

Range Vegetation Assessment in the Big Desert, Upper Snake River Plain, Idaho 2007

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ABSTRACT

Vegetation data was collected at 101 randomly located sample points between May 29 and June 13, 2007 in the US Department of Interior, Bureau of Land Management Big Desert Region. Data was collected describing the 1) percent cover of grasses, shrubs, litter, and bare ground, 2) dominant weed and shrub species, 3) fuel load, 4) sagebrush age, 5) GAP land cover classification, 6) presence of microbial crust, 7) litter type, 8) forage availability, and 9) photo points. Sample points were stratified by fire and grazing treatments. Analysis showed a decrease in shrub and litter cover, and an increase in bare ground cover following the 2006 Crystal Fire.

KEYWORDS: sampling, GIS, remote sensing, GPS

INTRODUCTION

Many factors influence land cover changes. Wildfire has been, and will continue to be, a primary source of broad scale land cover change. After a fire occurs, changes in both plant community composition and plant structure often result. In a completely unaltered system, native plants and shrubs reestablish themselves in a burned area very quickly, while in altered systems, such as the Big Desert, native plants compete with non-native vegetation. An increase in non-native vegetation and a resulting decrease in usable forage can reduce livestock and wildlife carrying capacities. Variability of fire frequency and fire intensity also plays a critical role in the composition and cover density of vegetative communities, native or otherwise. Cheatgrass (*Bromus tectorum*) is an example of a non-native grass species that is very competitive with native vegetation and also increases fire frequency.

Following the 2006 field season, a fire occurred in the Big Desert study area that burned approximately 89,000 ha. The 2007 field season was designed to assess post-fire recovery by comparing burned sites to immediately adjacent unburned sites.

Data from the 2006 field season was compared to data from the 2007 field season, in an attempt to find trends in shrub, litter, bare ground, and grass cover due both to fire and long term changes. These same ground cover data will also be analyzed within the context of the 220,000 acre Crystal Fire (Figure 1). Started on August 15, the Crystal Fire spread over the Big Desert field site, affecting 17% of points sampled during the previous month, 2006, and 52 % of subsequent sample points from the 2007 season.

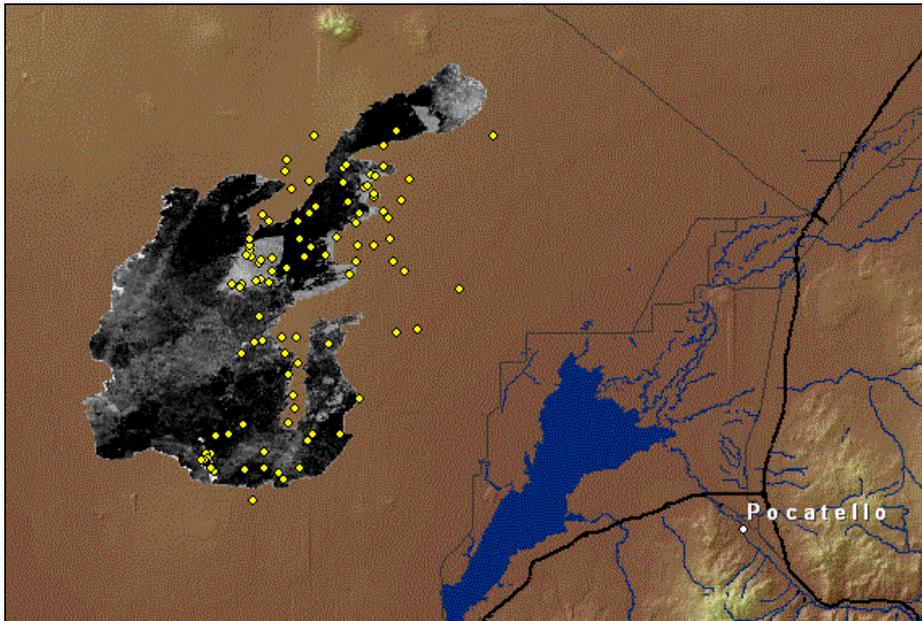


Figure 1. Big Desert sample points overlaying the 2006 Crystal Fire.

METHODS

The study area, known as the Big Desert, lies in southeastern Idaho, approximately 71 km northwest of Pocatello. The center of the study area is located at 113° 4' 18.68" W and 43° 14' 27.88" N (Figure 1). This area is managed by the Bureau of Land Management (BLM) and exhibits a large variety of native species as well as invasive species. The area is a sagebrush-steppe semi-desert which is bordered by

geologically young lava formations to the south and west. Irrigated agricultural lands border the study area to its north, south and east. The area has a history of livestock grazing and wildfire occurrence.

Sample points (n=101) were randomly generated across the study area (Figure 1). Each point met the following criteria;

- 1) >70 meters from an edge (road, trail, or fence line)
- 2) <750 meters from a road.

Sample points were stratified by treatment: 1) fire and 2) grazing. The location of each point was recorded using a Trimble GeoXH GPS receiver using latitude-longitude (WGS 84). Points were occupied until a minimum of 60 positions were acquired and Wide Area Augmentation System (WAAS) was used whenever available. All points were post-process differentially corrected (+/-0.20 m with a 95% CI) using an array of southeastern Idaho continuously operation reference stations (CORS) each located <80 km of the study area. All sample points were projected into Idaho Transverse Mercator NAD 83, using ESRI's ArcGIS (Gneiting, et al., 2005).

Ground Cover Estimation

Visual estimates were made of percent cover for the following; bare ground, litter and duff, grass, shrub, and dominant weed. Cover was classified into one of nine classes (None, 1-5%, 6-15%, 16-25%, 26-35%, 36-50%, 51-75%, 76-95%, and >95%).

Observations were assessed by viewing the vegetation perpendicular to the earth's surface. This was done to emulate what a "satellite sees". In other words the vegetation was viewed from nadir (directly overhead) as much as possible.

Fuel Load Estimation

Fuel load was estimated at each sample point. Visual observations of an area equivalent to a single SPOT5 pixel, (10 mpp or approximately 100 m²), centered over the sample point were used to estimate fuel load (Table 1).

Table 1. Fuel load classes and associated tonnage of fuels from Anderson (1982).

Fuel Load Class	(Tons/Acre)
1	0.74
2	1.00
3	2.00
4	4.00
5	>6.00

Forage Measurement

Available forage was measured using a plastic coated cable hoop 2.36 meters in circumference, or 0.44 m². The hoop was randomly tossed into each of four quadrants (NW, NE, SE, and SW) centered over the sample point. All grass species within the hoop considered forage for cattle, sheep, and wild ungulates were clipped and weighed (+/-1g) using a Pesola scale tared to the weight of an ordinary paper bag. The measurements were then used to estimate forage amount in AUM's, pounds per acre, and kilograms per hectare (Sheley et al. 1995).

Microbiotic Crust Presence

Microbiotic crusts (Johnston 1997) are formed by living organisms and their by-products, creating a surface crust of soil particles bound together by organic materials. These are common in very poor rangelands and are often one of the last organisms left alive during drought conditions. The presence of microbiotic crust was evaluated at each sample point and recorded as either present or absent. Any trace of a microbiotic crust was defined as “presence”

GAP Analysis

Land cover was described using a list of vegetation cover types from the GAP project (Jennings 1997). The GAP vegetation description that most closely described the sample point was selected and recorded.

Litter Type

Litter was defined as any biotic material that is no longer living. Litter decomposes and creates nutrients for new growth. For the litter to decompose it needs to be in contact with the soil in order for the microbes in the soil to break down the dead substance. If the litter is suspended in the air it turns a gray color and takes an immense amount of time to decompose through chemical oxidation. If it is on the ground it is a brownish color and decomposes biologically at a much faster rate. The type of litter present was recorded by color: either gray (oxidizing) or brown litter (decaying).

*Big Sagebrush (*Artemisia tridentata* spp.) Age Estimation*

Maximum stem diameter of Big sagebrush plants were used to approximate the age of each plant (Perryman and Olson 2000). A maximum of four samples were taken at each sample point, one within each quadrant (NW, NE, SE, and SW) centered over the sample point. The sagebrush plant nearest the plot center within each quadrant was measured using calipers (+/-1cm) and estimated to millimeters. The age of each big sagebrush plant was then estimated using the following equation ($AGE = 6.1003 + 0.5769 [\text{diameter in mm}]$).

Photo Points

Digital photos were taken in each of 4 cardinal directions (N, E, S, and W) from the sample point.

RESULTS

Percent Cover Bare Ground, Weed, Grass, and Microbiotic Crust

Twenty eight percent of all 2007 Big Desert field samples ($n = 101$) had >50% exposed bare ground. The dominant weed (if a weed was recorded) was always cheatgrass. Cheatgrass was present at 81% of all points sampled. Thirty-three percent of the sample points had >5% cheatgrass cover. Fifty one percent of the samples had <16% grass cover. Microbiotic crust was present at 10% of the points sampled.

Big Sagebrush Age Estimation

The mean age of sagebrush was 23.8 years ($n = 68$). The minimum age was 8 yrs and the maximum age was 89 years (Figure 2).

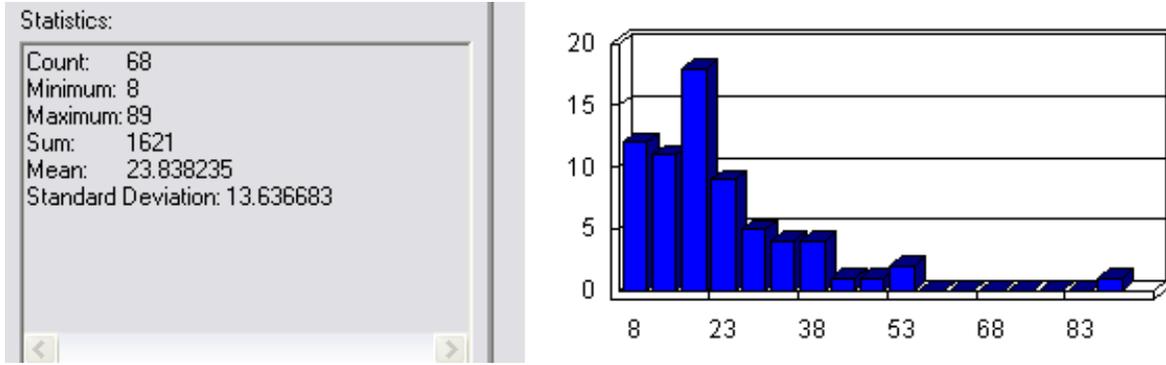


Figure 2. Sagebrush age distribution as sampled during the 2007 field season.

Forage Measurements

Using AUM Analyzer software (Sheley, Saunders, Henry 1995), forage amount and available Animal Units were calculated for the Big Desert sample points. Mean forage available was 361.97 kg/ha, which was lower than the 2006 mean of 460 kg/ha. The minimum forage available was 0 kg/ha and the maximum forage available was 1302 kg/ha (Figure 3).

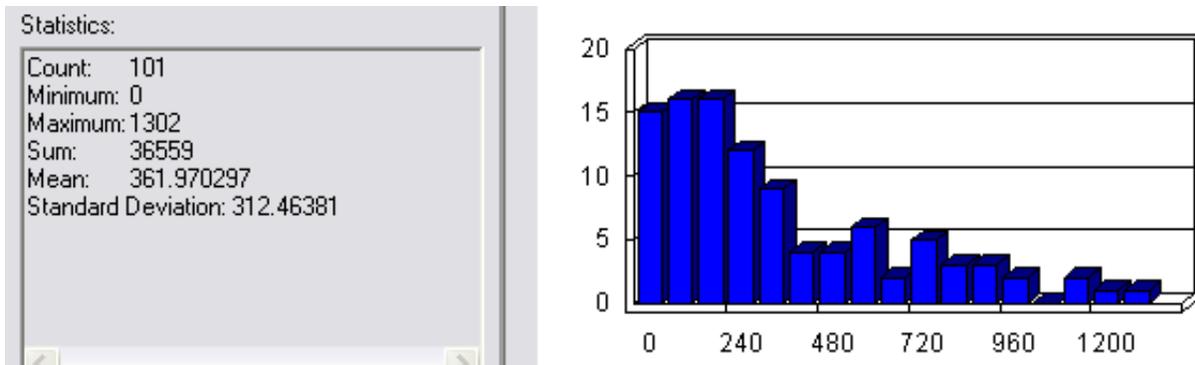


Figure 3. Forage estimates (kg/ha) as sampled during the 2007 field season.

Cover Class Trends and Fire

Simple comparisons between the 2006 and 2007 Big Desert sampling data show very interesting trends in the bare ground, shrub, grass, and litter cover classes (Figures 4 and 5). These trends include: an increase in bare ground cover (Figure 6), a decrease in litter cover (Figure 7), and a decrease in shrub cover (Figure 8). The Crystal Fire (Figure 1) spread over the Big Desert field site, affecting 17% of points sampled during 2006 field season, and 52 % of sample points from the 2007 season. There were fourteen 2006 (pre-burn) sample sites found within the boundary of the Crystal fire, these were compared to a random selection of fourteen 2007 post-burn sample sites. A pre- and post- fire comparison of litter, shrub, grass, and bare ground changes at these samples sites (Figures 9, 10, and 11) shows distinct changes in litter, shrub, and bare ground cover percentages. This comparison combined with a similar comparison of non-burn sample sites, confirms the effects of the fire on shrub, bare ground, and litter cover percentages in burned sample sites (Figures 12, 13, and 14). Weed cover showed little discernable change between the 2006 and 2007 samplings.

CONCLUSIONS

A portion of the trend in bare ground, litter, and shrub cover can be attributed to several sample points located on unvegetated lava; however, the pre- and post-fire comparison of select sites show that the decrease in litter and shrub cover, and the increase in bare ground, is most likely the result of the large range fire that occurred after the 2006 field season. Also, grass cover change anomalies might be attributed to the widespread Crested Wheatgrass (*Agropyron spicatum*) plantings during post fire recovery efforts.

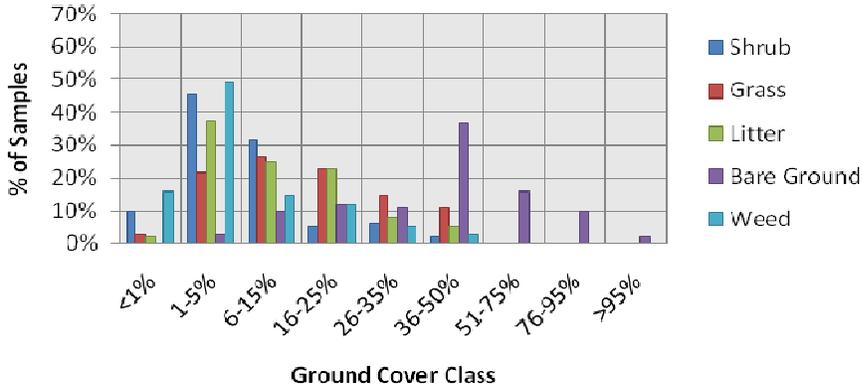


Figure 4. Big Desert ground cover in 2007 (n=101)

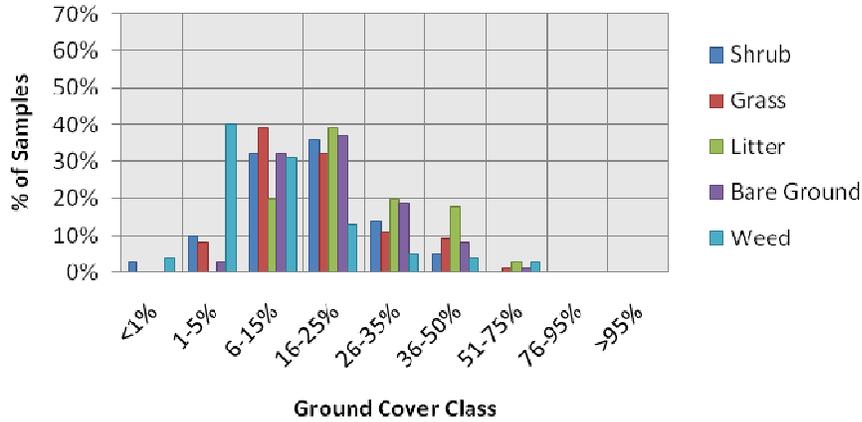


Figure 5. Big Desert ground cover in 2006 (n=100)

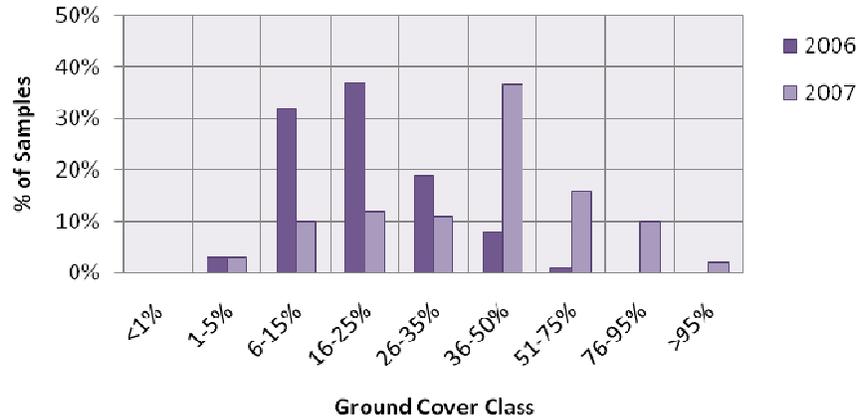


Figure 6. Comparison of Big Desert bare ground exposure in 2006 and 2007.

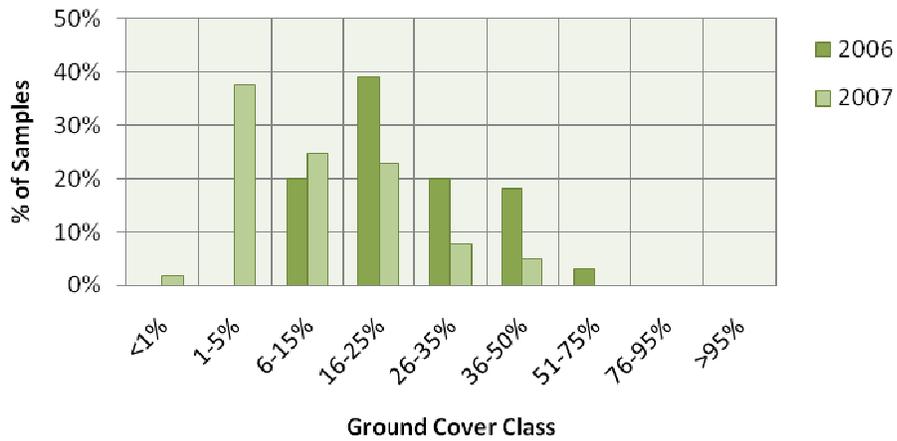


Figure 7. Comparison of litter amounts in the Big Desert between 2006 and 2007.

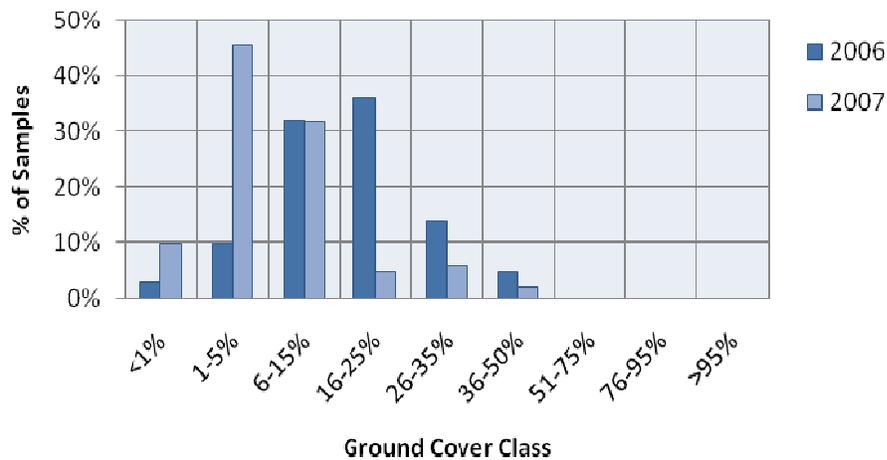


Figure 8. Comparison of shrub cover in the Big Desert Shrub between 2006 and 2007.

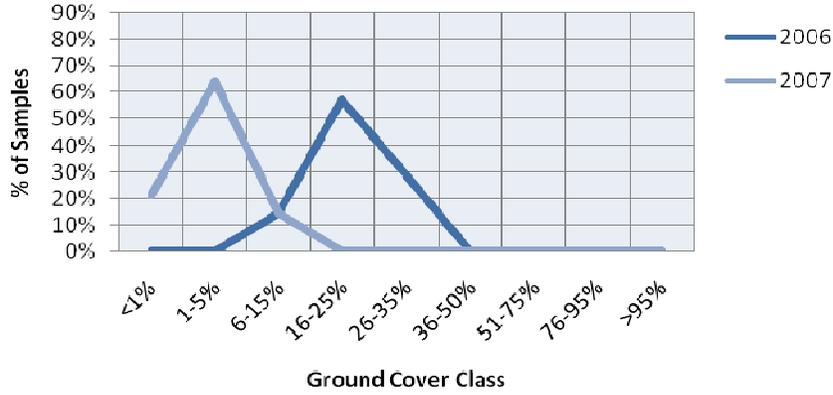


Figure 9. Comparison of pre/post fire shrub cover at sample points within the 2006 Crystal fire perimeter.

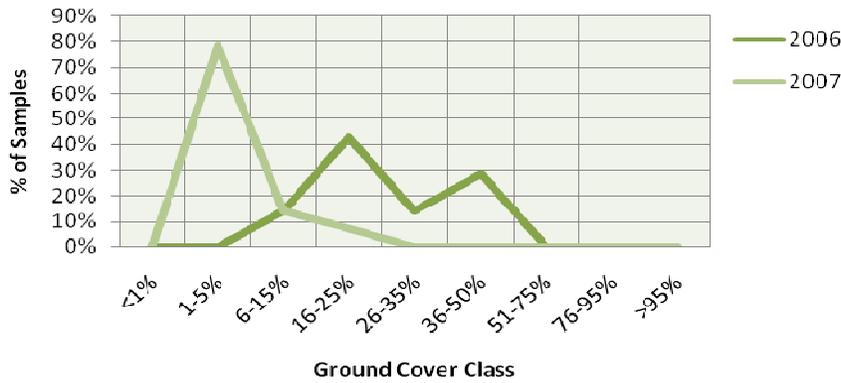


Figure 10. Comparison of pre/post fire litter amounts at sample points within the 2006 Crystal fire perimeter.

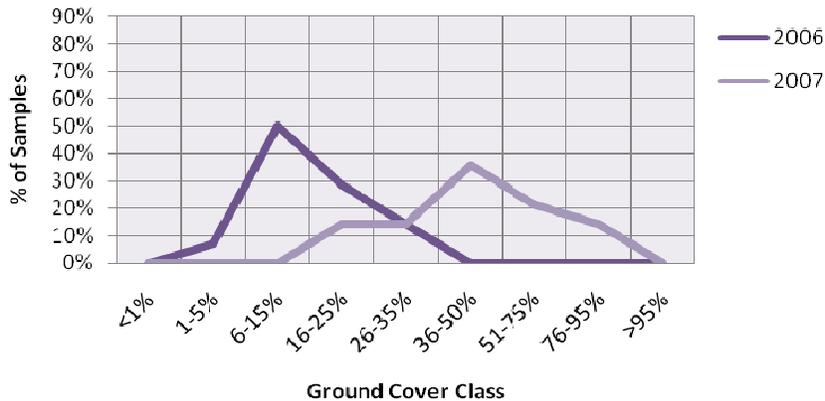


Figure 11. Pre Comparison of pre/post fire bare ground exposure at sample points within the 2006 Crystal fire perimeter.

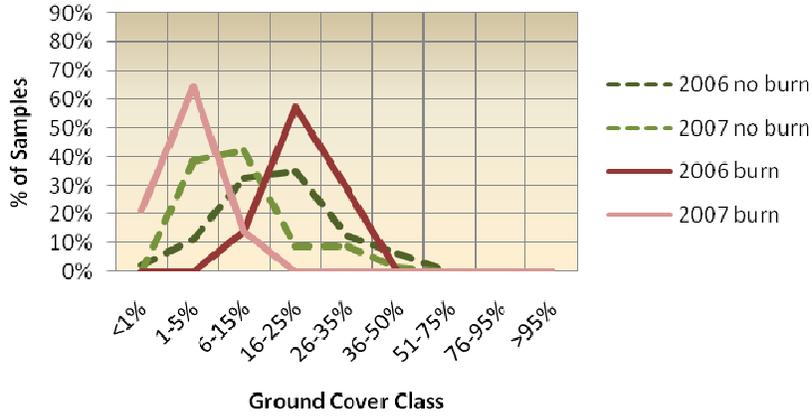


Figure 12. Pre/post burn shrub cover of sample points inside (burn) and outside (no burn) of the Crystal Fire perimeter.

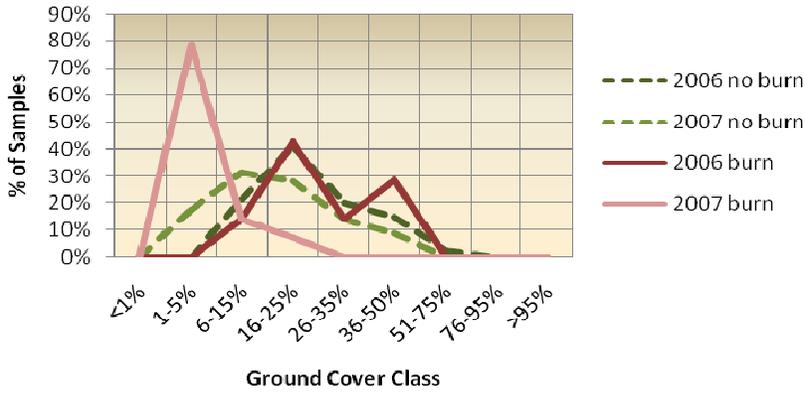


Figure 13. Pre/post burn litter cover of sample points inside (burn) and outside (no burn) of the Crystal Fire perimeter.

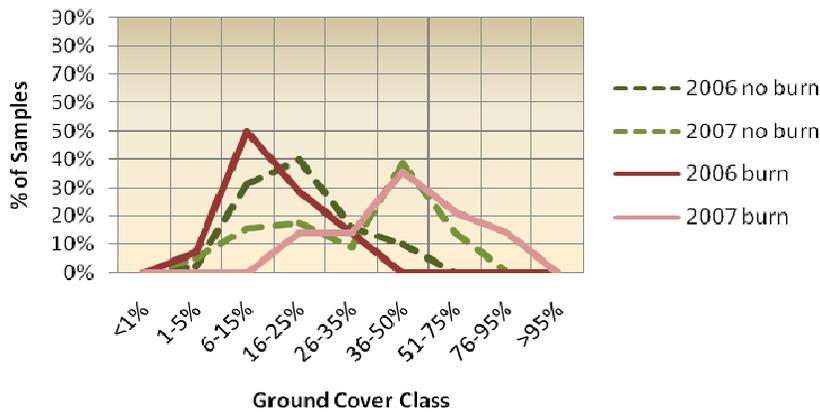


Figure 14. Pre/post burn bareground cover of sample points in and out of the Crystal Fire perimeter.

ACKNOWLEDGEMENTS

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