Revegetation Experiment in an Active Prairie Dog Town

Second Year Monitoring Report

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Second Year Monitoring.

ABSTRACT

This experiment was conducted to address the issue of prairie dog survival in the highly disturbed urban and rural environments of Boulder County. Prairie dog populations in these urban/agricultural "islands" are artificially isolated from both resources and predators that would naturally keep the populations in balance. This experiment tests the possibility of using direct seeding in order to reestablish native species in an active prairie dog town in an area that is heavily disturbed and dominated by introduced weeds. This experiment addresses only the resource aspects of the food pyramid in which the prairie dog plays such an important role.

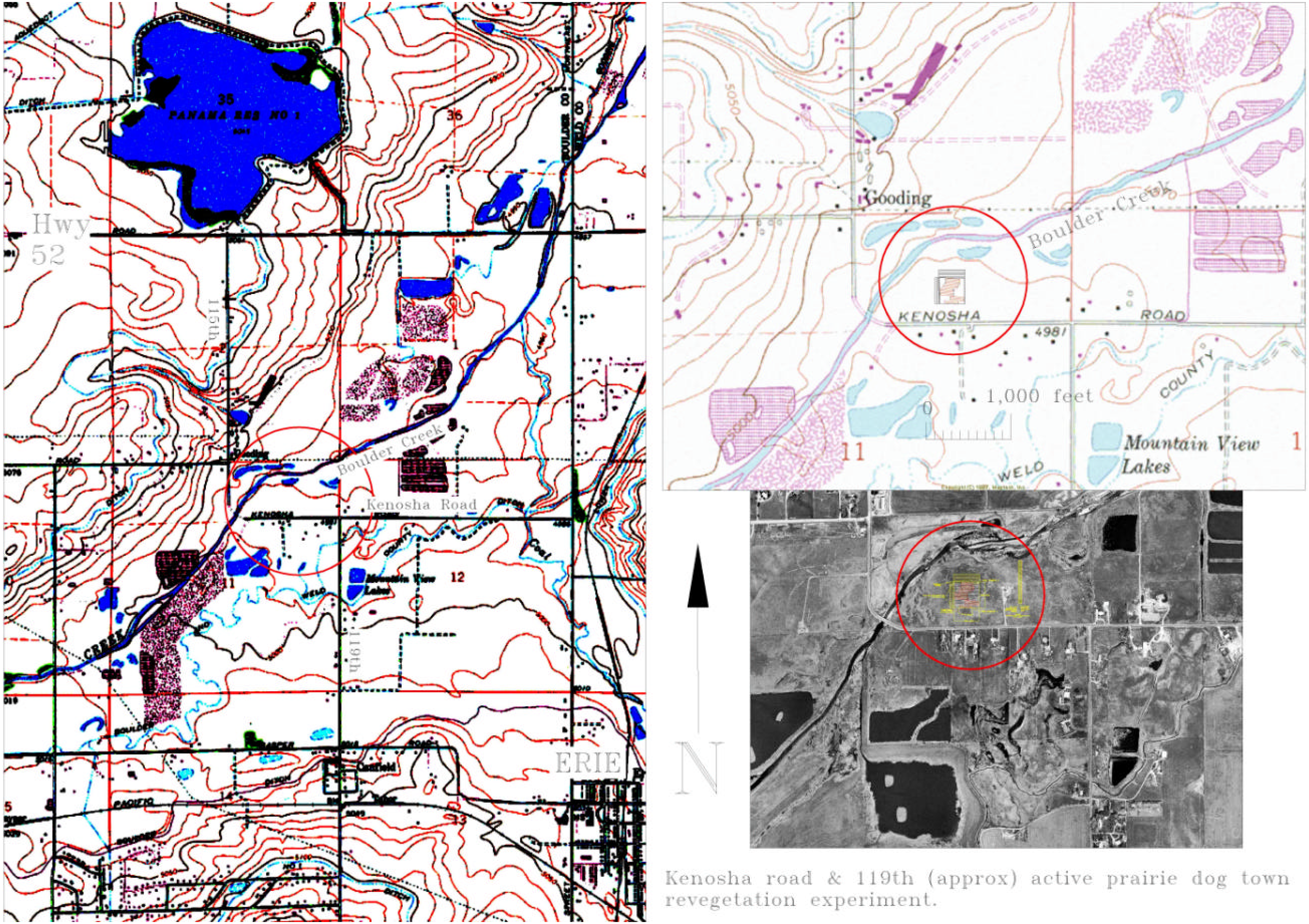
This is the second data report for this project. It includes a single vegetation cover sampling, and the first sampling for seedling density. The planted grass species have not achieved a total percent cover that is easily measurable by the point-intercept methodology using 100 points on a 50 meter transect. The presence of seedlings under the short canopy (3-10 cm) of the bindweed (*Convolvulus arvensis*) and burning bush (*Bassia sieversiana*) indicates that the native species are present, but not well established. The canopy of weeds is kept short by the prairie dog grazing and seems to benefit the planted seedlings by providing shade and mulch. Although there are places that are pitted by prairie dog digging for what might be underground plant resources, most of the area is not pitted and some of the planted seedlings are adjacent to prairie dog mounds. A systematic plot sampling technique using twenty 0.25-meter^2 plots per transect was used to estimate the abundance of these seedlings.

This project examined the response of vegetation and a prairie dog population to interseeding (overseeding) native shortgrass and mid-grass species in an active colony that occurs at a highly disturbed site (Figure 1) dominated by introduced weeds. Native grasses were seeded on April 6, 2000 using a low-till seed drill. Vegetation was sampled immediately before treatment and on June 3, June 30, August 4, and September 6, 2000. Prairie dog population characteristics were also assessed before and after treatment by means of above-ground prairie dog counts, active burrow counts (relative density), spatial dispersion, and burrow utilization. The results from the year 2000 were previously reported (Ecotone, 2000). This years report presents a single vegetation cover sampling in June, and an additional sampling for seedling densities of the planted grass species. The prairie dog population studies from year 2000 were not repeated in 2001.

Last year (2000) had an extremely dry period of April-May-June (the 5th driest in 105 years of record) that greatly reduced the germination and establishment of the native grasses. This year was much closer to average with a slightly wetter than average spring, and a slightly drier June.

Acknowledgements

I would like to thank those that supported and assisted with this research project. Boulder County Parks and Open Space provided the funding to initiate and sustain this study through their Small Grants Program. All experimentation has a risk of failure and we appreciate Boulder County for allowing this effort to try new ways of sustaining prairie dogs and native plant communities in the rapidly developing Colorado Front Range. Additional thanks goes to Sharon Daugherty, the field and data technician.



Kenosha road & 119th (approx) active prairie dog town revegetation experiment.

Figure 1. Project Location - Revegetation in an active prairie dog town experiment.

INTRODUCTION
The purpose of this experiment was to address the issue of prairie dog survival in the highly disturbed urban and rural environments of Boulder County. Prairie dogs are grazers that do not quickly migrating to better areas once an area's resources are depleted. The artificial barriers created by urban and agricultural boundaries prevent the more natural slow migration process of the prairie dog. Survival of the prairie dogs in these island refugia in the urban/agricultural matrix would be valuable for the following reasons:

1. Maintenance of the food base for the more adaptable predators such as raptors, badgers, fox and coyote,
2. Human observation and understanding of the food pyramid and web of life can be directly interpreted from the presence of prairie dog towns. This sometimes emotional focal point includes the lessons of both human and prairie dog overpopulation as demonstrated by depletion of resources, population stress, erosion, and propagation of non-native weedy plant species.

For prairie dog populations to survive in this highly modified environment, both the resources necessary for the prairie dog's survival and the prairie dog population densities must be managed. The alternative is the suffering and demise of prairie dogs due to starvation and plague, or the social decision to remove them due to the human and economic risks associated with plague and the establishment of aggressive non-native weeds. Methods for maintaining healthy populations of prairie dogs in the urban/agricultural environment have not yet been developed.

This experiment approaches two aspects of this issue:
1. providing resources to sustain the prairie dogs,
2. reducing the risk associated with aggressive introduced weeds by reintroducing native plant species.

It does not address the critical issue of prairie dog health and population control in the inevitable situation where the managed vegetation resources are eventually depleted.

It is reasonable to assume, and probable, that the prairie dogs will respond to the new vegetation growth and consume it, resulting in population growth and an expansion of the population. The response of the prairie dogs and amount and timing of the vegetation recovery can not be quantified until this simple experimental effort is made. This approach is sometimes called "Ockhams razor" and is the principle that sometimes the simplest solution is the correct one. It is our objective to test the simplest solution first.

The health of prairie dogs is fundamentally associated with their diet. The quantification of the amount and type of vegetation cover may be an easy way to estimate the health of a population, and may provide an advanced warning when population management is needed.

Regardless of the ultimate outcome of the experiment, the relationship between vegetation establishment and prairie dogs will be documented. Because this is not a greenhouse or laboratory experiment, climate and soils rather than prairie dogs may have a controlling effect on vegetation establishment. That is why climatic and soil factors are also incorporated into this experiment.

Specific Objectives
Revegetation Questions.

1. What is the vegetation response to seeding considering climate, soil, and prairie dog population factors?

LITERATURE SURVEY
This experiment will test the possibility of using direct seeding in order to revegetate an active prairie dog town in an area that is heavily disturbed and dominated by introduced weeds. No other studies of this type have been documented. Some undocumented (Dangoule Bockus FWS at Rocky Mtn. Arsenal) and anecdotal information (Mark Buckley with Custom Services of Colorado - Reclamation) is available, but real studies that incorporate climate, soils, and prairie dog population characteristics have not been discovered. A recently completed prairie dog management plan was prepared for Highlands Ranch and included the following information regarding Prairie dog carrying capacity.

> 1) Prairie dog population exceeds carrying capacity and/or results in destruction of natural resources. When there is 20% bare ground within a colony's boundary, this indicates the carrying capacity within that specific geographic area may have been met or exceeded. This is regardless of the ratio between the amount of original bare ground and the total town area before prairie dog inhabitation (Seery 1997). If the population exceeds 50 prairie dogs per hectare (20 per acre), this is also a good indicator that the carrying capacity has been exceeded in an area (Seery 1997). Site specific analysis will determine if natural resources are being destroyed.
>
> When prairie dog populations exceed carrying capacities, the prairie dogs are subjected to increased stress and higher incidence of disease. The lack of predators, high levels of outdoor recreation use of open space, and conflicts with adjacent residential and commercial properties, dictate that prairie dog populations (*located in suitable sites as defined in Section 4*), be best managed at 80% or less of the carrying capacity for that specific site.

The Seery reference was not fully documented and we could not find the original source.

The ecological consequences of Prairie Dog disturbance have been discussed by Whicker & Detling (1988). These studies were conducted in South Dakota grasslands that may have been dominated by native species, but no list of species was provided. Prairie dog colonies were compared based on subjectively determined periods of occupation vs. net primary production (NPP), and total above and below ground biomass. Net primary production was found to respond to precipitation but was not found to vary based on grazing intensity. Total biomass, however, was found to decrease with increased age of the colony.

Weltzin et al. studied the species composition and community diversity aspect of prairie dog grazing at a site that was estimated to have been established for 20 to 50 years near the southeastern corner of the Texas panhandle. Comparisons with off-site control areas indicated lower species diversity on the prairie dog site and lower biomass for all species other than the short grass species. Both of the on-site dominant species were short grasses. These dominant species were buffalo grass (*Buchlöe dactyloides*) a native warm-season grass, and tumble grass (*Schedonnardus paniculatus*) a native cool-season grass.

The Weltzin study did not include species associated with the heavily impacted prairie dog mounds thus obscuring the diversity estimate. The study discussed the conflicting diversity results in the prairie dog literature. Diversity itself is a term that is filled with uncertainty and is ecologically confusing in the sense that it is sometimes confused with community stability, and must be represented as a pair of values rather than just one (Magurran 1988).

The literature also has conflicting reports regarding the development of the plant communities after the removal of prairie dogs. Klatt & Hein (1978) compared vegetation differences among one active and 3 abandoned prairie dog towns. They confirmed findings by Koford (1958) that total vegetation cover was actual greater in the active prairie dog towns than it was in recovering areas outside of the towns. Both studies discuss the fact that cattle also grazed these areas but did not consider the potential for cattle selectively grazing the areas outside of the prairie dog towns. The dominant species at all sites was buffalo grass (25% - 37.2%) typically followed by blue grama (9.8-22.8%). Western wheatgrass (*Pascopyrum smithii*) was observed to increase with recovery duration. The fact that western wheatgrass produces most of its growth in a vertical direction (which is more available to cattle) was not discussed.

A much more comprehensive study by Cid et al. (1991) studied vegetation response after the exclusion of prairie dogs and/or bison in South Dakota. This study was very revealing because it was not obscured by the cattle grazing uncertainties. The four treatments were; 1) exclusion of prairie dogs, 2) exclusion of bison, 3) exclusion of prairie dogs and bison, 4) grazed by both species. What makes this study especially interesting is that it was a two-year study that included a dry year (11% below average) and a wet year (27% above average), and incorporated the climate into the analysis. They found that in the dry year the differences between the treatments were not significant (i.e., climate rather than grazing was controlling biomass). In the wet year the prairie dog exclusion areas averaged 38% greater biomass, the bison exclusion areas averaged 40% greater biomass and in the areas where both grazers were excluded the results were additive with approximately 78% greater biomass compared to areas that were grazed by both species. Although biomass data were collected by growth form rather than species, the authors indicated that buffalo grass was the dominant species followed by blue grama, western wheatgrass, and tumblegrass.

Archer et al. studied the reverse of the process that we hope to observe with the current revegetation study. The Archer study quantified the vegetation changes after a population of prairie dogs colonized and expanded. The colonization and expansion had been documented and mapped by previous studies. The trend was from a mixed grass community composed primarily of buffalo/blue grama, needle-and-thread (*Hesperostipa comata* cool season mid-grass), and bluegrass *(Poa pratensis* cool season mid-grass); to buffalo/blue grama and western wheatgrass after two years; to buffalo/blue grama, fetid marigold (*Dyssodia papposa* native annual forb), and spiderwort (*Tradescantia bracteata* native perennial forb) after 3 years; to a community dominated by fetid marigold and spiderwort after 4 years. This study also noted that the burrow density correlated with vegetation better than prairie dog density.

All of these studies demonstrated the dominance of buffalo grass in the typical prairie dog towns. The grass species used in this study included buffalo grass, blue grama, side oats grama, and western wheatgrass. These are common species recommended for reclamation in our area (McGinnies et al. 1963; CNAP 1998), but buffalo grass is surprisingly missing in some documents that provide seed mixes for highway reclamation (See 1986) or cattle grazing (Hart et al. 1996).

Germination, growth and establishment of the reclamation species used in the current study are discussed in Jones (1985) and Cheplick (1998). Large seed size with a hard coat, combined with cool dry conditions can extend seed longevity in the soil Baskin and Baskin (1998). Moisture stress (drought) can reduce the germination rates of seeds. The moisture stress that can reduce the germination rate to 50% or less is:

Blue grama	=	>1.6 -MPa
Side oats grama	=	>1.6 -MPa
Western wheatgrass	=	0.7 -MPa
Buffalo grass	=	0.1 -MPa

The greater the number, the greater the capacity to germinate in spite of moisture stress. Although this may be advantageous in some circumstances, if seeds germinate quickly, but hot dry weather follows germination, the seedlings may be killed. Additional discussion is found in the Results section. The inherently high longevity potential for buffalo grass has been reported in Justice & Bass (1978) and discussed in Desai et al. (1997).

The seeding rates used in the current study were much higher than is typically recommended. Hoffmann et al. (1995) studied the seed predation by rodents on buffalo and blue grama grass and found that although there was a preference for large seeded species such as buffalo grass, the increase of seeding rates was not significantly correlated with foraging rate. The rodents in the Hoffmann study did not include prairie dogs.

METHODS

Plant species nomenclature follows Weber & Wittmann 1992 (with 1999 addenda).

Site Surveying and Seeding

The sample plot markers were recovered and re-staked when necessary and marked with pin-flags as indicated on Figure 2. The 4.6 m (15 ft.) wide by 88.4 (290 ft.) long, seeded plots have an East-West orientation and alternate with unseeded "no treatment" control plots with the same dimensions. There are a total of 10 seeded and 10 unseeded plots. The endpoints of the perimeter of each plot are marked with wooden stakes and subsurface rebar. The rebar is placed below the surface to allow recovery of the location with a metal detector if the wooden stakes are lost or removed. The total area of the seeded plots is approximately one acre. An additional area to the north and east of the strips was also seeded to take advantage of the low cost of each additional acre of seeding in relation to the relatively high cost of the first acre. The mobilization expense of the seeding equipment makes the first acre almost three times more expensive than the second acre.

The seed mix, seed certification, and seed bag tags were presented in Appendix A of last years report. Only four native grass species were used. Three of the species are warm season grasses (buffalo grass *Buchloe dactyloides*, blue grama grass *Chondrosum gracile*, side-oats grama *Bouteloua curtipendula*) and the fourth was a cool season grass (western wheatgrass *Pascopyrum smithii*). These species were selected for their grazing tolerance or aggressive germination. Previous observations on Rocky Flats indicate that only buffalo grass and blue grama tolerated the heavy grazing of prairie dogs.

The initial seeding was done with a 2.13m (7 ft.) wide low-till seed drill, which left a 0.3m (1 ft.) wide unseeded strip in the center of the plot (Photograph 1). Rather than leave this strip unseeded, a third pass by the seed drill was centered on the unseeded strip (Photograph 2). This complicated the seeding rate within the plot by creating two different seeding rates. The outer four feet and the central one-foot wide strip are seeded at the original rate of 972 pure live seeds (PLS) per square meter (90 PLS/sq.ft.), but there are also two 0.91 m (3 ft.) wide strips on either side of the central strip that are seeded at 1,944 PLS/sq.m. (180 PLS/sq.ft.). This results in an average seeding rate of 1,360 PLS/sq.m. (126 PLS/sq.ft.). The vegetation cover sampling methodology averages this factor, but there may be visual evidence of the two seeding rates over time.

The presence of control plots closely associated with the treatment plots will allow continued assessment over time since there will be both treatment and control rows for comparison if the prairie dog population expands.

Vegetation transect location selection

Vegetation sample transects were located within the control and treatment plots. Prior to seeding, transect locations were subjectively selected within each seeded and unseeded plot to best represent the areas most affected by prairie dogs. The 50 meter (164 ft.) transects were oriented at a diagonal to the seed furrows, and the endpoints were marked with wooden stakes and subsurface rebar.

Vegetation Monitoring

Cover

Vegetation cover was sampled at the 20 transects (Figure 2) on June 15, 2001. Each 50 meter transect was sampled with 100 points using a point-intercept optical device. Two points were sampled at each meter on either side of the transect at 0.5 meter from the transect centerline (Figure 2). Each sample point recorded first-hit (top canopy) and additional hits for vegetation by species, litter, bare soil, rock, and standing-dead vegetation. Because the dominant cover at the site in April was provided by the standing-dead of the two dominant weed species (i.e., bindweed *Convolvulus arvensis*, and burning-bush *Bassia sieversiana* [a.k.a. *Kochia scoparia*]), the cover points were also distinguished for these species. Species within one meter (3.28 ft.) of the transect centerline were also recorded as "present". This will allow species with low cover to be represented in the data and provides a species density per 100 square meters (i.e., 50 meters long by 2 meters wide plot). This methodology is identical to the vegetation monitoring used by Boulder City Open Space in their prairie dog studies. Each transect was documented with a photograph immediately prior to each sample.

Seedling Density

Seedling density was estimated with twenty 0.25 meter^2 per treatment plot. The sample plots were systematically located in pairs at ten locations in the plot with twelve plots (six pairs) associated directly with the vegetation cover transect. These 6 pairs were located at 10 meter intervals along the transect and at the endpoints of the transect. The seedling density plots were numbered from one to twenty starting at the beginning of the vegetation cover transect, the number one plot was on the south side of the transect. There were twelve plots (6 pair) associate directly with the cover transect. The remaining plots were evenly distributed in the remainder of the treatment plot as shown in Figure 2 and sequentially numbered from east to west. The sampling was conducted on June 20, 2001.

The goal was primarily to get a high, medium, or low estimate for each transect rather than a statistically adequate sample. If sample adequacy is easily achievable, sampling to achieve adequacy will be pursued. The sample adequacy formula that will be used is as follows.
Sample adequacy will be based on a two-tailed t-test:

$$n_{min} = \frac{t_a^2 s^2}{(d\bar{x})^2}$$

where:

t_a = t table value with a rejection area equal to a
a = 0.1 in a two tailed test, meaning that the area at each end of the probability curve is 0.05.
s^2 = sample variance (s = sample standard deviation)
d = 0.1 the precision or acceptable confidence limit
$\bar{x}$ = mean value

Soil sampling and description

Soil sampling was not conducted this year, see last year's report for the soil sample results and discussion.

Climate

Climate data from Boulder was used to assess the monthly precipitation, temperature and potential evapotranspiration.

Intra-Colony Burrow Density & Burrow Area Utilization

No additional data were collected this year, see last year's report for results and discussion.

Burrow Spatial Dispersion

No additional data were collected this year, see last year's report for results and discussion.

Above Ground Animal Sightings, The Disturbance Effect of Seeding on Plot Use

No additional data were collected this year, see last year's report for results and discussion.

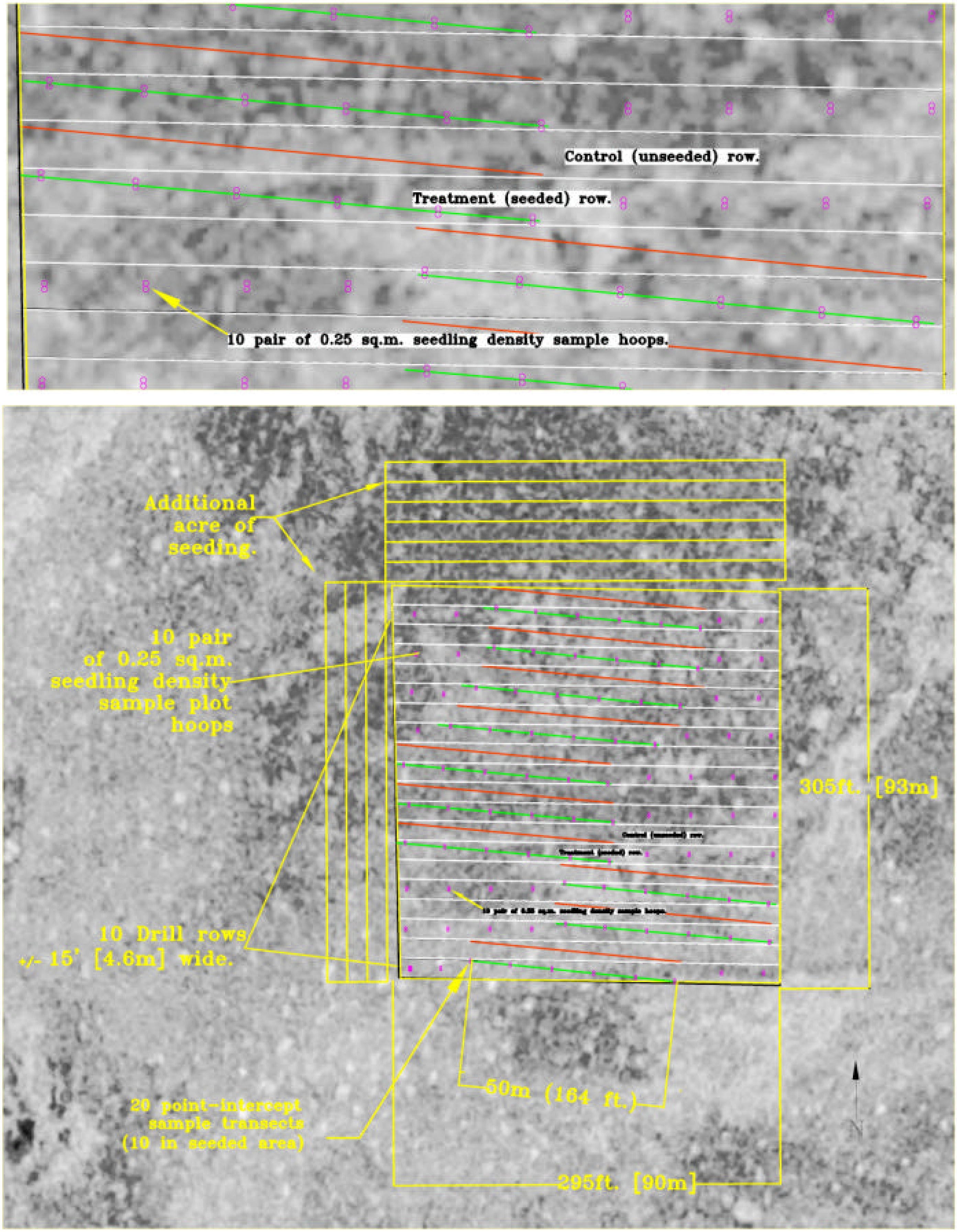


Figure 2. Vegetation Cover Transects and Seedling Density Plots Layout.

RESULTS & DISCUSSION

Vegetation transect and seedling density plot locations

Sample markers were recovered and reinforced or replaced when appropriate. The transects were numbered from 1 to 20, starting with the southern transect. The start point for each transect was the eastern end.

Vegetation Monitoring

Cover

Vegetation cover summary tables are presented in Appendix A. Three tables are presented for the June 15, 2001 sampling events. The first table has the combined summary statistics and original data for each transect, the second table has the summary statistics for the combined control plots, and third table has the summary statistics for the combined treatment plots. For convenience, the same set of three tables for the June 3, 2000 sampling event (provided in last year's report) has been included for comparison. Figure 3 summarizes the difference between the June 15, 2001 and the June 3, 2000 sample events. These pie diagrams present the proportions of each growth form as well as litter, bare ground, rock and standing dead vegetation along with a summary table at the bottom of the figure that highlights the statistically significant differences between the control and treatment areas plots. These graphics and statistics are based on averages that do not reveal the large variation between plots.

There was no significant difference between the average values of the 2001 control and treatment areas. Although the total vegetation cover was not significantly different between 2000 and 2001, the growth form composition did change. The differences between the 2000 and 2001 samples indicate an increase in introduced annual and biennial forbs and a decrease in introduced perennial forbs. This change occurred predominantly in the Treatment area. This may indicate that the control and treatment are returning to equilibrium and the effect of drill seeding may have temporarily produced a decrease in annual (*Bassia*) and increase in perennial (*Convolvulus*) species cover. This is just speculation, however, and other factors may have been involved.

Future comparisons that test changes over time should be based on comparisons of at least two subsets of the data. A discussion of this can be found in last year's report.

Seedling Density

Table 1 is a summary of the overall seedling density in the treatment areas, as well as a density by species. The overall seedling density was approximately 1 seedling per 1.8 ft^2. Table 2 provides the data for each transect, and includes sample adequacy calculations. Sample adequacy was not achieved (N = 233 vs. 200) even when using a method to correct for zeros in the data set. This is a good indicator of the patchy distribution of the seedlings in the treatment areas. Figure 4 shows the species composition of the seedlings.

Table 1. Seedling Density Summary

Prairie Dog Seedling Density Sample - 20-June-2001

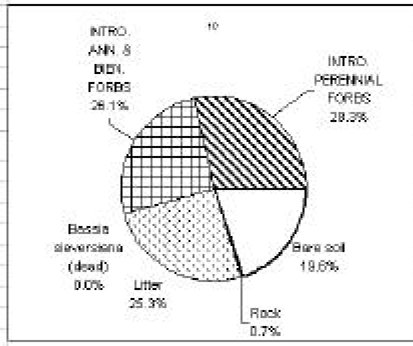
Ecotone - data collected with 0.25 m.sq hoops

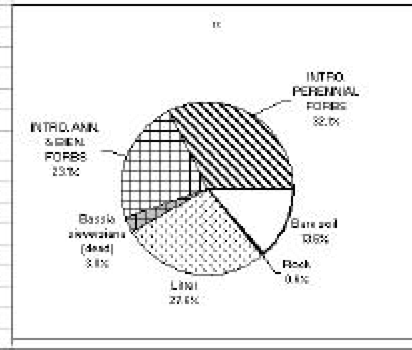
	Seedlings per 0.25 sq.m.	per m.sq.	per yd.sq.	per hectare	per acre
Grand Mean	1.53	6.12	5.11632	61,200.0	24,763.0

Average by species	Unknown	P.smithii	C. gracile	B. dactyl.	B. curt.
Per 0.25 m^2 Plot	0.02	0.84	0.09	0.56	0.03
per m^2	0.08	3.36	0.34	2.22	0.12
per yd^2	0.07	2.81	0.28	1.86	0.10
per hectare	800.00	33,600.00	3,400.00	22,200.00	1,200.00
per acre	323.70	13,595.37	1,375.72	8,982.65	485.55

	June 15, 2001	June 3, 2000

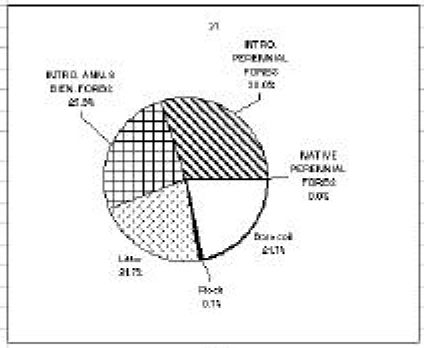
Control

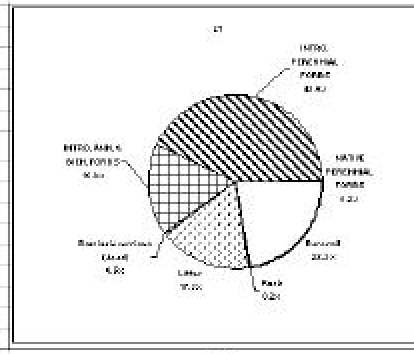




	1C	2C
Bare soil	19.6	13.6
Rock	0.7	0.6
Litter	25.3	27.7
Standing dead		
Bassia sieversiana (dead)	0	3
INTRO. ANN. & BIEN. FORBS	26.1	23.2
Convolvulus arvensis (dead)		0
INTRO. PERENNIAL FORBS	28.3	32.2
NATIVE ANN. & BIEN. FORBS		
NATIVE PERENNIAL FORBS		
NATIVE PERENNIAL GRASSES (c)		
NATIVE PERENNIAL GRASSES (w)		
Total Vegetation Cover	54.40	55.40

Treatment





	3T	2T
Bare soil	21.7	22.2
Rock	0.7	0.2
Litter	21.7	17.3
Standing dead		
Bassia sieversiana (dead)		0.5
INTRO. ANN. & BIEN. FORBS	25.9	16.8
Convolvulus arvensis (dead)		0
INTRO. PERENNIAL FORBS	30	42.9
NATIVE ANN. & BIEN. FORBS		
NATIVE PERENNIAL FORBS		0.2
NATIVE PERENNIAL GRASSES (c)		
NATIVE PERENNIAL GRASSES (w)		
Total Vegetation Cover	55.90	59.90

Significant Difference Testing - boxed values indicate significant difference.
two-tailed test, $\alpha = 0.05$, $n = 10$

		June 15, 2001	June 3, 2000
INTRO. ANN. & BIEN. FORBS	control	26.1	23.2
INTRO. ANN. & BIEN. FORBS		25.9	16.8
INTRO. PERENNIAL FORBS	control	28.3	32.2
INTRO. PERENNIAL FORBS		30	42.9
Vegetation Cover	control	54.40	55.40
Vegetation Cover		55.9	59.9

Summary of site characteristics for year 2001:
There was no significant difference between the average values of the 2001 treatment and control samples.
The differences between the 2000 and the 2001 samples indicates an increase in introduced annual and biennial forbs and a decrease in introduced perennial forbs.
This change occurred predominantly in the Treatment area. This may indicate that the control and treatment are returning to equilibrium and the effect of drill seeding may have produced a decrease in annual (*Bassia*) and increase in perennial (*Convolvulus*) species cover. This is just speculation.

Figure 3. Vegetation Summary by Growth Form.

Table 2. Seedling Density Plot Results.

Sample adequacy calculation include a recalculation that adds one to all scores to eliminate the influence of the Zero values.
Nmin = minimum samples to achieve adequacy with a= 0.1 and d = .1, df = degrees of freedom.

Transect	Sample	Total	Unknown	P. smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
1	1	0						1
1	2	1		1				2
1	3	2			1	1		3
1	4	1		1				2
1	5	0						1
1	6	0						1
1	7	0						1
1	8	0						1
1	9	0						1
1	10	0						1
1	11	2		1	1			3
1	12	0						1
1	13	0						1
1	14	0						1
1	15	0						1
1	16	0						1
1	17	0						1
1	18	0						1
1	19	0						1
1	20	0						1
Total		**6**	**0**	**3**	**2**	**1**	**0**	

Mean	0.3		**Mean**	1.3	
Std. Dev.	0.6569467		**Std. Dev.**	0.656947	
Nmin	1433.5331	for df = 19	**Nmin**	76.342	for df = 19

Seedling Density			
1.2	per m^2	12,000.0	Ha
1.0032	per yd^2	4,855.5	Acre

Transect	Sample	Total	Unknown	P. smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
3	1	0						1
3	2	0						1
3	3	2		2				3
3	4	2			1	1		3
3	5	2		2				3
3	6	7	1	3		3		8
3	7	0						1
3	8	2				2		3
3	9	0						1
3	10	0						1
3	11	0						1
3	12	2			2			3
3	13	3		2		1		4
3	14	3			1	2		4
3	15	0						1
3	16	2				2		3
3	17	10		4	3	3		11
3	18	2		1			1	3
3	19	2		1			1	3
3	20	4		3	1			5
Total		**43**	**1**	**18**	**8**	**14**	**2**	

Mean	2.15		**Mean**	3.15	
Std. Dev.	2.539685		**Std. Dev.**	2.539685	
Nmin	417.1313	for df = 19	**Nmin**	194.326	for df = 19

Seedling Density			
8.6	per m^2	86,000.0	Ha
7.1896	per yd^2	34,797.7	Acre

Transect	Sample	Total	Unknown	P. smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
5	1	1				1		2
5	2	2		1		1		3
5	3	0						1
5	4	0						1
5	5	0						1
5	6	0						1
5	7	0						1
5	8	2		2				3
5	9	1		1				2
5	10	5				5		6
5	11	0						1
5	12	0						1
5	13	2		1	1			3
5	14	2		2				3
5	15	0						1
5	16	3		2			1	4
5	17	3		1		2		4
5	18	1		1				2
5	19	1		1				2
5	20	0						1
Total		**23**	**0**	**12**	**1**	**9**	**1**	

Mean	1.15		**Mean**	2.15	
Std. Dev.	1.3869694		**Std. Dev.**	1.386969	
Nmin	434.8386	for df = 19	**Nmin**	124.4076	for df = 19

Seedling Density			
4.6	per m^2	46,000.0	Ha
3.8456	per yd^2	18,612.7	Acre

Transect	Sample	Total	Unknown	P. smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
7	1	0						1
7	2	0						1
7	3	0						1
7	4	0						1
7	5	3		2		1		4
7	6	0						1
7	7	7		5		2		8
7	8	7		5		2		8
7	9	3		2		1		4
7	10	9		6	1	2		10
7	11	2	1			1		3
7	12	1		1				2
7	13	0						1
7	14	2	1		1			3
7	15	0						1
7	16	0						1
7	17	2		1	1			3
7	18	1			1			2
7	19	2				2		3
7	20	1		1				2
Total		**40**	**2**	**23**	**4**	**11**	**0**	

Mean	2		**Mean**	3	
Std. Dev.	2.6754242		**Std. Dev.**	2.675424	
Nmin	534.9526	for df = 19	**Nmin**	237.7567	for df = 19

Seedling Density			
8	per m^2	80,000.0	Ha
6.688	per yd^2	32,369.9	Acre

Transect	Sample	Total	Unknown	P. smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
9	1	5		1		4		6
9	2	0						1
9	3	9		9				10
9	4	12		4		8		13
9	5	6		5		1		7
9	6	5		2		3		6
9	7	9		6		3		10
9	8	4		3		1		5
9	9	0						1
9	10	8		7		1		9
9	11	1		1				2
9	12	1				1		2
9	13	0						1
9	14	1		1				2
9	15	3		1		2		4
9	16	8		2	1	4	1	9
9	17	3		1		2		4
9	18	4		4				5
9	19	2		1		1		3
9	20	0						1
Total		**81**	**0**	**48**	**1**	**31**	**1**	

Mean	4.05		**Mean**	5.05	
Std. Dev.	3.6197557		**Std. Dev.**	3.619756	
Nmin	238.80228	for df = 19	**Nmin**	153.591	for df = 19

Seedling Density			
16.2	per m^2	162,000.0	Ha
13.5432	per yd^2	65,549.1	Acre

Transect	Sample	Total	Unknown	P.smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
11	1	0						1
11	2	0						1
11	3	0						1
11	4	9		7		2		10
11	5	4		2		2		5
11	6	4	1	1	1	1		5
11	7	0						1
11	8	11		6		5		12
11	9	8		4		4		9
11	10	5		3		2		6
11	11	0						1
11	12	1		1				2
11	13	0						1
11	14	1		1				2
11	15	0						1
11	16	0						1
11	17	0						1
11	18	2		2				3
11	19	2				2		3
11	20	2		1		1		3
Total		**49**	**1**	**28**	**1**	**19**	**0**	

Mean	2.45		**Mean**	3.45	
Std. Dev.	3.3791164		**Std. Dev.**	3.379116	
Nmin	568.67465	for df = 19	**Nmin**	286.7859	for df = 19

Seedling Density			
9.8	per m^2	98,000.0	Ha
8.1928	per yd^2	39,653.2	Acre

Transect	Sample	Total	Unknown	P.smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
13	1	0						1
13	2	3		1		2		4
13	3	0						1
13	4	3		1		2		4
13	5	2		2				3
13	6	2		1			1	3
13	7	1		1				2
13	8	1		1				2
13	9	4		4				5
13	10	0						1
13	11	1				1		2
13	12	2				2		3
13	13	1		1				2
13	14	0						1
13	15	2		2				3
13	16	1				1		2
13	17	2		1		1		3
13	18	0						1
13	19	4		4				5
13	20	2		1		1		3
Total		**31**	**0**	**20**	**0**	**10**	**1**	

Mean	1.55		**Mean**	2.55	
Std. Dev.	1.2763022		**Std. Dev.**	1.276302	
Nmin	202.69062	for df = 19	**Nmin**	74.88877	for df = 19

Seedling Density			
6.2	per m^2	62,000.0	Ha
5.1832	per yd^2	25,086.7	Acre

Transect	Sample	Total	Unknown	P.smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
15	1	0						1
15	2	0						1
15	3	0						1
15	4	1				1		2
15	5	3		1		2		4
15	6	1				1		2
15	7	1		1				2
15	8	2		1		1		3
15	9	1				1		2
15	10	0						1
15	11	1		1				2
15	12	4				4		5
15	13	3		2			1	4
15	14	1		1				2
15	15	0						1
15	16	0						1
15	17	0						1
15	18	2		1		1		3
15	19	0						1
15	20	2		1		1		3
Total		**22**	**0**	**9**	**0**	**12**	**1**	

Mean	1.1		**Mean**	2.1	
Std. Dev.	1.2096106		**Std. Dev.**	1.209611	
Nmin	361.4896	for df = 19	**Nmin**	99.18422	for df = 19

Seedling Density			
4.4	per m^2	44,000.0	Ha
3.6784	per yd^2	17,803.5	Acre

Transect	Sample	Total	Unknown	P.smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
17	1	2		1		1		3
17	2	1		1				2
17	3	0						1
17	4	0						1
17	5	2		1		1		3
17	6	0						1
17	7	0						1
17	8	0						1
17	9	0						1
17	10	0						1
17	11	0						1
17	12	0						1
17	13	0						1
17	14	0						1
17	15	0						1
17	16	1		1				2
17	17	0						1
17	18	2		2				3
17	19	0						1
17	20	0						1
Total		**8**	**0**	**6**	**0**	**2**	**0**	

Mean	0.4		**Mean**	1.4	
Std. Dev.	0.753937		**Std. Dev.**	0.753937	
Nmin	1062.0383	for df = 19	**Nmin**	86.697	for df = 19

Seedling Density			
1.6	per m^2	16,000.0	Ha
1.3376	per yd^2	6,474.0	Acre

Transect	Sample	Total	Unknown	P.smithii	C. gracile	B. dactyl.	B. curt.	Correction for Zeros
19	1	0						1
19	2	0						1
19	3	0						1
19	4	0						1
19	5	0						1
19	6	0						1
19	7	0						1
19	8	0						1
19	9	1				1		2
19	10	0						1
19	11	0						1
19	12	0						1
19	13	0						1
19	14	0						1
19	15	0						1
19	16	0						1
19	17	1		1				2
19	18	0						1
19	19	0						1
19	20	1				1		2
Total		**3**	**0**	**1**	**0**	**2**	**0**	

Mean	0.15		**Mean**	1.15	
Std. Dev.	0.3663475		**Std. Dev.**	0.366348	
Nmin	1783.1753	for df = 19	**Nmin**	30.33758	for df = 19

Seedling Density			
0.6	per m^2	6,000.0	Ha
0.5016	per yd^2	2,427.7	Acre

Sample adequacy for all samples combined:

Grand Mean	1.53	
Grand Sd	2.3487621	
Nmin	637.71556	for df = 199

Using zero correction method.

Grand Mean	2.53	
Grand Sd	2.348762	
Nmin	233.2216	for df = 199

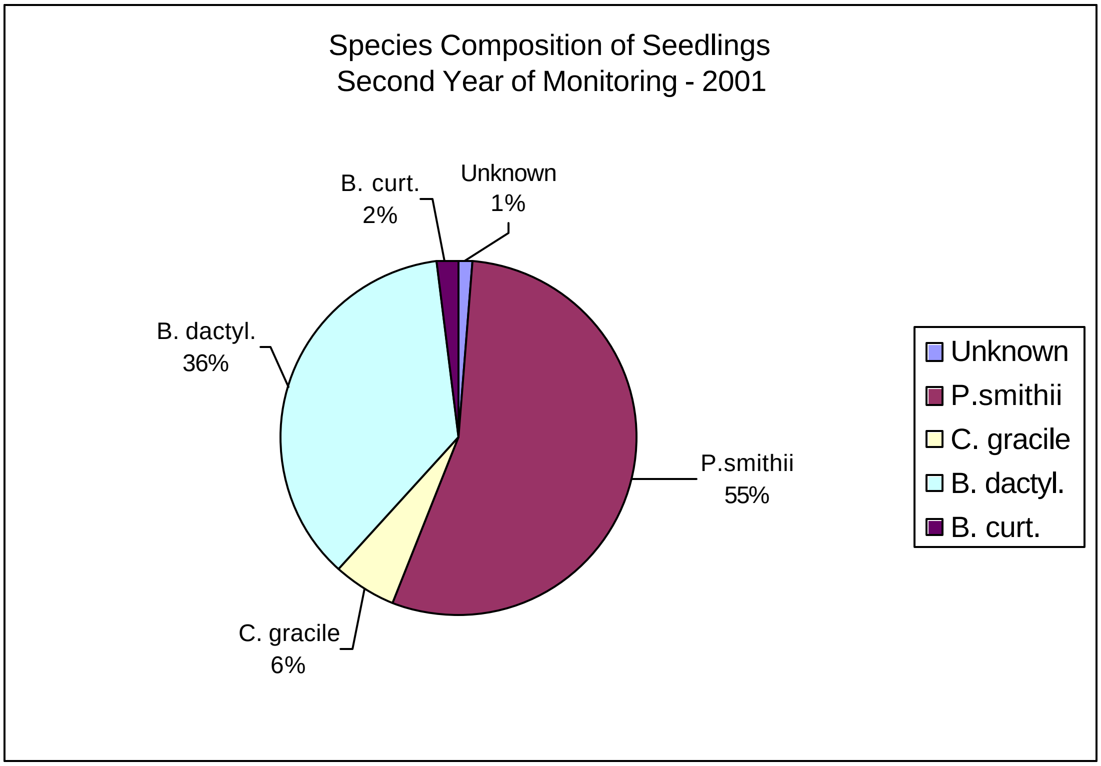


Figure 4. Species Composition of Seedlings.

Although sample adequacy was not achieved at the 0.1 detection limit, future statistical tests can be performed using a slightly lower detection limit (i.e., 0.11). Table 3 ranks the treatment plots based on the total seedlings counted in each plot.

Table 3. Treatment Plots Ranked by Seedling Density.

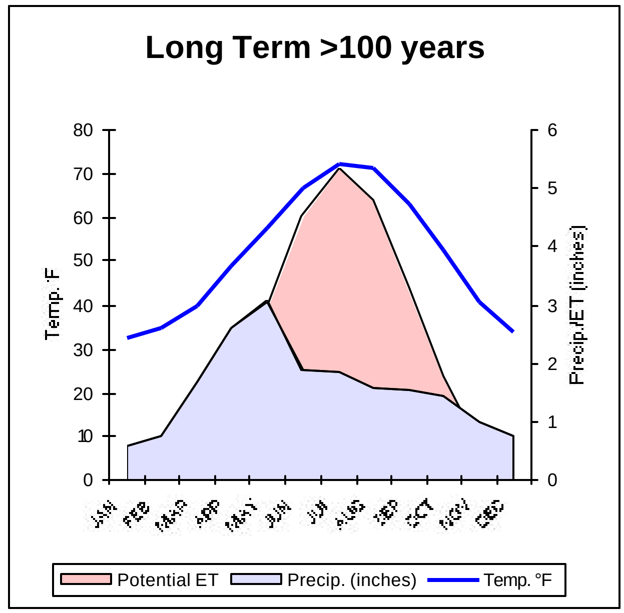
Rank	Plot ID	Total Seedlings Sampled
1	9	81
2	11	49
3	3	43
4	7	40
5	13	31
6	5	23
7	15	22
8	17	8
9	1	6
10	19	3

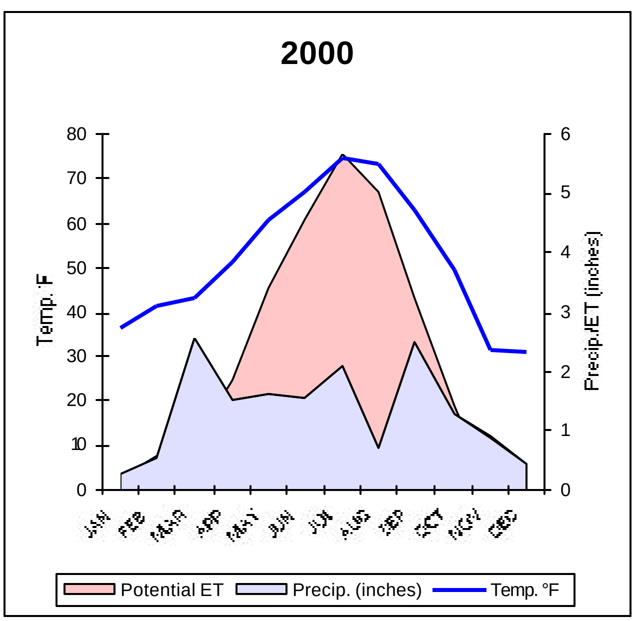
Although the planted species are not yet detectable using cover sampling techniques, they are present with a density that is easily quantifiable. Concerns regarding the immediate removal of seedlings by the praire dogs are not yet supported. There were some areas where "pitting" of the soil by prairie dogs was occurring, but this was limited to small patches, and in some areas the seedlings were abundant adjacent to large mounds. The occasional seedling abundance adjacent to large mounds may be due to enhanced water availability near the base of the mounds.

Climate

On-site temperature and precipitation data-logging equipment was installed and modified to counteract the effects of wildlife and some of the human disturbance. Human disturbances included triggering the reset buttons of the gauges. Analysis of the on-site data is not included as part of this report due to budget and time limitations.

Figure 5 shows a annual climate diagrams for Boulder. The study site is approximately 10 miles ENE of Boulder and is probably in a drier site than the Boulder NOAA Weather Station near 30th and Arapaho. The climate diagrams display the monthly precipitation and temperature along with the Thornthwaite potential evapotranspiration (Dunn & Leopold 1954). The graphs can be interpreted by observing the area under the curve of the potential evapotranspiration that exceeds precipitation. This area of the graph where potential evapotranspiration exceeds precipitation is a good indicator of drought stress experienced by plants. The first graph provides the long-term average (104 years, 1897-2000), the second shows year 2000 that had an April-May-June period that was the 5th warmest and driest in the last 105 years of record. Year 2001 can be seen to have a slightly wetter than average spring, slightly drier than average summer, and a very dry fall.





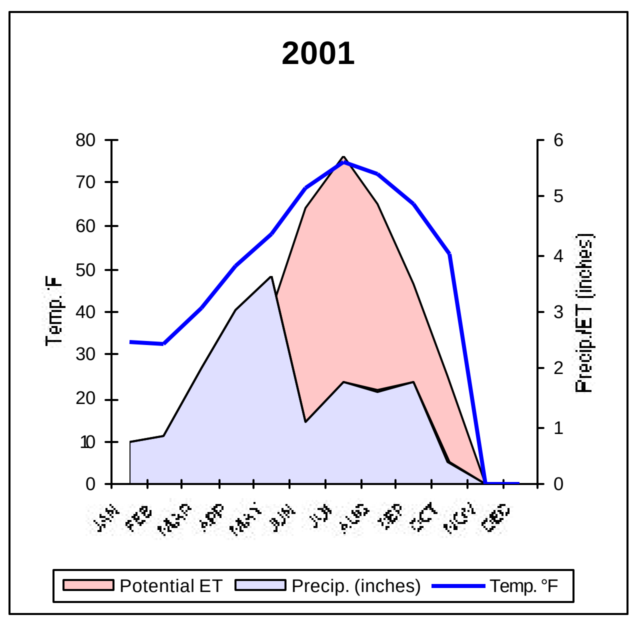


Figure 5. Boulder Climate Diagrams.

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Photographs

Photograph 1. Plot 1 – West-facing view – June 15, 2001.

Photograph 2. Plot 2 – West-facing view – June 15, 2001.

Photograph 3. Plot 3 – West-facing view – June 15, 2001.

Photograph 4. Plot 4 – West-facing view – June 15, 2001.

Photograph 5.   Plot 5 – West-facing view – June 15, 2001.

Photograph 6.   Plot 6 – West-facing view – June 15, 2001.

Photograph 7. Plot 7 – West-facing view – June 15, 2001.

Photograph 8. Plot 8 – West-facing view – June 15, 2001.

Photograph 9. Plot 9 – West-facing view – June 15, 2001.

Photograph 10. Plot 10 – West-facing view – June 15, 2001.

Photograph 11. Plot 11 – West-facing view – June 15, 2001.

Photograph 12. Plot 12 – West-facing view – June 15, 2001.

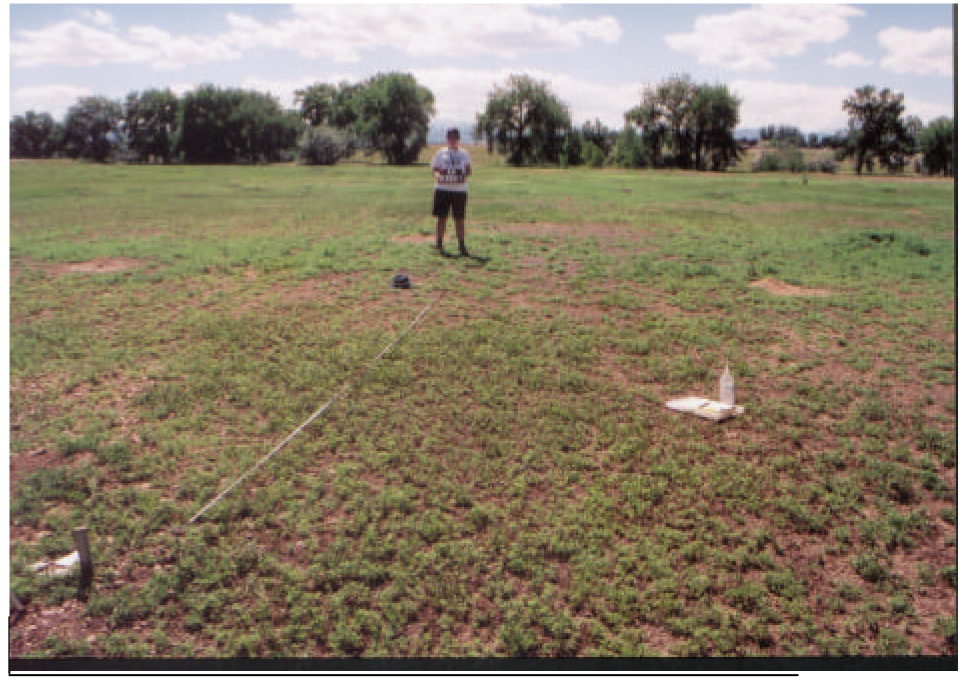
Photograph 13. Plot 13 – West-facing view – June 15, 2001.

Photograph 14. Plot 14 – West-facing view – June 15, 2001.

Photograph 15. Plot 15 – West-facing view – June 15, 2001.

Photograph 16. Plot 16 – West-facing view – June 15, 2001.

Photograph 17. Plot 17 – West-facing view – June 15, 2001.



Photograph 18. Plot 18 – West-facing view – June 15, 2001.

Photograph 19. Plot 19 – West-facing view – June 15, 2001.

Photograph 20. Plot 20 – West-facing view – June 15, 2001.

Photograph 21. Seedling density paired circular plots aligned with cover transect.

Photograph 22. Close up of seedling density paired sample plots.

APPENDIX A

Data Summary Tables

1X - Combined Transects June 15, 2001
1C - Control Transects June 15, 2001
1T - Treatment Transects June 15, 2001
2X - Combined Transects June 3, 2000
2C - Control Transects June 3, 2000
2T - Treatment Transects June 3, 2000

Table 1X. Combined Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 15, 2001

Scientific Name	Synonym	Common Name	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)
INTRODUCED ANNUAL & BIENNIAL FORBS							
Bassia sieversiana	KOCHIA SCOPARIA, K. SIEVERSIANA	BURNING-BUSH	25.95	100.00	47.05	27.20	47.93
Solanum triflorum		NIGHTSHADE	0.00	50.00	0.00	0.00	0.00
Verbascum thapsus		MULLEIN	0.05	10.00	0.09	0.05	0.09
TOTAL INTRO. ANN. & BIEN. FORBS			26.0	100.0	47.1	27.3	48.0
NATIVE PERENNIAL FORBS							
Argemone polyanthemos		PRICKLEY POPPY	0.00	25.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL FORBS			0.0	25.0	0.0	0.0	0.0
INTRODUCED PERENNIAL FORBS							
Convolvulus arvensis		BINDWEED	29.10	100.00	52.77	29.45	51.89
Verbena bracteata		VERVAIN	0.05	25.00	0.09	0.05	0.09
TOTAL INTRO. PERENNIAL FORBS			29.2	100.0	52.9	29.5	52.0
NATIVE PERENNIAL GRASSES (cool)							
Pascopyrum smithii	AGROPYRON SMITHII	WESTERN WHEATGRASS	0.00	50.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL GRASSES (c)			0.0	50.0	0.0	0.0	0.0
NATIVE PERENNIAL GRASSES (warm)							
Bouteloua curtipendula		SIDEOATS GRAMA	0.00	35.00	0.00	0.00	0.00
Buchloe dactyloides		BUFFALOGRASS	0.00	25.00	0.00	0.00	0.00
Chondrosum gracile	BOUTELOUA GRACILIS	BLUE GRAMA GRASS	0.00	45.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL GRASSES (w)			0.0	50.0	0.0	0.0	0.0
Litter		LITTER	23.50	100.00		23.50	
Bare soil		BARE SOIL	20.65	100.00		20.65	
Rock		ROCK	0.70	40.00		0.70	
TOTALS			100.0			101.6	
TOTAL VEGETATION COVER			55.1 (s=12.6)		100.0	56.7 (s=13.4)	100.0
GROUND COVER (Litter+Rock+Veg+St.Dead)			79.3			81.0	
SPECIES DENSITY (# of species/100 sq.m.)							
(AVERAGE= 4.7 Std.Dev.= 1.9)							

Table 1X. Combined Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 15, 2001

	Percent Foliar Cover ----- SAMPLE NUMBER -----									
Scientific Name	1	2	3	4	5	6	7	8	9	10
INTRODUCED ANNUAL & BIENNIAL FORBS										
Bassia sieversiana	15(2)	28	20(2)	24(3)	30(1)	19	22(3)	13(3)	14(2)	17(1)
Solanum triflorum	P*	P	P	P						
Verbascum thapsus					P	1				
TOTAL INTRO. ANN. & BIEN. FORBS	15(2)	28	20(2)	24(3)	30(1)	20	22(3)	13(3)	14(2)	17(1)
NATIVE PERENNIAL FORBS										
Argemone polyanthemos					P					
TOTAL NATIVE PERENNIAL FORBS	---	---	---	---	P	---	---	---	---	---
INTRODUCED PERENNIAL FORBS										
Convolvulus arvensis	29	18	30	53	45(1)	40	48(2)	60	55	47(1)
Verbena bracteata	1	P	P	P		P				
TOTAL INTRO. PERENNIAL FORBS	30	18	30	53	45(1)	40	48(2)	60	55	47(1)
NATIVE PERENNIAL GRASSES (cool)										
Pascopyrum smithii	P		P		P		P		P	
TOTAL NATIVE PERENNIAL GRASSES (c)	P	---	P	---	P	---	P	---	P	---
NATIVE PERENNIAL GRASSES (warm)										
Bouteloua curtipendula			P		P		P		P	
Buchloe dactyloides	P		P				P			
Chondrosum gracile	P		P		P		P		P	
TOTAL NATIVE PERENNIAL GRASSES (w)	P	---	P	---	P	---	P	---	P	---
Litter	19	21	29	16	15	18	23	23	24	24
Bare soil	35	30	20	7	7	19	7	4	6	12
Rock	1	3	1		3	3			1	
TOTALS	100	100	100	100	100	100	100	100	100	100
TOTAL VEGETATION COVER	45(2)	46	50(2)	77(3)	75(2)	60	70(5)	73(3)	69(2)	64(2)
GROUND COVER (Litter+Rock+Veg+St.Dead)	65(2)	70	80(2)	93(3)	93(2)	81	93(5)	96(3)	94(2)	88(2)
SPECIES DENSITY (# of species/100 sq.m.)	7	4	8	4	7	4	6	2	5	2
(AVERAGE= 4.7 Std.Dev.= 1.9)										

*P=Present within 1 m. on either side of the cover transect, but not quantitatively encountered.

(#)= additional hits after the first hit

Table 1X. Combined Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 15, 2001

	Percent Foliar Cover ----- SAMPLE NUMBER -----									
Scientific Name	11	12	13	14	15	16	17	18	19	20
INTRODUCED ANNUAL & BIENNIAL FORBS										
Bassia sieversiana	28(1)	25(2)	23(1)	31(3)	28	30	34(1)	38	45	35
Solanum triflorum					P*	P	P	P	P	P
Verbascum thapsus										
TOTAL INTRO. ANN. & BIEN. FORBS	28(1)	25(2)	23(1)	31(3)	28	30	34(1)	38	45	35
NATIVE PERENNIAL FORBS										
Argemone polyanthemos						P	P	P	P	
TOTAL NATIVE PERENNIAL FORBS	---	---	---	---	---	P	P	P	P	---
INTRODUCED PERENNIAL FORBS										
Convolvulus arvensis	34(1)	31	24(1)	11(1)	12	13	16	2	6	8
Verbena bracteata										
TOTAL INTRO. PERENNIAL FORBS	34(1)	31	24(1)	11(1)	12	13	16	2	6	8
NATIVE PERENNIAL GRASSES (cool)										
Pascopyrum smithii	P		P		P		P		P	
TOTAL NATIVE PERENNIAL GRASSES (c)	P	---	P	---	P	---	P	---	P	---
NATIVE PERENNIAL GRASSES (warm)										
Bouteloua curtipendula	P		P						P	
Buchloe dactyloides			P				P			
Chondrosum gracile	P		P		P		P			
TOTAL NATIVE PERENNIAL GRASSES (w)	P	---	P	---	P	---	P	---	P	---
Litter	18	25	31	28	20	28	25	32	13	38
Bare soil	20	19	21	29	40	29	25	28	36	19
Rock			1	1						
TOTALS	100	100	100	100	100	100	100	100	100	100
TOTAL VEGETATION COVER	62(2)	56(2)	47(2)	42(4)	40	43	50(1)	40	51	43
GROUND COVER (Litter+Rock+Veg+St.Dead)	80(2)	81(2)	79(2)	71(4)	60	71	75(1)	72	64	81
SPECIES DENSITY (# of species/100 sq.m.)	5	2	6	2	5	4	7	4	6	3
(AVERAGE= 4.7 Std.Dev.= 1.9)										

*P=Present within 1 m. on either side of the cover transect, but not quantitatively encountered.

(#)= additional hits after the first hit

Table 1C. Control Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 15, 2001

Scientific Name	Synonym	Common Name	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)
INTRODUCED ANNUAL & BIENNIAL FORBS							
Bassia sieversiana	KOCHIA SCOPARIA, K. SIEVERSIANA	BURNING-BUSH	26.00	100.00	47.79	27.20	48.75
Solanum triflorum		NIGHTSHADE	0.00	50.00	0.00	0.00	0.00
Verbascum thapsus		MULLEIN	0.10	10.00	0.18	0.10	0.18
TOTAL INTRO. ANN. & BIEN. FORBS			26.1	100.0	48.0	27.3	48.9
NATIVE PERENNIAL FORBS							
Argemone polyanthemos		PRICKLEY POPPY	0.00	20.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL FORBS			0.0	20.0	0.0	0.0	0.0
INTRODUCED PERENNIAL FORBS							
Convolvulus arvensis		BINDWEED	28.30	100.00	52.02	28.50	51.08
Verbena bracteata		VERVAIN	0.00	30.00	0.00	0.00	0.00
TOTAL INTRO. PERENNIAL FORBS			28.3	100.0	52.0	28.5	51.1
Litter			25.30	100.00		25.30	
Bare soil			19.60	100.00		19.60	
Rock			0.70	30.00		0.70	
TOTALS			100.0			101.4	
TOTAL VEGETATION COVER			54.4 (s=13.6)		100.0	55.8 (s=14.5)	100.0
GROUND COVER (Litter+Rock+Veg+St.Dead)			80.4			81.8	
SPECIES DENSITY (# of species/100 sq.m.)							
(AVERAGE= 3.1 Std.Dev.= 1.0)							

Table 1C. Control Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 15, 2001

	Percent Foliar Cover									
	----- SAMPLE NUMBER -----									
Scientific Name	2	4	6	8	10	12	14	16	18	20
INTRODUCED ANNUAL & BIENNIAL FORBS										
Bassia sieversiana	28	24(3)	19	13(3)	17(1)	25(2)	31(3)	30	38	35
Solanum triflorum	P	P						P	P	P
Verbascum thapsus			1							
TOTAL INTRO. ANN. & BIEN. FORBS	28	24(3)	20	13(3)	17(1)	25(2)	31(3)	30	38	35
NATIVE PERENNIAL FORBS										
Argemone polyanthemos								P	P	
TOTAL NATIVE PERENNIAL FORBS	---	---	---	---	---	---	---	P	P	---
INTRODUCED PERENNIAL FORBS										
Convolvulus arvensis	18	53	40	60	47(1)	31	11(1)	13	2	8
Verbena bracteata	P	P	P							
TOTAL INTRO. PERENNIAL FORBS	18	53	40	60	47(1)	31	11(1)	13	2	8
Litter	21	16	18	23	24	25	28	28	32	38
Bare soil	30	7	19	4	12	19	29	29	28	19
Rock	3		3				1			
TOTALS	100	100	100	100	100	100	100	100	100	100
TOTAL VEGETATION COVER	46	77(3)	60	73(3)	64(2)	56(2)	42(4)	43	40	43
GROUND COVER (Litter+Rock+Veg+St.Dead)	70	93(3)	81	96(3)	88(2)	81(2)	71(4)	71	72	81
SPECIES DENSITY (# of species/100 sq.m.)	4	4	4	2	2	2	2	4	4	3
(AVERAGE= 3.1 Std.Dev.= 1.0)										

*P=Present within 1 m. on either side of the cover transect, but not quantitatively encountered.

(#)= additional hits after the first hit

Table 1T. Treatment Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 15, 2001

Scientific Name	Synonym	Common Name	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)
INTRODUCED ANNUAL & BIENNIAL FORBS							
Bassia sieversiana	KOCHIA SCOPARIA, K. SIEVERSIANA	BURNING-BUSH	25.90	100.00	46.33	27.20	47.14
Solanum triflorum		NIGHTSHADE	0.00	50.00	0.00	0.00	0.00
Verbascum thapsus		MULLEIN	0.00	10.00	0.00	0.00	0.00
TOTAL INTRO. ANN. & BIEN. FORBS			25.9	100.0	46.3	27.2	47.1
NATIVE PERENNIAL FORBS							
Argemone polyanthemos		PRICKLEY POPPY	0.00	30.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL FORBS			0.0	30.0	0.0	0.0	0.0
INTRODUCED PERENNIAL FORBS							
Convolvulus arvensis		BINDWEED	29.90	100.00	53.49	30.40	52.69
Verbena bracteata		VERVAIN	0.10	20.00	0.18	0.10	0.17
TOTAL INTRO. PERENNIAL FORBS			30.0	100.0	53.7	30.5	52.9
NATIVE PERENNIAL GRASSES (cool)							
Pascopyrum smithii	AGROPYRON SMITHII	WESTERN WHEATGRASS	0.00	100.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL GRASSES (c)			0.0	100.0	0.0	0.0	0.0
NATIVE PERENNIAL GRASSES (warm)							
Bouteloua curtipendula		SIDEOATS GRAMA	0.00	70.00	0.00	0.00	0.00
Buchloe dactyloides		BUFFALOGRASS	0.00	50.00	0.00	0.00	0.00
Chondrosum gracile	BOUTELOUA GRACILIS	BLUE GRAMA GRASS	0.00	90.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL GRASSES (w)			0.0	100.0	0.0	0.0	0.0
Litter			21.70	100.00		21.70	
Bare soil			21.70	100.00		21.70	
Rock			0.70	50.00		0.70	
TOTALS			100.0			101.8	
TOTAL VEGETATION COVER			55.9 (s=12.1)		100.0	57.7 (s=13.0)	100.0
GROUND COVER (Litter+Rock+Veg+St.Dead)			78.3			80.1	
SPECIES DENSITY (# of species/100 sq.m.)							
(AVERAGE= 6.2 Std.Dev.= 1.0)							

	Percent Foliar Cover									
	----- SAMPLE NUMBER -----									
Scientific Name	1	3	5	7	9	11	13	15	17	19
INTRODUCED ANNUAL & BIENNIAL FORBS										
Bassia sieversiana	15(2)	20(2)	30(1)	22(3)	14(2)	28(1)	23(1)	28	34(1)	45
Solanum triflorum	P	P						P	P	P
Verbascum thapsus			P							
TOTAL INTRO. ANN. & BIEN. FORBS	15(2)	20(2)	30(1)	22(3)	14(2)	28(1)	23(1)	28	34(1)	45
NATIVE PERENNIAL FORBS										
Argemone polyanthemos			P						P	P
TOTAL NATIVE PERENNIAL FORBS	---	---	P	---	---	---	---	---	P	P
INTRODUCED PERENNIAL FORBS										
Convolvulus arvensis	29	30	45(1)	48(2)	55	34(1)	24(1)	12	16	6
Verbena bracteata	1	P								
TOTAL INTRO. PERENNIAL FORBS	30	30	45(1)	48(2)	55	34(1)	24(1)	12	16	6
NATIVE PERENNIAL GRASSES (cool)										
Pascopyrum smithii	P	P	P	P	P	P	P	P	P	P
TOTAL NATIVE PERENNIAL GRASSES (c)	P	P	P	P	P	P	P	P	P	P
NATIVE PERENNIAL GRASSES (warm)										
Bouteloua curtipendula		P	P	P	P	P	P			P
Buchloe dactyloides	P	P		P			P		P	
Chondrosum gracile	P	P	P	P	P	P	P	P	P	
TOTAL NATIVE PERENNIAL GRASSES (w)	P	P	P	P	P	P	P	P	P	P
Litter	19	29	15	23	24	18	31	20	25	13
Bare soil	35	20	7	7	6	20	21	40	25	36
Rock	1	1	3		1		1			
TOTALS	100	100	100	100	100	100	100	100	100	100
TOTAL VEGETATION COVER	45(2)	50(2)	75(2)	70(5)	69(2)	62(2)	47(2)	40	50(1)	51
GROUND COVER (Litter+Rock+Veg+St.Dead)	65(2)	80(2)	93(2)	93(5)	94(2)	80(2)	79(2)	60	75(1)	64
SPECIES DENSITY (# of species/100 sq.m.)	7	8	7	6	5	5	6	5	7	6
(AVERAGE= 6.2 Std.Dev.= 1.0)										

*P=Present within 1 m. on either side of the cover transect, but not quantitatively encountered.

(#)= additional hits after the first hit

Table 2X. Combined Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 3, 2000

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)
NATIVE ANNUAL & BIENNIAL FORBS					
Oenothera villosa ssp. strigosa	0.00	5.00	0.00	0.00	0.00
TOTAL NATIVE ANN. & BIEN. FORBS	0.0	5.0	0.0	0.0	0.0
INTRODUCED ANNUAL & BIENNIAL FORBS					
Arctium minus	0.00	5.00	0.00	0.00	0.00
Bassia sieversiana	19.95	100.00	34.61	23.95	37.63
Bassia sieversiana (dead)	1.75	35.00		1.75	2.75
Conyza canadensis	0.00	5.00	0.00	0.00	0.00
Descurainia sophia	0.00	50.00	0.00	0.00	0.00
Lactuca serriola	0.00	10.00	0.00	0.00	0.00
Sisymbrium altissimum	0.05	90.00	0.09	0.05	0.08
TOTAL INTRO. ANN. & BIEN. FORBS	20.0	100.0	34.7	24.0	38.8
NATIVE PERENNIAL FORBS					
Acetosella vulgaris	0.05	45.00	0.09	0.05	0.08
Ambrosia psilostachya var. coronopifolia	0.05	5.00	0.09	0.05	0.08
Argemone polyanthemos	0.00	5.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL FORBS	0.1	50.0	0.2	0.1	0.2
INTRODUCED PERENNIAL FORBS					
Breea arvensis	0.00	5.00	0.00	0.00	0.00
Convolvulus arvensis	37.50	100.00	65.05	37.75	59.31
Convolvulus arvensis (dead)	0.00	10.00		0.00	0.00
Rumex crispus	0.00	10.00	0.00	0.00	0.00
Verbena bracteata	0.05	55.00	0.09	0.05	0.08
TOTAL INTRO. PERENNIAL FORBS	37.6	100.0	65.1	37.8	61.1
NATIVE PERENNIAL GRASSES (cool)					
Pascopyrum smithii	0.00	45.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL GRASSES (c)	0.0	45.0	0.0	0.0	0.0
NATIVE PERENNIAL GRASSES (warm)					
Chondrosum gracile	0.00	45.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL GRASSES (w)	0.0	45.0	0.0	0.0	0.0
NATIVE SHRUBS					
Rosa arkansana	0.00	5.00	0.00	0.00	0.00
TOTAL NATIVE SHRUBS	0.0	5.0	0.0	0.0	0.0
Litter	22.50	100.00		22.50	
Bare soil	17.90	100.00		17.90	
Rock	0.40	25.00		0.40	
TOTALS (excludes standing dead)	98.4			104.5	
TOTAL VEGETATION COVER	57.6 (s=14.0)		100.0	63.6 (s=14.0)	100.0
GROUND COVER (Litter+Rock+Veg+St.Dead)	80.6			86.6	
SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 5.9 Std.Dev.= 1.8)					

Table 2X. Combined Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 3, 2000

PLANT SPECIES	Percent Foliar Cover* ----- SAMPLE NUMBER -----									
	1	2	3	4	5	6	7	8	9	10
NATIVE ANNUAL & BIENNIAL FORBS										
Oenothera villosa ssp. strigosa								P		
TOTAL NATIVE ANN. & BIEN. FORBS	---	---	---	---	---	---	---	P	---	---
INTRODUCED ANNUAL & BIENNIAL FORBS										
Arctium minus										
Bassia sieversiana	16(1)	28(3)	5(4)	27(9)	25(2)	26(10)	16(3)	9(4)	8(1)	19(5)
Bassia sieversiana (dead)					[1]	[9]	[1]			
Conyza canadensis	P									
Descurainia sophia	P	P	P		P	P	P	P		
Lactuca serriola										
Sisymbrium altissimum	P		P	P	P	P	P	1		P
TOTAL INTRO. ANN. & BIEN. FORBS	16(1)	28(3)	5(4)	27(9)	25(2)	26(10)	16(3)	10(4)	8(1)	19(5)
NATIVE PERENNIAL FORBS										
Acetosella vulgaris	P		1				P		P	
Ambrosia psilostachya var. coronopifolia					1					
Argemone polyanthemos										
TOTAL NATIVE PERENNIAL FORBS	P	---	1	---	1	---	P	---	P	---
INTRODUCED PERENNIAL FORBS										
Breea arvensis										
Convolvulus arvensis	51	28	70	56	48	25(1)	50	64(1)	65	43
Convolvulus arvensis (dead)				P	P					
Rumex crispus										
Verbena bracteata		1	P	P				P	P	P
TOTAL INTRO. PERENNIAL FORBS	51	29	70	56	48	25(1)	50	64(1)	65	43
NATIVE PERENNIAL GRASSES (cool)										
Pascopyrum smithii	P		P				P		P	
TOTAL NATIVE PERENNIAL GRASSES (c)	P	---	P	---	---	---	P	---	P	---
NATIVE PERENNIAL GRASSES (warm)										
Chondrosum gracile	P		P				P		P	
TOTAL NATIVE PERENNIAL GRASSES (w)	P	---	P	---	---	---	P	---	P	---
NATIVE SHRUBS										
Rosa arkansana										
TOTAL NATIVE SHRUBS	---	---	---	---	---	---	---	---	---	---
Litter	9	27	8	14	20	24	19	20	12	23
Bare soil	23	16	16	3	6	15	14	6	15	15
Rock	1	1				3				
TOTALS (excludes standing dead)	100	101	100	100	100	93	99	100	100	100
TOTAL VEGETATION COVER	67(1)	57(3)	76(4)	83(9)	74(2)	51(11)	66(3)	74(5)	73(1)	62(5)
GROUND COVER (Litter+Rock+Veg+St.Dead)	77(1)	85(3)	84(4)	97(9)	94(2)	78(11)	85(3)	94(5)	85(1)	85(5)
SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 5.9 Std.Dev.= 1.8)	8	4	8	4	5	4	7	6	6	4

*P=Present within 1 m. on either side of the cover transect, but not quantitatively encountered.
(#)= additional hits after the first hit
[#] = first hits on standing dead vegetation

Table 2X. Combined Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 3, 2000

PLANT SPECIES	Percent Foliar Cover* ----- SAMPLE NUMBER -----									
	11	12	13	14	15	16	17	18	19	20
NATIVE ANNUAL & BIENNIAL FORBS										
Oenothera villosa ssp. strigosa										
TOTAL NATIVE ANN. & BIEN. FORBS	---	---	---	---	---	---	---	---	---	---
INTRODUCED ANNUAL & BIENNIAL FORBS										
Arctium minus						P				
Bassia sieversiana	13(3)	13(5)	13	25(1)	19(2)	24(2)	17(2)	28(10)	36(5)	32(8)
Bassia sieversiana (dead)		[1]						[12]	[3]	[8]
Conyza canadensis										
Descurainia sophia		P	P				P			
Lactuca serriola						P		P		
Sisymbrium altissimum	P	P	P	P	P	P	P	P	P	P
TOTAL INTRO. ANN. & BIEN. FORBS	13(3)	13(5)	13	25(1)	19(2)	24(2)	17(2)	28(10)	36(5)	32(8)
NATIVE PERENNIAL FORBS										
Acetosella vulgaris	P		P		P		P		P	
Ambrosia psilostachya var. coronopifolia										
Argemone polyanthemos									P	
TOTAL NATIVE PERENNIAL FORBS	P	---	P	---	P	---	P	---	P	---
INTRODUCED PERENNIAL FORBS										
Breea arvensis						P				
Convolvulus arvensis	44(1)	47(1)	42	23	28	17	21	8	10	10(1)
Convolvulus arvensis (dead)										
Rumex crispus					P	P				
Verbena bracteata	P	P			P	P		P		
TOTAL INTRO. PERENNIAL FORBS	44(1)	47(1)	42	23	28	17	21	8	10	10(1)
NATIVE PERENNIAL GRASSES (cool)										
Pascopyrum smithii	P		P		P		P		P	
TOTAL NATIVE PERENNIAL GRASSES (c)	P	---	P	---	P	---	P	---	P	---
NATIVE PERENNIAL GRASSES (warm)										
Chondrosum gracile	P		P		P		P		P	
TOTAL NATIVE PERENNIAL GRASSES (w)	P	---	P	---	P	---	P	---	P	---
NATIVE SHRUBS										
Rosa arkansana						P				
TOTAL NATIVE SHRUBS	---	---	---	---	---	P	---	---	---	---
Litter	14	20	20	30	25	42	25	40	21	37
Bare soil	29	19	25	20	27	17	37	12	30	13
Rock				2	1					
TOTALS (excludes standing dead)	100	99	100	100	100	100	100	88	97	92
TOTAL VEGETATION COVER	57(4)	60(6)	55	48(1)	47(2)	41(2)	38(2)	36(10)	46(5)	42(9)
GROUND COVER (Litter+Rock+Veg+St.Dead)	71(4)	80(6)	75	80(1)	73(2)	83(2)	63(2)	76(10)	67(5)	79(9)
SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 5.9 Std.Dev.= 1.8)	7	5	7	3	8	9	7	5	7	3

*P=Present within 1 m. on either side of the cover transect, but not quantitatively encountered.
(#)= additional hits after the first hit
[#] = first hits on standing dead vegetation

Table 2C. Control Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 3, 2000

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)
NATIVE ANNUAL & BIENNIAL FORBS					
Oenothera villosa ssp. strigosa	0.00	10.00	0.00	0.00	0.00
TOTAL NATIVE ANN. & BIEN. FORBS	0.0	10.0	0.0	0.0	0.0
INTRODUCED ANNUAL & BIENNIAL FORBS					
Arctium minus	0.00	10.00	0.00	0.00	0.00
Bassia sieversiana	23.10	100.00	41.70	28.80	44.65
Bassia sieversiana (dead)	3.00	40.00		3.00	4.65
Descurainia sophia	0.00	40.00	0.00	0.00	0.00
Lactuca serriola	0.00	20.00	0.00	0.00	0.00
Sisymbrium altissimum	0.10	90.00	0.18	0.10	0.16
TOTAL INTRO. ANN. & BIEN. FORBS	23.2	100.0	41.9	28.9	47.0
INTRODUCED PERENNIAL FORBS					
Breea arvensis	0.00	10.00	0.00	0.00	0.00
Convolvulus arvensis	32.10	100.00	57.94	32.50	50.39
Convolvulus arvensis (dead)	0.00	10.00		0.00	0.00
Rumex crispus	0.00	10.00	0.00	0.00	0.00
Verbena bracteata	0.10	70.00	0.18	0.10	0.16
TOTAL INTRO. PERENNIAL FORBS	32.2	100.0	58.1	32.6	53.0
NATIVE SHRUBS					
Rosa arkansana	0.00	10.00	0.00	0.00	0.00
TOTAL NATIVE SHRUBS	0.0	10.0	0.0	0.0	0.0
Litter	27.70	100.00		27.70	
Bare soil	13.60	100.00		13.60	
Rock	0.60	30.00		0.60	
TOTALS	97.3			106.4	
TOTAL VEGETATION COVER	55.4 (s=15.0)		100.0	64.5 (s=15.4)	100.0
GROUND COVER (Litter+Rock+Veg+St.Dead)	83.7			92.8	
SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 4.7 Std.Dev.= 1.8)					

Table 2C. Control Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 3, 2000

PLANT SPECIES	Percent Foliar Cover* ----- SAMPLE NUMBER ----- 2	4	6	8	10	12	14	16	18	20
NATIVE ANNUAL & BIENNIAL FORBS										
Oenothera villosa ssp. strigosa				P						
TOTAL NATIVE ANN. & BIEN. FORBS	---	---	---	P	---	---	---	---	---	---
INTRODUCED ANNUAL & BIENNIAL FORBS										
Arctium minus								P		
Bassia sieversiana	28(3)	27(9)	26(10)	9(4)	19(5)	13(5)	25(1)	24(2)	28(10)	32(8)
Bassia sieversiana (dead)			[9]			[1]			[12]	[8]
Descurainia sophia	P		P	P		P				
Lactuca serriola								P	P	
Sisymbrium altissimum		P	P	1	P	P	P	P	P	P
TOTAL INTRO. ANN. & BIEN. FORBS	28(3)	27(9)	26(10)	10(4)	19(5)	13(5)	25(1)	24(2)	28(10)	32(8)
INTRODUCED PERENNIAL FORBS										
Breea arvensis								P		
Convolvulus arvensis	28	56	25(1)	64(1)	43	47(1)	23	17	8	10(1)
Convolvulus arvensis (dead)		P								
Rumex crispus								P		
Verbena bracteata	1	P		P	P	P		P	P	
TOTAL INTRO. PERENNIAL FORBS	29	56	25(1)	64(1)	43	47(1)	23	17	8	10(1)
NATIVE SHRUBS										
Rosa arkansana								P		
TOTAL NATIVE SHRUBS	---	---	---	---	---	---	---	P	---	---
Litter	27	14	24	20	23	20	30	42	40	37
Bare soil	16	3	15	6	15	19	20	17	12	13
Rock	1		3				2			
TOTALS	101	100	93	100	100	99	100	100	88	92
TOTAL VEGETATION COVER	57(3)	83(9)	51(11)	74(5)	62(5)	60(6)	48(1)	41(2)	36(10)	42(9)
GROUND COVER (Litter+Rock+Veg+St.Dead)	85(3)	97(9)	78(11)	94(5)	85(5)	80(6)	80(1)	83(2)	76(10)	79(9)
SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 4.7 Std.Dev.= 1.8)	4	4	4	6	4	5	3	9	5	3

*P=Present within 1 m. on either side of the cover transect, but not quantitatively encountered.
(#)= additional hits after the first hit
[#] = first hits on standing dead vegetation

Table 2T. Treatment Cover Data - Prairie Dog Revegetation Area, Boulder County Open Space, CO - June 3, 2000

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)
INTRODUCED ANNUAL & BIENNIAL FORBS					
Bassia sieversiana	16.80	100.00	28.05	19.10	30.41
Bassia sieversiana (dead)	0.50	30.00		0.50	0.80
Conyza canadensis	0.00	10.00	0.00	0.00	0.00
Descurainia sophia	0.00	60.00	0.00	0.00	0.00
Sisymbrium altissimum	0.00	90.00	0.00	0.00	0.00
TOTAL INTRO. ANN. & BIEN. FORBS	16.8	100.0	28.0	19.1	30.7
NATIVE PERENNIAL FORBS					
Acetosella vulgaris	0.10	90.00	0.17	0.10	0.16
Ambrosia psilostachya var. coronopifolia	0.10	10.00	0.17	0.10	0.16
Argemone polyanthemos	0.00	10.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL FORBS	0.2	100.0	0.3	0.2	0.3
INTRODUCED PERENNIAL FORBS					
Convolvulus arvensis	42.90	100.00	71.62	43.00	68.47
Convolvulus arvensis (dead)	0.00	10.00		0.00	0.00
Rumex crispus	0.00	10.00	0.00	0.00	0.00
Verbena bracteata	0.00	40.00	0.00	0.00	0.00
TOTAL INTRO. PERENNIAL FORBS	42.9	100.0	71.6	43.0	69.0
NATIVE PERENNIAL GRASSES (cool)					
Pascopyrum smithii	0.00	90.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL GRASSES (c)	0.0	90.0	0.0	0.0	0.0
NATIVE PERENNIAL GRASSES (warm)					
Chondrosum gracile	0.00	90.00	0.00	0.00	0.00
TOTAL NATIVE PERENNIAL GRASSES (w)	0.0	90.0	0.0	0.0	0.0
Litter	17.30	100.00		17.30	
Bare soil	22.20	100.00		22.20	
Rock	0.20	20.00		0.20	
TOTALS	99.6			102.5	
TOTAL VEGETATION COVER	59.9 (s=13.3)		100.0	62.8 (s=13.2)	100.0
GROUND COVER (Litter+Rock+Veg+St.Dead)	77.4			80.3	
SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 7.0 Std.Dev.= 0.9)					

PLANT SPECIES	Percent Foliar Cover*									
	----- SAMPLE NUMBER -----									
	1	3	5	7	9	11	13	15	17	19
INTRODUCED ANNUAL & BIENNIAL FORBS										
Bassia sieversiana	16(1)	5(4)	25(2)	16(3)	8(1)	13(3)	13	19(2)	17(2)	36(5)
Bassia sieversiana (dead)			[1]	[1]						[3]
Conyza canadensis	P									
Descurainia sophia	P	P	P	P			P		P	
Sisymbrium altissimum	P	P	P	P		P	P	P	P	P
TOTAL INTRO. ANN. & BIEN. FORBS	16(1)	5(4)	25(2)	16(3)	8(1)	13(3)	13	19(2)	17(2)	36(5)
NATIVE PERENNIAL FORBS										
Acetosella vulgaris	P	1		P	P	P	P	P	P	P
Ambrosia psilostachya var. coronopifolia			1							
Argemone polyanthemos										P
TOTAL NATIVE PERENNIAL FORBS	P	1	1	P	P	P	P	P	P	P
INTRODUCED PERENNIAL FORBS										
Convolvulus arvensis	51	70	48	50	65	44(1)	42	28	21	10
Convolvulus arvensis (dead)			P							
Rumex crispus								P		
Verbena bracteata		P			P	P		P		
TOTAL INTRO. PERENNIAL FORBS	51	70	48	50	65	44(1)	42	28	21	10
NATIVE PERENNIAL GRASSES (cool)										
Pascopyrum smithii	P	P		P	P	P	P	P	P	P
TOTAL NATIVE PERENNIAL GRASSES (c)	P	P	---	P	P	P	P	P	P	P
NATIVE PERENNIAL GRASSES (warm)										
Chondrosum gracile	P	P		P	P	P	P	P	P	P
TOTAL NATIVE PERENNIAL GRASSES (w)	P	P	---	P	P	P	P	P	P	P
Litter	9	8	20	19	12	14	20	25	25	21
Bare soil	23	16	6	14	15	29	25	27	37	30
Rock	1							1		
TOTALS	100	100	100	99	100	100	100	100	100	97
TOTAL VEGETATION COVER	67(1)	76(4)	74(2)	66(3)	73(1)	57(4)	55	47(2)	38(2)	46(5)
GROUND COVER (Litter+Rock+Veg+St.Dead)	77(1)	84(4)	94(2)	85(3)	85(1)	71(4)	75	73(2)	63(2)	67(5)
SPECIES DENSITY (# of species/100 sq.m.) (AVERAGE= 7.0 Std.Dev.= 0.9)	8	8	5	7	6	7	7	8	7	7

*P=Present within 1 m. on either side of the cover transect, but not quantitatively encountered.
(#)= additional hits after the first hit
[#] = first hits on standing dead vegetation