site Interaction
	R	T	R	T	R	T	R	T	R	T	R	T			
Bare Ground Prairie Dog		24		5		25		27		15		19	P < .18	P < .01	P < .18
Bare Ground Natural	45	25	50	34	34	14	23	7	54	18	41	20	P < .01	P < .01	P < .07
Bare Ground Total	45	49	50	39	34	39	23	34	54	33	41	39	P < .08	P < .54	P < .02
Litter	37	35	39	47	44	48	63	53	31	53	43	47	P < .09	P < .34	P < .02
Vegetation	18	17	11	14	18	13	13	13	14	13	15	14	P < .01	P < .36	P < .14

[1]Mansker-Potter Complex (Mp), Otero-Vona Fine Sandy Loam (Ov), Mansker Clay Loam (MaB), Dalhart Fine Sandy Loam (DaA), Dalhart Loamy Fine Sand (DsB).

slightly higher average plant density, primarily because of a relatively higher percentage of Buchloe dactyloides plants or stolons.

Range Condition

Range condition for sites averaged over all soils series was 16% lower ($P < .01$) on prairie dog towns (26%) than on adjacent rangeland (42%). The average range condition on prairie dog towns in this study area was similar to the 25-50% range condition Koford (1958) found on prairie dog towns in his study. Based on percent of climax vegetation present, range condition was consistently lower on prairie dog towns (Table 14). The difference in range condition between each dog town and adjacent rangeland, however, varied from only a 2% difference on the Dalhart fine sandy loam to a 36% difference on the Dalhart loamy fine sand.

Range condition differences between dog towns and rangeland appeared to be more related to prairie dog activity and soil characteristics than to cattle use. Cattle use was relatively high on one rangeland area in good condition and only intermediate on the other rangeland area in good condition. The two rangeland areas in good condition had relatively high percentages of Bouteloua curtipendula and B. gracilis, which are climax for these range sites. These two species were greatly reduced by prairie dog activity and replaced by Buchloe dactyloides. From a forage production standpoint, prairie dog activity was detrimental. From the standpoint of ground cover and reduced wind erosion potential, however, prairie dog activity was beneficial on these two soil series. On the finer textured soils which have higher percentages of Buchloe dactyloides in the climax vegetation and which

had lower range condition on the rangeland areas in this study, prairie dog activity had less effect on either range condition or ground cover. Additional research is needed to determine what effect prairie dog activity has on range sites with fine textured soils and in good or excellent condition.

Table 14. Range condition classes for prairie dog towns (T) and adjacent rangeland (R) on five soil series.

	Soil Series									
	Mp[1]		Ov		MaB		DaA		DsB	
	R	T	R	T	R	T	R	T	R	T
Existing Climax Vegetation (%)	38	25	53	30	30	25	30	28	57	21
Range Condition Class	Fair	Low Fair	Low Good	Low Fair	Low Fair	Low Fair	Low Fair	Low Fair	Low Good	Poor

[1]Mansker-Potter Complex (Mp), Otero-Vona Fine Sandy Loam (Ov), Mansker Clay Loam (MaB), Dalhart Fine Sandy Loam (DaA), Dalhart Loamy Fine Sand (DsB).

These results indicate prairie dog activity will have a greater effect on the range condition of those range sites with a greater percentage of taller climax species. On those range sites where short, stoloniferous grasses, such as Bouteloua gracilis and Buchloe dactyloides, are the dominant species, the effect of prairie dog activity on range condition will probably not be as great. Any range

livestock management decisions concerning prairie dogs should also consider the interrelationships of prairie dogs, range sites, range condition and livestock use on prairie dog towns.

Questionnaire for School Students

A total of 1093 school questionnaires were handed out to students; 1031 (94%) were returned. Of the returns, 183 were rejected because the respondent did not follow the instructions.

The age of the students ranged from 13 to 18 yr. A total of 429 females and 419 males answered the questionnaire. Table 15 shows the number and percentage of replies to questions 4 through 13. Percentages do not total 100 because not all the students answered each question or because some gave multiple answers for one question. Forty-three students stated that the reason they did not like prairie dogs was because livestock break their legs in the burrows. At each of the schools, after the questionnaires were completed and handed in, the audience was asked if they had ever seen any livestock that had broken its leg in a burrow. None of the students had actually observed this happening but stated their relatives or friends had told them that livestock break their legs in the burrows. The author never observed livestock with broken legs in a dog town nor saw evidence that it had occurred.

Voting Resident Questionnaire

A total of 206 usable questionnaires were returned. These returns represented only 25% of the 813 questionnaires mailed out. Land managers returned 110 questionnaires; non-managers returned 96.

Table 15. Total number of replies and the percentage of students answering the school questionnaire, questions 4 through 13.

Questions	Responses
4. Do you know what a prairie dog is?	Yes 826 (97%) No 17 (2%)
5. Have you ever seen a prairie dog?	Yes 804 (95%) No 40 (5%)
6. Have you ever read anything about prairie dogs in	
	Newspapers? 192 (23%)
	Leaflets? 124 (15%)
	Books? 363 (43%)
	Other? 224 (27%)
7. Have you ever known anyone who felt strongly that prairie dogs were:	
Useful or nondestructive?	Yes 259 (30%) No 475 (56%)
Useless or destructive?	Yes 509 (60%) No 282 (33%)
8. Which of the following people, if any, felt prairie dogs were useful or nondestructive?	
Father:	74 (9%)
Mother:	65 (8%)
Teacher:	57 (7%)
Friend:	141 (17%)
Brother:	30 (3%)
Sister:	36 (4%)
Others:	24 (3%)
9. Which of the following people, if any, felt prairie dogs were useless or destructive?	
Father:	247 (29%)
Mother:	125 (15%)
Teacher:	71 (8%)
Friend:	270 (32%)
Brother:	128 (15%)
Sister:	51 (6%)
Others:	52 (6%)
10. Would you like to have the prairie dogs:	
Protected?	474 (56%)
Decreased?	133 (16%)
Maintained?	256 (30%)
Increased?	157 (18%)
Killed off?	96 (11%)

Table 15 (Continued)

Questions	Responses	
11. Do you know if your school or town library has any books or other literature on prairie dogs?	Yes 399 (47%)	No 385 (45%)
12. Do you feel that prairie dogs are:		
Useful?	216 (25%)	
Useless?	216 (25%)	
Neither?	340 (40%)	
13. Why do you feel that prairie dogs are:		
Useful?	Ecology	53
	Hunting	27
	Cute	17
	They eat bugs	9
	For observation	7
	Good to eat	4
	God's creation	3
	They eat weeds	3
	Good pets	2
Useless?	They destroy pasture	122
	Livestock break their legs in holes	43
	They transmit disease	3
	Burrows harbor snakes	2
	They eat horses	2
	They drain ponds	1
Neither Useful or Useless?	They haven't hurt me	3

Table 16 presents the number and percentages of land managers and non-managers that replied to questions 6 through 9 of Part I of the Voting Residents questionnaire. Percentages were computed from the

Table 16. Number and percentage of affirmative replies to questions 6 through 9, part I, of the voting residents' questionnaire.

Questions	Total Affirmative Replies		Male Affirmative Replies		Female Affirmative Replies	
	Number	%	Number	%	Number	%
Managers						
6. Do you hunt:						
a. Prairie dogs?	29	26	24	33	5	13
b. Coyotes?	31	28	23	32	8	21
c. Rabbits?	37	34	30	42	7	18
d. Rattlesnakes?	24	22	19	26	5	13
e. Other animals?	28	25	26	36	2	5
7. Have you ever known anyone who felt strongly that prairie dogs were:						
a. Useful?	8	7	6	8	2	5
b. Useless?	63	57	45	62	18	47
c. Of no value?	71	64	46	64	25	66
8. Have you ever read any publications concerning prairie dogs:						
a. Newspaper?	54	49	37	51	17	45
b. Leaflets?	30	28	24	33	6	16
c. Books?	11	10	9	12	2	5

Table 16 (Continued)

Questions	Total Affirmative Replies		Male Affirmative Replies		Female Affirmative Replies	
	Number	%	Number	%	Number	%
Managers (Continued)						
9. Would you like to have the present number of prairie dogs:						
a. Decreased?	44	40	32	44	12	32
b. Maintained?	15	14	11	15	4	10
c. Increased?						
d. Exterminated?	57	52	37	51	20	53
Non-Managers						
6. Do you hunt:						
a. Prairie dogs?	15	16	14	25	1	2
b. Coyotes?	16	17	15	26	1	2
c. Rabbits?	27	28	22	39	5	13
d. Rattlesnakes?	10	10	10	17		
e. Other animals?	19	20	17	30	2	5
7. Have you ever known anyone who felt strongly that prairie dogs were:						
a. Useful?	14	15	8	14	6	15
b. Useless?	49	51	34	60	15	38
c. Of no value?	43	45	32	56	11	28

Table 16 (Continued)

Questions	Total Affirmative Replies		Male Affirmative Replies		Female Affirmative Replies	
	Number	%	Number	%	Number	%
Non-Managers (Continued)						
8. Have you ever read any publications concerning prairie dogs:						
a. Newspaper?	41	43	25	44	16	41
b. Leaflets?	18	19	16	28	2	5
c. Books?	10	10	7	12	3	8
9. Would you like to have the present number of prairie dogs:						
a. Decreased?	22	23	14	25	8	20
b. Maintained?	48	60	25	44	23	59
c. Increased?	8	8	6	10	2	5
d. Exterminated?	7	7	7	12		

total replies in each category.

Replies to question 6 indicate the average land manager hunted more than the non-manager. Prairie dogs, coyotes, rabbits, and rattlesnakes are considered pests by most of the land managers. Non-managers have a less negative attitude toward prairie dogs. Twice as many non-managers knew someone who felt prairie dogs were useful.

Land managers read more (newspaper articles) about prairie dogs than most non-managers. The author read three newspaper articles about prairie dogs published within the research area; each was strongly anti-prairie dog.

Responses to question 9 possibly reflect the influence the newspaper articles may have had, in combination with the actual problems with prairie dogs, encountered by the land managers. A large difference of opinion occurred between land managers and non-managers. Land managers strongly preferred reduction or extermination of prairie dog populations. The non-managers showed a strong preference toward maintaining the population.

Linder et al. (1972:34) interviewed Mellette County, South Dakota ranchers and reported that

> . . . 19 percent were against having any prairie dogs, 19 percent were against any poisoning of prairie dogs, and 62 percent of them stated they would like to have prairie dog towns if they could keep the towns from becoming too large.

The difference in opinions of land managers in South Dakota and the Oklahoma Panhandle may be due to several reasons. In South Dakota the data was gathered by interview instead of mailed questionnaires. The presence or actions of the interviewer may have modified the respondents' answers. The questionnaires, in Oklahoma, were mailed during a

period when ferrets and prairie dogs were controversial subjects due to a recently expired moratorium, imposed by the Oklahoma Department of Wildlife Conservation, on poisoning of prairie dogs. The opinions of land managers in South Dakota may have also been modified by the active black-footed ferret research program going on in Mellette County, where ferrets are known to exist. The attitudes of non-respondents to the Oklahoma survey were not determined but may have been more tolerant toward prairie dogs.

Results of communications by the author indicate land managers have a negative attitude towards prairie dogs. This attitude is a serious deterrent to maintaining the present populations of prairie dogs and may be a major obstacle in any future attempt to introduce black-footed ferrets into the study area.

Some land managers indicated they would not poison their prairie dog town if they knew ferrets existed there. Attitudes of land managers about exterminating the prairie dogs might moderate if ferrets were found in the study area and if an intensive research program were started.

Table 17 presents the age groups, education levels, the length of time that the land managers and non-managers have lived in the Oklahoma Panhandle, and the organizations they belong to. Two major differences occur in the age strata between the two groups. No large educational difference existed between managers and non-managers. During interviews with land managers, the author noted that the older the respondent was, and the longer he had lived in Oklahoma, the stronger were his or her objections to prairie dogs.

Table 17. Percentage of respondents by age groups, education levels, length of time as resident in the Oklahoma Panhandle, and membership in organizations.

	Percentage of Respondents in Respective Category	
	Managers	Non-Managers
Age Groups:		
18-30	12	24
31-40	17	15
41-50	53	32
> 50	53	32
Education Level in Years of School:		
12 or <	56	56
14 or >	39	42
Years in Panhandle:		
1-5	2	20
6-10	4	10
11-20	4	23
21-30	21	18
31-40	16	8
41-50	16	13
> 50	34	5
Organizations:		
Farm Bureau	42	13
Farmers' Union	13	1
Oklahoma Cattlemen's Association	15	0
Oklahoma Wheatgrower's Association	21	0
Soil and Water Conservation District	27	0

Table 17 (Continued)

	Percentage of Respondents in Respective Category	
	Manager	Non-Managers
Organizations (Continued):		
Sportsman's Club	12	4
Others	4	2

The major objections to prairie dogs were destroyed grass (59%), livestock injury (20%), and increased number of rattlesnakes (9%).

Prairie dogs do compete for some of the major vegetation species but may also reduce some noxious weeds (Koford 1958). Fewer forage grasses are found on the dog town than on the adjacent range. These differences are caused by a combination of over grazing by livestock and foraging by prairie dogs. None of the ranges sampled were in a good condition class (Table 14). On some of the units prairie dogs actually increased certain species of desirable grasses (Table 11).

The author observed numerous instances where cattle stepped in burrows and frequently observed over 30 head of horses running and playing in a 122 ha prairie dog town. On none of these occasions was an animal injured.

During 14 months in the field, 31 rattlesnakes were observed. Only 9 of these were on or within 500 m of a prairie dog town and these represent only 29% of the total rattlesnakes observed. This percentage is misleading because the author spent most of his time on or near

prairie dog towns. If prairie dog towns attracted rattlesnakes, then the percentage of rattlesnakes observed on the prairie dog towns should have been much higher.

Membership in organizations was much greater for land managers than for non-managers. These organizations may provide additional incentive for eradication of prairie dogs because they are primarily agriculture oriented. Fourteen percent of the respondents who were members of sportsmens clubs indicated they wanted the prairie dogs exterminated. This is a higher percentage than expected and is indicative of the strong anti-prairie dog sentiment found in the Oklahoma Panhandle.

Table 18 presents the results of part II, questions 1, 5, and 6. The results of this inquiry indicated that 74% of the land managers own land. Approximately 34% of the land managers (owners) also lease land owned by others and 3% of the owners of land operate land owned or leased by others.

Many of the land owners, in effect, lose all control of the land during the lease period. This leasing policy could be detrimental to a program designed to manage prairie dogs. The lessee has the opportunity to destroy prairie dogs on his own land as well as on the land he leases. The land owner who might not poison prairie dogs would seldom prevent the lessee from poisoning them.

Approximately 86% of the land managers reported the condition of their range land; 14% of this total (86) said that over 63% of their range land was in excellent condition, and 33% said that 80% was in good condition. None reported any range in poor condition. According to the Texas County Conservation District (1973:42) "There are several thousand acres of rangeland in the district that are producing very

Table 18. Response to questions 1, 5 and 6, part II, of voting residents' questionnaire.

Questions	% Land Reported	% Respondents Reporting	$\bar{X}$ in Hectares	Minimum-Maximum Size of Land Hectares
1. Do you:				
a. Own land?		74	354	2.43-4451.6
b. Lease land?		56	448	2.43-2023.5
c. Operate land owned or leased by others?		29	323	32.00-1214.0
5. On the land you manage, what percent is:				
a. Range?	49			
b. Crops?	67			
c. Other?				
6. Evaluate the condition of forage on your range land as a percent of your total range:				
a. Excellent	64	14		
b. Good	80	33		
c. Fair	66	39		
d. Poor				

little desirable forage". The report (op. cit., 1973) shows that over 198,000 ha need proper grazing use and 109,267 ha need a deferred grazing plan. These results suggest that the average land manager may not be familiar with the condition of his range.

Prairie dog towns were reported by 57 people (52%) on the lands they manage. Thirty percent reported the size of their towns and these averaged 14.4 ha. This average was similar to the author's size estimate of the average prairie dog town (14 ha). The total hectares managed by these respondents was not available from the questionnaires. It is apparent that recipients with prairie dog towns were more interested in returning the questionnaire than the average recipient, because 52% of the respondents reported prairie dog towns. This greater response by land managers with prairie dog towns may have negatively biased the average response of land managers. If time and funds had permitted, a personal interview of a sample of non-respondents to the mail questionnaire would have been desirable to evaluate possible respondent bias.

Land managers were asked if they would exterminate a prairie dog town if financial assistance were available from the government; 76% said yes, and 7% said no. Approximately 23% said they would control their own towns. Only 5% reported they would lease their prairie dog town to a governmental agency and 43% said they would not; the remainder did not answer the question. Five people reported the maximum size prairie dog town that they would permit on their land. These ranged from 0.4 to 55 ha with a mean of 4 ha. Only two land managers reported the minimum amount of money they would lease their prairie dog town for. The amounts were 7 and 123 dollars per ha. This

lease fee was assumed to be for 1 yr.

Forty percent of the land managers indicated they would allow research to be conducted on their prairie dog towns; 14% said they would not.

Forty-seven managers said they would allow hunters to shoot prairie dogs and 48 said they would not. Reasons for not allowing hunting were: shooting livestock (28), lack of respect by hunters (6), fire hazard (1), and the land owner hunted prairie dogs (1).

Until managers have accurate knowledge of the role prairie dogs play in the ecosystem and also have effective methods of controlling (not exterminating) them, the possibility of a successful reintroduction of ferrets in the Oklahoma Panhandle is low. The prevalent anti-prairie dog sentiment will create a problem of maintaining suitable habitat for ferrets. The anti-prairie dog sentiments may be modified if ferrets can be found in Oklahoma or adjacent states, and if an intensive research program on prairie dogs and ferrets is initiated. Some land managers indicated they would not poison their prairie dog town if ferrets were present. Many managers were interested in having ferrets released on their towns. Even though these attitudes are encouraging, they do not indicate a receptive environment for reintroduction of ferrets. The major reason land managers wanted ferret on their prairie dog towns was to control the prairie dogs.

Traps

The padded steel traps were the most successful of the three types of traps tested (padded steel traps, dome traps, and the "drift" trap). They were more compact, easier to handle, less time consuming to set,

and more successful in capturing prairie dogs.

The steel traps had to be far enough from the burrow entrance to prevent a captured prairie dog from entering the burrow and pulling out of the trap. A minimum of two traps, set on opposite sides of the mound, were needed for success. The tubing used as padding was highly effective in preventing injury to captured prairie dogs. One prairie dog remained in a trap approximately two hr without injury. The rubber tubing was strong and resistant to gnawing. Padding had to be replaced on only five traps during 18 days of trapping.

For maximum success the traps had to be set the night before trapping was to start. Prairie dogs avoided for the entire day any mound disturbed in the morning. There were two major deficiencies of the steel trap. Prairie dogs had to be removed within a few minutes of capture to prevent escape or predation by hawks, and the traps could not be used where rabbits occurred because animals captured at night would break a leg.

Dome traps were bulky, expensive to construct, and time-consuming to set. Before the trap would function properly the mound had to be leveled. Prairie dogs were not captured in four days of testing.

The drift trap was bulky and time consuming to set up. Two men were needed to operate this trap. Prairie dogs would exit from the burrows through the plastic pipe but an assistant was not available to properly test this trapping method.

Marking and Population Study

Results of marking studies are summarized in Table 19. Dyes had no apparent affect on the health of prairie dogs. All dyes faded after 20

Table 19. Results of preliminary testing of dyes for marking prairie dogs during population studies.

Dye	Marking Methods	Transfer of Dye	Permanency of Dye (days)	Drying Time (hr)
Series One: Cloudy Windless Day:				
Human Hair Dye	Plastic squeeze bottle	none	> 30	> 2
	Spray (atomized)	none	> 30	2
	Swab	none	> 30	> 2
Rhodamine B	Plastic squeeze bottle	yes	> 30	> 2
	Spray (atomized)	yes	> 30	> 2
	Swab	yes	> 30	> 2
Clothing Dye	Plastic squeeze bottle	none	> 30	> 2
	Spray (atomized)	none	> 30	> 2
	Swab	none	> 30	> 2
Picric Acid	Plastic squeeze bottle	unknown	> 30	> 2
	Spray (atomized)	unknown	> 30	2
	Swab	unknown	> 30	> 2

Table 19 (Continued)

Dye	Marking Methods	Transfer of Dye	Permanency of Dye (days)	Drying Time (hr)
Series Two: Sunny Windy Day				
Human Hair Dye	Plastic squeeze bottle plus swab	none	> 30	2
Rhodamine B	Plastic squeeze bottle plus swab	yes	> 30	2
Picric Acid	Plastic squeeze bottle plus swab	unknown	> 30	2

days, but were still noticable after 30 days. Rhodamine B transferred from marked prairie dogs to unmarked prairie dogs after all drying periods and marking methods. Rhodamine B transferred even after 4 days of drying. Picric acid may have had a slight transfer but it was difficult to verify on the brownish coat of the prairie dog. Clothing dye and human hair dye had no detectable transfer.

The two most permanent and visible dyes, human hair dye (black) and Rhodamine B, were used to mark the prairie dogs for the population study. Seven prairie dogs were marked across the back, sides, and belly with black human hair dye. The tail and head were marked with Rhodamine B. To reduce losses by predation, all captured prairie dogs were kept in cages until the trapping period was complete. On 18 May the prairie dogs were released on the prairie dog town.

During the two days following the release, 20 observations were made (~~Table 20~~), each lasting 10 min. Marked prairie dogs were seen 63 times for an average of 3.1 observed per period. Unmarked prairie dogs were seen 29 times for an average of 1.4 observed per period. A population of 10 to 11 (10.2) prairie dogs was estimated to inhabit the 0.69 ha portion of the prairie dog town. The estimated population would be 14.5 prairie dogs per hectare.

A total of 35 mounds of at least 25 cm radius were counted on the 0.69 ha area. This was equivalent to 51 burrows per hectare or approximately 3.5 burrows per prairie dog. The author considered this an average number of burrows and prairie dogs per hectare for a dog town in Texas County, Oklahoma.

Table 20. Numbers of marked and unmarked prairie dogs observed during population study, 19 and 20 May, 1974.

Time	Prairie Dogs Observed	
	Marked	Unmarked
19 May		
0800	2	1
0900	2	3
1000	4	0
1100	1	1
1200	2	1
1500	0	0
1600	0	0
1700	3	1
1800	4	2
1900	3	3
Total	21	12
20 May		
0800	5	1
0900	5	4
1000	4	2
1100	5	3
1200	5	2
1500	4	1
1600	5	2
1700	4	1
1800	4	0

Table 20 (Continued)

Time	Prairie Dogs Observed	
	Marked	Unmarked
20 May (Continued)		
1900	1	1
Total	42	17

CHAPTER V

SUMMARY

Surveys for black-footed ferrets were conducted in the Oklahoma Panhandle and adjoining counties of Texas, Kansas, and Colorado. Five prairie dog towns, each on a different soil series in Texas County, Oklahoma, were selected for an ecological study of the prairie dog.

An analysis of variance was conducted on all variables selected for the study of the five prairie dog towns. The variables included species of vegetation grouped into desirability classes for livestock, ground cover, soil chemicals, and numbers of cow droppings. Significant differences between dog towns and adjacent rangeland on each soil series were compared for each parameter measured.

The ecological study of prairie dogs was designed to test for any differences in species composition of vegetation, soil chemicals, and ground cover that existed between the prairie dog towns and the adjoining range. An estimate of cattle use of the sites was made using a version of the pellet group count. Questionnaires were distributed to 1093 students and 813 voting residents of the Oklahoma Panhandle to determine the attitudes of the local residents towards prairie dogs. Range condition classes and techniques for capturing and marking prairie dogs were studied. An estimate was made of the population of a portion of a dog town.

Black-footed ferrets may still be present in very small numbers in

the southern portion of its original range. A comparison was made of the numbers and distribution of prairie dog towns in Mellette County, South Dakota, where ferrets occur, with the numbers and distribution of prairie dog towns in Texas County, Oklahoma. This comparison indicates prairie dog numbers in Texas County are probably still sufficient to maintain a small population of black-footed ferrets.

One hundred and twenty-three prairie dog towns were located (verified) in Texas County, Oklahoma. The average size of 85 of these towns was estimated as 14 ha. The most successful method of locating these towns was by interviewing land owners and hunters.

Species composition of vegetation was influenced by soil series and prairie dogs. Percent composition of all vegetative groups except the Less Desirable Annual Forbs ($P < .13$) and Least Desirable Woody plants ($P < .54$) were significantly ($P < .01$ to $P < .05$) influenced by soil series.

Buchloe dactyloides was found on all ranges and prairie dog towns and was increased by prairie dogs on all soil series except the Mansker Clay Loam. The Desirable Grasses showed no significant ($P < .46$) difference between sites because of a concurrent increase in Buchloe dactyloides and decrease in taller desirable grasses. Two Less Desirable Grass species, Bouteloua hirsuta and Chloris verticillata, were reduced or eliminated on three dog towns.

Localized occurrence of some species created significant interactions between soil series and sites. Annual forbs flourished on the disturbed soils of the prairie dog towns of some soil series. These forbs were generally grazed low by the prairie dogs.

Bare ground caused by prairie dog activity varied from 5 to 27%, but average bare ground influenced by causes other than prairie dogs was greater on adjacent ranges than on the prairie dog towns. Total bare ground and litter were not greatly different on dog towns and adjacent rangeland except on coarser textured soils.

The mean number of cattle droppings was higher on all prairie dog towns except on the Mansker Fine Sandy Loam. The prairie dog town on the Otero-Vona soil showed the only significant ($P < .02$) increase of cattle droppings.

Prairie dogs significantly increased organic matter ($P < .01$), phosphorus ($P < .01$), potassium ($P < .01$), and calcium ($P < .03$) on the prairie dog towns, however, these increases were not consistent on all soil series. Organic matter and phosphorus contents were significantly less in prairie dog town soil samples on the Otero-Vona and Mansker Clay Loam soils. Potassium and calcium were consistently increased on all prairie dog towns.

The Dalhart Loamy Fine Sand series showed a consistent increase of all soil chemicals except soil acidity. The other four series showed increases on the prairie dog towns for some soil chemicals but decreases in others. These changes were not consistent for any soil series and were apparently influenced by the inherent differences of the soil series and prairie dog activity.

Prairie dogs consistently lowered the range condition on the prairie dog towns. Prairie dogs tended to equalize range condition on the towns on different range sites. Forage production was generally reduced, but ground cover was increased on sandy soils.

Questionnaires showed that 56% of the students want the prairie

dogs protected and 11% want them exterminated. The major objections to prairie dogs were destroyed pasture (122) and livestock injury (43).

Only 206 usable questionnaires were returned from the 813 questionnaires sent to voting residents. Land managers returned 110 and non-managers returned 96. Approximately 53% of the land managers wanted the prairie dogs exterminated; only 7% of the non-managers wanted prairie dogs destroyed. The major complaints of the land managers about prairie dogs were destroyed grass (59%), livestock injury (20%), and increased number of rattlesnakes (9%).

Approximately 86% of the land managers reported the condition of their range land. Fourteen percent of this total said that over 63% of their range land was in excellent condition, and 33% said that 80% was in good condition. None reported any range in poor condition. Literature reviews and studies showed that 198,000 ha exceeded proper grazing levels and that the average land manager overestimates his range condition.

Prairie dog towns were reported by 57 people (52%) on lands they manage. This indicated a response bias; land managers with prairie dog towns on their land had a greater probability of answering the questionnaire. Only 30 respondents reported the size of their towns. The average size reported was 14.4 ha, very similar to the author's estimate of 14 ha for the average prairie dog town in Texas County, Oklahoma. Over 76% of the land managers said they would exterminate their prairie dog town if financial assistance was available from the government.

Three types of traps were tested: padded steel traps, dome traps, and a "drift" trap. The padded traps were the most successful. Surgical rubber tubing was used as padding and reduced injury to the

captured prairie dogs.

Rhodamine B and human hair dye (black) were used to mark seven prairie dogs for a population study on a 0.69 ha portion of a prairie dog town. A population of 10 to 11 prairie dogs was estimated to inhabit the area. The projected population density was 14.5 prairie dogs per hectare.

Mellette County, South Dakota, where the ferret population appears stable, contains approximately 1300 ha of prairie dog towns (Linder et al. 1972). The southwest region of Mellette County is similar to Texas County, Oklahoma. Mellette County has considerable cropland interspersed with pastures, some containing prairie dog towns. The number of prairie dog towns in Mellette County (151), their average size (14 ha), and the total hectares is quite similar to Texas County, Oklahoma.

The present habitat in Texas County appears to be favorable for introduction of ferrets to increase the remnant population that may exist there or to reintroduce ferrets if they are extinct in the County. However, one of the potential obstacles to transplanting ferrets is availability of suitable habitat in the future. Most of the study area is privately owned and approximately 53% of the managers, who responded to the questionnaire, wanted prairie dogs exterminated. This sentiment was also expressed by most managers interviewed by the author. Only 11% of the students indicated they wanted the prairie dog exterminated (the number of students that were children of land managers was not determined).

Unless the land managers are able to see some benefit of having prairie dogs they will continue to poison them. An intensive education

campaign to inform the future and present land managers of the ecological role of the prairie dog would be an essential part of any transplanting program for ferrets. Additional information about prairie dogs must be acquired before such an education program can be initiated. The author suggests the following research needs to determine this additional information.

1. Effective methods of controlling prairie dogs must be found. These methods should include range management techniques such as grazing systems, adjustment of grazing seasons, and selective chemical control of prairie dogs. Adequate control methods are necessary to encourage land owners to participate in any management programs for prairie dogs or ferrets.
2. Detailed studies of population dynamics of the prairie dog are needed, including research to determine why previously stable populations often experience rapid population growth. In the study area small stable populations (2 ha) of prairie dogs create less problem for the land manager and are poisoned less frequently than the larger or rapidly growing towns. Small dog towns with stable populations may provide suitable habitat for ferrets with less likelihood that the ferrets would become victims of secondary poisoning during control programs directed at prairie dogs.
3. Research is needed to determine if the presence of a prairie dog town is an indicator of range condition. If so, manipulation of livestock grazing could increase or decrease prairie dog habitat.
4. More indepth studies are needed on the effect that prairie dogs

have on rangeland, including soil moisture, micro-nutrients, and changes in plant species composition as time passes. This information would be valuable in determining the prairie dog's role in the ecosystem and might reduce some of the antagonism of the land manager toward prairie dogs.

5. The competition between prairie dogs and livestock should be determined to provide a sound economic basis for any future leasing of prairie dog towns as a part of a management program for ferrets.
6. The aesthetic values of prairie dogs should be estimated in an attempt to explore all avenues to prevent the extermination of the species.

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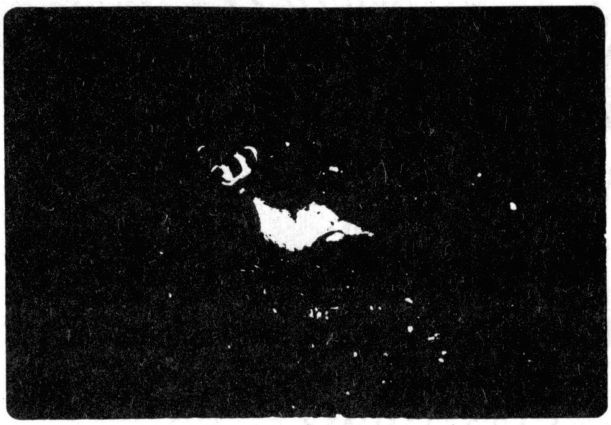
APPENDIX A

SAMPLE OF POSTER OFFERING A REWARD FOR INFORMATION LEADING TO DISCOVERY OF A BLACK-FOOTED FERRET

REWARD
$100



A $100 reward will be given to the FIRST person providing information leading to the discovery and verification of the existence of black-footed ferrets (Mustela nigripes) in the Oklahoma Panhandle or a 150-mile radius from the Panhandle. All reports will be checked by Fred Hassien, Project Leader, Rout 1, Eva, Oklahoma 73936. Skins and / skeletons of ferrets struck by cars and found along roads, reports of ferrets seen or photographs taken in an area where Mr. Hassien subsequently observes a ferret will qualify for the reward.

There may be as few as 60 black-footed ferrets still alive in the U. S., therefore, the reward WILL NOT be paid for any ferret caught in traps or killed by the finder. The ferret is endangered and is protected by federal law.

The only population of black-footed ferrets known to exist today is in South Dakota, but sightings of the ferret have been reported in the Oklahoma Panhandle and adjacent counties of bordering states in the last 10 years. These sightings have not been varified. The ferret is often found on prairie dog towns in South Dakota, but most sightings reported in Oklahoma have been around irrigation pipe, old buildings, etc.

The black-footed ferret is approximately two feet long and weighs approximately two and one-half pounds. It has a distinct black mask bordered by white on the forehead and on the muzzle. It has a black-tipped tail and all four feet are black. Its coat is golden-brown with white under fur. The light fur and black feet are very important identifying characteristics.

The ferret may be confused with the bridled or masked weasel (Mustela frenata). The masked weasel is approximately half the size of the ferret. He has a brown coat, white feet, white mask bordered by brown or black on the forehead and muzzle. He may be found in the same habitat as that of the black-footed ferret.

If you should find a black-footed ferret, please contact Fred Hassien, Route 1, Eva, Oklahoma 73936 as soon as possible after the sighting. Call collect at any hour to (405) 545-3407.

If a dead ferret is found it should be placed in a plastic bag and frozen. If the animal is decomposed it should be buried and the spot marked with anything prominent enough to be seen and the location written down and then reported.

This offer will be in effect until September 1, 1974.

APPENDIX B

SCIENTIFIC NAMES AND SYMBOLS DESIGNATING THE SPECIES OF VEGETATION FOUND ON TRANSECTS

SCIENTIFIC NAMES AND SYMBOLS DESIGNATING THE SPECIES OF VEGETATION FOUND ON TRANSECTS

Grasses

Scientific Name	Symbol	Common Name
Andropogon saccharoides	ANSA	silver beardgrass
Aristida fendleriana	ARFE	fendler three-awn
Aristida spp.	ARI	three-awn
Aristida longiseta	ARLO	red three-awn
Bouteloua curtipendula	BOCU	side-oats grama
B. gracilis	BOGR	blue grama
B. hirsuta	BOHI	hairy grama
Buchloe dactyloides	BUDA	buffalo grass
Chloris verticillata	CHVE	windmill grass
Erioneuron pilosum	ERPI	hairy tridens
Festuca octoflora	FEOC	sixweeks fescue
Hordeum pusillum	HOPU	little barley
Muhlenbergia spp.	MUH	muhly
M. torreyi	MUTO	ringgrass
Munroa squarrosa	MUSQ	false buffalo
Paspalum setaceum	PASE	
Panicum obtusum	PAOB	vine mesquite grass
Schedonnardus paniculatus	SCPA	tumblegrass
Sporobolus spp.	SPO	dropseed
S. cryptandrus	SPCR	sand dropseed

Forbs

Amaranthus blitordes	AMBL	prostrate amaranth
Ambrosia psilostachya	AMPS	western ragweed
Artemisia ludoviciana	ARLU	western mugwort
Aster leucelene	ASLE	
Chenopodium album	CHAL	lamb's-quarters
Chamaesaracha coniodes	CHCO	
Chrysopsis villosa	CHVI	aster
Cirsium undulatum	CIUN	wavyleaf thistle
Conyza canadensis	COCA	mare's tail
Cryptantha spp.	CRY	borage
C. jamesii	CRJA	borage
Cymopterus montanus	CYMO	indian bread root
Cyperus ovularis	CYOV	cyperus
Dalea enneandra	DAEN	plume dalea
Englemannia pinnatifida	ENPI	engeleman's daisy
Erigeron bellidiastrum	ERBE	
Erysimum capitatum	ERCA	wall flower
Euphorbia glyptosperma	EUGL	spurge

Forbs (Continued)

Scientific Name	Symbol	Common Name
Evolvulus nuttallianus	EVNU	
Gaillardia pulchella	GAPU	indian blanket
Gutierrezia sarothrae	GUSA	broom snakeweed
Haplopappus spinulosis	HASP	cutleaf golden weed
Heterotheca latifolia	HELA	camphor weed
Kochia scaparia	KOSC	kochia
Lithospermum spp.	LIT	gromwell
Melampodium leucanthum	MELE	plains black-foot
Mirabilis linearis	MILI	linearleaf four-o'clock
Physalis virginiana	PHVI	sand ground cherry
Plantago purshii	PLPU	wooly plantain
Psoralea argophylla	PSAR	silver leafed scurf-pea
Ratibida columnaris	RACO	prairie cone flower
Salsola kali	SAKA	tumbling russian thistle
Solanum triflorum	SOTR	nightshade
Sphaeralcea coccinea	SPCO	red false mallow
Talinum parviflorum	TAPA	fameflower
Unidentified forb	UNFB	
Vernonia spp.	VER	ironweed
Zannia grandiflora	ZAGR	rocky mountain zannia

Woody Species

Artemisia filifolia	ARFI	sand sage
Opuntia spp.	CAC	cactus
Mamillaria vivipara	MAVI	mamillaria cactus
Opuntia macrorhiza	OPMA	prickly pear
O. tortispina	OPTO	prickly pear
Yucca glauca	YUGL	soapweed (yucca)

APPENDIX C

VEGETATIVE GROUPS AND SYMBOLS OF SPECIES BELONGING TO EACH GROUP

VEGETATIVE GROUPS AND SYMBOLS OF SPECIES

BELONGING TO EACH GROUP

Vegetative Groups	Definition	Species Symbol
DGBOCU	Desirable Grass *Bouteloua curtipendula*	BOCU
DGGRASS	Desirable Grasses	ANSA BOCU BOGR BUDA PAOB SPCR SPO
DGMEDCHV	Less Desirable Grass *Chloris verticillata*	CHVE
DGMED	Less Desirable Grasses	BOHI CHVE HOPU PASE
LDGRASS	Least Desirable Grasses	ARFE ARI ARLO FEOC ERPI MUH MUSQ MUTO SCPA
DFORBAK	Desirable Annual Forb *Kochia scoparia*	KOSC
DFORBA	Desirable Annual Forbs	AMBL CHAL COCA GAPU KOSC SAKA
DMFORBA	Less Desirable Annual Forbs	ERBE
LDFORBA	Least Desirable Annual Forbs	EUGL PLPU SOTR

Vegetative Groups	Definition	Species Symbol
DFORBP	Desirable Perennial Forbs	ENPI PSAR RACO
DMFORBPA	Less Desirable Perennial Forb *Artemisia ludoviciana*	ARLU
DMFORPH	Less Desirable Perennial Forb *Heterotheca latifolia*	HELA
DMFORBP	Less Desirable Perennial Forbs	ARLU CRY CYOV DAEN HELA LIT SPCO ZAGR
LDFORBP	Least Desirable Perennial Forbs	AMPS ASLE CHCO CHVI CIUN CRJA CYMO ERCA EVNU GUSA HASP MELE MILI PHVI TAPA UNFB VER
MEDWOODY	Less Desirable Woody Plants	ARFI YUGL
LDWOODY	Least Desirable Woody Plants	CAC MAVI OPMA OPTO
DFORB	Desirable Forbs	

APPENDIX D

QUESTIONNAIRE COMPLETED BY JUNIOR AND SENIOR HIGH SCHOOL STUDENTS

CONFIDENTIAL QUESTIONNAIRE

SCHOOL _____ LOCATION_____

INSTRUCTIONS: Please complete the following questionnaire by filling in the blanks or by placing a checkmark or an X in the spaces indicated.

---

1. Sex: Male _____ Female _____

2. Age: _____

3. What grade are you in? _____

4. Do you know what a prairie dog is? Yes _____ No _____

5. Have you ever seen a prairie dog? Yes _____ No _____

6. Have you ever read anything about prairie dogs in:

   a. Newspapers? _____ b. Leaflets? _____ c. Books? _____

   d. Other? _____

7. Have you ever known anyone who felt <u>strongly</u> that prairie dogs were:

   a. Useful or nondestructive? Yes _____ No _____

   b. Useless or destructive? Yes _____ No _____

8. Which of the following people, if any, felt prairie dogs were useful or nondestructive?

   Father _____ Mother_____ Teacher_____ Friend _____

   Brother _____ Sister_____ Others (please specify) _____

9. Which of the following people, if any, felt prairie dogs were useless or destructive?

   Father _____ Mother _____ Teacher _____ Friend _____

   Brother _____ Sister _____ Others (please specify) _____

10. Would you like to have:

    a. The prairie dogs protected? _____

    b. The present number of prairie dogs decreased? _____

c. The present number of prairie dogs maintained? _____

d. The present number of prairie dogs increased? _____

e. The present number of prairie dogs killed off? _____

11. Do you know if your school or town library has any books or other literature on prairie dogs? Yes _____ No _____

12. Do you feel that prairie dogs are:

Useful? _____ Useless? _____ Neither? _____

13. Why do you feel that prairie dogs are useful or useless or of no consequence?

_____

14. Are you a member of:

a. Cub Scouts? _____ b. Boy Scouts? _____

c. Girl Scouts? _____ d. FFA? _____

e. FHA? _____ f. 4-H? _____

g. Others (please specify)? _____

_____

TEAR OFF AND SAVE

IF YOU OR ANY MEMBER OF YOUR FAMILY SEE A BLACK-FOOTED FERRET PLEASE CALL ME COLLECT:

FRED HASSIEN
PHONE: 405-545-3407
ROUTE ONE
EVA, OKLAHOMA 73936

APPENDIX E

QUESTIONNAIRE MAILED TO VOTING RESIDENTS

CONFIDENTIAL QUESTIONNAIRE

Part One

Questionnaire No. _____

Instructions: Please complete the following questionnaire by filling in the blanks or by placing a checkmark or an X in the spaces indicated.

---

1. Sex: Male _____ Female _____

2. Age: _____

3. Present occupation (please fill in): _____

4. Education (please mark the highest grade completed):

a. Less than 5 years	_____	g. 11th grade	_____
b. 6th grade	_____	h. 12th grade	_____
c. 7th grade	_____	i. 2 yrs. college	_____
d. 8th grade	_____	j. 4 yrs. college	_____
e. 9th grade	_____	k. more than 4 yrs. college	_____
f. 10th grade	_____		

5. Are you presently a member of (please indicate membership by an X next to the organization[s]):

a. Farm Bureau?	_____	e. Soil & Water Conserv. District?	_____
b. Farmers' Union?	_____	f. Sportsman's Club?	_____
c. Okla. Cattlemen's Assoc.?	_____	g. Others (please specify)?	
d. Okla. Wheatgrower's Assoc.?	_____		_____

6. Do you hunt:

a. Prairie dogs?	Yes _____	No _____
b. Coyotes?	Yes _____	No _____
c. Rabbits?	Yes _____	No _____
d. Rattlesnakes?	Yes _____	No _____
e. Other animals?	Yes _____	No _____

7. Have you ever known anyone who felt strongly that prairie dogs were:

a. Useful?	Yes _____	No _____
b. Useless?	Yes _____	No _____
c. Of no value?	Yes _____	No _____

8. Have you ever read any publications concerning prairie dogs?

a. Newspaper?	Yes _____	No _____
b. Leaflets?	Yes _____	No _____
c. Books?	Yes _____	No _____

9. Would you like to have the present number of prairie dogs:

   a. Decreased? _____
   b. Maintained? _____
   c. Increased _____
   d. Exterminated? _____

10. Would you please explain the reason for your answer in number 9 above? _____

    _____

11. How long have you lived in the Oklahoma Panhandle? _____

Part Two Anyone owning, leasing, or operating land leased or owned by others should complete this section.

1. Do you:

   a. Own land? Yes____ No____ Acres____
   b. Lease land? Yes____ No____ Acres____
   c. Operate land owned or leased by others? Yes____ No____ Acres____

2. Is a prairie dog town located on the land you own, lease or operate? What is its size in acres? Yes____ No____ Acres____

3. Please answer these three questions even if you do not have prairie dogs.

   If financial assistance were available from federal, state or county government would you:

   a. Exterminate a prairie dog town that was on property you own, lease or operate? Yes____ No____
   b. Control the size of the prairie dog town? Yes____ No____
   c. Lease the prairie dog town to a governmental agency? (this lease would allow normal grazing and control of the town but would not allow extermination of the prairie dogs) Yes____ No____

   If you checked yes to part "b", what is the maximum acreage of prairie dog town you would permit on land you own, lease or operate? _____ acres

   If you checked yes to part "c", what minimum amount would you be willing to accept as a lease fee? $_____ per acre

4. Would you allow research (population counts, soil analysis, etc.) to be conducted on your prairie dog town? Yes_____ No_____

5. On the land you manage, what percent is:

   a. Range? _____%
   b. Crops? _____%
   c. Other (please specify)? _____%

6. Please evaluate the condition of forage on your range land as a percent of your total range:

   a. Excellent _____%
   b. Good _____%
   c. Fair _____%
   d. Poor _____%

7. Please evaluate your land concerning wildlife numbers:

a. Cottontail rabbit	High_____	Moderate_____	Low_____
b. Jackrabbit	High_____	Moderate_____	Low_____
c. Badger	High_____	Moderate_____	Low_____
d. Coyote	High_____	Moderate_____	Low_____
e. Hawks	High_____	Moderate_____	Low_____

8. Would you allow hunters to shoot prairie dogs on the land you manage? Yes_____ No_____

9. If not, why? _____

_____

10. What is your opinion of prairie dogs? _____

_____

VITA

Frederick Dale Hassien

Candidate for the Degree of

Master of Science

Thesis: A SEARCH FOR BLACK-FOOTED FERRETS IN THE OKLAHOMA PANHANDLE AND ADJACENT AREA AND AN ECOLOGICAL STUDY OF BLACK-TAILED PRAIRIE DOGS IN TEXAS COUNTY, OKLAHOMA

Major Field: Wildlife Ecology

Biographical:

Personal Data: Born in Mexico, Missouri, October 23, 1942, the son of Joe and Ora M. Hassien.

Education: Graduated from Van-Far High School, Vandalia, Missouri, in May, 1960; received Associate of Science degree in Wildlife Ecology from Mesa Junior College, Grand Junction, Colorado in 1969; Bachelor of Science degree in Agriculture from University of Missouri, Columbia, Missouri in 1970; completed requirements for the Master of Science degree at Oklahoma State University in May, 1976.

Professional Experience: Undergraduate Assistant in Wildlife, University of Missouri, Columbia, Missouri, 1969-1972; Research Assistant in Wildlife, Missouri Department of Conservation, Columbia, Missouri, 1970-1972; Research Fellowship, Oklahoma Cooperative Wildlife Research Unit, Oklahoma State University, 1972-1976.

Honorary and Professional Societies: Member of the Gamma Sigma Delta Honor Society of Agriculture; American Society of Mammalogists; Missouri Chapter of the Wildlife Society; National Geographic Society.