

Final Report

A BASELINE STUDY OF THE PAST AND PRESENT STATUS OF THE
UTAH PRAIRIE DOG (Cynomys parvidens) IN BRYCE CANYON NATIONAL PARK

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Project Associates:

Steve Elmore, Student Assistant, Utah State University, Department of
Wildlife Science

Gar W. Workman, Project Supervisor, Utah State University, Department of
Wildlife Science

Charles Budge, Superintendent, Bryce Canyon National Park

George E. Neusaenger, Chief, Interpretation and Resource Management,
Bryce Canyon National Park

Cooperators:

National Park Service, U. S. Department of Interior

Utah Cooperative Wildlife Research Unit, U. S. Fish and Wildlife Service

Utah Division of Wildlife Resources

Department of Wildlife Resource, Utah State University

Extension Services, Utah State University

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ABSTRACT

At one time, large colonies of the Utah prairie dog (Cynomys parvidens) were very common in the Bryce Canyon National Park area of Utah. Today there are no native prairie dogs residing within the Park boundary, although one colony does reside a few miles north of the main entrance to the Park.

During the summers of 1974 and 1975, attempts were made to reestablish the Utah prairie dog within the Bryce Canyon National Park boundary. These animals were provided by the Utah Division of Wildlife Resources. The new animals were transplanted in artificial burrows made with a soil auger. Some food was also provided at each site. Daily observations were made at each transplant site to evaluate prairie dog activity, migration from the area, and factors which might influence their ability to survive.

In addition to the above activities, an inventory of suitable transplant sites within the Park was made. This also included documentation of previous prairie dog colony sites within the Park.

TABLE OF CONTENTS

	Page
INTRODUCTION	1
DESCRIPTION, HABITAT, AND ECOLOGY OF THE UTAH PRAIRIE DOG	3
1974 TRANSPLANT AREA: DESCRIPTION AND COMPARISON	6
PREVIOUS UTAH PRAIRIE DOG COLONIES WITHIN BRYCE CANYON NATIONAL PARK	14
DECIMATION OF THE UTAH PRAIRIE DOG WITHIN BRYCE CANYON NATIONAL PARK	18
1975 TRANSPLANT AREAS: DESCRIPTION AND COMPARISON	22
BEHAVIORAL CHARACTERISTICS OF THE TRANSPLANTED PRAIRIE DOGS	31
CONCLUSIONS	38
LITERATURE CITED	40

LIST OF TABLES

		Page
Table		
1	Vegetative composition, density, and palatability in the 1974 prairie dog transplant site in August 1975, Bryce Canyon National Park.	8
2	Total number and percent composition of Utah prairie dogs captured at the "Y-dogtown" near Panguitch and transplanted to the visitors' center site, Bryce Canyon National Park. .	24
3	Vegetative composition, density, and palatability in the area of the 1975 visitors' center transplant site in August 1975, at Bryce Canyon National Park.	25
4	Potential increaser, decreaser, and invader plant species at the visitors' center prairie dog transplant site, Bryce Canyon National Park.	28
5	Total number and percent composition of Utah prairie dogs captured at Churchwell, Cedar City and transplanted at East Creek, Bryce Canyon National Park.	30
6	Vegetative composition, density, and palatability in the 1975 East Creek prairie dog transplant site as of August 15, 1975, Bryce Canyon National Park.	33
7	Potential increaser, decreaser, and invader plant species at the East Creek transplant site, Bryce Canyon National Park.	36

LIST OF FIGURES

		Page
Figure		
1	Average temperature and degrees Fahrenheit for Bryce Canyon National Park, Panguitch and Cedar City, Utah areas.	12
2	Average precipitation in inches in the Bryce Canyon National Park, Panguitch and Cedar City, Utah areas.	13
3	Prairie dog burrows in Bryce Canyon National Park. The East Creek Dogtown shown below is approximately 2 1/2 miles south of the Bryce Canyon National Park Visitors' Center	16
4	Prairie dog burrows in Bryce Canyon National Park. The visitors' center dogtown shown below is located approximately 50 yards south of the Park's sewage lagoon.	19

INTRODUCTION

The summer of 1975 marks the second consecutive year that an attempt has been made to reintroduce the Utah prairie dog into Bryce Canyon National Park. It is of special interest to the National Park Service to attempt to reestablish this mammal into its previous habitat. This is especially significant in the light of its present rare and endangered status.

At one time, large colonies of the Utah prairie dog (Cynomys parvidens) were very common in the Bryce Canyon National Park area of southcentral Utah. Today there are no native prairie dogs residing within the Park boundary, although one colony is a few miles north of the main entrance.

During the late summer of 1974, an attempt was made to reestablish the Utah prairie dog within the Bryce Canyon National Park boundary once again. On August 10, 1974 the Utah Division of Wildlife Resources provided 38 animals for the initial transplant. These animals, captured from a prairie dog town near Cedar City, were released untagged in the south end of an open meadow directly north of Sunset campground and west of the main park road. The sex of these prairie dogs was unknown. Four additional animals were captured at an active colony near Bryce Canyon Airport. The sex of these animals was determined, they were aged and then released in the park in about the same area.

A soil auger was used to drill artificial holes in the ground of the transplant area in an effort to detain newly released prairie dogs. A limited amount of additional food was also provided after the transplant. Daily observations of the new colony indicated that they were

feeding, socially interacting, and vocalizing. At this time they were thought to be successful in their adaptation to the area.

It was not until August 17 that any marked change in the colony was noted. On that date, and on a number of succeeding days, a significant reduction in the number of prairie dogs was noted in the transplanted colony. Since there was no indication of increased predation, it was assumed that the animals had either commenced with hibernation or migrated to some new area. Approximately one week later the remainder of the colony was found in an area not more than 90 meters north of the original transplant site and bordering the south side of a service road. Again, the colony was observed to be carrying out "normal" dogtown activities. As average daily temperatures declined, fewer animals were seen, and on September 19, the last prairie dog was observed. It was assumed that the animals sensed the outset of winter and, in turn, initiated their semi-hibernative or "cold narcosis" state.

As of August 25, 1975 the status of the colony is unknown. Observations of the transplant site this spring and summer has not revealed any prairie dog activity. Since it is highly unlikely that predation eliminated the entire colony, it is hypothesized that the colony perished as a result of adverse environmental conditions, disease, or have dispersed during the winter months to more suitable areas. There are two lines of evidence to support the migratory theory. First, excavation of two burrows this spring did not disclose any animal remains; and secondly, two prairie dogs (thought to be transplanted) were discovered within 1.6 kilometers (one mile) of the original transplant site in late July.

In light of this situation, and as a request from Bryce Canyon National Park administrators, phase one of a three-phase research

project to be conducted during the summer over a three-year period was designed by Dr. Gar Workman, Department of Wildlife Science, Utah State University, and carried out by a Utah State University student biologist, Steve Elmore. Phase one of the project, beginning in the spring of 1975, included a four-part study:

(1) To inventory meadow environments including a study of similarities of potential Utah prairie dog habitat in Bryce Canyon National Park in relation to present Utah prairie dog habitat outside the park;

(2) To document past Utah prairie dog colony sites within Bryce Canyon National Park;

(3) Locate areas within Bryce Canyon National Park thought to be capable of sustaining prairie dog (transplant) colonies; and

(4) To capture and transplant Utah prairie dogs into chosen transplant sites in Bryce Canyon National Park.

DESCRIPTION, HABITAT, AND ECOLOGY OF THE UTAH PRAIRIE DOG

The Utah prairie dog is a plump, tawny rodent, weighing about two pounds and measuring 35-42 centimeters (14-17 inches) from nose to tail tip. It belongs to the squirrel family (Sciuridae) and is closely related to the marmots. Prairie dogs are classified into two groups, the black-tails and the whitetails. Distinguishing characteristics between the two groups are fur color and tail length. Whereas the blacktail prairie dogs are stocky with long, black-tipped tails, the whitetail species are more slender with shorter, white-tipped tails.

Four species of prairie dogs occur in the United States. Three of these, all in the whitetail group, occur in Utah: the Whitetail (Cynomys lecurus) in eastern and northeastern Utah, the Zuni (C. gunnisoni) in

southeastern Utah, and the Utah prairie dog (C. parvidens) in southcentral Utah. The remaining species is the blacktail prairie dog (C. ludovicianus) of the great plains. A study initiated in the summer of 1972 by the Bureau of Sport Fisheries and Wildlife estimates the entire Utah prairie dog population at 6,000 animals, occupying 1,200 hectares (3,000 acres) in six southcentral Utah counties. These findings also indicate that if the population trend of recent years had continued the Utah prairie dog would have been extinct prior to the turn of the century (Collier and Spillet 1972).

A labyrinth of burrows honeycomb a prairie dogtown. The mounds surrounding the burrow entrances keep surface water out of the system and serve as lookout vantage points. Many burrows have at least two exits, which are believed to be a protective mechanism against digging predators. Bulbous excavations, known as nesting chambers, are dotted throughout the burrow system. The lateral passageways vary from 0.6-4.5 meters (2-15 feet) below the surface, depending on a number of variables including soil composition, depth to bedrock, and climate.

It is important that the burrows of the Utah prairie dog are located on well-drained sites. Many holes utilized are moundless and could easily be flooded if drainage is poor. Shallow water tables or shallow depth to bedrock limit vertical burrow development and enhance the chances of predation, particularly from badgers.

Outside the burrow, enemies of the prairie dog are plentiful. Remaining alert and cautious is important to its survival. In the air, raptorial predators include the golden eagle and the red-tailed hawk. Terrestrial enemies include the coyote and bobcat.

Prairie dog social behavior, including touch, visual, and vocal

interactions are key to its communal survival. The most significant division within the dogtown are invisible yet highly defended territories. Each territory consists of approximately one adult male and three adult females together with about five offspring. The identity of the territory is maintained by frequent contacts with other members of the dogtown. The territory usually covers about 0.2 hectares (one-half an acre), though its extent may vary, particularly at the edge of a town, where animals may move into adjacent uninhabited regions (King 1971).

Dogtowns must be located near areas that support moist herbage, even during severe drought. It has also been shown that drier, slower growing vegetation tends to have less nutrient value. Utah prairie dogs rarely range over 60 meters in the spring yet may range up to 400 meters from the home burrow in the summer. In June and July, 1974 quality forage in dogtowns near Bryce Canyon became so scarce that prairie dogs traveled daily up to 400 meters from their home burrows to forage (Crocker-Bedford 1975).

Habitat appears too advantageous if burrows are very near a swale area for three reasons. First, great proximity to food requires less travel energy consumption. Second, greater proximity to food results in less predation; and third, until June, prairie dogs are confined to the area near their home burrows until the young are weaned. Thus, in years of early drought, reproduction is probably substantially reduced if moist herbage is not nearby.

The predominant vegetation height within Utah prairie dogtowns must be low enough to allow prairie dogs to scan their environment while standing, even if they are not on mounds (Crocker-Bedford 1975). Koford (1958) stated that prairie dogs "seldom enter grass so tall and thick

that they cannot see through or over it." Collier (in press) found that "vegetative cover taller than 12 inches was slight in nearly all dogtowns." There are two possible reasons for avoidance of taller vegetation. First, taller vegetation disrupts the prairie dogs view of predators and social communications. Second, lower vegetation is often of low fiber content and, in turn, more palatable. It has been shown that as a result of the disruption of view, the animals do not enter into rabbitbrush (Chrysothamnus spp.) stands to feed on highly preferred flowers, nor into tall alfalfa stands.

Prairie dog breeding activity near Bryce Canyon occurs in early May, and gestation requires about 30 days. Lactation must be completed before the early summer dry period takes effect so that animals can travel to moist, cool season, palatable forage. Parturition occurs in late June or early July. The mean litter size is approximately 5.5, yet varies from 3 to 8. One litter is produced annually. Movement of the young occurs chiefly in early summer. The animals moult twice a year: in the spring, following emergence; and in the fall, preceding "hibernation." Expansion and dispersal of established colonies is not uncommon, however, and the success in transplanting and establishing a colony in the wild is still unknown.

1974 TRANSPLANT AREA: DESCRIPTION AND COMPARISON

Bryce Canyon National Park, containing 55 square miles, lies at the southern edge of the plateau region of southwest Utah. The transplant area is located in the northeastern part of the Park on a rather flat-topped plateau, characterized by a few minor hills and ridges. The range in elevation of the Park is 1980 meters (6,600 feet) to

approximately 2,730 meters (9,100 feet) with the transplant area approximately 2,400 meters (8,000 feet) above sea level.

The transplant area is located on a slightly east slope clearing dominated by a number of grasses, forbs and shrubs. Table 1 shows the vegetation composition, density and palatability in the transplant area in August, 1975. The canopy coverage method was used to collect vegetative composition and density data. A one-half meter quadrat was the basic sampling unit. Quadrats were spaced along a transect line at five meter intervals. Percent cover was determined by mentally outlining the peripheral portions of each plant. Each species was then assigned a specific percent cover. All vegetation within 91.5 meters (300 feet) of the mound aggregation was considered within the "dogtown unit" and was sampled to reflect habitat value of the entire area (Collier 1974). Table 1 reveals that there were a number of different species of plants that have been shown to play a significant role in the prairie dog diet. It should be understood, however, that many other plants as well as insects in the transplant area may play a smaller yet important role in the total food intake of the animals.

The area adjacent to the transplant clearing is bordered by ponderosa pine (Pinus ponderosa), an overwhelming dominant species. Other kinds of trees in the forest occupy only minor roles, being much smaller and fewer in number. The ground cover of the surrounding area is dominated by bitterbrush (Purshia tridentata), greenleaf manzanita (Arctostaphylos patula), and mountain lilac (Ceanthos martini).

The soil textural classification of the transplant area consists of silty clay loam extending to a depth of 150 centimeters (60 inches) from the surface. The depth of bedrock, quite adequate for burrows, was

Table 1. Vegetative composition, density, and palatability in the 1974 prairie dog transplant site in August 1975, Bryce Canyon National Park.

Common name	Scientific name	Percent composition	Palatability	
			leaf	seed flower
	GRAMINAE			
Crested wheatgrass	1 <u>Agropyron cristatum</u>		3	3
Western wheatgrass	1 <u>Agropyron smithii</u>	11.5	2	3
Bluebunch wheatgrass	1 <u>Agropyron spicatum</u>	Trace		
Nodding brome	1 <u>Bromus anomalus</u>	Trace	2	3
Smooth brome	1 <u>Bromus inermis</u>		2	2
Cheatgrass	1 <u>Bromus tectorum</u>		2	2
Foxtail barley	2 <u>Hordeum jubatum</u>			2
Junegrass	1 <u>Koeleria cristata</u>	2.5	2	2
Indian ricegrass	2 <u>Oryzopsis hymenoides</u>		2	3
Kentucky bluegrass	1 <u>Poa pratensis</u>	1.6	3	3
Needle and thread	2 <u>Stipa comata</u>	Trace	2	3
	BORAGINACEAE			
Cryptantha	5 <u>Cryptantha spp.</u>		1	3
Stickseed	5 <u>Lappula redowski</u>	1.5	1	1
	COMPOSITAE			
Yarrow	5 <u>Achillea millefolium</u>		1	1
Black sagebrush	6 <u>Artemisia arbuscula</u>	1.1	1	1
Fringed sagebrush	6 <u>Artemisia frigida</u>	Trace	1	1
Aster	5 <u>Aster spp.</u>			
Rabbitbrush	6 <u>Chrysothamus spp.</u>	Trace	1	3
Arizona thistle	4 <u>Cirsium arizonicum</u>		3	
Thistle	4 <u>Circium spp.</u>		3	
Oregon fleabane	5 <u>Erigeron speciosus</u>	Trace	2	2
Broom snakeweed	6 <u>Gutierrezia sarothrae</u>		1	1
Colorado rubberweed	5 <u>Hymenoxys richardsonii</u>	Trace	1	1

Table 1 (Continued).

Common name	Scientific name	Percent composition	Palatability	
			leaf	seed flower
	COMPOSITAE (Con't.)			
Common dandelion	5 <u>Taraxicum officinale</u>		3	2
Horsebrush	6 <u>Tetradymia canescins</u>	Trace		
	CHENOPODIACEAE			
Fremont goosefoot	4 <u>Chenopodium fremontii</u>		1	
Goosefoot	4 <u>Chenopodium atrovirens</u>		1	
	CRUCIFERAE			
Wallflower	4 <u>Erysimum capitatum</u>			
	ERICACEAE			
Greenleaf manzanita	6 <u>Arctostaphylos patula</u>			
	EUPHORBIACEAE			
Fendler spurge	4 <u>Euphorbia fendleri</u>		3	3
	IRIDACEAE			
Wild iris	5 <u>Iris missouriensis</u>			
	LABIATAE			
American dragonhead	4 <u>Moldavica parviflora</u>		1	2
	LEGUMINOSAE			
Locoweed	5 <u>Astragalus spp.</u>			
	LINACEAE			
Yellow flax	5 <u>Linum kingii</u>		1	3
Blue flax	5 <u>Linum lewisii</u>		1	3

Table 1 (Continued).

Common name	Scientific name	Percent composition	Palatability	
			leaf	seed flower
Scarlet globemallow	MALVACEAE 5 <u>Sphaeralcea coccinea</u>		1	1
Yellow evening primrose	ONAGRACEAE 5 <u>Oenothera brachycarpa</u>		2	1
Evening primrose	5 <u>Oenothera coronopifolia</u>		2	1
Lavenderleaf evening primrose	5 <u>Oenothera lavandulaefolia</u>		2	1
Scarlet gilia	POLEMONIACEAE 5 <u>Gilia aggregata</u>			
Redroot erigonum	POLYGANACEAE 5 <u>Erigonum racemosum</u>		1	3
Winged erigonum	5 <u>Erigonum alatum</u>		1	3
Cinquefoil	ROSACEAE <u>Potentilla crinata</u>	1.3	1	1
Wild rose	<u>Rosa woodsii</u>			
Wax currant	SAXIFRAGACEAE 6 <u>Ribes cereum</u>			
Mat penstemon	SCROPHULARIACEAE 5 <u>Penstemon caespitosus</u>		1	2
Penstemon	5 <u>Penstemon leiophyllus</u>			

Palatability

- 1 - Often eaten
- 2 - Sometimes eaten
- 3 - Rarely eaten

Plant type

- 1 - Cool season grasses
- 2 - Intermediate grasses
- 3 - Warm season grasses
- 4 - Annual forbs
- 5 - Perennials
- 6 - Shrubs

estimated at 175 centimeters (70 inches). Because burrows occur in many kinds of soil, the distribution of the prairie dog does not seem to be limited by soil composition or texture; more important is the depth to bedrock and the indirect effects of soil texture on moisture and vegetation.

On August 10, 1974, 38 Utah prairie dogs were brought in from the Churchwell dogtown near Cedar City, 80 kilometers (50 miles) west of the Park and at an elevation of approximately 1,680 meters (5,600 feet). Four additional animals were captured at a dogtown near Bryce Canyon Airport, 9.6 kilometers (six miles) north of the transplant area at an elevation of 2,274 meters (7,580 feet).

There is a difference in the elevation from the Cedar City area and the transplant area of 720 meters (2,400 feet). The difference in elevation is directly related to a number of environmental variables including: temperature, precipitation, length of season, light intensity, vegetation, and prevailing winds, any of which might be a factor in determining the cause of failure of the transplanted population. Figures 1 and 2 have been constructed in order to compare average monthly temperatures and precipitation in Cedar City with Bryce Canyon National Park. Panguitch climatological data has also been compiled for comparative purposes with the 1975 transplant. The data reveals that the mean yearly temperature in Cedar City averages 4.8°C (8.8°F) above that of Bryce Canyon, whereas the mean yearly precipitation averages 14 centimeters (5.5 inches) below that of Bryce Canyon. The precipitation adjustment for the animals was compounded, however, for spring 1975 precipitation averages were up nearly fifty percent from the norm. The exact impact of these factors upon the transplanted prairie dogs is unknown. There are, however, three

Figure 1. Average temperature and degrees Fahrenheit for Bryce Canyon National Park, Panguitch and Cedar City, Utah areas.

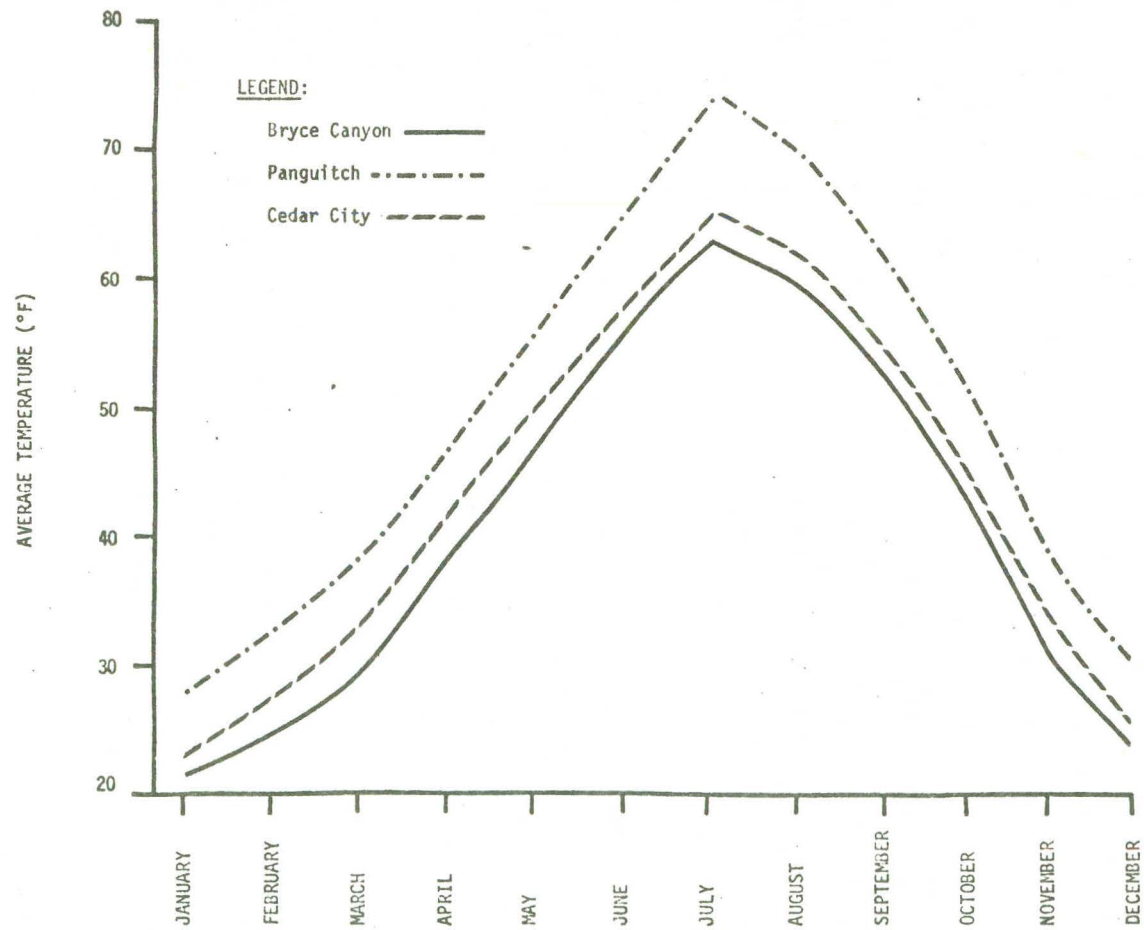
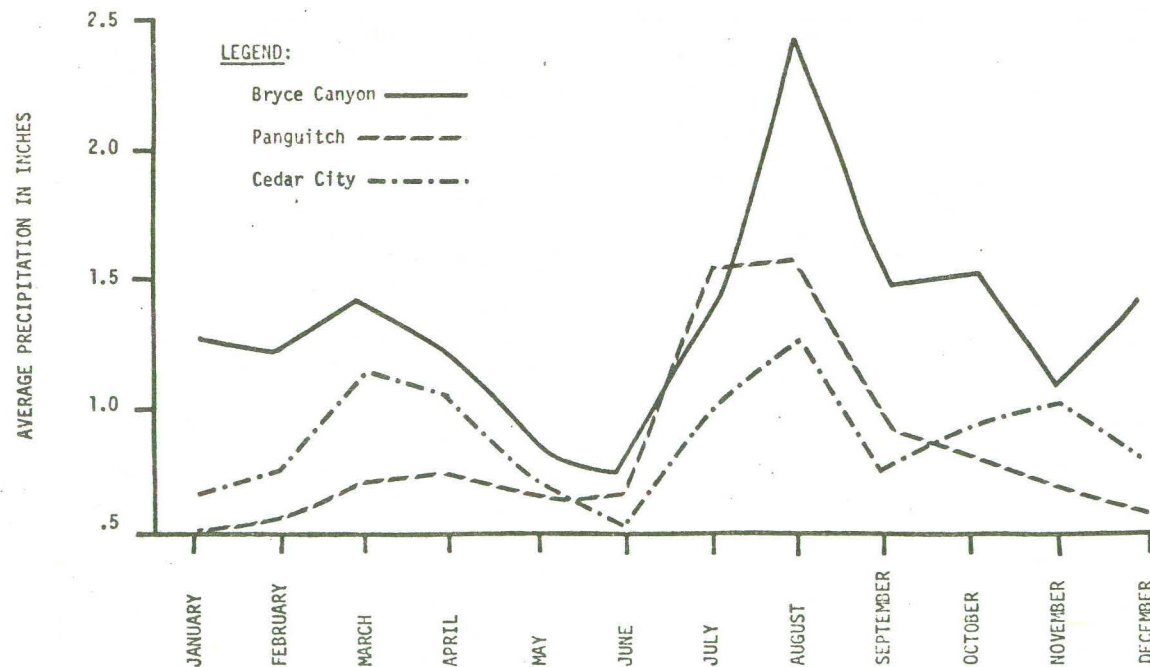


Figure 2. Average precipitation in inches in the Bryce Canyon National Park, Panguitch and Cedar City, Utah areas.



possible ways in which precipitation extremes could have effected the transplanted prairie dogs. First, if burrow development was incomplete, excessive rainfall can drown or dislodge the animals. Second, with high precipitation, low temperatures, and shallow burrow depth, there is a critical soil depth at which hibernating animals can maintain vital body processes during the winter months. Third, high moisture can create ideal bacteria or virus growth conditions within the burrows which may result in the death of animals.

Other variables, not directly connected with elevation differences, yet possibly influential in determining the failure of the transplanted prairie dogs, are as follows: unsuitable habitat (drainage, slope, aspect), lack of habitat adjustment time, too much disturbance, predation, or lack of "critical mass."

PREVIOUS UTAH PRAIRIE DOG COLONIES WITHIN BRYCE CANYON NATIONAL PARK

Most of the land which present day as well as previous colonies were located on has been heavily overgrazed. The years of heaviest use were between 1905 and 1930. Grazing of the area for fifty years prior to the establishment of Bryce Canyon National Park in 1928 caused considerable accelerated erosion. Grazing within the Park was phased out in the years 1931-37 and terminated in 1947.

In the years since grazing was stopped, range conditions have improved to a marked degree; however, a number of species of sagebrush (Artemisia spp.) and gray horsebrush (Tetradymia canescens) have overtaken much of the former grasslands. The years following the overgrazing included a period of large prairie dog populations. According to old

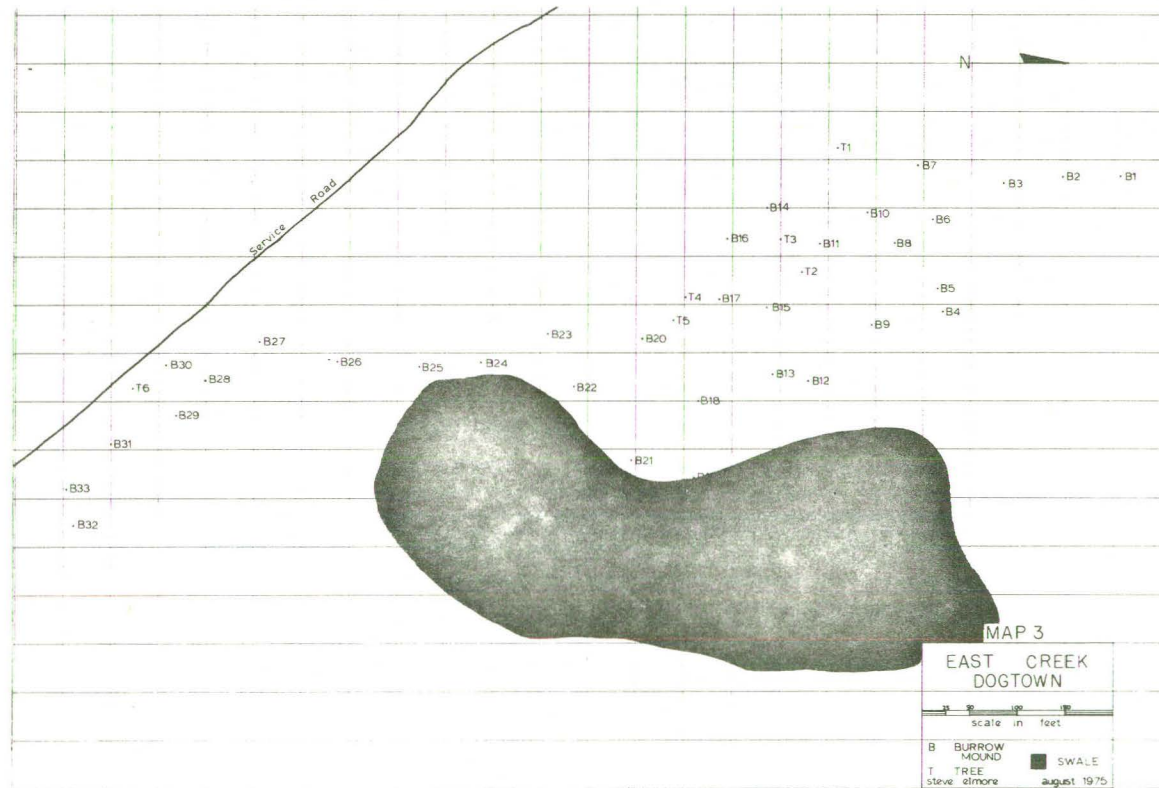
reports, the animals literally covered the overgrazed hillsides and meadows. (Stebbins 1971.)

Today, the open areas of the ponderosa pine forest constitute the principal prairie dog habitat in the Bryce Canyon area. This can also be said of the former colonies which are now extinct. In the past, a few colonies were reported in the higher elevations in the spruce-fir community. In the lower areas, the animals occupied the clearings.

An attempt has been made to record the areas of former Utah prairie dog occupation within the Park (Figure 3). This information was obtained from a number of different sources. The Bryce Canyon National Park maintenance workers recorded and observed a number of active prairie dog sites within the Park. Many of these employees have worked in the Park for more than twenty years and distinctly recall the locations and approximate sizes of the extinct colonies. Another source of information has been the wildlife observation cards on file in the Park's library. This data, and data from the maintenance employees, reveals that in 1958 and early spring 1959 there were active prairie dog towns in the East Creek section of the Park. In midsummer 1959, however, no prairie dogs were seen and the burrows appeared to be abandoned. The exact cause of this phenomena is unknown. Several theories are discussed later in this paper. Another source for this type of information is The Plant Ecology of Bryce Canyon National Park (Buchanan 1960).

The main area of the Park in which the animals occurred in any numbers was East Creek, located about 3.2 kilometers (two miles) south of the Park headquarters. At one time, five separate colonies, four within the boundaries, were located along a 4.8 kilometer (three miles) stretch of the East Creek Valley. The largest colony (colony 1) was

Figure 3. Prairie dog burrows in Bryce Canyon National Park. The East Creek Dogtown shown below is approximately 2 1/2 miles south of the Bryce Canyon National Park Visitors' Center.



located northeast of the old Civilian Conservation Corp camp. As in most colonies, this one followed the typical pattern in that it was located in a large sagebrush clearing on a gentle slope. The density of the mounds in the area indicate that at one time the colony was quite extensive, possibly 1,000 or more animals (Buchanan 1960). The colony population was quite sparse in 1959 and in the late summer of that same year the colony seemed to be abandoned. It was not until 1962 that a single prairie dog was spotted in the old colony site. This animal was observed and only recorded once and since that time the colony has been inactive. An interesting event took place in July 1966 when a Utah prairie dog was found killed on the road near the vicinity of the old colony. Where the animal came from is not certain.

Another colony (colony II) along an east branch of the East Creek was located further south in a meadow, immediately south of the main park road. A park service road, running from the main park road to the canyon rim, overlooks a portion of the old colony. The number of mounds in the area indicate that the colony was smaller than the colony to the north. This historic dogtown has presently been chosen as one of the two 1975 Utah prairie dog transplant sites. This colony followed the same pattern of decline as the larger one to the north.

A third colony (colony III) is located along a west branch of East Creek, adjacent to the main park road. The colony site contains about nine old mounds. No information as to size was recorded on this dogtown.

The last colony (colony IV) of recorded significance along East Creek was located approximately 0.8 kilometers (one-half mile) north of the park boundary along East Creek and near the pumphouses which supply water to the park. According to observations made, it was flourishing

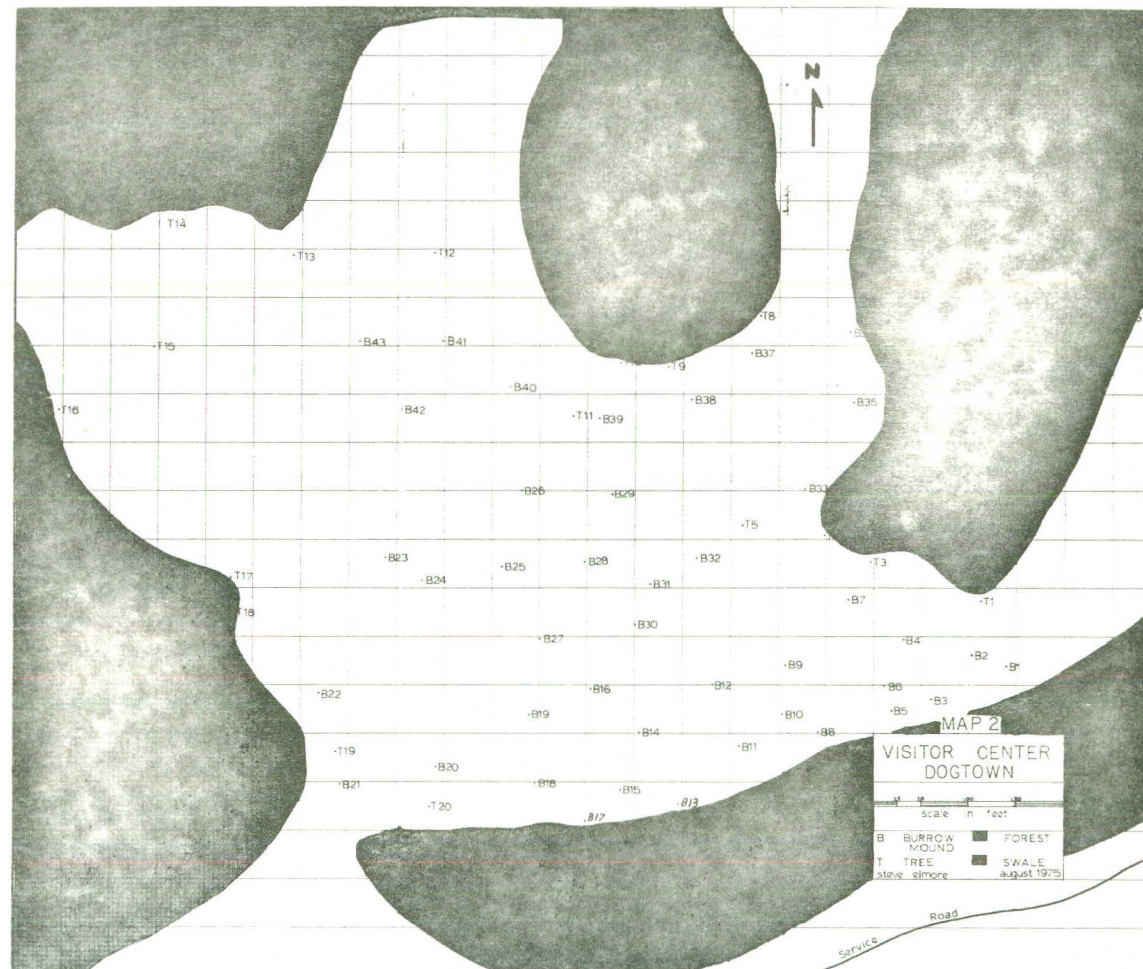
well into the early 1950's like the other colonies just a few miles up the valley. Apparently the population of the colony was greater than either of those within the park. In fact, it was recorded that during the peak of its population, some animals were moving out into the surrounding areas due to overcrowding (Stebbins 1971). This colony flourished and declined in sequence with the other colonies within the park. The site of this colony was examined in 1975, and it is even less noticeable than the others. This, I believe, is not only due to increased ground moisture in the area, but also to the increased soil erosion due to recent land alteration practices in the area.

The only other historic colony (colony V), and presently the second transplant site, is located 135 meters (150 yards) west of the visitors' center and 45 meters (50 yards) south of the Park's sewage lagoon (Figure 4). An infrequently used maintenance road runs north-south through the swale containing the colony. It is rather unusual that no records were kept on the dogtown, as at least fifty mounds are still discernable in the area.

DECIMATION OF THE UTAH PRAIRIE DOG WITHIN BRYCE CANYON NATIONAL PARK

Because of the presumed "direct competition" with livestock, prairie dogs have been subject to continuous disturbance and killing by federal, state and private interests for about 100 years. Prairie dogs have been regarded as "pests" since the settlers began intensive use of the Great Plains, deserts, and Intermountain grasslands for grazing and agriculture. Wholesale slaughter of the natural predators of the prairie dog (badger, coyote, bobcats, weasels and raptors) has accompanied this intensive use (Clark 1971).

Figure 4. Prairie dog burrows in Bryce Canyon National Park. The Visitors' Center dogtown shown below is located approximately 50 yards south of the Park's sewage lagoon.



The decimation of the Utah prairie dog within the Park, as well as localities outside the Park, cannot be attributed to any one particular variable, but rather to a combination of variables of which a few will be discussed in the following paragraphs.

Poisoning has definitely played a significant role in the elimination of large numbers of prairie dogs. The brunt of the poisoning activity was carried out in the mid 1940's by ranchers and government personnel. At that time, strychnine impregnated baits were the most effective and widely used poisoning technique. Later, another residual chemical, sodium fluoroacetate, or better known as "1080," became the most effective and most widely used poison. Many of the areas poisoned were located in ponderosa pine clearings or meadows or other typical prairie dog habitat. Even today, as a result of agricultural expansion and resulting conflict with ranchers, the prairie dog is still privately poisoned.

Habitat destruction is another reason for the decline of the animals in the area. Many dogtowns are located on areas that have been converted or that have the potential to be converted to farm land. Cultivation practices, such as reseeding operations adjacent to the Park, have resulted in changes in plant composition and soil moisture, in turn, decimating or seriously reducing prairie dog populations in those areas. Other dogtowns stand in the way of "progress." Such has been the case involving a number of colonies outside the Park boundary.

The intensified grazing which took place in the park from 1905-1930 could also be a factor. As a result of overgrazing and the resulting loss of topsoil due to erosion, the plant composition and density has been changed markedly. Overgrazing caused many gullies to be cut through swales. When the swales drained, they became shrubby and prairie dog

habitat was lost. Many annual and perennial grass communities which supported active dogtown colonies in the 1950's have been altered to the point that they now sustain climax sagebrush communities. In nearly all historic dogtowns, with a few exceptions, sagebrush height and density is the restricting factor for any further reintroduction of the animals. In addition, it appears that of the herbaceous cover remaining, cool season grasses, a primary diet item, constitute a much smaller proportion of the total vegetation than they did 75 years ago. The same overgrazing also caused much reduction in the quality of low fiber, palatable plants and greatly reduced the amount of early spring forage.

Bubonic and/or sylvatic plague are other possible factors for the decline of the Utah prairie dog within the Park. Tests for the plague have been conducted on some of the common rodents in the Park during previous years. These tests proved to be positive in a few cases, so the plague is known to be here. If the prairie dog colonies within the Park became seriously overpopulated, it is very possible that factors such as the plague wiped out or drastically reduced the number of animals (Stebbins 1971). Shooting seems to be the only unimportant variable in relation to the decimation of the Utah prairie dog within the Park. As a result of its endangered classification in 1973, shooting or habitat destruction of the Utah prairie dog is prohibited. The enforcement of this law, however, is a matter of judgment in many circumstances, particularly when the expansion of a dogtown conflicts with agriculture.

The Utah Division of Wildlife Resources has made an attempt to alleviate this conflict by capturing and transplanting problem prairie dogs to areas where less potential for disturbance exists. A number of years are needed to evaluate the successfulness of these efforts. Such is the case for the

Bryce Canyon National Park transplant of 1975.

The total decline of the prairie dogs, as mentioned before, is probably due to a combination of factors and possibly other unknown ones.

1975 TRANSPLANT AREAS: DESCRIPTION AND COMPARISON

Although the actual transplant was not scheduled until the spring of 1976, a transplant phase was initiated in July 1975 as a result of the availability of animals and cooperation of the Utah Division of Wildlife Resources.

Two transplant sites were chosen for the 1975 transplant (Figures 3 and 4, colony site I and colony site V). These sites were selected on the basis of a number of variables including vegetation composition and density, soil composition and depth to bedrock, slope, and aspect. Both of these areas, as mentioned before, are located where active dogtowns once existed. The historic prairie dog mounds, still discernable, are located on a gentle sloping hill which overlooks the immediate area. It should be noted, however, that as a result of overgrazing activities from 1905-1930 there has been an accelerated erosion of topsoil and, in turn, a change in vegetative composition and density in both sites. The areas have become progressively more dry with an increase in vegetative species more adapted to xeric conditions. Both areas, nevertheless, are within close proximity to excellent foraging sites (swales).

The first transplant site is located in a ponderosa pine clearing 200 meters (220 yards) west of the visitors' center and 50 meters east of the Park's sewage lagoon (Figure 4). The area encompasses approximately 8.1 hectares (20.2 acres) and is bordered on the east, west and south sides by ponderosa pine forests and by the Park's sewage lagoon on the

north side. The area is dotted with approximately 50 historic mounds, assumed to be last used in the mid 1950's. Approximately 50 holes, 60-90 centimeters (two to three feet) deep, were augered in nine of the mounds. Burrow mapping was done by the angle intersection method, with angles taken from two points along a north-south baseline. The instrument used was a Ushikata, Tragon compass.

A total of 54 prairie dogs were trapped in a five-day period from July 14 through July 18 at the "Y-dogtown," located 25.6 kilometers (16 miles) from the transplant area, near the intersection of routes 12 and 89 (Figures 3 and 4). Prairie dogs captured were examined to determine sex and age (Table 2). Twenty-one prairie dogs were captured and released July 16th, 21 prairie dogs July 17th, and 12 prairie dogs the morning of July 18th. Within a week after the transplant, 83 percent of the augered holes had been abandoned, with the animals dispersing randomly throughout the immediate area.

The elevation of the transplant site is approximately 2,349 meters (7,830 feet) whereas the "Y-dogtown" site is approximately 2,040 meters (6,800 feet), an elevational difference of 308 meters (1,030 feet).

The soil of the range site is deep and well drained. It has a silty clay loam profile to a depth of 150 centimeters (60 inches) or more. The soil occurs on an alluvial fan with slopes ranging from one to three percent. Average annual precipitation is 30-40 centimeters (12-16 inches).

The potential native plant community is an open cover of black sagebrush (Artemisia arbuscula) with an understory of grasses and forbs (Table 3). Shrubs are the dominant species in the mound area, whereas grasses and forbs, particularly cinquefoil (Potentilla crinata), constitute the greatest density in the swale.

Table 2. Total number and percent composition of Utah prairie dogs captured at the "Y-dogtown" near Panguitch and transplanted to the visitors' center site, Bryce Canyon National Park.

Sex	Age	Total Number	Percent Composition
Male	immature	11	20.2
Female	immature	18	33.4
Male	mature	7	13.0
Female	mature	18	33.4
Total		54	100.0

Table 3. Vegetative composition, density, and palatability in the area of the 1975 visitors' center transplant site in August 1975, at Bryce Canyon National Park.

Common name	Scientific name	Percent composition	Palatability	
			leaf	seed flower
	GRAMINAE			
Crested wheatgrass	1 <u>Agropyron cristatum</u>		3	3
Western wheatgrass (a)	1 <u>Agropyron smithii</u>	36.5 & 7.3	2	3
Nodding brome	1 <u>Bromus anomalus</u>	Trace	2	3
Smooth brome	1 <u>Bromus inermis</u>		2	2
Foxtail barley	2 <u>Hordeum jubatum</u>			2
Junegrass (a)	1 <u>Koeleria cristata</u>	3.6 & .7	2	2
Indian ricegrass	2 <u>Oryzopsis hymenoides</u>		2	3
Needle and thread	2 <u>Stipa comata</u>	Trace	2	3
	CYPERACEAE			
Sedge (a)	3 <u>Carex praegracilis</u>		1	1
	JUNCACEAE			
Rush (a)	3 <u>Juncus balticus</u>	Trace	1	1
	BORAGINACEAE			
Cryptantha spp.	5 <u>Cryptantha spp.</u>		1	2
Stickseed	5 <u>Lappula redowski</u>	Trace	1	1
	COMPOSITAE			
Yarrow	5 <u>Achillea millefolium</u>		1	1
Pussytoes	5 <u>Antennaria parviflora</u>			
Black sagebrush	6 <u>Artemisia arbuscula</u>	22.1	1	1
Fringed sagebrush	6 <u>Artemisia frigida</u>	Trace	1	1
Rabbitbrush spp.	6 <u>Chrysothamus spp.</u>	Trace	1	3
Dandelion hawk's beard	4 <u>Crepis runcinata</u>		2	1
Fleabane spp.	5 <u>Erigeron spp.</u>		2	2

Table 3 (Continued).

Common name	Scientific name	Percent composition	Palatability	
			leaf	seed flower
	COMPOSITAE (Con't.)			
Broom snakeweed	6 <u>Gutierrezia sarothrae</u>	1	1	1
Colorado rubberweed	5 <u>Hymenoxys richardsonii</u>		1	1
Salisfy	5 <u>Tragopogon dubius</u>		2	1
	IRADACEAE			
Wild iris	5 <u>Iris missouriensis</u>			
	LEGUMINOSAE			
Locoweed	5 <u>Astragalus agrestis</u>			
	LILIACEAE			
Sego lily	5 <u>Calochortus nuttallii</u>			
	LINACEAE			
Yellow flax	5 <u>Linum kingii</u>		1	3
Blue flax	5 <u>Linum lewisii</u>		1	3
	MALVACEAE			
Scarlet globemallow	5 <u>Sphaeralcea coccinea</u>		1	1
	POLEMONIACEAE			
Prickly phlox	6 <u>Leptodactylon pungens</u>	2.1	2	
	POLYGONACEAE			
Redroot erigonum	5 <u>Erigonum racemosum</u>	Trace	1	3
	PRIMULACEAE			
Lavenderleaf evening primrose	5 <u>Oenothera lavandulaefolia</u>		2	1

Table 3 (Continued).

Common name	Scientific name	Percent composition	Palatability		
			leaf	seed	flower
	ROSACEAE				
Cinquefoil	5 <u>Potentilla crinata</u>	<u>18.5</u> & 3.7	1		1
Wild rose	6 <u>Rosa woodsii</u>				
	SCROPHULARIACEAE				
Mat penstemon	5 <u>Penstemon caespitosus</u>		1		2

Palatability

- 1 - Often eaten
- 2 - Sometimes eaten
- 3 - Rarely eaten

Plant type

- 1 - Cool season grasses
- 2 - Intermediate grasses
- 3 - Warm season grasses
- 4 - Annual forbs
- 5 - Perennials
- 6 - Shrubs

(a) Swale species or swale percent composition

Table 4. Potential increaser, decreaser, and invader plant species at the visitors' center prairie dog transplant site, Bryce Canyon National Park.

Decreasers	Increasers	Invaders
Indian ricegrass	Western wheatgrass	Rabbitbrush
Needle and thread	Pussytoes	Thistle
Dandelion hawk's beard	Locoweed	Snakeweed
Scarlet globemallow	Stickseed	Utah juniper
	Penstemon	Pinon pine
	Phlox spp.	
	Black sagebrush	
	Cinquefoil	

The potential plant community consists of important decreaser, increaser, and invader species listed in Table 4 (Stott 1966). As a result of overgrazing, black sagebrush and cinquefoil have increased rapidly, while rabbitbrush and broom snakeweed are continuing to invade the site. The present trend of the vegetative cover is one of improving forage production and improvement of total vegetation toward the potential or climax.

The second transplant colony is located 4.2 kilometers (2.6 miles) south of the visitors' center along East Creek Valley, 135 meters (150 yards) south of the main road (Figure 3). The historic dogtown area encompasses approximately 5.6 hectares (14 acres) and is dotted with approximately 50 inactive mounds. The map indicates all discernable mounds in the immediate transplant area, yet only a portion of the total number of mounds in the vicinity. The area is bordered on the east, west and southwest by ponderosa pine forest and on the north by the main park road. Approximately 100 holes were augered in 12 of the historic mounds.

A total of 160 Utah prairie dogs were examined in relation to sex and age and then released in the transplant area during the latter part of July (Table 5). These animals were captured at the Churchwell dogtown near Cedar City using the irrigation technique (Figures 2-6). A total of 111 prairie dogs were captured July 20th and transplanted July 22nd at the East Creek site. An additional 49 prairie dogs were captured and released July 31st.

Within a week after the initial transplant, 88 percent of the animals had abandoned the augered holes and scattered randomly throughout the historic dogtown. This allowed the reuse of a portion of the augered holes for the July 31st transplant. Although the augered holes were being

Table 5. Total number and percent composition of Utah prairie dogs captured at Churchwell, Cedar City and transplanted at East Creek, Bryce Canyon National Park.

Sex	Age	Total Number	Percent Composition
Male	immature	38	23.8
Female	immature	73	45.6
Male	mature	26	16.2
Female	mature	23	14.4
Total		160	100.0

abandoned, an interesting pattern was being followed in that a number of relocated, freshly dug burrows were situated on old mounds. The cause is likely related to both increased visibility and loose soil of the old mounds. This same phenomena was also observed at the visitors' center transplant site.

The soil of the East Creek transplant site is deep and well drained. The surface soil is a very fine sandy loam or clay loam. The substratum ranges may be sandy loam, clay loam, or very gravelly sandy loam. The soil occurs on alluvial fans, toe slopes, and the East Creek Valley bottom with slopes ranging from two to nine percent. Average annual precipitation is 32.5-50 centimeters (13-20 inches).

The potential native plant community is an open cover of black sagebrush and other shrub species with an understory of grasses and forbs (Table 6). Black sagebrush, followed by pussytoes, cinquefoil, and needle and thread constitute the greatest of plant species in the mound area, whereas junegrass and yellow brush are by far the most dominant swale species. Potential increaser, decreaser, and invader plant species are listed in Table 7 (Stott 1966).

As a result of overgrazing, black sagebrush has increased rapidly and rubber rabbitbrush, annual weeds, and broom snakeweed have invaded the area. The present trend of the vegetative cover on the site is also one of improving forage production toward a potential or climax plant composition.

BEHAVIORAL CHARACTERISTICS OF THE TRANSPLANTED PRAIRIE DOGS

As befits a town dweller, the prairie dog has developed well-defined

patterns of social behavior which sets it apart from other prairie rodents. Moreover, the prairie dog's social behavior is the key to its continued existence. The construction of prairie dogtowns modified the environment, making it more suitable to prairie dog needs. Within the towns, the social organization protects them from predators and their own regulation of population density minimizes the risk of famine (King 1971).

Since dogtowns are closely knit organizations and because the animals establish defined and defended territories within the colony, it should come as no surprise that the behavior of the transplanted prairie dogs deviates a great deal from the norm. Capturing, caging, and transporting the animals are all factors which must be taken into consideration when evaluating the overall disturbance. In addition, the drastic change in vegetative composition and density as well as other environmental changes from their native colonies constitute other factors influencing the success of the transplant.

The transplanted animals were never observed before sunrise or after sunset. The exact time of emergence each morning was never constant, varying between 8:30 and 9:15 a.m. for the East Creek transplants, and 9:00 and 9:30 a.m. for the visitors' center transplants.

After emerging from the burrow, the prairie dog sits or stands near the burrow entrance. For a number of days directly following the transplant, the animals inhabiting each mound, sometimes up to seven, would congregate at the highest point on the mound and scrutinize the surrounding area. For the first two days, the transplants were never observed venturing more than three meters (3.3 yards) from their respective burrows, feeding on those species of forbs and grasses near their home mounds. Within a week after the transplant, over 80 percent of the augered holes had been

Table 6. Vegetative composition, density, and palatability in the 1975 East Creek prairie dog transplant site as of August 15, 1975, Bryce Canyon National Park.

Common name	Scientific name	Percent composition	Palatability	
			leaf	seed flower
	GRAMINAE			
Western wheatgrass	1 <u>Agropyron smithii</u>	Trace	2	3
Blue grama	3 <u>Bouteloua gracilis</u>			
Nodding brome	1 <u>Bromus anomalus</u>	Trace	2	3
Junegrass (a)	1 <u>Koeleria cristata</u>	33.4 & 6.7	2	2
Mountain muhly (a)	1 <u>Muhlenbergia montana</u>			
Mutton grass	2 <u>Poa fendleriana</u>			
Needle and thread	2 <u>Stipa comata</u>	1.0	2	3
	BORAGINACEAE			
Cryptantha spp.	5 <u>Cryptantha spp.</u>		1	2
Stickseed	5 <u>Lappula redowskii</u>	Trace	1	1
	CARYOPHYLLACEAE			
Compact sandwort	5 <u>Arenaria kingii</u>		1	1
	COMPOSITAE			
Yarrow	5 <u>Achillea millefolium</u>		1	1
Orange agoseris	5 <u>Agoseris aurantiaca</u>			
Black sagebrush	6 <u>Artemisia arbuscula</u>	3.75	1	1
Fringed sagebrush	6 <u>Artemisia frigida</u>	Trace	1	1
Pussytoes	5 <u>Antennaria parviflora</u>	1.6		
Chaenactis	4 <u>Chaenactis douglasii</u>			
Rabbitbrush spp.	6 <u>Chrysothamus spp.</u>		1	3
Yellowbrush (a)	6 <u>Chrysothamus visidiflorus</u>	9.4 & 1.8	1	2
Arizona thistle	4 <u>Circium arizonicum</u>		3	
Dandelion hawk's beard	4 <u>Crepis runcinata</u>		2	1
Fleabane spp.	5 <u>Erigeron spp.</u>		2	2
Broom snakeweed	6 <u>Gutierrezia sarothrae</u>	Trace	1	1

Table 6 (Continued).

Common name	Scientific name	Percent composition	Palatability	
			leaf	seed flower
	COMPOSITAE (Con't.)			
Colorado rubberweed	5 <u>Hymenoxys richardsonii</u>	Trace	1	1
Horsebrush	6 <u>Tetradymia canescens</u>			
Salisfy	5 <u>Tragopogan dubius</u>		2	1
	LILIACEAE			
Sego lily	5 <u>Calochortus nuttallii</u>			
	LINACEAE			
Yellow flax	5 <u>Linum kingii</u>		1	3
Blue flax	5 <u>Linum lewisii</u>	Trace	1	3
	ORBANCHACEAE			
Broomrape	5 <u>Orobanche fasciculata</u>			
	POLEMONIACEAE			
Phlox spp.	4 <u>Phlox spp.</u>		2	3
Prickly phlox	6 <u>Leptodactylon pungens</u>		2	
	POLYGONACEAE			
Winged erigonum	5 <u>Erigonum alatum</u>		1	3
Redroot erigonum	5 <u>Erigonum racemosum</u>	Trace	1	3
Erigonum	5 <u>Erigonum umbellatum</u>		1	3
	ROSACEAE			
Cinquefoil	5 <u>Potentilla crinata</u>	1.6	1	1
	SCROPHULARIACEAE			
Mat penstemon	5 <u>Penstemon caespitosus</u>		1	2

Table 6 (Continued).

Palatability

- 1 - Often eaten
- 2 - Sometimes eaten
- 3 - Rarely eaten

Plant type

- 1 - Cool season grasses
- 2 - Intermediate grasses
- 3 - Warm season grasses
- 4 - Annual forbs
- 5 - Perennials
- 6 - Shrubs

(a) Swale species or swale percent composition

Table 7. Potential increaser, decreaser, and invader plant species at the East Creek transplant site, Bryce Canyon National Park.

Decreasers	Increasers	Invaders
Western wheatgrass	Blue grama grass	Stickseed
Nodding brome	Junegrass	Snakeweed
Mutton grass	Mt. muhly	
Dandelion hawk's beard	Needle and thread	
	Yarrow	
	Thistle	
	Agoseris	
	Pussytoes	
	Compact sandwort	
	Sego lilly	
	Phlox spp.	
	Black sagebrush	
	Yellowbrush	
	Rabbitbrush spp.	
	Horsebrush	

abandoned, and a number of freshly dug burrows were found, scattered throughout the transplant site, particularly, as mentioned before, on historic mounds.

Another interesting observation at the visitors' center transplant site was that after the second day, particularly the third and fourth days, a number of prairie dogs were seen ranging up to 150 meters (165 yards) from their home burrows. The peculiarity was that these animals were not foraging, but rather moving along the edge of the ponderosa pine forest overlooking the transplant site. The animals would return to their home burrows periodically, feed for a while, and then once again venture out along the periphery of the forest. This activity continued throughout the day. The most probable reason for this activity is curiosity, leading to the investigation of an alien territory.

A week after the transplant, colonial activity became more uniformly bimodal, with activity periods from 9:00 till 11:15 a.m., when temperatures began to rise, and 4:30 till 6:00 p.m., when temperatures began to drop. Feeding patterns and preferred areas soon became established with specific paths used to get to and from these places. On many occasions, prairie dogs were observed cutting sagebrush branches near burrow openings which interfered with visual contacts.

Another significant point to note was the marked degradation of vocal communications after the prairie dogs were transplanted. Vocalization is perhaps the most significant sensory cue for uniting the dogtown. There are two principle vocalizations which are commonly used. The most distinctive is the two syllable territorial call which is delivered in a loud, clear series of two or three. The approach of danger provokes the warning call, a high pitched, repetitive yip (King 1971).

It was not until August 4th that any form of vocalization was noted from the transplanted prairie dogs. On that date prairie dogs were observed giving the territorial and warning call at the visitors' center dogtown. The first vocalization from the East Creek colony was noted on August 8th in the form of a warning call. Two days later the territorial call was heard. It is speculated that because of the lack of normal social behavior, including territorial designations, as well as all factors related to an alien environment, frequency of vocalizations declined. It will, indeed, be interesting to note the process of behavioral readjustment, particularly vocalizations, in correlation with transplant success.

CONCLUSIONS

Implications of this transplant are much broader than the relocation of a single endangered species. Information and procedures used for this transplant, as well as other such transplants, could prove invaluable for future programs of this kind. It will take a number of years, possibly three or four, before the success of the transplant can be determined. Orientation, burrow and mound development, animal contacts, colonial organization, reproduction and dogtown growth are all factors which need be considered before the success of the transplant can be evaluated. All information gained this summer concerned only the first two factors: orientation, including habitat acceptance and utilization; and to a lesser degree, burrow and mound development.

Transplanted prairie dogs will always be particularly susceptible to predation at least until some form of colonial organization is established. Dispersion of the animals will also lower the density, thereby reducing security, social organization, and animal interactions necessary for the

establishment of a thriving dogtown.

Population predictions of transplanted prairie dogs for the spring of 1976 are not too good. An estimated 15 percent return (8 animals at the visitors' center site and 25 animals at the East Creek site) is the estimate based on the population trend this summer. For these reasons, further transplants will be needed in the next few years in order to establish a "critical mass" or sufficient number of animals within a specific area to carry out "normal" dogtown activities. If success is achieved, the Bryce Canyon National Park transplant operation might help remove the Utah prairie dog from the endangered species list.

It is indeed fortunate that the National Park Service has a special interest in this species. This is especially important as the Park itself serves as a sanctuary where prairie dogs can live in a protected environment.

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