EFFECTS OF CLIMATE ON ACTIVITY OF BLACK-TAILED PRAIRIE DOGS

BY

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ABSTRACT

Black-tailed prairie dogs (Cynomys ludovicianus) living in Boulder County, Colo. experience diverse, rapidly changing climates, as well as numerous human-caused disturbances. In this study, a single colony was observed from Oct. 15 -- Nov. 15, 1991, spanning a shift of seasons from warm Indian summer to winter conditions. The purpose was to discover what correlations climatic conditions have on above-ground activities of these animals. Air and burrow temperatures were recorded, weather conditions noted, and a record of # of prairie dogs visible was also kept. Results indicate that low temperatures, precipitation, lack of sunlight, and wind appear to be major restricting factors to their above-ground activity. It was also noted that black-tailed prairie dogs adhere strictly to diurnal habits, not appearing before or after dark.

INTRODUCTION

Black-tailed prairie dogs (Cynomys ludovicinus) are large, diurnal, colonial rodents whose basic social structure is the coterie (Hoogland, 1981, King, 1955), normally containing one adult male, several adult females, yearling males and females, and young of the year (pups). Their range includes parts of New Mexico, Arizona, Colorado, Wyoming, Nebraska, Oklahoma, and Texas (Clark, et al, 1982, Cockrum, 1982). Colonies often cover many acres and can include up to 200 individuals. Complex communications involving sight, sound and odor provide cues for maintaining their social system. Food sources consist of various plant materials, especially short grasses. Roots and bulbs or other plants, as well as worms and insects are also eaten.

Formerly widely distributed in rangelands, prairie dogs are now much reduced in numbers and distribution. (Cockrum, 1982) Various studies (S. Jones, 1989, Clark, 1982) demonstrate that prairie dog colonies are significant in enriching grassland

habitats. They manipulate soil and increase plant and animal density and therefore may be viewed as ecosystem regulators. Over 140 species have been reported as associated with prairie dogs. They improve habitat for prairie animals that are benefited by holes. They are an important food source for black-footed ferrets, badgers, foxes, coyotes, bobcats, weasels, as well as a variety of raptors. The prairie dog burrow is a critical element of prairie dog survival, and allows them to escape extremes of temperature (Stromberg, 1978)

A number of studies have been done on prairie dogs, such as foraging influences (Deveport, 1989); discrimination of predators (Loughry, 1989); avoidance responses (Adams et al, 1987), and importance as a food source (S. Jones, 1989). This study is concerned with the question of what effects, if any, does climate have on the above-ground activities of black-tailed prairie dogs (Cynomys ludovicianus). Do climatic conditions restrict above-ground activity in any way? Boulder county is situated in a unique position between the Rocky Mts. and the Great Plains. This physiography provides a wide range of climatic conditions throughout the year, sometimes harsh, and rapidly changing. Boulder county also contains unusually large populations of Black-tailed prairie dogs, who must adapt to these conditions, and seem to do so well. A survey of activities as they correlate to temperature and weather was made over the period of one month, at a "city" colony in Boulder Colo.

MATERIALS AND METHODS

Observations were made from Oct. 15 -- Nov. 15, 1991, at a "city" colony located at the easternmost end of Pearl Street in Boulder, Colo. The study site is approximately 1.5 ha in size. It is bordered on the west by a ravine, on the north by Pearl Street, on the east by another street, and on the south by a waterway and a bikepath. The site was visited most weekdays, often twice a day -- a total of 21 days, including 26 visits in the morning, and 16 visits in the afternoon, for a total of 42 visits. At each visit binoculars were used to make a scanning count of # of prairie dogs (PDs) visible. Ad lib sampling technique was used, recording weather conditions, and any other information of interest. Until thermometers were employed, radio temperature was recorded. Later, thermometers were used, one tied to a cottonwood branch, and one lowered approx. 1.5 feet into an

unused burrow. Air and burrow temperatures were recorded at each visit therafter, for a total of 29 visits. Weather conditions noted included sunshine, cloud cover, precipitation, and wind. Morning visits were 13 at 8:30AM, 10 at 7:30AM, and 3 at ~9:30AM. Afternoon visits were 10 between 2-2:30PM, 3 between 3-3:30PM, 2 at 5PM, and 1 at 4PM. Individual vists lasted an average of 20 minutes.

RESULTS

In the first week, temperatures ranged from 31 C to 3 C, the 2nd week from 25 C to -1 C, the 3rd week from -5 C to -13 C, the 4th week from 21 C to -4 C, and the 5th week from 13 C to 1 C. Conditions ranged from dry and hot in the 1st week to cold and snowy, with frequent fluctuations in between.

Greatest # of PDs seen at one visit was 89, least # seen was 0. Average #PDs seen per visit was 24. However, there were generally no PDs seen at 7:30AM or at 5PM (fig 1). Discounting the 0s at these times, the average #PDs seen per visit was 31.5. It is interesting to note that as time passed, the last 2 visits at 7:30 showed PDs and the # was increasing (fig 1a).

Virtually no PDs were seen when temperatures were below 0 C (figs 1 & 2). PDs were most active in temperatures ranging from 1 C to 13 C (fig 2), though the most were seen at temp. 21 C. There was a steady decline in #PDs seen at temps. above 21 C.

Although air temperatures fluctuated widely, burrow temperatures remained within a range from 0 C to 10 C (fig 3). This was from a depth of only approx. 1.5 ', in a burrow opening. It might be expected that temperatures would be even more stable deeper within a burrow.

Effects of different weather conditions are clearly shown (fig 4). Sunny skies with temps. above 0 C showed highest amount of activity (44.5 PDs ave. per visit). Partly cloudy days were next highest, with 28.2 PDs ave. per visit. Windy days appeared somewhat restrictive of activity (17 PDs ave. per visit),and overcast days (10 PDs ave. per v.). Two conditions appeared to be highly restrictive. Precipitation (rain or snow) resulted in 3.8 PDs ave. per v., and sunny days with temps. below 0 C (2.6 PDs ave. per v.).

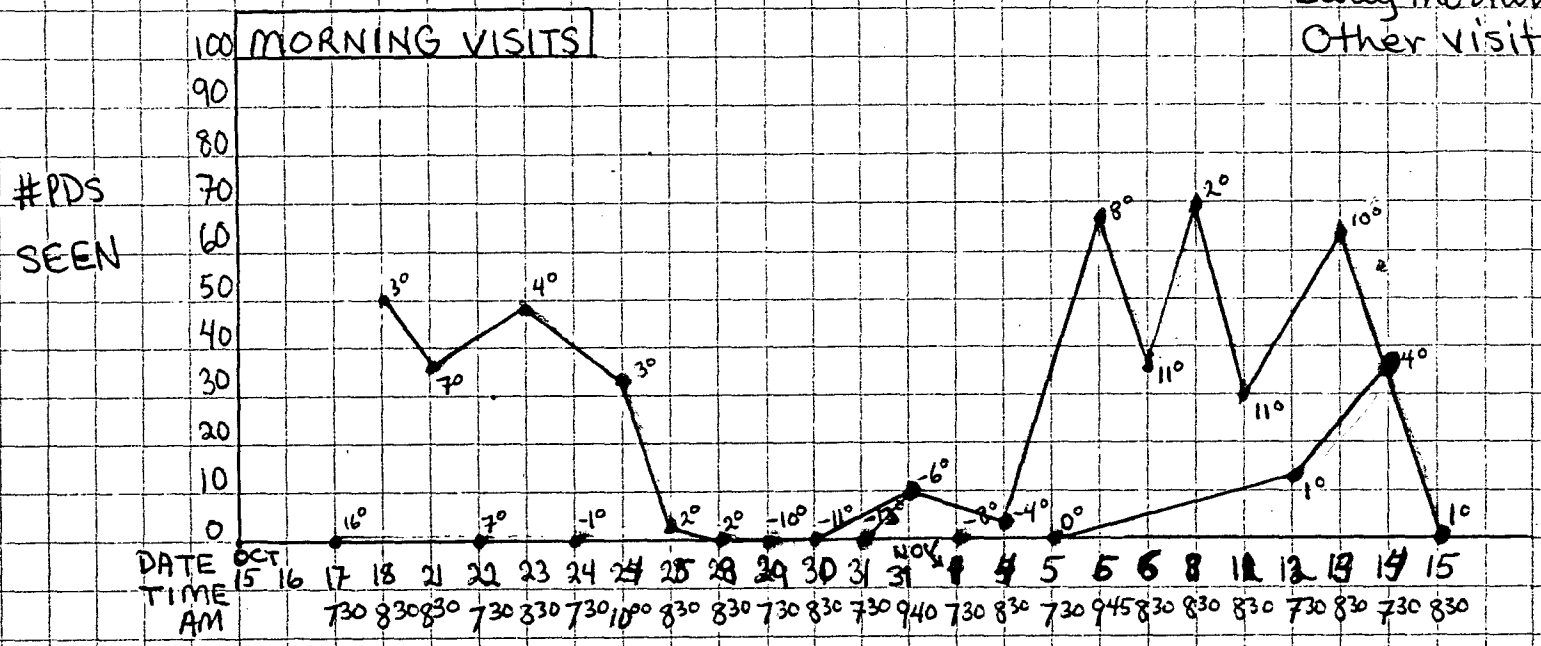
DISCUSSION AND CONCLUSIONS

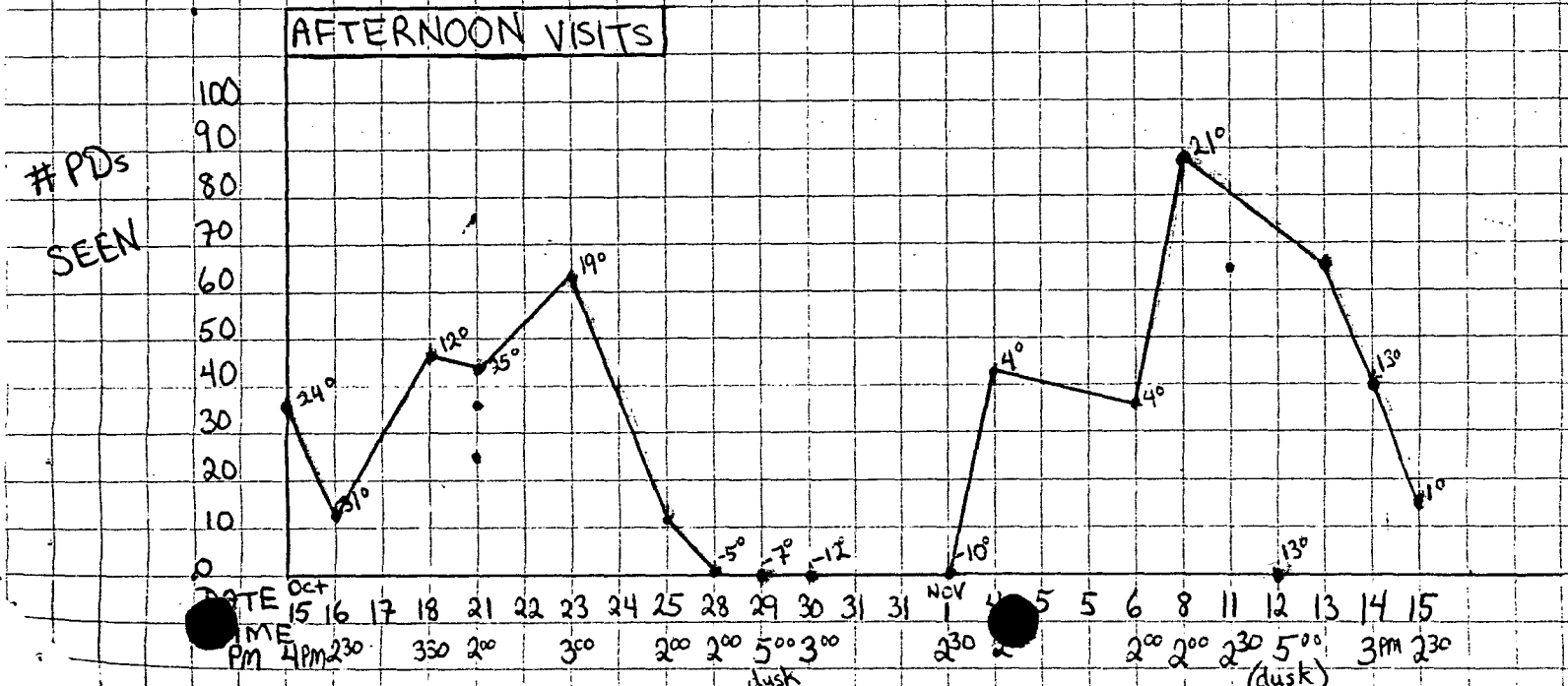
These results show 3 major findings:
1) Temperature has a major effect on activity of Black-tailed

Fig 1 Oct 15 – Nov 15 (21 days of visits)

Morning visits = 25
Afternoon visits = 16
} 42 Total visits

Temperatures added (°C)
Early morning + dusk visits:
Other visits:





It might have to be a bar graph # dogs vs time of day + overall over date

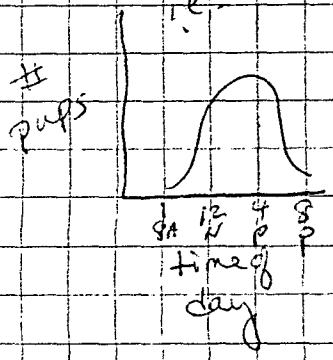


Fig 2 # of PDs (Prairie dogs) seen (data points) at corresponding temperatures. It can be seen that below 0°C, very little activity occured. Between 1°C (yellow area) and 13°C, many data points & high # of PDs evidence high activity in this range. Activity decreases at temps. above 21°C. Pink data points are in the dawn & dusk period, & have been discounted.

see rest of graph at bottom of page

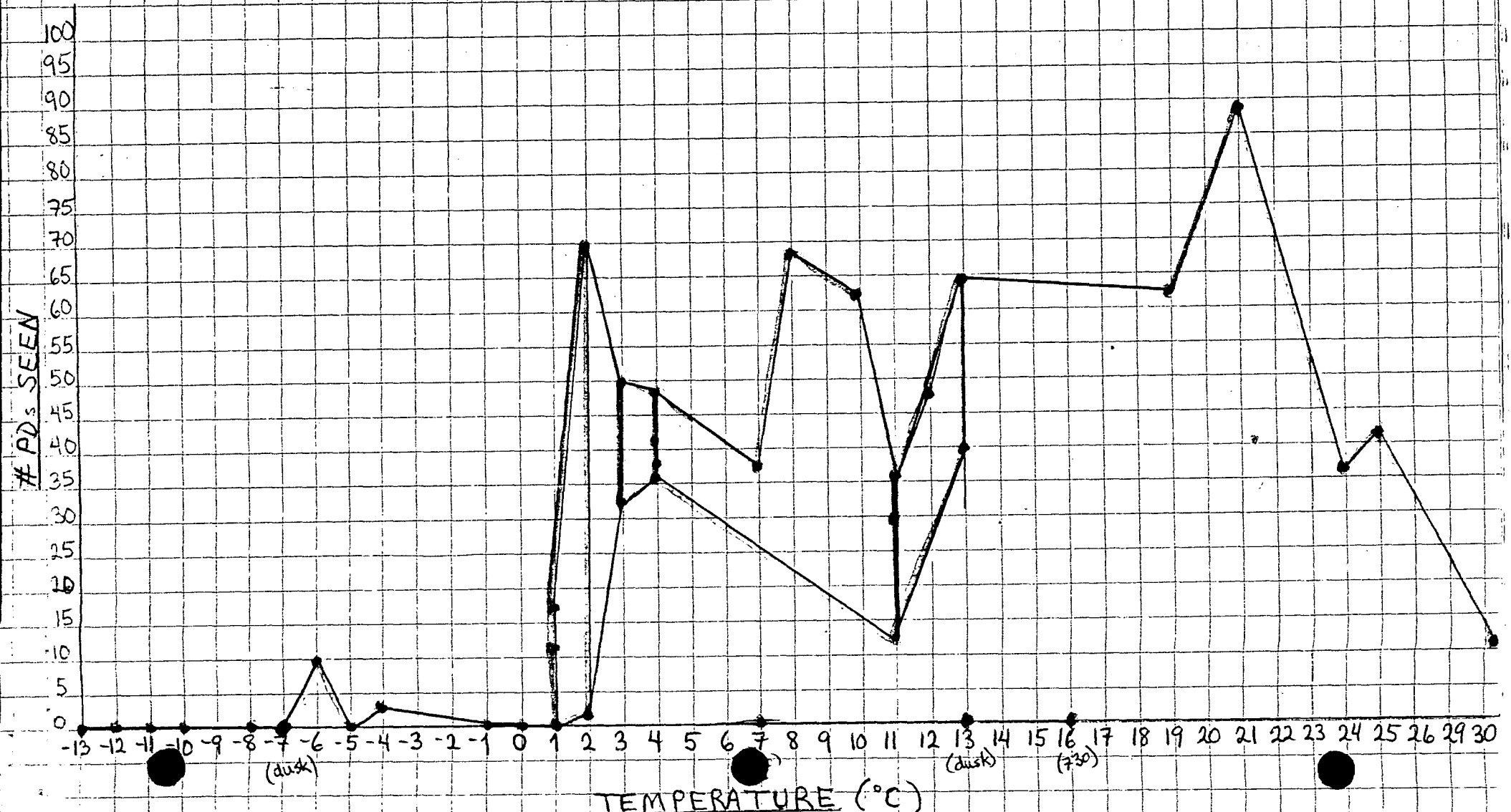


Fig 3 Oct 24 – Nov 15 Burrow temperature fluctuation
29 visits vs. Air temperature fluctuation

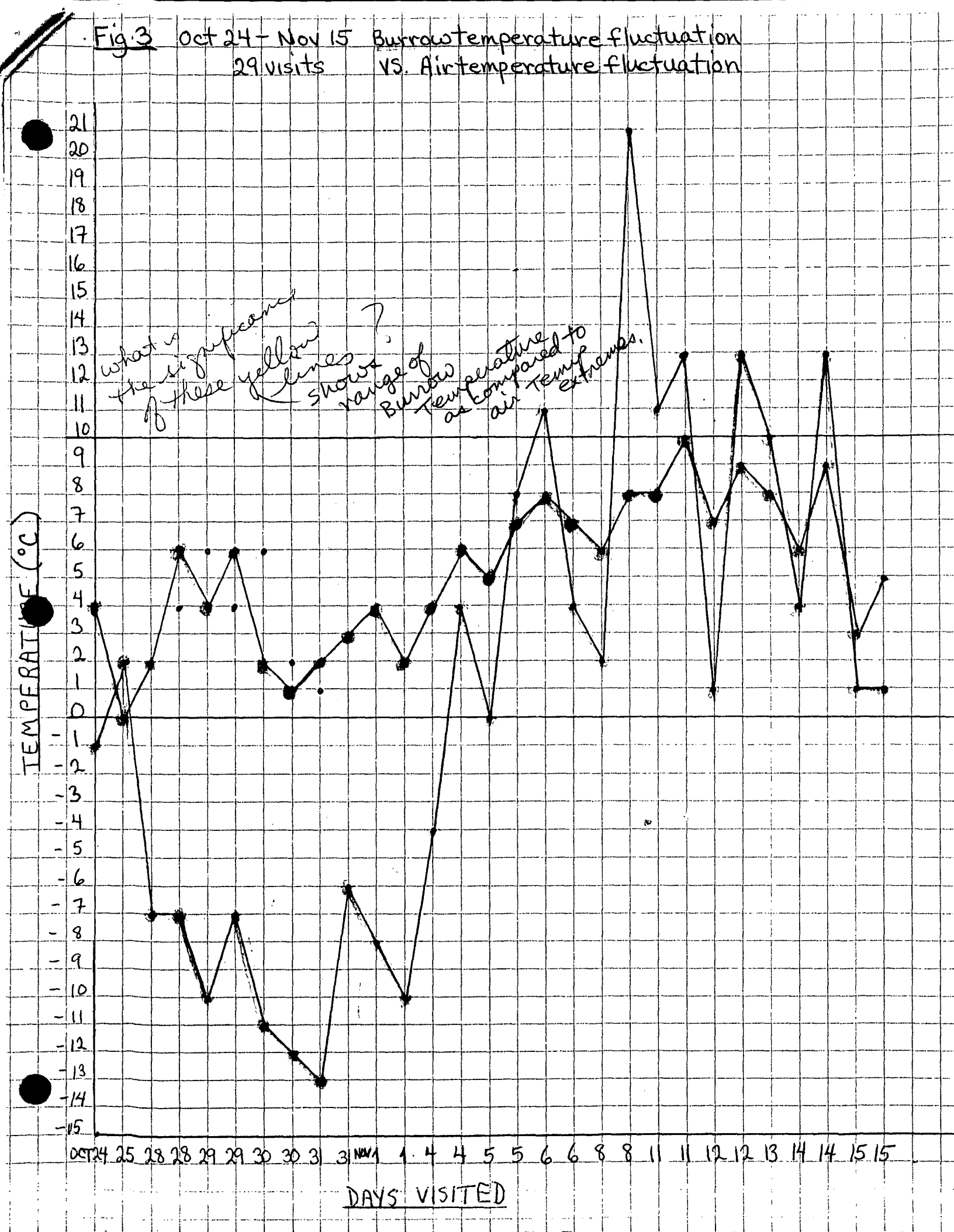
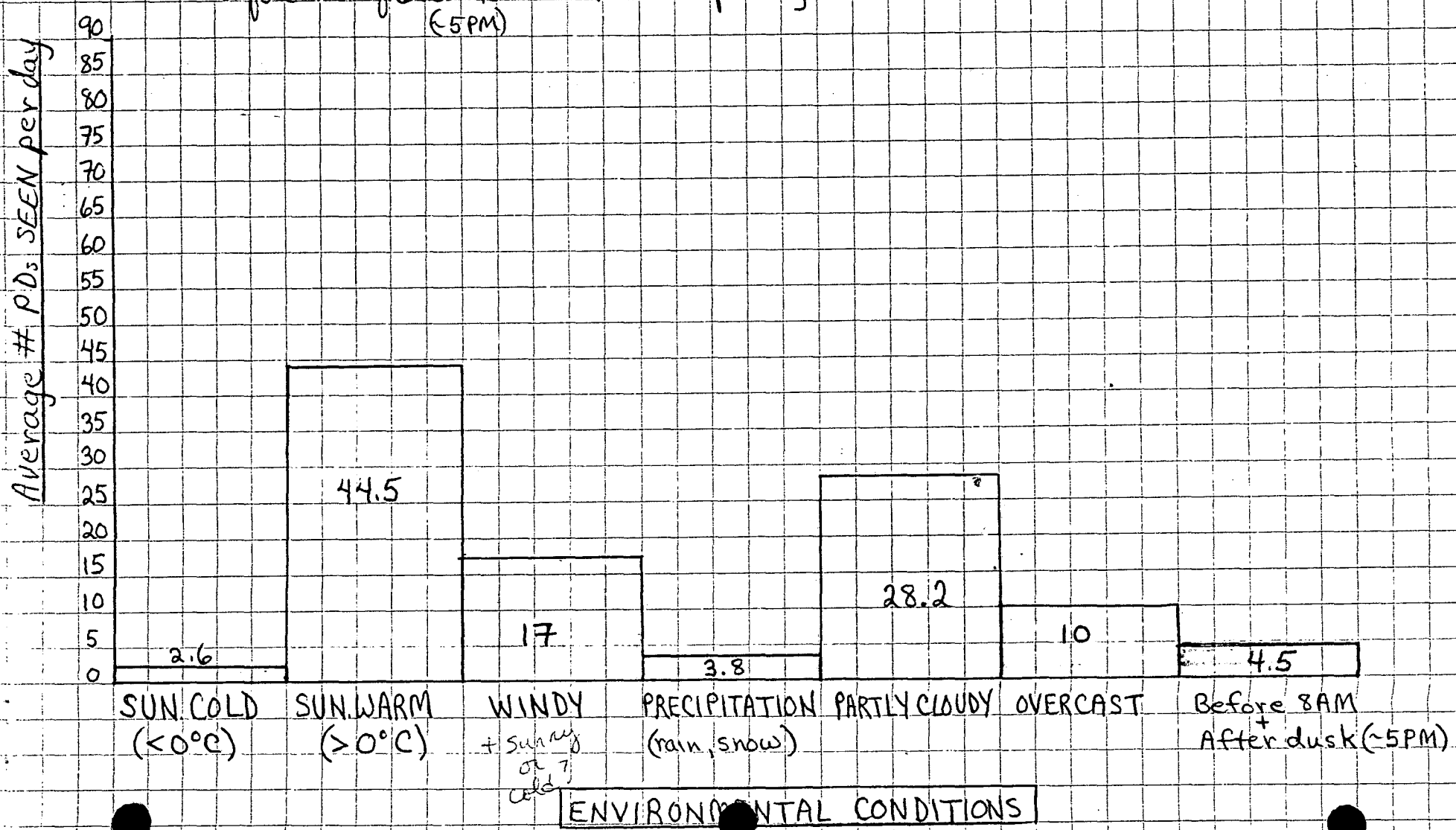


Fig 4 Average # PDs (prairie dogs) seen under different environmental conditions.

Sunny + warm (>0°C) = 44.5 ave per day
Sunny + cold (<0°C) = 2.6 ave per day
Windy = 17 ave per day
Precipitation = 3.8 ave per day
Partly cloudy = 28.2 ave per day
Overcast = 10 ave per day
Before 8AM + after dusk (~5PM) = 4.5 ave per day



prairie dogs (Cynomys ludovicianus). Data indicates that above-ground activity is severely restricted at temperatures below 0 C, and that temperatures above 21 C tend to also restrict to a degree, most likely due to dessication. An optimal temperature for activity appears to be between 1 C and 13 C.

2) PDs tend to adhere to a fairly strict diurnal schedule. None were seen after dusk. Even though the sun was often up at 7:30AM, no PDs were seen at this time, regardless of temperature, until well into the study. I speculate that, after experiencing a period of inactivity due to snow and cold, they were more in need of foraging. I further speculate that as the winter progresses, they will take more advantage of the early morning sunlight, even though it may present a threat from nocturnal predators (e.g. owls), as the benefit outweighs the costs.

3) Results implied a clear effect of weather on activity. Cold and precipitation were the most restrictive of environmental conditions, and lack of sunshine appears be a factor as well. Wind appears to be restrictive as well, though not as much. Its' effect may increase with its' severity, but more data would be necessary to show this. Sun and warmth appear to be optimal, as would be expected. I noticed that after the melt of the 1st snow, the PDs spread out and were very actively foraging. This could be due to increased hunger, but might also be due to the ground being more moist after the precipation and thawing.

One factor which has not been discussed is the effect of numerous humans in close proximity on PD activity. As demonstrated by (Adams et al, 1987), PDs in "city" colonies become habituated to human presence. This appeared to be true with my study colony. I found that I could come as close as 10' before a PD would retreat into its' burrow. I found that if one stayed on the bike path, the PDs took only passing notice. But whenever I walked into the colony itself, they responded with typical avoidance behavior (Adams et al, 1987). Therefore, I tried to do as much counting from my car as possible, before going into their midst.

Other factors to be considered are what predators or competetors were present, and what was their effect on PD activity. I'm sure I missed a lot, but at the times I was there, I often saw magpies. There was also evidence of beavers. These animals seemed to cause no threat. Three times I saw a Buteo in a nearby cottonwood tree, however, it was always facing away from the PD colony. One morning after some snow melt, I found deer tracks, and what may have been mt. lion tracks, following the deer tracks, in among the PD burrows. I was unable to determine effects of predators or competetors on PD activity, but it was amazing to realize the diversity of wildlife activity in such a human disturbed site.

SUMMARY

I have read little in the literature of correlation of climate to PD activity. However, nothing that I observed contradicted anything I have read about PD behavior. The null hypothesis being that weather would have no effect on PD activity, it was found that the trend would say that weather does affect PD behavior, in much the same ways that it affects other mammals.

SUGGESTIONS FOR FUTURE WORK

I would like to see this study prolonged over at least a year, to obtain more data over a broader spectrum of climate changes. I would leave out the dusk visits, and gather separate data on the early morning visits, to see if there is a trend, as was implied by my small sample. I would definitely try to obtain more accurate thermometers for my readings. The ones I used did not consistantly calibrate with each other. I had two for air temp., and took the average of their readings, so the temperatures were somewhat rough estimates.

ACKNOWLEDGEMENTS

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SKY CODE	SKY CONDITION	WEATHER	
		4	CALM
3	clear	3	WIND
2	scattered	2	RAIN
1	overcast	1	SNOW

DATE	TIME	SK SKY	PR PRECIP	WI WIND	Air Temp TA	Temp of Burrow TB	west WI	center C	East E

CODES:

	SKY CONDITION	WIND	PRECIPITATION
1	clear	1 Calm	1 NONE
2	Pthy cldy (scattered more SUN)	2 Lt. Breeze	2 RAIN
3	~~overcast~~ (more clouds)	3 WIND (MOD)	3 SNOW
4	Overcast	4 STRONG WIND	4 HAIL

Mark, This is a key to abbreviations and codes used.

DATE/

W 1/15/9

F 1/17/92

F 1/17/92

T 1/21/92

W 1/22/92

Th 1/23/92

Th 1/23/92

F 1/24/92

F 1/24/92

M 1/27/9

M 1/27/92

JANUARY 1992

DATE/TIME	WEATHER/COMMENTS	TEMPERATURES Air	Burrow	# PDs SEEN W	C	E	TOTAL
	Sk.1 Pr.1 Wr.1						
W 1/15/92 2:30PM	Sunny Burrow therm. 4" snow missing	- 8°C					3
F 1/17/92 9:10AM	Overcast 2" melted off 4 1 1	- 4°C		0	0	0	0
F 1/17/92 2:30PM	Overcast some sun more melt off 3 1 1	0°C		8	3		11
T 1/21/92 9AM	Clear, sunny 1 1 1	4°C		5	7	1	13
W 1/22/92 9AM	Clear, sunny Starlings, Robins, Hawk 1 1 1	8°C		7	6	6	19
Th 1/23/92 8:50AM	Sunny, ptly cldy, mildly windy 2 2	7°C		2	3	0	5
Th 1/23/92 2:45PM	Sunny, ptly cldy, very windy found my therm. Placed in burrow ~ 1½' deep 2 1 4	9°C	4°C	17	2	2	21
F 1/24/92 9AM	Cldy, WIND (chinooks) fm So. 3 1 4	10°C	3°C	0	6	5	11
F 1/24/92 2:15PM	Windy, sun, ptly cldy 2 1 3	16°C	4°C	14	7	2	23
M 1/27/92 9AM	Smokey, scattered clds, sun Scat around burrow Digging in burrow evid. therm. missing.	3°C	B therm. Gone	13	10	10	33
1/27/92 2:15PM	Sunny, clear 2 11	10°C	Gone	20	10	5	35

JANUARY 1992

DATE/TIME	WEATHER/COMMENTS	TEMPERATURES		#PDs SEEN			TOTAL
		AIR	BURROW	W	C	E	
	Sk Pr Wi						
T 1/28/92 845AM	Sunny, clear all snow gone 1 1 1	3°C	gone	10	20	0	30
W 1/29/92 9AM	Sunny, clear 1 1 1 Hawk	6°C	gone	11	20	10	41
W 1/29/92 230PM	Sunny, clear 1 1 1	13°C	gone	20	20	8	48
Th 1/30/92 855AM	Sunny, clear 1 1 1	6°C	gone	14	20	17	51
Th 1/30/92 145PM	Sunny, clear 1 1 1	12°C	gone	27	23	12	62
F 1/31/92 9AM	Ptly cldy/sun 2 1 1 deer tracks	7°C	7°C	18	19	14	51
F 1/31/92 240PM	Ptly cldy/sun 2 1 1	19°C	5°C	19	23	12	54
	FEBRUARY 1992						
T 2/4/92 2PM	Sunny, sparse clds 2 1 1	7°C	3°C	20	24	14	58
Th 2/6/92 145PM	Sunny, clear 1 1 1	12°C	4°C	15	27	17	52
F 2/7/92 3PM	Sunny, sparse clds, breezy 1 PD road killed in AM, gone now. 2 1 2	8°C	3°C	27	13	12	52

FEBRUARY 1992

DATE/TIME	WEATHER/COMMENTS	TEMPERATURES		#PDs SEEN			TOTAL
	Sk Pr Wi	AIR	BURROW	W	C	E	
	2 1 1						
M 2/10/92 905AM	Hazy, sunny, no clds 2 geese	5°C	3°C	26	24	17	67
M 2/10/92 245PM	Sunny, ptly cldy	12°C	3°C	23	24	12	59
	2 1 1						
T 2/11/92 9AM	Low clds, sun above	3°C	3°C	17	15	17	49
	3 1 1						
T 2/11/92 525PM	Cldy (dusk)	4°C	3°C	0	0	0	0
	4 1 1						
	3 1 1						
W 2/12/92 9AM	Cldy, misty sun coming up out of the mist	3°C	3°C	2	8	2	12
(5 MIN LATER)	Sunny	~~4°C~~		4	18	2	24
	1 1 1						
W 2/12/92 230PM	Sunny, scattered clds More PDs in vegetated areas than on bare areas *This is generally true at this time	14°C	6°C	30	24	17	71
	2 1 1						
Th 2/13/92 8AM	Sunny, ptly cldy	2°C	3°C	13	7	8	28
	2 1 1						
Th 2/13/92 230PM	Sunny, ptly cldy high clds	12°C	5°C	17	22	10	49
	2 1 1						
F 2/14/92 9AM	Clouds, ptly sun, Breezy Lots of Robins	11°C	5°C	30	24	17	71
	3 1 2						

FEBRUARY 1992

DATE/TIME	WEATHER/COMMENTS	TEMPERATURES		PD's SEEN			TOTAL
	Sky Prec Wind	IA	IB	W	C	E	
W 2/19/92 9AM	2 1 1 City Open Space people talked to me.	6°C	4°C	18	14	17	49
W 2/19/92 2PM	2 1 1	12°C	4°C	22	15	12	49
Th 2/20/92 9AM	4 1 1 3 pr ducks in water	4°C	3°C	12	15	17	44
Th 2/20/92 2PM	2 1 1 PDs sunning 1 had a napkin or something in it's mouth.. Ducks on water.	19°C	5°C	29	28	10	67
M 2/24/92 9AM	1 1 1 Geese	4°C	4°C	17	15	20	52
M 2/24/92 2PM	1 1 1	12°C	5°C	26	22	8	56
T 2/25/92 9AM	4 1 2	6°C	5°C	10	5	12	27
W 2/26/92 9AM	3 1 1 ~~Feeding~~ Feeding; always run N. to trees, & burrows, when I turn in.	11°C	5°C	28	15	20	58
W 2/26/92 2:30PM	2 1 1 A truck drove thru, PD's ran for cover. Several sunning	18°C	6°C	15	20	6	41
F 2/28/92 9:10AM	1 1 1	18°C	7°C	10	20	18	48
F 2/28/92 2:10PM	1 1 1	22°C	3°C	14	19	3	36

MARCH 1992

DATE/TIME	WEATHER/COMMENTS			TEMPERATURES		# PDs SEEN			TOTAL
	Sky	Precip	Wind	TA	TB	W	C	E	
M 3/2/92 9:10AM	1	1	1	18°C	6°C	18	20	7	45
T 3/3/92 9:05AM	4	1	1	10°C	7°C	20	16	7	43
W 3/4/92 9:05AM	4	2	1	6°C	6°C	Ø	Ø	Ø	Ø
W 3/4/92 2:20PM	4	2	1	6°C	7°C	1	Ø	Ø	1
F 3/6/92 9AM	2	1	1	9°C	7°C	37	25	4	66
	Ground very wet from rain.								
F 3/6/92 2:15PM	2	1	1	16°C	8°C	22	18	7	47
	1 PD dead on road								
Su 3/8/92 - BLIZZARD -									
T 3/10/92 9AM	1	1	1			1	1	1	3
	After blizzard. Snow 2' deep site inaccessable. Looked from road (Pearl). PDs clearly visable against snow.								
W 3/11/92 9AM	1	1	1	~40°F					11
	same as above								
W 3/11/92 2PM	1	1	1	(Radio) 49°F					18
	same as above								
3/12/92 9AM	4	1	1	(Radio) 46°F					18
	snow melting								

MARCH 1992

DATE/TIME	WEATHER/COMMENTS	TEMPERATURES	#PDs SEEN	TOTAL
	Sky Precip Wind	TA TB	W C E	
Th 3/12/92 2PM	3 1 1 (Radio) 57°F Still no access. Lot of melt water running.			34
F 3/13/92 915AM	1 1 1 Area by road melted away Snow on site still 3" deep + melting. Several people present ∴ Ø in center. Numerous PD tracks, also rabbit	15°C 4°C	20 Ø 3	23
F 3/13/92 215PM	1 1 1 Muddy in center	16°C 4°C	31 22 5	58
T 3/17/92 840AM	4 1 1	6°C 6°C	15 10 5	30
W 3/18/92 9AM	3 1 1	7°C 6°C	20 20 5	45
W 3/18/92 235PM	4 2 1	6°C 6°C	1 5 Ø	6
F 3/20/92 825AM	2 1 1	7°C 6°C	30 20 10	60
M 3/30/92 9AM	2 1 1 Burrow Thomas gone	11°C gone	28 10 8	46
M 3/30/92 215PM	2 1 1	19°C –	38 10 5	53

APRIL 1992

DATE/TIME	WEATHER/COMMENTS			TEMPERATURES		#PDs SEEN			TOTAL
	Sky	Precip	Wind	T_A	T_B	W	C	E	
W 4/1/92 9:10 AM	1	1	1	5°C	(gone)	20	8	8	36
W 4/1/92 2:20 PM	1	1	1	14°C	–	19	12	10	41
F 4/3/92 9 AM	1	1	1	20°C	–	37	11	9	57
F 4/3/92 2 PM	2	1	1	24°C	–	22	7	ø	29
M 4/6/92 9:10 AM	1	1	1	18°C	–	14	12	8	34
T 4/7/92 9:10 AM	2	1	1	7°C	–	24	13	14	51
W 4/8/92 9:10 AM	2	1	1	15°C	–	22	18	12	52
W 4/8/92 2:20 PM	2	1	1	24°C	–	21	10	16	47
Th 4/9/92 9:08 AM	4	1	1	11°C	–	27	12	12	51
Th 4/9/92 2:20 PM	4	1	3	24°C		13	12	1	26

APRIL 1992

DATE/TIME	WEATHER/COMMENTS			TEMPERATURES		#PDs SEEN			TOTAL
	SKY	Precip	Wind	TA	Ta	W	C	E	
F 4/10/92 9[10]AM	2	1	2	21°C	-	19	16	5	40
	Diff. behavior of some. (mating behavior?)								
F 4/10/92 2[15]PM	2	1	1	26°C	-	17	7	6	30
	Same as above								
T 4/14/92 9AM	4	1	1	19°C	-	20	12	12	44
T 4/14/92 2PM	4	2	3	14°C	-	0	0	0	0
W 4/15/92 9[10]AM	3	1	1	15°C	-	21	10	12	43
F 4/17/92 9[05]AM	4	1	1	13°C	-	35	13	9	57
F 4/24/92 9[10]AM	1	1	1	9°C	-	30	15	10	55
M 4/27/92 9[10]AM	4	1	1	16°C	-	29	9	3	41
M 4/27/92 2[30]PM	3	1	1	31°C	-	6	5	9	20

MAY 1992

DATE/TIME	WEATHER/COMMENTS	TEMPERATURES		#PDs SEEN			TOTAL
	Sky Precip. Wind	T_A	T_B	W	C	E	
M 5/11/92 950AM	1 1 1 Trees all leaved	23c	–	15	10	4	29
F 5/22/92 930AM	4 2 1	10c	–	3	1	0	4

JUNE 1992

OUT OF TOWN - NO DATA

JULY 1992

DATE/TIME	WEATHER/COMMENTS			TEMPERATURES		# PDs SEEN			TOTAL
	SKY	Precip	Wind	TA	TB	W	C	E	
T 7/7/92 1:30PM	4	2	1	30°C	20°C (new Therm)	13	8	0	21
	Vegetation: full leaves, weeds - ground well covered								
Th 7/9/92 9AM	3	1	1	22°C	19°C	32	20	6	58
Su 7/12/92 9:26AM	3	1	1	22°C	20°C	42	13	6	61
	Magpie								
M 7/13/92 9:20AM	3	1	2	25°C	20°C	37	19	7	63
W 7/22/92 7:50AM	1	1	1	19°C	19°C	45	20	20	85
	Came on bicycle								
M 7/27/92 4:50PM	3	1	1	33°C	21°C	16	7	6	29
W 7/29/92 8:15AM	4	1	1	21°C	20°C	31	23	4	58
Th 7/30/92 9:30AM	3	1	1	22°C	20°C	20	16	8	44

AUGUST 1992

DATE/TIME	WEATHER/COMMENTS			TEMPERATURES		# PD's SEEN			TOTAL
	SKY	Precip	Wind	TA	TB	W	C	E	
Th 8/6/92 3:20PM	4	2	4	29°C	21°C	35	16	5	56
	Sprinkling								
F 8/7/92 3:30PM	2	1	2	36°C	21°C	17	16	6	39
T 8/18/92 3:39PM	4	1	2	27°C	21°C	22	13	11	46
	Lightning + Thunder								
Th 8/20/92 8:10AM	1	1	1	21°C	19°C	32	12	16	60
	Came on bicycle								
Th 8/20/92 1:39PM	2	1	2	33°C	22°C	7	2	2	11
T 8/25/92 1:45PM	4	1	2	20°C	20°C	12	10	11	33
	muddy, after all day rain yesterday								
W 8/26/92 3:05AM	1	1	2	24°C	19°C	28	8	7	43
Th 8/27/92 NOON	1	1	1	22°C	18°C	28	12	5	45
Th 8/27/92 3:10PM	1	1	1	28°C	19°C	45	17	9	71
F 8/28/92 3:40PM	1	1	1	32°C	19°C	16	10	8	34
M 8/31/92 11:05AM	2	1	2	24°C	19°C	23	14	12	49
M 8/31/92 3:10PM	4	1	2	23°C	19°C	24	12	9	45

16 Nov '92

Mark,

Here's data for Sept. & Oct.

(Please NOTE ENTRIES) Lot of activity late Sept. & early Oct. with the construction. Sorry this is so late. Hard to find time.

The fence hasn't gone up yet (I hope, I've missed the last few days). Is there any possibility that there will be a gate, & that I might be allowed access through it to continue my work?? I'd appreciate any information you could give me.

Thank you for your interest.

Dora E. Perry
652-3889

Happy Thanksgiving!

SEPTEMBER 1992

DATE/TIME	WEATHER/COMMENTS	TEMPERATURES		#PDS SEEN			TOTAL
	Dry Precip Wind	TA	TB	W	C	E	
T 9/1/92 8:30 AM	3 1 1 Wet ground	13°C	17°C	24	15	18	57
T 9/1/92 3:30 PM	2 1 3	26°C	19°C	48	12	16	76
	Certain strips of taller vegetation have been mowed (?)						
W 9/2/92 3 PM	1 1 1	29°C	19°C	37	11	12	60
Th 9/3/92 8:40 AM	2 1 1	22°C	18°C	32	20	14	66
Th 9/3/92 3:30 PM	3 1 2	30°C	19°C	32	11	11	54
W 9/9/92 3 PM	1 1 2 Dry 2 adjacent burrow mounds have been undermined & dirt spread between them.	24°C	20°C	15	6	6	27
Th 9/10/92 9 AM	1 1 1	15°C	17°C	35	15	12	62
F 9/11/92 3 PM	2 1 2 People + dogs present in center. 3 cars parked.	34°C	19°C	28	8	6	42
M 9/14 3:30 PM	2 1 1	29°C	20°C	30	12	10	52
T 9/15 8:30 AM	2 1 1 7 magpies around one mound	21°C	19°C	34	15	12	61
W 9/16 3 PM	3 1 3	29°C	19°C	32	8	11	51

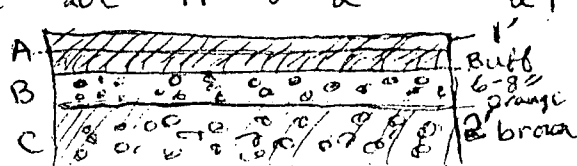
SEPTEMBER 1992

DATE/TIME	WEATHER/COMMENTS			TEMPERATURES		#PDs SEEN			TOTAL
	Sky	Prec	Wind	TA	TB	W	C	E	
9/18/92 11AM	1	1	1	16°C	19°C	19	10	13	42
	Surveyors present. One right on my TB burrow. The other W. alongside Pearl. Susp. for a fence for Boulder City Open Space								
F 9/18/92 3PM	1	1	2	22°C	19°C	13	5	9	27
	Surveyors present again								
T 9/22/92 4PM	1	1	2	30°C	20°C	22	6	10	38
W 9/23/92 11:30AM	1	1	2	31°C	19°C	20	9	5	34
W 9/23/92 3:05PM	1	1	2	33°C	19°C	18	10	6	34
Th 9/24/92 11:10AM	3	1	3	30°C	19°C	40	10	5	55
F 9/25/92 3:10PM	2	1	4	23°C	19°C	40	11	5	56
	Construction at East end. Pile of dirt, stacks of conduits (PVC pipes), trucks & bulldozers								
M 9/28/92 11:05AM	1	1	2	15°C	17°C	25	16	6	47
	Surveys here again, at W end. Construction vehicles at E. end								
M 9/28/92 3:36PM	1	1	2	24°C	18°C	26	10	3	39
	Construction E. end. Digging 2 big holes. 2 PDs were watching from the drive-thru.								
T 9/29/92 8:15AM	1	1	1	10°C	16°C	20	10	3	33
	same as above								
T 9/29/92 3:30PM	1	1	1	31°C	19°C	30	8	1	39
	same, + holes & equip at West end as well								

SEPTEMBER 1992

DATE/TIME	WEATHER/COMMENTS	Sky	Precip	Wind	T_A	T_B	W	C	E	TOTAL
W 9/30/92 11:30 AM	Holes filled, workers absent. Dirt pilot equip. remain.	1	1	1	27°C	18°C	26	.13	.7	46
W 9/30/92 3:05 PM	Same as above. PDs on E. end re-opening holes which were bull-dozed & covered over.	1	1	1	31°C	18°C	26	13	12	51
	OCTOBER 1992									
Th 10/1/92 3:30 PM	A trench being dug along the whole N.W. edge of the colony between the parking & the trees. US West - PVC conduits & cement. Total mess & disturbance, trench abutting my T_B burrow.	1	1	2	34°C	20°C	10	8	5	23
F 10/2/92 11 AM	Machines are at rest, but the work is not finished. When they're done, they will have dug through at least 5 PD holes. They may be staying within agreed boundaries, but they are still making a significant impact (disturbance) to this prairie dog colony.	1	1	1	27°C	18°C	20	20	5	45
F 10/2/92 3:05 PM	same as above. Dry. People sitting at E. end w/ bicycles	1	1	2	31°C	18°C	20	5	0	25
S 10/3/92 11:30 AM		1	1	2	23°C	18°C	42	6	8	56
M 10/5/92 11:30 AM	No workers.	1	1	1	18°C	18°C	34	15	10	59
M 10/5/92 3:10 PM	Excavating - from T_B burrow → West, lay East of PVC. Surveyors also present. I examined soil in trench:	3	1	2	20°C	20°C	19	8	2	29

A = Buff - loose
B = Orange 6-8" lg gravel
C = Brown lg gravel 2'



October 1992

DATE/TIME	WEATHER/COMMENTS	TEMPERATURES		#PDs SEEN			TOTAL
	Sky Prec. Wind	T_A	T_B	W	C	E	
T 10/6/92 345PM	4 1 1	13°C	—	30	15	10	55
	Bulldozers have leveled all along the trench line including my T_B burrow - which was occupied by PDs and my T_B thermometer!						
W 10/7/92 11:30AM	3 1 2	11°C	—	30	10	10	50
W 10/7/92 3PM	3 1 3 Workers present on E. end.	11°C	—	45	15	2	62
Th 10/8/92 7:50AM	1 1 1 No workers. 1st Freeze	-2°C	—	1	0	0	1
Th 10/8/92 9AM	1 1 1 Workers beyond W. End. Talked to a surveyor. He said U.S.West had gone over the line.	4°C	—	20	12	14	46
Th 10/8/92 4PM	2 1 3 Replaced a new thermometer in a diff. P.D. hole	20°C	18°C	42	15	14	71
F 10/9/92 10:45AM	3 1 3 People walking on W. End No workers. Stakes marking fence line	12°C	14°C	6	10	10	26
M 10/12/92 11:30AM	1 1 1 Posts next to stakes.	20°C	15°C	19	14	9	42
M 10/12/92 3:30PM	2 1 2	23°C	20°C	29	20	5	54
T 10/13/92 9:15AM	3 1 2	17°C	15°C	32	21	10	63
T 10/13/92 3:45PM	2 1 3 Lot of particulates (seed, dust, pollen etc) in air. Disturbed burrows being dug out again (restored) by PDs.	32°C	22°C	27	15	10	52

OCTOBER 1992

DATE/TIME	WEATHER/COMMENTS			TEMPERATURES		#PDs SEEN			TOTAL
	SKY	PDS.	WIND	TA	TB	W	C	E	
W 10/14/92 10AM	2	1	1	10°C	14°C	36	20	13	69
W 10/14/92 3:15PM	2	1	1	18°C	17°C	40	8	10	58
Th 10/15/92 10AM	2	1	2	11°C	14°C	30	23	8	61
Th 10/15/92 4PM	2	1	2	17°C	17°C	30	11	10	51
F 10/16/92 10:45AM	3	1	2	4°C ↓	12°C ↓	40 ↓	24 ↓	10 ↓	74 ↓
F 10/16/92 3:15PM	3	1	2	12°C	15°C	34	8	11	53
M 10/19/92 11:30AM	3	1	3	23°C	—	27	17	5	49
TB Thermometer out on ground I put it back in the hole – had to leave.									
M 10/19/92 3PM	2	1	3	26°C	16°C	24	8	9	41
W 10/21/92 3:15PM	3	1	3	28°C	20°C	39	18	9	66
several lying flat to grade by burrow. A Couple laying on one another. Magpies.									
Th 10/22/92 3:45PM	2	1	2	25°C	18°C	42	18	10	70
Beavers chewed on an old cottonwood trunk.									
F 10/23/92 10:30AM	3	1	2	18°C	16°C	33	13	10	56
F 10/23/92 3PM	2	1	1	23°C	17°C	40	20	10	70
Magpies									

OCTOBER 1992

DATE/TIME	WEATHER/COMMENTS			TEMPERATURES		#PDs SEEN			TOTAL
	SKY	PRC	WIND	TA	TB	W	C	E	
M 10/26/92 11:30 AM	1	1	1 rained last night	17C	17C	26	22	10	58
T 10/27/92 8 AM	2	1	1	15C	14C	10	7	0	17
T 10/27/92 3:50 PM	3	1	1	22°C	15C	21	10	5	36
W 10/28/92 10:45 AM	4	1	1 rained last night	8°C	12°C	21	15	2	38
W 10/28/92 3PM	4	1	2	8°C	12°C	11	4	3	18
Th 10/29/92 9:15 AM	4	1	1 rained last night	6°C	11°C	10	3	1	14
Th 10/29/92 3:45 PM	4	1	2	8°C	12C	9	2	0	11
F 10/30/92 10:45 AM	3 多	1	2	11°C	13°C	25	15	10	50