Report 6

Prescribed Burn

6. 2000 Buffer Zone Prescribed Burn: Pre- and Post-Burn Monitoring Summary

6.1 Purpose

Prescribed burning is an important tool for managing native grasslands. To maintain the health and vigor of the native plant species, reduce plant litter and the potential for wildfire, recycle nutrients, and help with weed control, the use of prescribed burns has been proposed to help manage the grassland communities at the Rocky Flats Environmental Technology Site (the Site). As with all land management actions, monitoring is an integral part of determining whether the objectives and goals for a particular management technique are being achieved. On April 6, 2000, a 48-acre prescribed burn was conducted by the U.S. Forest Service on the xeric tallgrass prairie in the south Buffer Zone at the Site. (Photographic documentation of the prescribed burn is available in Appendix C on the CD-ROM). To evaluate the effect of the prescribed burn on the plant community, a quantitative monitoring program was instituted in the summer of 1999 to provide pre-burn data. After the burn, monitoring was conducted throughout the summer of 2000 to gather post-burn data.

The following general questions were proposed for investigation:

1. How will a prescribed burn affect the species richness and species diversity of the xeric tallgrass prairie?
2. What impact will a prescribed burn have on the foliar cover of the xeric tallgrass prairie? Specifically, what impact is there to the following categories of foliar cover: overall cover, native cover, non-native cover, forb cover, overall graminoid cover, warm-season graminoid cover, and cool-season graminoid cover?
3. What impact will a prescribed burn have on the frequency of individual plant species on the xeric tallgrass prairie?
4. What impact will a prescribed burn have on specific weed species?
5. How much litter biomass will be removed by a prescribed burn?
6. How does the fire response of the xeric tallgrass prairie at the Site compare to other locations of the tallgrass prairie?
7. What recommendations can be made with regard to the use of prescribed burns for management of the xeric tallgrass prairie at the Site?

This report summarizes the pre-burn and post-burn conditions at the locations where monitoring was conducted during 1999 and 2000.

6.2 Methods

The xeric tallgrass prairie at the Site is located primarily on the pediment, which is underlain by Rocky Flats Alluvium (SCS 1980). The soils are classified as Flatirons very cobbly sandy loams (SCS 1980). Historically, the 48-acre burn area had not been grazed since the early 1950s, and the control plot locations had not been grazed since the early 1970s. Both the control and treatment areas have had little human influence or activity over the past 25 to 50 years. However, prior to the burn, in May 1999, the control and treatment locations were sprayed by helicopter with Tordon 22K to help control the noxious weed diffuse knapweed (*Centaurea diffusa*).

During 1999, a monitoring program was developed and initiated to provide quantitative pre-burn and post-burn information to help answer the questions listed above. A stratified, random sampling design was used. Initially, six plots—three control (no burn), and three treatment (burn)—were chosen for monitoring the response of the Site's xeric tallgrass prairie to the prescribed burn (Figure 6-1).

The control plots selected were BC1, BC2, and TR01. Plots BC1 and TR01 were pre-existing sites that had been used previously for other quantitative monitoring. BC2 was set out specifically for this study as a third replicate. The treatment plots were BT1, BT2, and BT3. Sites BT1 and BT2 were also pre-existing plots used for other monitoring, and BT3 was set out specifically for this study to provide a third replicate treatment site. At each plot, a total of five randomly located 50-m transects were sampled. Pre-burn sampling was conducted from September 9 through 24, 1999. The decision to conduct a controlled burn was made at a time that precluded collecting any spring pre-burn data. Thus, the study can evaluate only the late-summer effects on the prairie.

The study design was modified in spring 2000, because the actual prescribed burn was not conducted over the entire area that was originally scheduled to be burned. Treatment plots BT1 and BT2 were burned, but plot BT3 was not. Therefore, data were summarized by combining the data from two of the three control plots (BC1 and TR01) and two of the three treatment plots (BT1 and BT2), respectively. Control plot TR01 was chosen over plot BC2 because it was more similar to plots BC1, BT1, and BT2. In 2000, post-burn monitoring data were gathered throughout the summer using qualitative photographs and quantitative measurements from September 5 through 21, 2000.

Species richness, cover, and frequency were measured at each of the 50-m transects. Species richness was determined in a 2-m-wide belt centered along the length of each 50-m transect. Every plant species rooted within the 100-m^2 area was recorded. In addition, the number of woody plant stems and cactus stems were counted and recorded for the 100-m^2 area. Basal cover and foliar cover estimates were made using a point-intercept method along each of the 50-m transects. A 2-m-long rod, with a 6-mm diameter, was dropped vertically at 50-cm increments along the transect to record a total

of 100 intercept points. Two categories of hits were recorded, basal and foliar. Basal cover hits indicated what material the rod contacted at the ground surface. Hits could be vegetation (live plants), litter (fallen dead material), rock (pebbles and cobbles that were greater than the rod diameter), bare ground, or water, in that order of priority based on the protection from erosion provided by each type of cover. Basal vegetation hits were recorded by species only if the rod was touching the stem or crown of the plant where the plant entered the ground. Foliar vegetation hits (defined as a portion of a plant touching the rod) were recorded by species in three categories as defined by height and growth form. The topmost hit of each growth form was recorded. The growth forms measured were herbaceous, woody <2 m in height, and woody >2 m in height. Frequency information by species was gathered by randomly locating five 1-m^2 quadrats along each of the 50-m transects (total of 25 quadrats/site) and recording all species present in each plot. Density stem counts for diffuse knapweed were also made using these same quadrats. No distinctions were made during the counts to differentiate seedlings, rosettes, or adult plants.

Biomass sampling was conducted on different transects than those described above, to prevent disturbance. Sampling was conducted along a single transect in the burn area and another transect outside the burn area. Five randomly located 0.25-m^2 quadrats were located along the right-hand side of each transect. Vegetation was clipped and sorted as current-year live or litter and placed into separately labeled paper bags. The bags were dried in an oven at 65° C until no further weight loss was observed, and then the vegetation weight was recorded. More detailed summaries of these specific methods are found in the *Environmental Monitoring Department Operating Procedures Manual* (DOE 1995), the *High-Value Vegetation Survey Plan for the Rocky Flats Environmental Technology Site* (K-H 1997), and the *1999 Ecological Field Monitoring Plan for the Rocky Flats Environmental Technology Site* (K-H 1999a).

Photographs were taken before and after the burn to document the recovery of the vegetation on the prairie throughout the summer of 2000. A photograph was taken of each transect during the sampling session to visually document the condition of the transect. Photographs were taken from near the 0-m end of the transect, near the permanent marker, looking toward the 50-m endpoint. A placard was placed in the photograph against the 0-m endpoint to provide the site and transect number, and date. Photographs were taken with a digital camera with the lens set at approximately 50 mm.

Additional photographs were also taken looking straight down on the grassland along the transects in the area that burned. Each of these photographs was taken of a quadrat (1 m $\times$ 0.5 m), placed at the 50-m end of the transect and aligned north-south, with the 50-m stake at the southwest corner of the quadrat. The photographs were taken throughout the summer, with the digital camera centered over the middle of the quadrat at eye level (approximately 1.5 m). A total of 10 quadrats (one at each transect) were photographed during each photography session. The lens was set at 35 mm for these photographs. Photographs were taken from the north side facing south, so that the permanent stake was in the upper right-hand corner of the photograph. A placard was placed in the photograph to provide the site and transect number, and date. At the end of

the summer, after all the photographs had been taken, visual estimates of the percent total current-year vegetation cover were made by viewing the photographs on the computer screen. Estimates were classified into the following cover class categories: 1 = 1–10%, 2 = 11–20%, 3 = 21–30%, 4 = 31–40%, 5 = 41–50%, 6 = 51–60%, 7 = 61–70%, 8 = 71–80%, 9 = 81–90%, and 10 = 91–100%. Midpoints of each range (5, 15, 25, 35, etc.) were used for calculations.

Estimates were recorded on data sheets, entered into the database, and checked for quality prior to analysis. Additional landscape photographs were also taken from permanent locations within the burn area and around the perimeter of the burn. These photographs, with a map of the burn area and photo locations, can be viewed in Appendix C on the CD-ROM.

Species richness data were summarized by generating a species list for the control and treatment locations. In addition, other species richness variables were calculated from the species lists. A Sorensen coefficient of similarity was used to assess the species richness similarity between the control and treatment data (Brower and Zar 1977). Basal cover data were reported as total percent cover of vegetation, litter, rock, and bare ground. Foliar cover data were reported as frequency, absolute cover, and relative cover for each species encountered. Frequency from the cover data was defined as the percent of point-intercept transects in which a species occurred, out of the total 10 possible. Absolute foliar cover was the percentage of the number of hits on a species out of the total number of hits possible (1,000). This value is the actual cover of a species. Relative foliar cover was the number of hits on a species relative to the total number of vegetative hits recorded (i.e., the percent of total vegetative cover [100 percent] represented by the species). A Shannon-Weaver diversity index was used to calculate diversity based on the relative foliar cover data (Brower and Zar 1977). Frequency based on quadrats (n=50; 2 transects $\times$ 25 quadrats each) was defined as the number of quadrats in which a species was recorded, divided by 50 (the total number of quadrats possible), multiplied by 100. Density count data were summarized as the mean number of stems per square meter. Biomass data were summarized as the mean litter, current-year live, and total biomass (litter and current-year live combined).

Statistical analysis of the results was conducted only when mean values were different enough to suggest a meaningful interpretation. Where normality, variance, and dependence requirements were met, parametric tests were used to compare results. Nonparametric tests were used for all analyses where normality, variance, and independence requirements were not met. Independent samples (i.e., the control and treatment plots) were compared using t-tests or Mann-Whitney U tests (SigmaStat 1997; Fowler and Cohen 1990; Sheskin 1997). Dependent sample comparisons (i.e., within treatment over time) were done using paired t-tests or Wilcoxon's test for matched pairs (SigmaStat 1997; Fowler and Cohen 1990; Sheskin 1997). Frequency analyses were done using a McNemar test (Sheskin 1997).

6.3 Results

In 1999, the control plots had a total of 66 species, and the treatment plots had 73 species (Table 6-1). In 2000, both the control and treatment plots showed an increase of six species to 72 and 79 species, respectively (Table 6-1). A Sorensen coefficient of similarity index showed a high similarity in species richness within the control (0.90) and treatment plots (0.89) from 1999 to 2000. When the control plots were compared to the treatment plots, however, similarity decreased slightly from 1999 (0.76) to 2000 (0.72). The percentage of native species decreased more in the control plots (86 percent to 81 percent) than in the treatment areas (78 percent to 77 percent) during the same time period. The mean number of species per quadrat showed no substantial change from 1999 to 2000 (Table 6-1). Shannon-Weaver diversity indices were calculated using the relative cover data. In the control plots, diversity declined slightly from 1.068 in 1999 to 1.036 in 2000. In the treatment plots, diversity increased from 0.931 in 1999 to 0.963 in 2000.

Cactus densities were higher in the treatment areas than in the control areas (Table 6-2). Twistspine prickly pear (*Opuntia macorhiza*) density declined significantly in both the control and treatment areas from 1999 to 2000, by 61 percent and 62 percent, respectively (control: paired t-test, $t = 4.858$, 9 df, $P < 0.001$; treatment: $t = 7.252$, 9 df, ($P < 0.001$; Table 6-2). Changes in hedgehog cacti (*Echinocereous viridiflorus*) density were not statistically significant ($P > 0.05$; Table 6-2).

Total foliar vegetation cover was initially 79.2 percent in the control areas and 77.2 percent in the treatment areas in 1999 (Table 6-3 and 6-4). In 2000, both the control and treatment plots showed declines of approximately 2.5 percent (Tables 6-3 and 6-4). Tables 6-3 and 6-4 show the foliar cover for individual species and various groupings of species for both the control and treatment locations. Of the total vegetation cover, more than 94 percent was provided by graminoids at both the control and treatment locations (Tables 6-3 and 6-4). Three graminoid species—big bluestem (*Andropogon gerardii*), Canada bluegrass (*Poa compressa*), and mountain muhly (*Muhlenbergia montana*)—dominated the vegetative cover at both the control and treatment locations (Tables 6-3 and 6-4). Only the order of dominance of these three species differed between the control and treatment areas. At the control plots, cool-season graminoid cover and warm-season graminoid cover did not change significantly from 1999 to 2000 ($P > 0.05$; Figure 6-2). In the treatment plots, however, cool-season graminoid cover decreased significantly (by 7.4 percent; paired t-test, $t = 4.024$, 9 df, $P < 0.01$), and warm-season graminoid cover increased significantly from 1999 to 2000 (by 5.9 percent; $t = -3.276$, 9 df, $P = 0.01$; Figure 6-2). In the treatment plots, native cover increased significantly, by almost 10 percent (from 57.8 to 67.2; paired t-test, $t = -4.964$, 9 df, $P < 0.001$), but did not change significantly in the control plots ($P > 0.05$; Tables 6-3 and 6-4).

Ground cover was dominated by litter, which accounted for 75 percent at the control and 77 percent at the treatment locations in 1999 (Figure 6-3). In 2000, litter cover increased significantly (by 5.7 percent; paired t-test, $t = -2.578$, 9 df, $P < 0.05$) in the control plots while decreasing significantly in the treatment plots (by 7.2 percent; paired t-test, $t = 4.548$, 9 df, $P = 0.001$; Figure 6-3). Bare ground cover decreased significantly in the

control plot (by 2.7 percent, paired t-test, t = 2.400, 9 df, P <0.05) while increasing significantly in the treatment plots from 1999 to 2000 (by 4.2 percent; paired t-test, t = –4.996, 9 df, P <0.001; Figure 6-4). Rock cover increased significantly at the treatment locations (by 3.7 percent; paired t-test, t = –2.645, 9 df, P <0.05) while remaining the same at the control plots (P >0.05; Figure 6-4).

Overall biomass on the grassland (combined current-year live and litter) was reduced significantly, by approximately 77 percent, as a result of the prescribed burn (t-test, t = 6.521, 8 df, P <0.001; Figure 6-5). Biomass values were decreased from approximately 465 g/m^2 (4,152 lbs/acre) to 108 g/ m^2 (963 lbs/acre). By winter 2001, however, overall biomass in the burn area had increased to 276 g/ m^2 (2460 lbs/acre), but was still significantly below the initial levels (t-test, t = 2.914, 8 df, P <0.05; Figure 6-5).

The recovery of the vegetation cover throughout the growing season is shown in Figure 6-6. The pre-burn vegetation and litter combined cover value (as estimated from quadrat photographs) was approximately 95 percent. After the fire, live vegetation cover (no litter included) was reduced to approximately 5 percent. Throughout the summer, vegetation cover increased and had returned to approximately 75 percent by September 27, 2000. Figures 6-7 and 6-8 visually document the recovery of the grassland throughout the growing season at both the landscape and quadrat levels. Additional photographic documentation of the fire recovery is contained in Appendix C on the CD-ROM.

Individual species frequency results from the 1-m^2 quadrats are presented in Table 6-5. The most frequently encountered species in the control plots in 1999 were sun sedge (*Carex heliophila*), dotted gayfeather (*Liatris punctata*), blue grama (*Bouteloua gracilis*), mountain muhly, sideoats grama (*Bouteloua curtipendula*), and big bluestem (Table 6-5). In the treatment plots in 1999, the most frequently encountered species were sun sedge, Canada bluegrass, mountain muhly, big bluestem, blue grama, and twistspine prickly pear (Table 6-5). In 2000, some shifting of the order of each of these species was noted in both the control and treatment plots, but generally, these same species remained the most frequently encountered. A comparison of the amount of change exhibited by each species within the control and treatment plots, respectively, and then compared between the control and treatment plots, showed that blue grama, Porter's aster (*Aster porteri*), side-oats grama, winged eriogonum (*Eriogonum alatum*), blanket flower (*Gallardia aristata*), mountain muhly, and field alyssum (*Alyssum minus*) showed the greatest frequency response to the burn. Blue grama, Porter's aster, side-oats grama, and winged eriogonum, had the most positive frequency responses to the fire, compared to changes in the control. Blanket flower, mountain muhly, and field alyssum responded more negatively to the fire than they did in the control. Diffuse knapweed frequency increased slightly in both the control and treatment plots.

6.4 Discussion

Monitoring was conducted on the xeric tallgrass prairie at the Site during the summers of 1999 and 2000 to collect pre- and post-burn vegetation data at locations where a 48-acre

prescribed burn was conducted in April 2000. Data were collected from control (unburned) and treatment (burned) areas for comparison. All control and treatment monitoring areas were treated with the herbicide Tordon 22K, applied by helicopter, in May 1999.

Analysis of the data shows that species richness was not affected by the fire. Both control and treatment plots increased by six species from 1999 to 2000. Species diversity increased only slightly as a result of the burn. It would be interesting to know whether species diversity would have changed more if the areas had not been treated with herbicides the year before the burn, because the forb component would not have been quite so depressed. Cactus densities declined, but similar declines were observed in both the control and treatment areas; therefore, these declines are best explained as a response to the herbicide application, rather than the prescribed burn. Similar losses of cactus density have been observed at other monitoring locations for herbicide effects where no prescribed fire has been used (see other sections of this annual report or K-H 1999b, 2000).

One of the objectives of the prescribed burn was to reduce the amount of dead plant litter on the prairie, thereby reducing the potential for a wildfire and also recycling nutrients to the plants. Ground cover data showed that surface litter decreased significantly, by approximately 7 percent. Most of this decrease was offset by increases in rock and bare ground cover. Although a 7 percent reduction in litter cover at the ground surface doesn't seem like much, it must be remembered that this value was determined using a point-intercept cover methodology and thus records only what is found at the ground surface. It does not measure the actual amount or depth of the litter present. The biomass data, on the other hand, showed that overall biomass was reduced by 77 percent (from 4,152 lbs/acre to 963 lbs/acre) in the burned areas, so it is clear that the potential for a wildfire was lessened. By winter 2001, overall biomass was still significantly below initial levels, with most of the reduction still a result of reduced litter amounts (Figure 6-9). The fact that the cover of litter at the ground surface was not completely removed is beneficial, because it means there was still some cover protecting the ground surface from wind and/or water erosion. For these reasons, the fire accomplished what it was designed to do. The amount of biomass available as fuel on the grassland was reduced, but the ground surface itself remained protected from wind and water erosion as the vegetation returned throughout the summer. Additionally, the fire recycled nutrients that were tied up in the dead plant litter and stimulated the growth of the perennial grass species.

By the end of the growing season, total foliar cover on the grassland was essentially unchanged by the fire. Total foliar cover was approximately 2.5 percent less in 2000 than in 1999, in both the control and treatment plots. Forb cover increased only slightly in the treatment area, compared to the control. In general, however, forb cover was depressed in both the control and treatment plots by the herbicide application from the year before.

Overall graminoid cover also remained essentially unchanged as a result of the fire. However, the ratio of cool-season to warm-season graminoids was changed as a result of the burn. One of the goals of the prescribed burn was to increase the dominance of the

warm-season graminoid species, especially those that are the characteristic species of the xeric tallgrass prairie. This was done by timing the fire so that it would have the greatest detrimental effect on the cool-season species. In the unburned control plot, neither cool-season nor warm-season graminoid cover changed significantly from 1999 to 2000. In the treatment plot, however, cool-season cover was reduced significantly after the fire, and warm-season graminoid cover increased significantly. The prescribed burn shifted the species composition of the treatment plots from a cool-season-dominated community to a warm-season-dominated community. The warm-season species that showed increases in the treatment areas included big bluestem, little bluestem, blue grama, and side-oats grama. Big bluestem and little bluestem showed declines in cover at the unburned control locations. The cool-season graminoids that showed decreases in the treatment plot were Canada bluegrass, Kentucky bluegrass (*Poa pratensis*), and sun sedge. The data show that the prescribed burn helped push the species composition in the direction that Site ecologists wanted it to go. Continued prescribed burns in the same area every few years would help continue to promote the dominance of the warm-season species.

One dominant warm-season species that did not increase as a result of the fire was mountain muhly, a montane warm-season species. Why this is the case is unknown. It actually showed a slight increase in the control plots, but a slight decline in the treatment plots. Perhaps the timing of the fire was not appropriate for this species, or some other factor(s) affected its response. Studies from ponderosa pine forests in Arizona have shown that mountain muhly generally decreases in density after a fire, but fully recovers after approximately three years (FEIS 2001). It would be useful to gather further information on the response of mountain muhly to fire under the prairie conditions here at the Site, because this species forms a dominant and unique part of the xeric tallgrass prairie species composition on the Rocky Flats Alluvium—a species composition that is not found elsewhere along the Front Range (Buckner 2000).

In general, the warm-season graminoids responded to the burn as anticipated, although the dry spring and early summer caused the height and overall flowering response to be somewhat less than what had been hoped for. Had normal precipitation occurred, it is likely that a greater response of the warm-season graminoids would have been seen, because many species began to wither and go dormant in late July and August (Figures 6-6 and 6-8). The response of the dominant warm-season species frequency in the treatment area generally paralleled that of the cover data. Big bluestem frequency remained unchanged, while little bluestem, blue grama, hairy grama, and side-oats grama increased. Mountain muhly frequency decreased in the burn area, while increasing in the control area.

With respect to the noxious weed diffuse knapweed, both the control and treatment areas showed no significant changes. The slight increases in the cover and frequency of diffuse knapweed were not statistically significant in either the control or treatment plots, suggesting that the fire did not affect diffuse knapweed abundance. The significant loss of twistspine cactus density shown in both the control and treatment plots is best explained by the herbicide application at all the monitoring locations in spring 1999.

Results from studies elsewhere at the Site have shown a similar decline in response to the herbicide alone.

Direct comparisons to studies conducted elsewhere on the response of the tallgrass prairie to fire are difficult to make because of differences in location, soil types, precipitation amounts, community composition, variation in conditions before and after burning, fire frequency, and monitoring methodologies. No other comparable data were available on the response of a xeric tallgrass prairie to fire. However, an attempt was made to compare the Site data to responses of the mesic tallgrass prairie to fire that have been recorded elsewhere around the country (Collins and Wallace 1990).

With respect to species richness, Collins and Gibson (1990) state that there "appears to be no clear relationship between fire and species richness during the year in which the fire occurred." They report results from several studies, some showing increases in species richness and others showing decreases in response to fire. Data from the Site burn showed no difference in species richness in the burned area compared to the unburned locations.

Collins and Gibson (1990) also report that most studies show a loss of species diversity after a fire because of an increase in dominance by the matrix species (i.e., species occupying the greatest amount of space in a community). Data from the Site showed a slight increase in species diversity in response to the burn. This response may have been confounded, however, by the herbicide application in the year before the fire. It is also well documented that a spring fire enhances the productivity and vigor of warm-season graminoids, while reducing that of the cool-season species (Ewing and Engle 1988; Collins and Wallace 1990). The increase in warm-season graminoid cover and reduction in cool-season graminoid cover from the Site burn substantiate this occurrence on the xeric tallgrass prairie in Colorado as well. Qualitative observations also concurred with the literature that there appeared to be an increase in flowering of many of the warm-season species within the burned area compared to those outside the burn area (Svejcar 1990).

The results of the 2000 spring prescribed burn on the xeric tallgrass prairie demonstrate the utility of fire as a tool for effective management and restoration of the prairie ecosystems at the Site. Continued monitoring of these transects will provide a better understanding of the longer-term implications for fire on the xeric tallgrass prairie at the Site. With clearly stated objectives, the use of prescribed fire, integrated with other resource management techniques, can help maintain the viability and sustainability of the prairie ecosystems at the Site.

6.5 Conclusions

In April 2000, a prescribed burn was conducted on 48 acres of the xeric tallgrass prairie at the Site. Monitoring results have shown that the prescribed burn was successful not only because it demonstrated that it could be accomplished through the coordinated

efforts of many organizations both on and off Site, but because the objectives of the prescribed burn were achieved.

The prairie benefited from the prescribed burn in multiple ways. The fire removed and recycled much of the plant litter that had been burying and stressing the native species and reducing their ability to compete with noxious weeds. The reduction in plant litter reduced the risk of a wildfire. The fire stimulated the growth, health, and reproduction of the native perennial plant species, which was observed quantitatively in the increased cover and frequency of many of these species, and qualitatively in the increased flowering observed on the prairie at the burn location in 2000. The burn also caused a species composition shift from a cool-season-dominated community to a warm-season-dominated community, as intended. The use of prescribed burns is a valuable tool for prairie management and restoration and should be continued at the Site.

6.6 References

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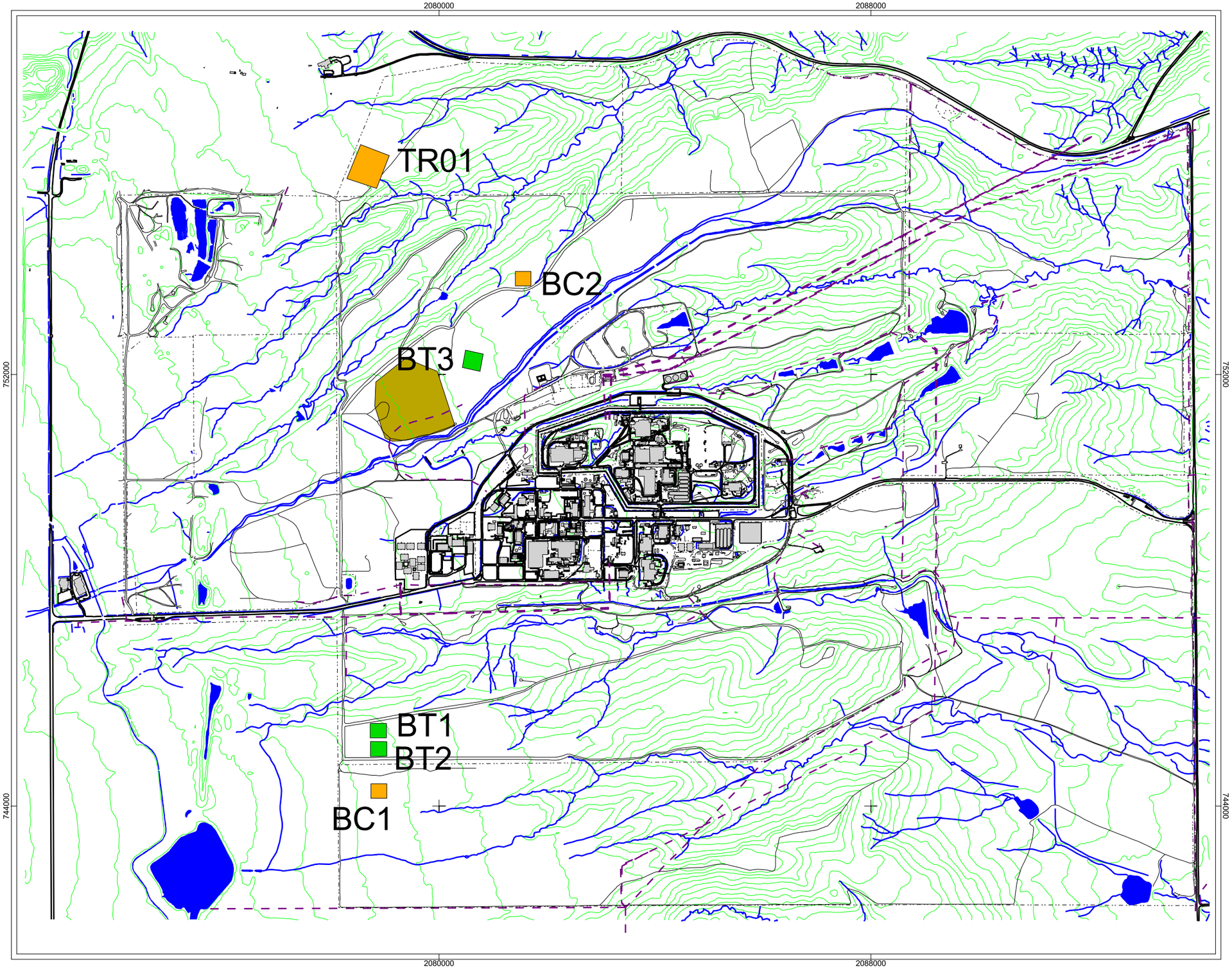

Prescribed Burn Monitoring Plot Locations

Figure 6-1

LEGEND

- Control Plots
- Treatment Plots

Standard Features

- Buildings
- Lakes & ponds
- New Landfill
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft)
- Power Lines

DATA SOURCE BASE FEATURES:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs, 1/95
Hypsography derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

Data Source Ecology Features:
Location data provided by Exponent.
K-H Ecology Group POC; Karan North 303-966-9876.

N

1:23552

1000 0 1000 Feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Exponent®

For: Kaiser-Hill Company, LLC

RFETS GIS Dept. 303-966-7707

MAP ID: 2k-0038

May 3, 2001

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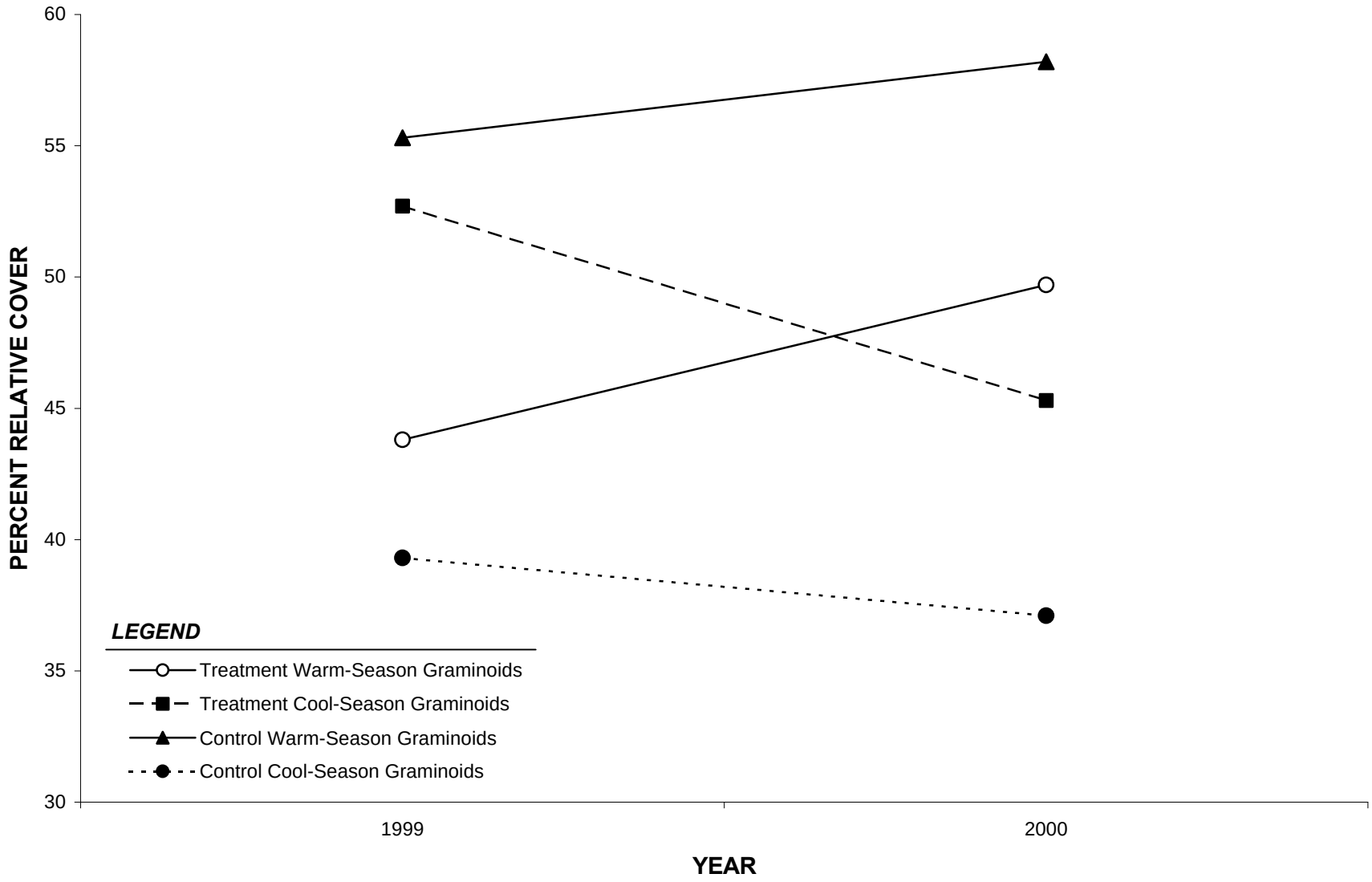


Figure 6-2. Pre- and post-burn cool-season vs. warm-season graminoid cover.

\\Boulder1\Groups\Graphics\1454\2001\2ktables.xls Figure 2 5/3/01 CO

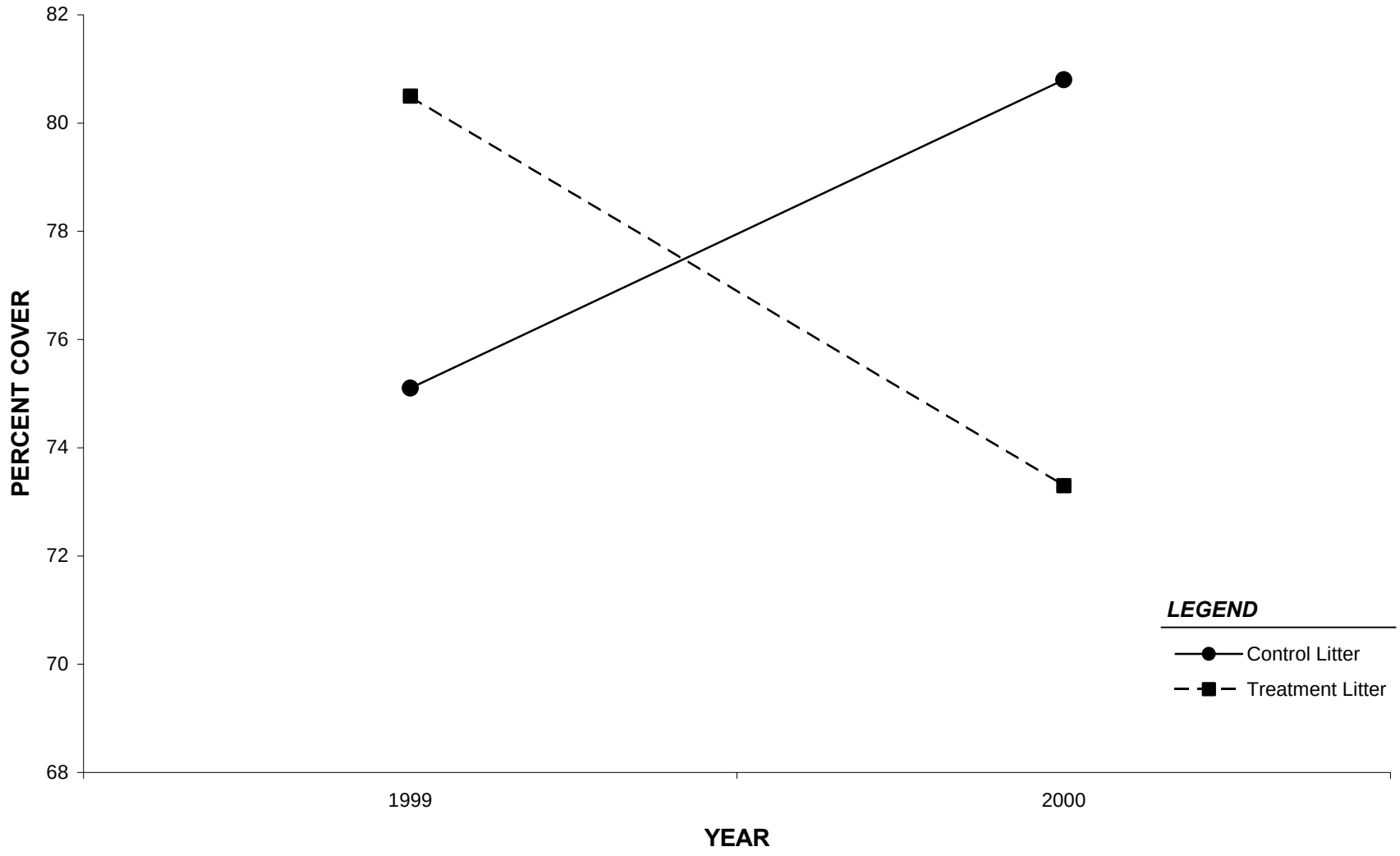


Figure 6-3. Pre- and post-burn litter cover.

\\Boulder1\Groups\Graphics\1454\2001\2ktables.xls Figure 3 5/3/01 CO

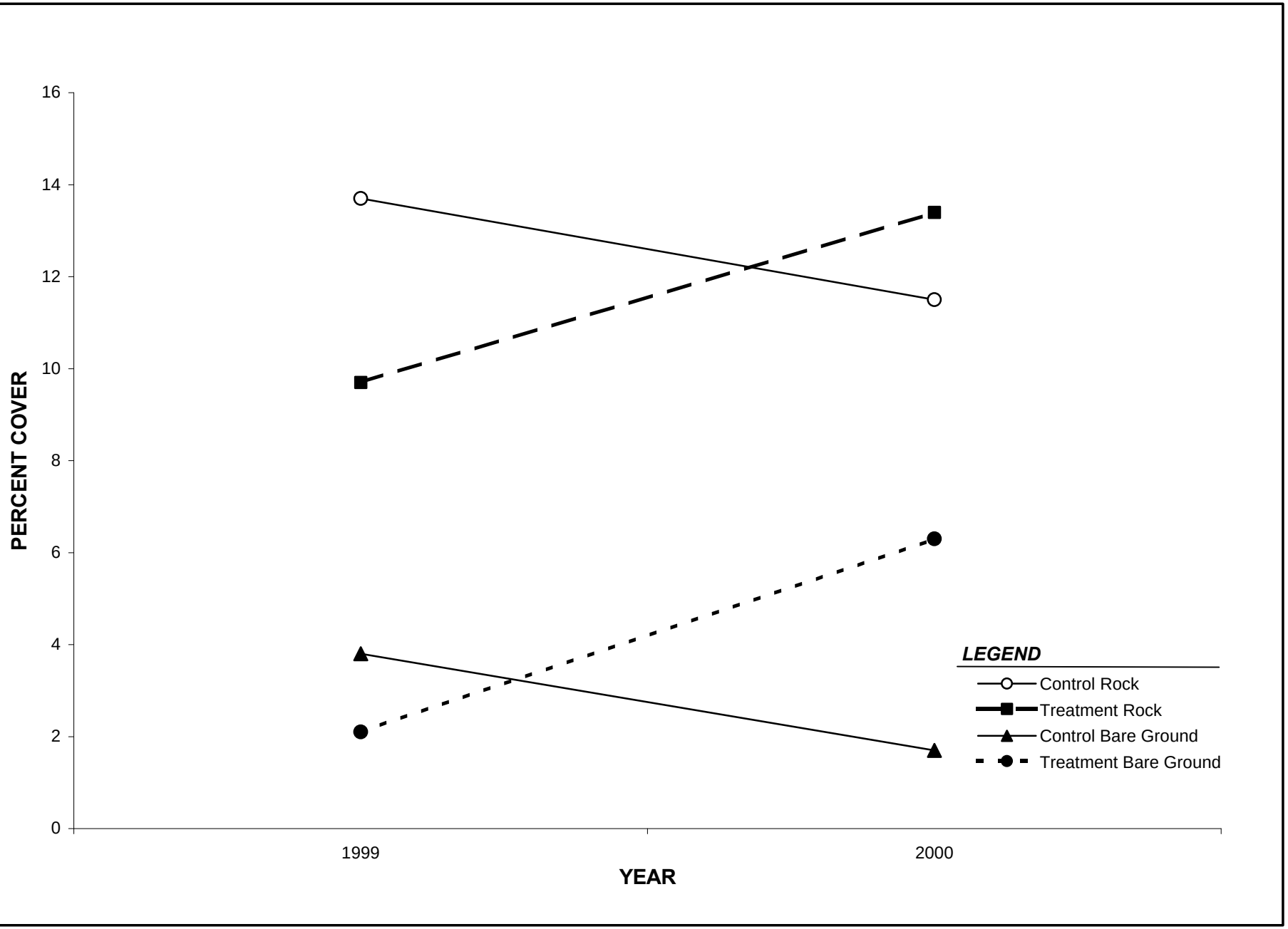


Figure 6-4. Pre- and post-burn rock and bare ground cover.

\\Boulder1\Groups\Graphics\1454\2001\2ktables.xls Figure 4 5/3/01 CO

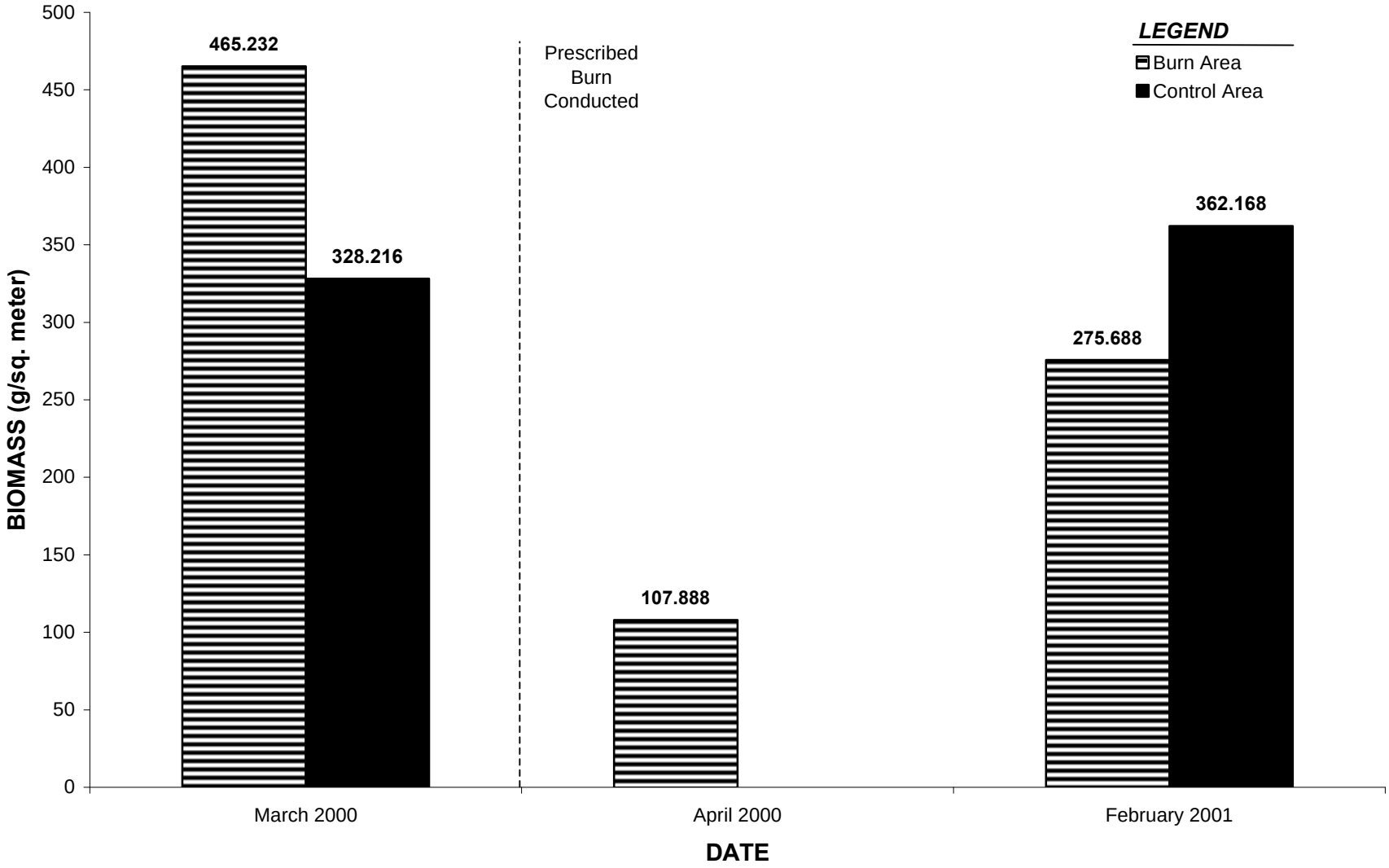


Figure 6-5. Prescribed burn biomass changes.

Boulder1\Data\Groups\Graphics\Projects\1454\2001\burn biomass values.xls 5/3/01 CO

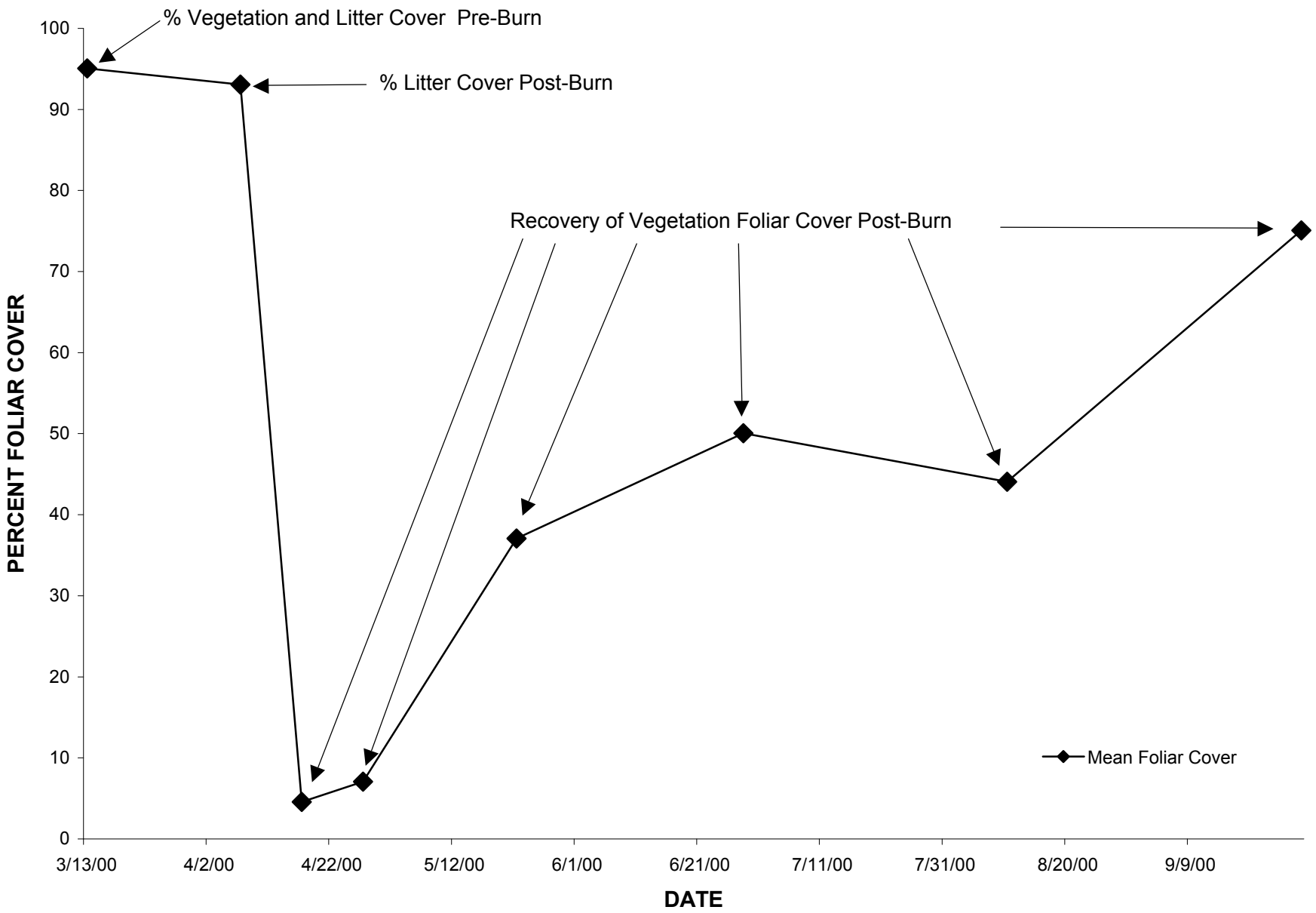
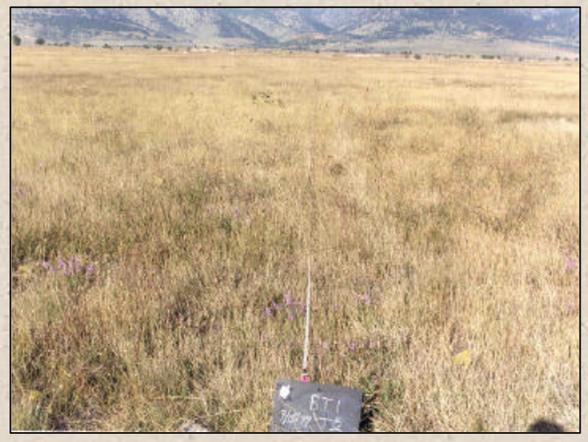


Figure 6-6. Recovery of post-burn vegetative cover based on photo quadrats.

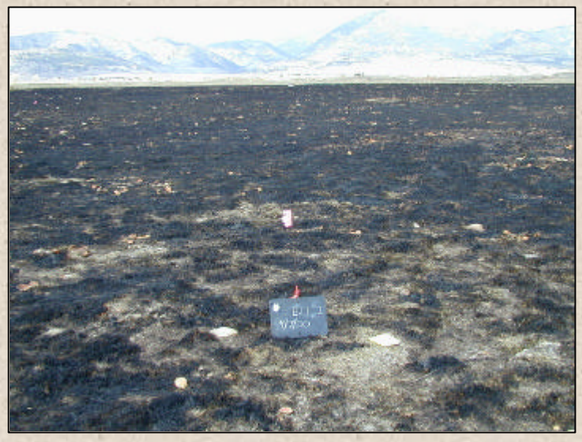
\\Boulder1\Groups\Graphics\Projects\1454/2001\Photo quad data1.xls Figure 6 5/10/01 CO

Figure 6-7. Time Series of 2000 Prescribed Burn Area at Rocky Flats Environmental Technology Site

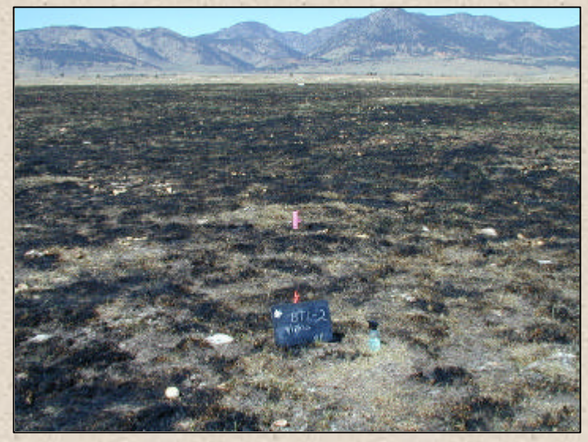
Prescribed Burn Conducted on April 6, 2000



9/15/99



4/7/00



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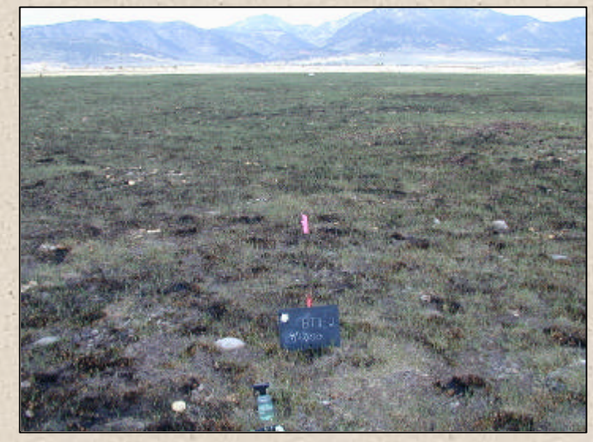
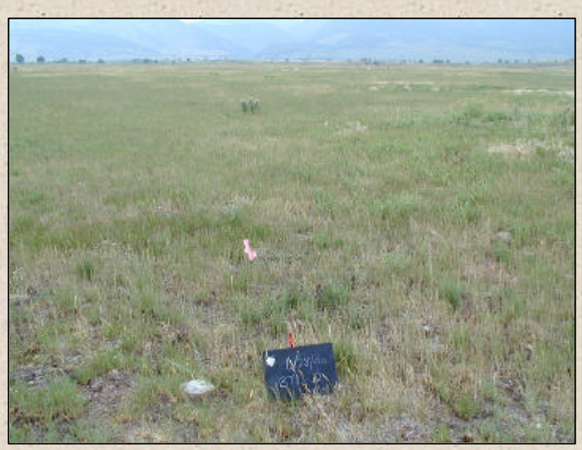


4/27/00

5/22/00



6/28/00

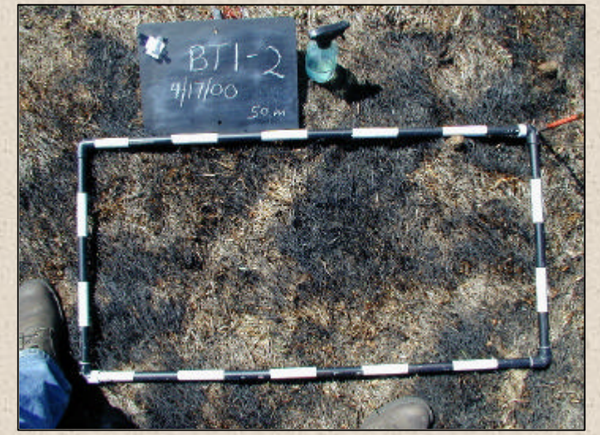
8/10/00

9/27/00

Figure 6-8. Time Series of Ground Surface in 2000 Prescribed Burn Area
at Rocky Flats Environmental Technology Site
Prescribed Burn Conducted on April 6, 2000

3/13/00

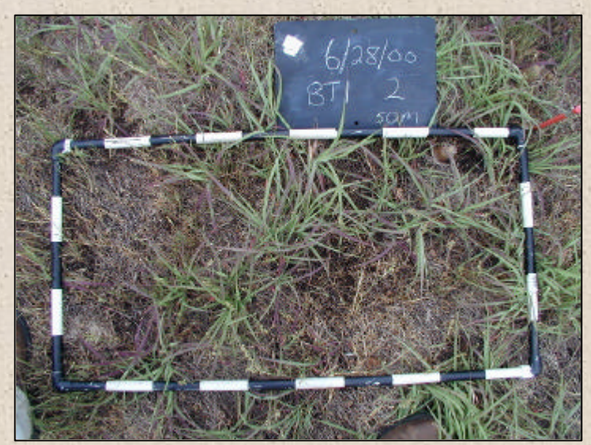
4/7/00



4/17/00

4/27/00

5/22/00



6/28/00

8/10/00

9/27/00

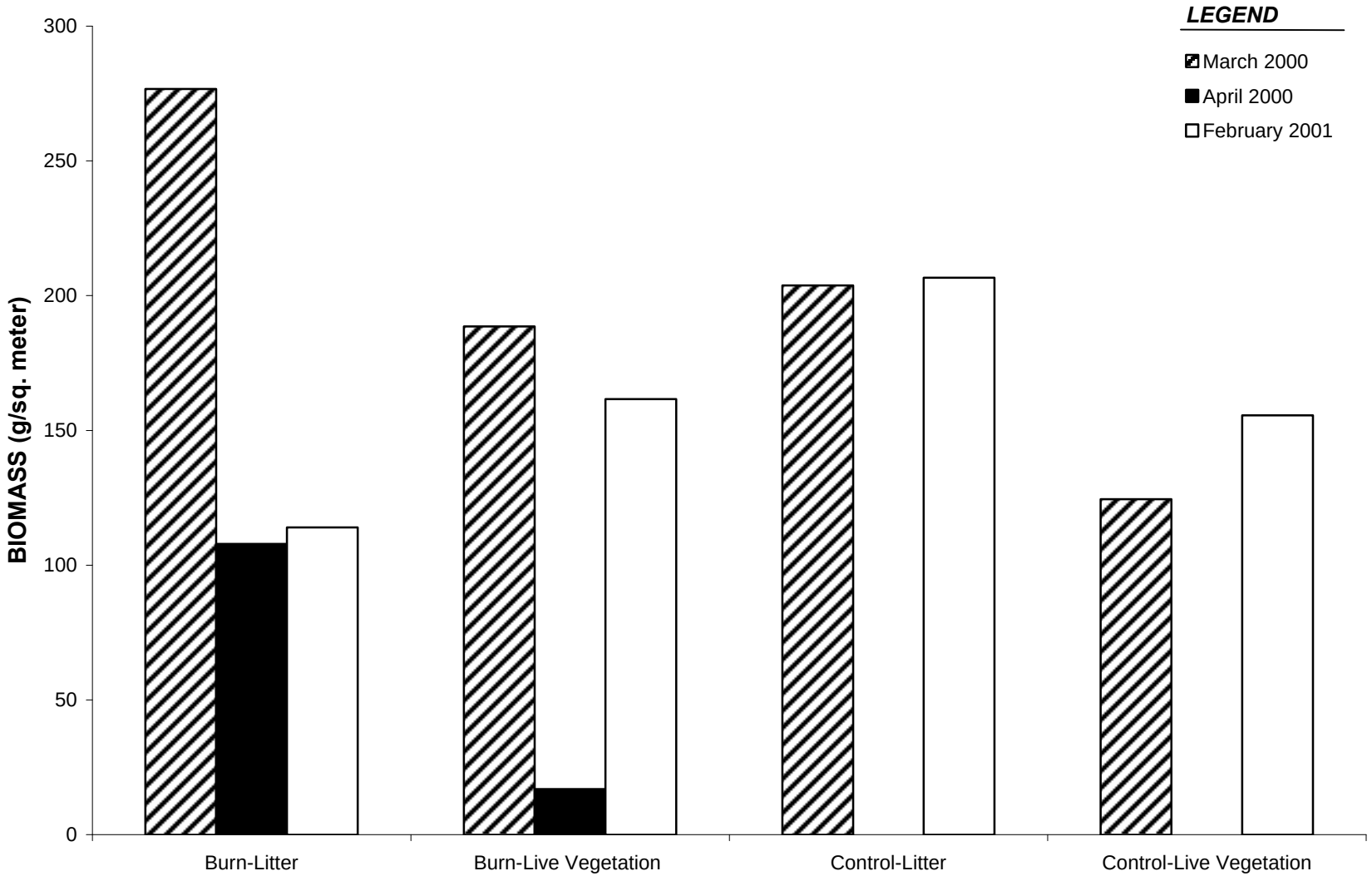


Figure 6-9. Prescribed burn biomass changes.

Boulder1\Data\Groups\Graphics\Projects\1454\2001\burn biomass values.xls 5/3/01 CO

Table 6-1. Prescribed Burn Pre- and Post-Burn Species Richness (1999-2000)

				Control		Treatment	
Family	**Scientific Name**	**Speccode**	**Native**	**1999**	**2000**	**1999**	**2000**
AGAVACEAE	Yucca glauca Nutt.	YUGL1	Y				
ANACARDIACEAE	Rhus aromatica Ait. var. trilobata (Nutt.) A. Gray	RHAR1	Y	X	X		
APIACEAE	Lomatium orientale Coult. & Rose	LOOR1	Y	X		X	
ASCLEPIADACEAE	Asclepias speciosa Torr.	ASSP1	Y			X	X
ASCLEPIADACEAE	Asclepias stenophylla A. Gray	ASST1	Y	X	X	X	X
ASCLEPIADACEAE	Asclepias viridiflora Raf.	ASVI1	Y	X	X	X	X
ASTERACEAE	Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y	X	X		
ASTERACEAE	Ambrosia psilostachya DC.	AMPS1	Y	X	X	X	X
ASTERACEAE	Antennaria parvifolia Nutt.	ANPA1	Y	X	X	X	X
ASTERACEAE	Artemisia campestris L. ssp. caudata (Michx.) Hall & Clem.	ARCA1	Y			X	X
ASTERACEAE	Artemisia dracunculus L.	ARDR1	Y				
ASTERACEAE	Artemisia frigida Willd.	ARFR1	Y	X	X	X	X
ASTERACEAE	Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	Y	X	X	X	X
ASTERACEAE	Aster falcatus Lindl.	ASFA1	Y				
ASTERACEAE	Aster porteri Gray	ASPO1	Y	X	X	X	X
ASTERACEAE	Carduus nutans L. ssp. macrolepis (Peterm.) Kazmi	CANU1	N				X
ASTERACEAE	Centaurea diffusa Lam.	CEDI1	N	X	X	X	X
ASTERACEAE	Chrysanthemum leucanthemum L.	CHLE1	N				
ASTERACEAE	Chrysopsis fulcrata Greene	CHFU1	Y	X	X	X	X
ASTERACEAE	Chrysopsis villosa Pursh.	CHVI1	Y	X	X	X	X
ASTERACEAE	Cirsium arvense (L.) Scop.	CIAR1	N				
ASTERACEAE	Cirsium undulatum (Nutt.) Spreng.	CIUN1	Y			X	X
ASTERACEAE	Conyza canadensis (L.) Cronq.	COCA1	Y				X
ASTERACEAE	Erigeron divergens T. & G.	ERDI1	Y	X		X	X
ASTERACEAE	Erigeron flagellaris A. Gray	ERFL1	Y				X
ASTERACEAE	Gaillardia aristata Pursh.	GAAR1	Y	X	X	X	X
ASTERACEAE	Grindelia squarrosa (Pursh.) Dun.	GRSQ1	Y		X	X	X
ASTERACEAE	Helianthus annuus L.	HEAN1	Y				X
ASTERACEAE	Helianthus pumilus Nutt.	HEPU1	Y	X	X		
ASTERACEAE	Helianthus rigidus (Cass.) Desf. ssp. subrhomboideus (Rydb.) Heiser	HERI1	Y	X	X		
ASTERACEAE	Kuhnia chlorolepis Woot. & Standl.	KUCH1	Y				
ASTERACEAE	Kuhnia eupatorioides L.	KUEU1	Y				
ASTERACEAE	Lactuca serriola L.	LASE1	N		X	X	X
ASTERACEAE	Liatris punctata Hook.	LIPU1	Y	X	X	X	X
ASTERACEAE	Ratibida columnifera (Nutt.) Woot. & Standl.	RACO1	Y				X
ASTERACEAE	Scorzonera laciniata L.	SCLA1	N				
ASTERACEAE	Senecio plattensis Nutt.	SEPL1	Y	X	X	X	X
ASTERACEAE	Senecio spartioides T. & G.	SESP1	Y			X	X
ASTERACEAE	Solidago mollis Bart.	SOMO1	Y	X	X	X	
ASTERACEAE	Taraxacum officinale Weber	TAOF1	N		X	X	X
ASTERACEAE	Tragopogon dubius Scop.	TRDU1	N	X	X	X	X
BORAGINACEAE	Cryptantha virgata (Porter) Payson	CRVI1	Y			X	X
BORAGINACEAE	Lappula redowskii (Hornem.) Greene	LARE1	Y				
BORAGINACEAE	Lithospermum incisum Lehm.	LIIN1	Y			X	X
BRASSICACEAE	Alyssum alyssoides (L.) L.	ALAL1	N		X		
BRASSICACEAE	Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	N	X	X	X	X
BRASSICACEAE	Arabis fendleri (S. Wats.) Greene var. fendleri	ARFE3	Y		X		
BRASSICACEAE	Arabis hirsuta (L.) Scop. var. pynocarpa (Hopkins) Rollins	ARHI1	Y	X	X	X	X
BRASSICACEAE	Camelina microcarpa Andrz. ex DC.	CAMI1	N				
BRASSICACEAE	Draba reptans (Lam.) Fern.	DRRE1	Y		X		
BRASSICACEAE	Erysimum capitatum (Nutt.) DC.	ERCA2	Y	X	X	X	X
BRASSICACEAE	Lepidium campestre (L.) R. Br.	LECA1	N				
BRASSICACEAE	Lepidium densiflorum Schrad.	LEDE1	Y		X		X
BRASSICACEAE	Lesquerella montana (A. Gray) Wats.	LEMO1	Y	X	X	X	X
BRASSICACEAE	Sisymbrium altissimum L.	SIAL1	N				
CACTACEAE	Echinocereus viridiflorus Engelm.	ECVI1	Y	X	X	X	X
CACTACEAE	Opuntia macrorhiza Engelm.	OPMA1	Y	X	X	X	X
CARYOPHYLLACEAE	Arenaria fendleri A. Gray	ARFE2	Y	X	X	X	X
CARYOPHYLLACEAE	Paronychia jamesii T. & G.	PAJA1	Y	X	X	X	X
CARYOPHYLLACEAE	Silene antirrhina L.	SIAN1	Y				X
CARYOPHYLLACEAE	Silene drummondii Hook.	SIDR1	Y	X	X		
CHENOPODIACEAE	Chenopodium leptophyllum Nutt. ex Moq.	CHLE2	Y				
CHENOPODIACEAE	Kochia scoparia (L.) Schrad.	KOSC1	N		X		
CHENOPODIACEAE	Salsola iberica Senn. & Pau.	SAIB1	N		X		

Table 6-1. (cont.)

				Control		Treatment	
Family	**Scientific Name**	**Speccode**	**Native**	**1999**	**2000**	**1999**	**2000**
CLUSIACEAE	Hypericum perforatum L.	HYPE1	N	X	X	X	X
COMMELINACEAE	Tradescantia occidentalis (Britt.) Smyth	TROC1	Y				
CONVOLVULACEAE	Convolvulus arvensis L.	COAR1	N				X
CRASSULACEAE	Sedum lanceolatum Torr.	SELA1	Y				
CYPERACEAE	Carex heliophila Mack.	CAHE1	Y	X	X	X	X
EUPHORBIACEAE	Euphorbia robusta (Engelm.) Small	EURO1	Y			X	X
FABACEAE	Astragalus agrestis Dougl. ex G. Don	ASAG1	Y		X	X	X
FABACEAE	Astragalus shortianus Nutt. ex T.&G.	ASSH1	Y				
FABACEAE	Dalea purpurea Vent	DAPU1	Y	X	X	X	X
FABACEAE	Melilotus officinalis (L.) Pall.	MEOF1	N				X
FABACEAE	Oxytropis lambertii Pursh.	OXLA1	Y				
FABACEAE	Psoralea tenuiflora Pursh.	PSTE1	Y	X	X	X	X
GERANIACEAE	Erodium cicutarium (L.) L'Her.	ERCI1	N			X	X
HYDROPHYLLACEAE	Phacelia heterophylla Pursh.	PHHE1	Y				
JUNCACEAE	Juncus interior Wieg.	JUIN1	Y	X	X	X	X
LILIACEAE	Allium textile A. Nels. & Macbr.	ALTE1	Y	X	X	X	
NYCTAGINACEAE	Mirabilis linearis (Pursh.) Heimerl	MILI1	Y	X	X	X	X
ONAGRACEAE	Calylophus serrulatus (Nutt.) Raven	CASE2	Y	X			
ONAGRACEAE	Gaura coccinea Pursh.	GACO1	Y				
OROBANCHACEAE	Orobanche fasciculata Nutt.	ORFA1	Y	X			
PLANTAGINACE	Plantago lanceolata L.	PLLA1	N			X	X
POACEAE	Aegilops cylindrica Host	AECY1	N			X	
POACEAE	Agropyron smithii Rydb.	AGSM1	Y			X	X
POACEAE	Andropogon gerardii Vitman	ANGE1	Y	X	X	X	X
POACEAE	Andropogon scoparius Michx.	ANSC1	Y	X	X	X	X
POACEAE	Aristida purpurea Nutt. var. robusta (Merrill) A. Holmgren & N. Holmgr	ARLO1	Y	X	X	X	X
POACEAE	Bouteloua curtipendula (Michx.) Torr.	BOCU1	Y	X	X	X	X
POACEAE	Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y	X	X	X	X
POACEAE	Bouteloua hirsuta Lag	BOHI1	Y	X	X	X	X
POACEAE	Bromus japonicus Thunb. ex Murr.	BRJA1	N	X	X	X	X
POACEAE	Bromus tectorum L.	BRTE1	N	X	X	X	X
POACEAE	Buchloe dactyloides (Nutt.) Engelm.	BUDA1	Y	X	X		X
POACEAE	Koeleria pyramidata (Lam.) Beauv.	KOPY1	Y	X	X	X	X
POACEAE	Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	Y	X	X	X	X
POACEAE	Muhlenbergia wrightii Vasey	MUWR1	Y	X	X		
POACEAE	Panicum capillare L.	PACA1	Y			X	X
POACEAE	Poa compressa L.	POCO1	N	X	X	X	X
POACEAE	Poa pratensis L.	POPR1	N	X	X	X	X
POACEAE	Setaria viridis (L.) Beauv.	SEVI1	N			X	X
POACEAE	Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	Y	X	X	X	X
POACEAE	Sorghastrum nutans (L.) Nash	SONU1	Y	X	X	X	X
POACEAE	Sporobolus asper (Michx.) Kunth	SPAS1	Y			X	X
POACEAE	Sporobolus cryptandrus (Torr.) A. Gray	SPCR1	Y			X	X
POACEAE	Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	Y	X	X	X	X
POACEAE	Stipa comata Trin. & Rupr.	STCO1	Y	X	X	X	X
POLEMONIACEAE	Ipomopsis spicata (Nutt.) V. Grant ssp. spicata	IPSP1	Y	X	X		
POLYGONACEAE	Eriogonum alatum Torr.	ERAL1	Y	X	X	X	X
POLYGONACEAE	Eriogonum umbellatum Torr.	ERUM1	Y				
PORTULACACEAE	Talinum parviflorum Nutt.	TAPA1	Y	X	X	X	X
ROSACEAE	Potentilla fissa Nutt.	POFI1	Y	X	X		
ROSACEAE	Potentilla hippiana Lehm.	POHI1	Y	X	X		
ROSACEAE	Rosa arkansana Porter	ROAR1	Y				
SANTALACEAE	Comandra umbellata (L.) Nutt.	COUM1	Y	X	X		
SCROPHULARIACEAE	Castilleja sessiliflora Pursh.	CASE3	Y	X	X	X	
SCROPHULARIACEAE	Linaria dalmatica (L.) Mill.	LIDA1	N	X	X	X	X
SCROPHULARIACEAE	Penstemon secundiflorus Benth.	PESE1	Y				
SCROPHULARIACEAE	Penstemon virens Penn.	PEVI1	Y	X	X	X	X
SCROPHULARIACEAE	Verbascum thapsus L.	VETH1	N			X	X
SELAGINELLACEAE	Selaginella densa Rydb.	SEDE1	Y				X
	Total Species Richness			66	72	73	79
	Percent Native Species			86	81	78	77
	Mean # Species/Quadrat			12.7	12	10.6	10.7

Table 6-2. Pre- and Post-Burn Cactus Densities

		Density (plants/m^2)		
Scientific Name	**Site**	**1999**	**2000**	**% Change**
Opuntia macorhiza	Control	25.4	10.0	-61
	Treatment	98.2	37.4	-62
Echinocereus viridiflorus	Control	43.8	31.0	-29
	Treatment	55.0	73.6	34

Sample size (n=10)

Table 6-3. Prescribed Burn Pre-Burn vs. Post-Burn Control Plot Foliar Cover Summary

					Frequency		Absolute Cover		Relative Cover	
Scientific Name	**Speccode**	**Form**	**Native**	**Cool/Warm Season**	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**
Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	F	N			10		0.1		0.1
Linaria dalmatica (L.) Mill.	LIDA1	F	N		30	20	0.4	0.2	0.5	0.3
Arenaria fendleri A. Gray	ARFE2	F	Y		20	30	0.2	0.4	0.3	0.5
Arabis hirsuta (L.) Scop. var. pynocarpa (Hopkins) Rollins	ARHI1	F	Y		10		0.1		0.1	
Aster porteri Gray	ASPO1	F	Y		10		0.3		0.4	
Chrysopsis villosa Pursh.	CHVI1	F	Y		20		0.2		0.3	
Eriogonum alatum Torr.	ERAL1	F	Y		10		0.2		0.3	
Lesquerella montana (A. Gray) Wats.	LEMO1	F	Y			10		0.1		0.1
Liatris punctata Hook.	LIPU1	F	Y		80	90	2.2	2.3	2.8	3.0
Paronychia jamesii T. & G.	PAJA1	F	Y			10		0.1		0.1
Penstemon virens Penn.	PEVI1	F	Y		10		0.1		0.1	
Psoralea tenuiflora Pursh.	PSTE1	F	Y		40	30	0.5	0.4	0.6	0.5
Solidago mollis Bart.	SOMO1	F	Y		10		0.1		0.1	
Bromus japonicus Thunb. ex Murr.	BRJA1	G	N	C	30		0.4		0.5	
Bromus tectorum L.	BRTE1	G	N	C	20	20	0.5	0.5	0.6	0.7
Poa compressa L.	POCO1	G	N	C	90	100	10.2	7.5	12.9	9.8
Poa pratensis L.	POPR1	G	N	C	80	70	5.8	5.6	7.3	7.3
Aristida purpurea Nutt. var. robusta (Merrill) A. Holmgren & N. Holmgr	ARLO1	G	Y	C	60	20	0.9	0.3	1.1	0.4
Carex heliophila Mack.	CAHE1	G	Y	C	90	100	4.9	5.3	6.2	6.9
Juncus interior Wieg.	JUIN1	G	Y	C	10		0.1		0.1	
Koeleria pyramidata (Lam.) Beauv.	KOPY1	G	Y	C	100	90	4	3.9	5.1	5.1
Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	G	Y	C		30		0.4		0.5
Stipa comata Trin. & Rupr.	STCO1	G	Y	C	80	90	4.3	5	5.4	6.5
Andropogon gerardii Vitman	ANGE1	G	Y	W	100	100	14.3	13.4	18.1	17.4
Andropogon scoparius Michx.	ANSC1	G	Y	W	60	50	1.8	0.9	2.3	1.2
Bouteloua curtipendula (Michx.) Torr.	BOCU1	G	Y	W	80	90	3	3.3	3.8	4.3
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	G	Y	W	90	100	2.5	2.7	3.2	3.5
Bouteloua hirsuta Lag	BOHI1	G	Y	W	40	80	0.8	1.1	1.0	1.4
Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	G	Y	W	90	90	18.5	20.3	23.4	26.4
Sorghastrum nutans (L.) Nash	SONU1	G	Y	W	80	70	2.3	2.3	2.9	3.0
Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	G	Y	W	30	30	0.6	0.7	0.8	0.9
Total foliar cover							79.2	76.8	100.0	100.0
Total forb cover							4.3	3.6	5.4	4.7
Total native forb cover							3.9	3.3	4.9	4.3
Total non-native forb cover							0.4	0.3	0.5	0.4

Table 6-3. (cont.)

					Frequency		Absolute Cover		Relative Cover	
Scientific Name	**Speccode**	**Form**	**Native**	**Cool/Warm Season**	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**
Total graminoid cover							74.9	73.2	94.6	95.3
Total warm-season graminoid cover							43.8	44.7	55.3	58.2
Total cool-season graminoid cover							31.1	28.5	39.3	37.1
Total native cover							61.9	62.9	78.2	81.9
Total non-native cover							17.3	13.9	21.8	18.1

Absolute cover = Absolute foliar cover is the percentage of the number of hits on a species out of the total number of hits possible (1500).

Relative cover = Relative foliar cover was the number of hits a species had relative to the total number of all vegetative hits recorded per site (i.e., the percent of vegetative cover the species represented).

All cover values presented are means (n = 10).

Native categories: Y = Native, N = Non-Native

Form categories: C = Cactus, F = Forb, G = Graminoid

Cool/Warm Season categories: C = Cool season species, W = Warm season species

Table 6-4. Prescribed Burn Pre-Burn vs. Post-Burn Treatment Plot Foliar Cover Summary

					Frequency		Absolute Cover		Relative Cover	
Scientific Name	**Speccode**	**Form**	**Native**	**Cool/Warm Season**	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**
Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	F	N		10		0.1		0.1	
Centaurea diffusa Lam.	CEDI1	F	N		10	30	0.1	0.3	0.1	0.4
Linaria dalmatica (L.) Mill.	LIDA1	F	N		10	10	0.1	0.1	0.1	0.1
Verbascum thapsus L.	VETH1	F	N			10		0.1		0.1
Arenaria fendleri A. Gray	ARFE2	F	Y		10		0.1		0.1	
Artemisia frigida Willd.	ARFR1	F	Y		10		0.1		0.1	
Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	F	Y		10	30	0.1	0.4	0.1	0.5
Chrysopsis villosa Pursh.	CHVI1	F	Y		10		0.1		0.1	
Liatris punctata Hook.	LIPU1	F	Y		80	90	1.6	2.2	2.1	2.9
Penstemon virens Penn.	PEVI1	F	Y		10		0.1		0.1	
Psoralea tenuiflora Pursh.	PSTE1	F	Y		20	50	0.3	0.6	0.4	0.8
Aegilops cylindrica Host	AECY1	G	N	C	10		0.1		0.1	
Bromus japonicus Thunb. ex Murr.	BRJA1	G	N	C	40		0.9		1.2	
Bromus tectorum L.	BRTE1	G	N	C	10	20	0.3	0.5	0.4	0.7
Poa compressa L.	POCO1	G	N	C	100	100	23.3	17.6	30.2	23.6
Poa pratensis L.	POPR1	G	N	C	100	90	7.7	5.9	10.0	7.9
Aristida purpurea Nutt. var. robusta (Merrill) A. Holmgren & N. Holmgr	ARLO1	G	Y	C	20	30	0.2	0.3	0.3	0.4
Carex heliophila Mack.	CAHE1	G	Y	C	90	90	3.3	2.9	4.3	3.9
Koeleria pyramidata (Lam.) Beauv.	KOPY1	G	Y	C	60	50	0.8	0.8	1.0	1.1
Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	G	Y	C		20		0.2		0.3
Stipa comata Trin. & Rupr.	STCO1	G	Y	C	80	90	4.1	5.6	5.3	7.5
Andropogon gerardii Vitman	ANGE1	G	Y	W	100	100	14.4	17.4	18.7	23.3
Andropogon scoparius Michx.	ANSC1	G	Y	W	70	80	1.8	2	2.3	2.7
Bouteloua curtipendula (Michx.) Torr.	BOCU1	G	Y	W	40	90	1	2.3	1.3	3.1
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	G	Y	W	80	90	1.3	1.9	1.7	2.5
Bouteloua hirsuta Lag	BOHI1	G	Y	W	30	10	0.3	0.1	0.4	0.1
Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	G	Y	W	100	100	13.2	11.8	17.1	15.8
Sorghastrum nutans (L.) Nash	SONU1	G	Y	W	50	50	1.6	1.5	2.1	2.0
Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	G	Y	W	10	10	0.2	0.1	0.3	0.1
Total foliar cover							77.2	74.6	100.0	100.0
Total forb cover							2.7	3.7	3.5	5.0
Total native forb cover							2.4	3.2	3.1	4.3
Total non-native forb cover							0.3	0.5	0.4	0.7
Total graminoid cover							74.5	70.9	96.5	95.0
Total warm-season graminoid cover							33.8	37.1	43.8	49.7
Total cool-season graminoid cover							40.7	33.8	52.7	45.3

Table 6-4. (cont.)

					Frequency		Absolute Cover		Relative Cover	
Scientific Name	**Speccode**	**Form**	**Native**	**Cool/Warm Season**	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**
Total native cover							44.6	50.1	57.8	67.2
Total non-native cover							32.6	24.5	42.2	32.8

Absolute cover = Absolute foliar cover is the percentage of the number of hits on a species out of the total number of hits possible (1500).

Relative cover = Relative foliar cover was the number of hits a species had relative to the total number of all vegetative hits recorded per site (i.e., the percent of vegetative cover the species represented).

All cover values presented are means (n = 10).

Native categories: Y = Native, N = Non-Native

Form categories: C = Cactus, F = Forb, G = Graminoid

Cool/Warm Season categories: C = Cool season species, W = Warm season species

Table 6-5. Prescribed Burn Pre- and Post-Burn Species Frequency (1999-2000)

				Control		Treatment		Change		
Family	**Scientific Name**	**Native**	**Speccode**	**1999**	**2000**	**1999**	**2000**	**Control**	**Treatment**	**Difference**
APIACEAE	Lomatium orientale Coult. & Rose	Y	LOOR1	16		16		-16	-16	0
ASCLEPIADACEAE	Asclepias stenophylla A. Gray	Y	ASST1				2	0	2	2
ASCLEPIADACEAE	Asclepias viridiflora Raf.	Y	ASVI1	2	2			0	0	0
ASTERACEAE	Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	Y	ACMI1	6	4			-2	0	2
ASTERACEAE	Ambrosia psilostachya DC.	Y	AMPS1	2	2	8	10	0	2	2
ASTERACEAE	Artemisia campestris L. ssp. caudata (Michx.) Hall & Clem.	Y	ARCA1			2		0	-2	2
ASTERACEAE	Artemisia frigida Willd.	Y	ARFR1	6	2	8	4	-4	-4	0
ASTERACEAE	Artemisia ludoviciana Nutt. var. ludoviciana	Y	ARLU1	4	8	26	24	4	-2	6
ASTERACEAE	Aster porteri Gray	Y	ASPO1	30	2	10	6	-28	-4	24
ASTERACEAE	Carduus nutans L. ssp. macrolepis (Peterm.) Kazmi	N	CANU1				2	0	2	2
ASTERACEAE	Centaurea diffusa Lam.	N	CEDI1		2	6	16	2	10	8
ASTERACEAE	Chrysopsis fulcrata Greene	Y	CHFU1	8	8	2	2	0	0	0
ASTERACEAE	Chrysopsis villosa Pursh.	Y	CHVI1	26	12	2		-14	-2	12
ASTERACEAE	Cirsium undulatum (Nutt.) Spreng.	Y	CIUN1			2	2	0	0	0
ASTERACEAE	Conyza canadensis (L.) Cronq.	Y	COCA1				2	0	2	2
ASTERACEAE	Erigeron divergens T. & G.	Y	ERDI1			4		0	-4	4
ASTERACEAE	Erigeron flagellaris A. Gray	Y	ERFL1				6	0	6	6
ASTERACEAE	Gaillardia aristata Pursh.	Y	GAAR1	8	18	12	8	10	-4	14
ASTERACEAE	Grindelia squarrosa (Pursh.) Dun.	Y	GRSQ1			8	8	0	0	0
ASTERACEAE	Helianthus pumilus Nutt.	Y	HEPU1	2	2			0	0	0
ASTERACEAE	Lactuca serriola L.	N	LASE1				2	0	2	2
ASTERACEAE	Liatris punctata Hook.	Y	LIPU1	82	86	52	60	4	8	4
ASTERACEAE	Senecio plattensis Nutt.	Y	SEPL1	6	6	4	4	0	0	0
ASTERACEAE	Solidago mollis Bart.	Y	SOMO1	6	6			0	0	0
ASTERACEAE	Taraxacum officinale Weber	N	TAOF1			2	10	0	8	8
ASTERACEAE	Tragopogon dubius Scop.	N	TRDU1		2	2	10	2	8	6
BRASSICACEAE	Alyssum alyssoides (L.) L.	N	ALAL1		2			2	0	2
BRASSICACEAE	Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	N	ALMI1	8	4	18		-4	-18	14
BRASSICACEAE	Arabis hirsuta (L.) Scop. var. pynocarpa (Hopkins) Rollins	Y	ARHI1	8	4	8	2	-4	-6	2
BRASSICACEAE	Draba reptans (Lam.) Fern.	Y	DRRE1		2			2	0	2
BRASSICACEAE	Erysimum capitatum (Nutt.) DC.	Y	ERCA2	4	4	4	2	0	-2	2
BRASSICACEAE	Lesquerella montana (A. Gray) Wats.	Y	LEMO1	34	48	54	80	14	26	12
CACTACEAE	Echinocereus viridiflorus Engelm.	Y	ECVI1	46	34	48	46	-12	-2	10
CACTACEAE	Opuntia macrorhiza Engelm.	Y	OPMA1	28	12	58	36	-16	-22	6
CARYOPHYLLACEAE	Arenaria fendleri A. Gray	Y	ARFE2	32	22	14	10	-10	-4	6
CARYOPHYLLACEAE	Paronychia jamesii T. & G.	Y	PAJA1	22	20	4		-2	-4	2
CARYOPHYLLACEAE	Silene antirrhina L.	Y	SIAN1				2	0	2	2
CLUSIACEAE	Hypericum perforatum L.	N	HYPE1	4	6	2	2	2	0	2
CYPERACEAE	Carex heliophila Mack.	Y	CAHE1	94	96	84	82	2	-2	4
FABACEAE	Astragalus agrestis Dougl. ex G. Don	Y	ASAG1			4	4	0	0	0
FABACEAE	Dalea purpurea Vent	Y	DAPU1	10	10	4	6	0	2	2
FABACEAE	Psoralea tenuiflora Pursh.	Y	PSTE1	26	40	18	20	14	2	12
JUNCACEAE	Juncus interior Wieg.	Y	JUIN1	4	4	8	2	0	-6	6

Table 6-5. (cont.)

				Control		Treatment		Change		
Family	**Scientific Name**	**Native**	**Speccode**	**1999**	**2000**	**1999**	**2000**	**Control**	**Treatment**	**Difference**
LILIACEAE	Allium textile A. Nels. & Macbr.	Y	ALTE1	4				-4	0	4
POACEAE	Agropyron smithii Rydb.	Y	AGSM1			2	2	0	0	0
POACEAE	Andropogon gerardii Vitman	Y	ANGE1	64	64	76	76	0	0	0
POACEAE	Andropogon scoparius Michx.	Y	ANSC1	56	54	38	40	-2	2	4
POACEAE	Aristida purpurea Nutt. var. robusta (Merrill) A. Holmgren & N. Holmgr	Y	ARLO1	14	12	4	14	-2	10	12
POACEAE	Bouteloua curtipendula (Michx.) Torr.	Y	BOCU1	74	66	44	50	-8	6	14
POACEAE	Bouteloua gracilis (H. B. K.) Lag ex Griffiths	Y	BOGR1	78	60	58	68	-18	10	28
POACEAE	Bouteloua hirsuta Lag	Y	BOHI1	52	60	18	30	8	12	4
POACEAE	Bromus japonicus Thunb. ex Murr.	N	BRJA1	4		14	2	-4	-12	8
POACEAE	Bromus tectorum L.	N	BRTE1	2	2	4	4	0	0	0
POACEAE	Buchloe dactyloides (Nutt.) Engelm.	Y	BUDA1	2	2			0	0	0
POACEAE	Koeleria pyramidata (Lam.) Beauv.	Y	KOPY1	62	74	28	32	12	4	8
POACEAE	Muhlenbergia montana (Nutt.) Hitchc.	Y	MUMO1	76	78	76	64	2	-12	14
POACEAE	Poa compressa L.	N	POCO1	56	52	84	88	-4	4	8
POACEAE	Poa pratensis L.	N	POPR1	38	38	48	50	0	2	2
POACEAE	Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	Y	SIHY1	18	22		6	4	6	2
POACEAE	Sorghastrum nutans (L.) Nash	Y	SONU1	24	22			-2	0	2
POACEAE	Sporobolus heterolepis (A. Gray) A. Gray	Y	SPHE1	8	8			0	0	0
POACEAE	Stipa comata Trin. & Rupr.	Y	STCO1	34	42	50	58	8	8	0
POLYGONACEAE	Eriogonum alatum Torr.	Y	ERAL1	38	22	12	10	-16	-2	14
PORTULACACEAE	Talinum parviflorum Nutt.	Y	TAPA1	4	10			6	0	6
ROSACEAE	Potentilla fissa Nutt.	Y	POFI1	2	2			0	0	0
ROSACEAE	Potentilla hippiana Lehm.	Y	POHI1	2	2			0	0	0
SANTALACEAE	Comandra umbellata (L.) Nutt.	Y	COUM1	6	16			10	0	10
SCROPHULARIACEAE	Castilleja sessiliflora Pursh.	Y	CASE3	2	2			0	0	0
SCROPHULARIACEAE	Linaria dalmatica (L.) Mill.	N	LIDA1	14	14	2	2	0	0	0
SCROPHULARIACEAE	Penstemon virens Penn.	Y	PEVI1	8	2	2	4	-6	2	8
SCROPHULARIACEAE	Verbascum thapsus L.	N	VETH1			2		0	-2	2

Sample size (n=50)