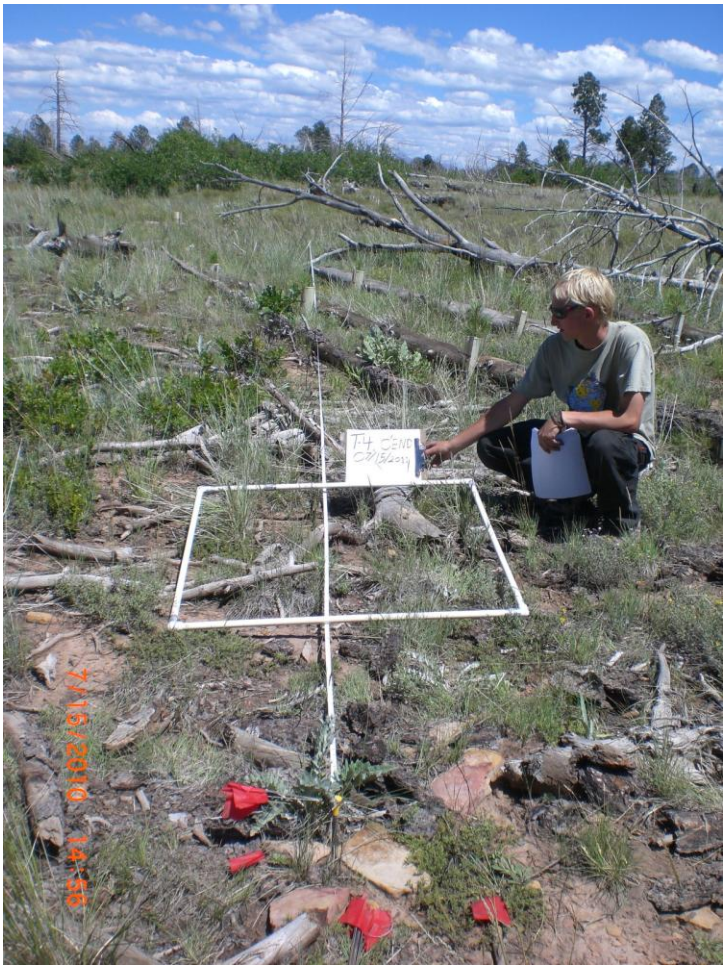
Burn Canyon Vegetation Monitoring
Final Report

October, 2011



Prepared for San Miguel County and U. S. Forest Service

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Table of Contents

List of Figures and Tables

Acknowledgements

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Funding for the 2011 field work was provided by the Collaborative Forest Landscape Restoration Program, a program of the U.S. Forest Service. Thanks to them, and the many partners who have supported the monitoring project since its inception.

Thanks to Kari Distefano for finding and providing data from previous years, and to Phil and Linda Miller and numerous volunteers for many years of setting up and reading the transects. We know now how hard you worked!

We were very fortunate in having Skyler Hollinbeck, Norwood native and Fort Lewis College student, as an intern. He learned quickly, and by the end of the project could identify nearly all of the plants we encountered. He was also great at leaping over logs, crawling through oak brush and finding hidden rebar. He even enlisted his mother, Marty, to help.

We are extremely grateful to Barry Johnston, GMUG botanist, for advice throughout the project and his excellent work in analyzing and presenting the data. His edits to this report have greatly improved it. We hope that we can work closely with him in the future.

Introduction

In July 2002, a bolt of lightning ignited a fire in the Uncompahgre National Forest south of Norwood, CO. This grew to become the largest naturally caused wildfire in Colorado history, with over 31,000 acres burned, including National Forest, BLM, state and private lands (Figure 1). Immediately, the forest service, BLM and others began to plan for recovery of the area. Plans were made for erosion control, re-seeding, and replanting trees. One proposal, to allow salvage logging in the burned area, proved to be controversial.

In the absence of data showing the effects of salvage logging on forest recovery, the Burn Canyon Community Monitoring Project was conceived. The major goal of the project was to determine whether there was a significant difference in understory vegetation cover and composition between logged and unlogged areas. To accomplish this, only part of the area was logged, and permanent transects were established in both logged and unlogged areas. These were read from 2003 through 2007 by Phil Miller, volunteer and retired Forest Service employee.

Once this baseline data was obtained, a schedule of reading the transects every three or four years was implemented. Field work in 2011 was completed by Peggy Lyon, Colorado Natural Heritage Program, and Skyler Hollinbeck, Fort Lewis College intern. Barry Johnston, GMUG Botanist graciously volunteered to analyze the data and created most of the tables and graphs included in the Appendices.

A field trip for stakeholders (National Forest, San Miguel County and interested citizens) was held in August, 2011, and an additional trip is planned for spring, 2012.

Figure 1. The Burn Canyon landscape immediately after the burn in 2002. Photo from San Miguel County.

The Burn Canyon study area is located in San Miguel County, Colorado, about five air miles southwest of Norwood (Figure 2). Before the fire, vegetation was primarily ponderosa pine forest with patches of Gambel oak, grasses, and forbs in the understory.

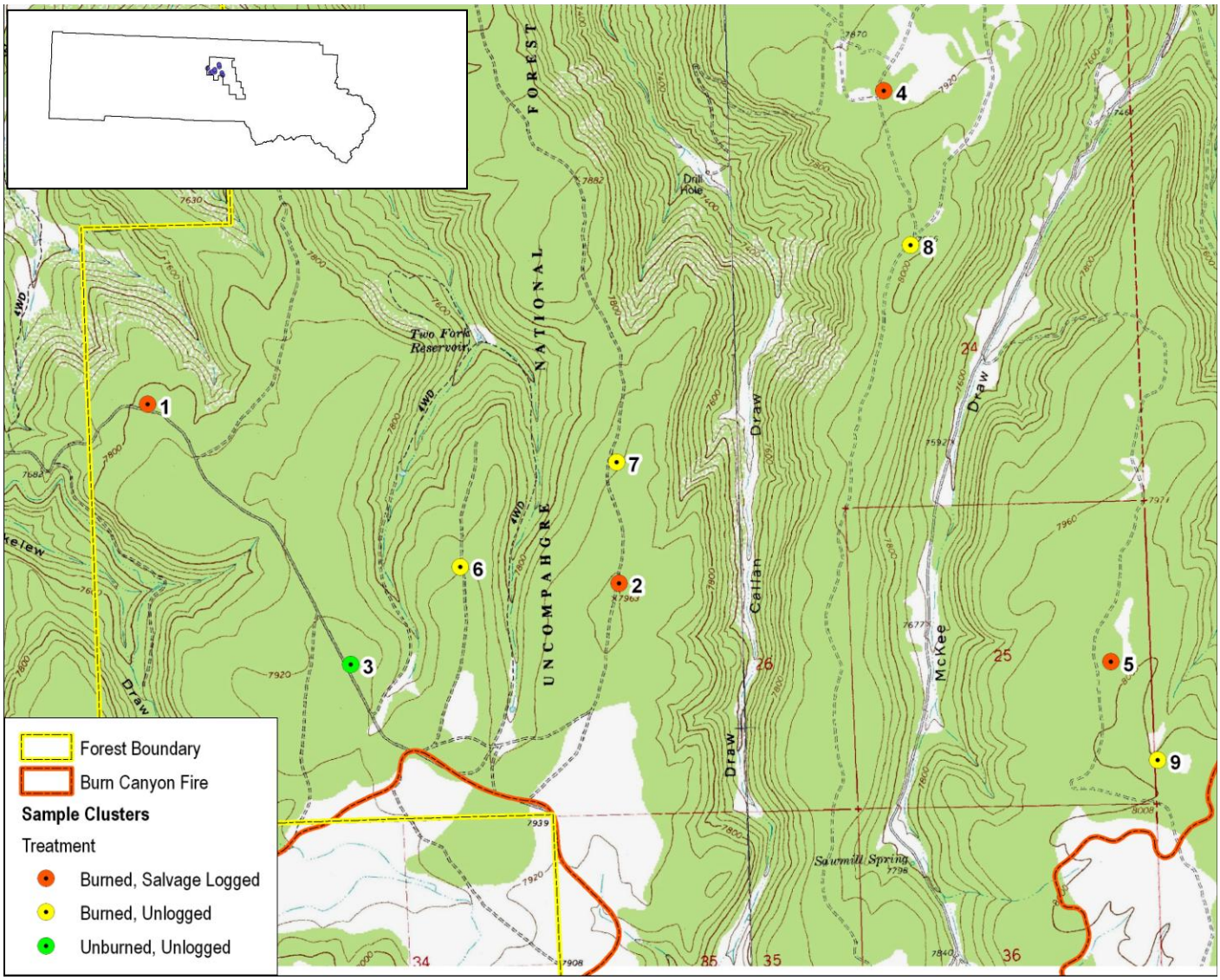

Figure 2. Location of transects. Inset: location of Burn Canyon study area in San Miguel County.

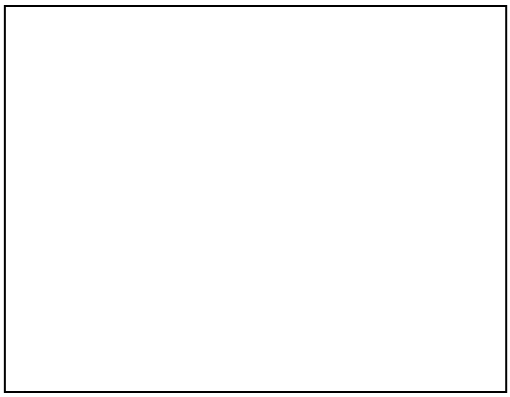

Figure 3. Sample arrangement of transects in clusters, transect cluster 2

Methods

Methods in 2011 followed as closely as possible those used in 2003 to 2007, so that meaningful comparisons could be made.

A total of 27 transects, each 100 feet long, were included in the study (Figure 2). They were located in nine clusters, three transects in each cluster, labeled 1, 1a, 1b, 2, 2a, 2b….These included twelve transects (four groups of three) in areas that were burned and logged, twelve in areas burned but not logged, and three in an unburned area.

Methods developed for the USFS loosely following Daubenmire (1959, 1970) were employed. A 100 ft. tape was stretched between pieces of rebar. Twenty 20 cm × 50 cm frames were positioned along the right side of the tape at five foot intervals beginning at zero and ending at 95 ft (Fig. 4). Percent cover was estimated for each plant species that was rooted within the frame and for several abiotic characteristics within each frame. Abiotic cover included bare ground, litter, wood (larger than 1 inch diameter), gravel, cobble, stone, boulder and bedrock. In addition, when oak overhung the frame, that cover was recorded separately.

Cover classes (Table 1) were used in the 2003 to 2007 samples, but in 2011, we estimated actual cover as nearly as possible, using the percentages 1%, 3%, 5%, 8%, 10% and increments of 5% above that in order to give more precise measurements.

Table 1. Cover estimations used in various years.

2003-2007		2011			
Cover Class	Cover Range	Cover Midpoint			
T	0-1%	1%	25%	60%	
1	1-5%	3%	30%	65%	
2	5-25%	5%	35%	70%	
3	25-50%	8%	40%	75%	
4	50-75%	10%	45%	80%	
5	75-95%	15%	50%	85%	
6	95-100%	20%	55%	90%	

Figure 4. Position of Daubenmire frame at 5 foot mark on 100 foot tape.

Reading the transects was most efficient when two people worked as a team, with one person calling out the species and percentages and the other recording. A sample of the field form used is included in Appendix IX.

Photos were taken of the transect from the zero and the 100 foot ends, as well as a one-meter square frame positioned at the 5 foot mark. Photos were also taken of the reference tree for each site (Appendix 5).

The end points of each transect were recorded with GPS and entered on the field form. In addition, the distance and compass direction (magnetic) from the reference tree to the zero end of the primary transect at each site (numbers 1, 2,…) were recorded. Distance and azimuth from the zero end of the primary transect to the zero end of each secondary transect (1a, 1b, etc.) was recorded. The azimuth of the transect (from 0° to 360°, magnetic) was also measured.

After all the transects had been read, we returned to install taller rebar and fence posts to make finding them easier in the future.

Raw data was entered into an Excel database, following the template used in 2007, then converted to a relational data base using Paradox®, Version 11 (Corel Corporation 2003). Statistics were calculated using Statistix®, Version 9 (Analytical Software 2008).

Results

Data was recorded for 27 transects. Of these, 21 were previously established, and six were new in 2011 to replace ones that we were unable to locate (clusters 1 and 3). In general, it appears that the area is recovering well, with few non-native species, an overall increase in vegetation cover (Figure 5) and decrease in bare soil. Photos comparing 2011 with previous years are included in Appendix V, with one example below (Figure 7). Differences readily observed between 2007 and 2011 were the decrease in standing dead (burned) trees and increase in down trees. There was an increase in wood on the ground, and in cover of Gambel oak. Many of the young trees that were planted following the fire were found to be growing and healthy.

Vegetation of all categories (shrubs, graminoids, forbs) increased in 2011 from previous years in both logged and unlogged areas. For details, see Appendix IV. Shrub cover has been consistently lower in logged areas than unlogged, while graminoid cover has been higher in logged areas every year. By 2011, total vegetation was nearly the same under both treatments (Figure 5 and Appendix IV).

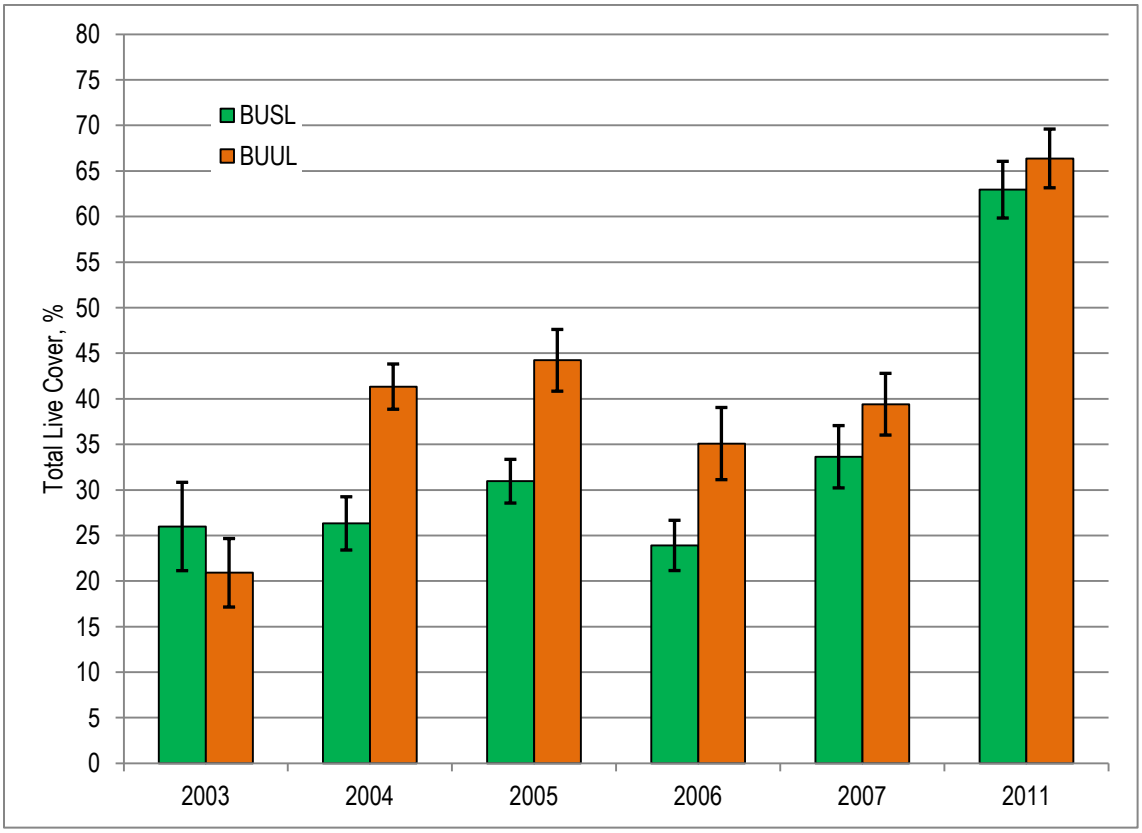

Figure 5. Total Live Cover by year. The whiskers are one standard error from the mean. There was significantly more cover in all stands in 2011. In 2004, 2005, and 2006, there was significantly more cover in unlogged stands; in other years, there was no significant difference between logged and unlogged stands. (BUSL = burned, salvage logged; BUUL = burned, unlogged)

Species richness increased significantly in 2011 over previous years, in both logged and unlogged areas (Figure 6). A total of 78 species were observed in 2011. These included 1 tree (*Pinus ponderosa*), 14 shrubs, 13 graminoids, and 50 forbs. The most common species, occurring in over 20 of the 27 transects, were yarrow (*Achillea lanulosa*), redroot buckwheat (*Eriogonum racemosum*), hairy golden aster (*Heterotheca villosa*), Kentucky bluegrass (*Poa pratensis*, a non-native but ubiquitous grass); squirreltail (*Elymus elymoides*), and Oregon grape (*Mahonia repens*). The most common non-native species, in addition to Kentucky bluegrass, were salsify (*Tragopogon dubius*) and common dandelion (*Taraxacum officinale*). A list of species in the order of their frequency in the transects is in Table 2.

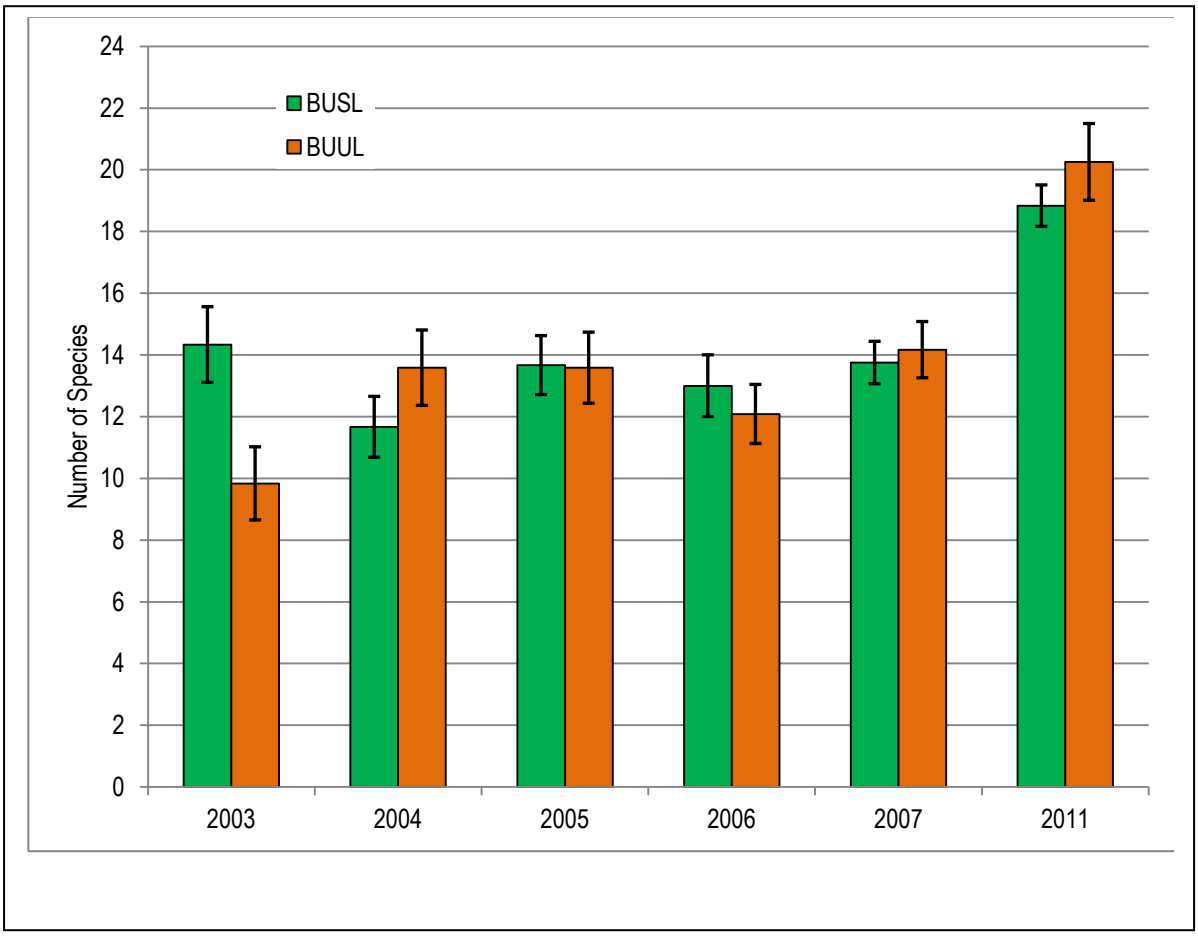

Figure 6. Number of species by year. The whiskers are one standard error from the mean.
There were more species in logged stands in 2003, in other years no significant difference between logged and unlogged stands. There were significantly more species in all stands in 2011 compared with all other years.

Table 2. List of species by frequency in transects (number of transects out of 27). Non-native species are indicated with an asterisk.

Total Transects	Species Code*	Species Name†
25	ACLA5	*Achillea lanulosa*
24	ERRA3	*Eriogonum racemosum*
24	HEVI4	*Heterotheca villosa*
24	POPR	*Poa pratensis**
22	ELEL5	*Elymus elymoides*
20	MARE11	*Mahonia repens*
18	SOVE5	*Solidago velutina*
17	ASFL	*Astragalus flexuosus*
17	PANE7	*Packera neomexicana*
17	QUGA (understory)	*Quercus gambelii (understory)*
15	COPA3	*Collinsia parviflora*
15	VIAM	*Vicia americana*
14	QUGA (overhead)	*Quercus gambelii (overhead)*
13	KOMA	*Koeleria macrantha*
13	TAOF	*Taraxacum officinale**
13	TRDU	*Tragopogon dubius**
12	CAGE2	*Carex geyeri*
12	ERCO24	*Eremogone congesta*
12	ERDI4	*Erigeron divergens*
11	ELTR7	*Elymus trachycaulus*
11	HEMU3	*Heliomeris multiflora*
10	ERFL	*Erigeron flagellaris*
10	PODO4	*Polygonum douglasii*
08	ANSE4	*Androsace septentrionalis*
08	~~ARLU~~	*Artemisia ludoviciana*
08	PASM	*Pascopyrum smithii*
07	ANRO2	*Antennaria rosea*
07	ERSP4	*Erigeron speciosus*
07	PECA4	*Penstemon caespitosus*
07	SPCO	*Sphaeralcea coccinea*
06	COUM	*Comandra umbellata*
06	LUCA	*Lupinus caudatus*
05	OXLA3	*Oxytropis lambertii*
05	PIPO	*Pinus ponderosa*
05	PSAC	*Psilochenia acuminata*
03	BOPE5	*Boechera perennans*
03	SYRO	*Symphoricarpos rotundifolia*
03	BRIN7	*Bromopsis inermis**
03	CANU	*Carduus nutans**
03	CAGE	*Carex geophila*
03	CEFE	*Ceanothus fendleri*
03	CITR4	*Cirsium tracyi*
03	PHLO2	*Phlox longifolia*
03	TECA2	*Tetradymia canescens*
02	ANTE6	*Anisantha tectorum**
02	DEPI	*Descurainia pinnata*
02	ARBI3	*Artemisia bigelovii*
02	BASA3	*Balsamorhiza sagittata*
02	DAGL	*Dactylis glomerata**
02	AMUT	*Amelanchier utahensis*
02	BADI	*Bahia dissecta*
02	BRPO5	*Bromopsis porteri*
02	HEMI2	*Helianthella microcephala*
02	HECO26	*Hesperostipa comata*
02	LOWR	*Lotus wrightii*
02	PIPO	*Pinus ponderosa (seedling)*
02	POHI6	*Potentilla hippiana*
01	BRAR	*Breea arvense**
01	BRGR	*Brickellia grandiflora*
01	COHI5	*Coriflora hirsutissima*

Total Transects	Species Code*	Species Name†
01	GECA3	*Geranium caespitosum*
01	PAMY	*Paxistima myrsinites*
01	PRVU	*Prunella vulgaris*
01	RATE	*Ranunculus testiculatus**
01	YUHA	*Yucca harrimaniae*
01	PHAU3	*Phlox austromontana*
01	ARNO4	*Artemisia nova*
01	CHDE	*Chrysothamnus depressus*
01	CHVI8	*Chrysothamnus viscidiflorus*
01	CIVU	*Cirsium vulgare**
01	ERUM	*Eriogonum umbellatum*
01	IPAG	*Ipomopsis aggregata*
01	LALE2	*Lathyrus leucanthus*
01	MABI	*Machaeranthera bigelovii*
01	MEOF	*Melilotus officinalis**
01	PEPU7	*Petradoria pumila*
01	POFE	*Poa fendleriana*
01	TRGY	*Trifolium gymnocarpon*
01	TECA2	*Tetraneuris acaulis*
01	SYAS3	*Symphyotrichum ascendens*

*. Species codes from USDA Natural Resources Conservation Service 2011. †. Plant species names follow Weber and Wittmann 2001a.

Figure 7. Transect 2 at 5 foot mark. July 15, 2007 (above), July 11, 2011 (below).
Note presence of new pine sapling and weathering of log in 2011. There was less bunchgrass in 2011.

Discussion

A large amount of our time in 2011 was spent in locating the transects. The UTM's given for the reference point trees were incorrect, and the rebar marking the transect ends was very short, often hidden in grass or below logs (Figure 8). We were eventually able to find all but the transects in clusters one and three. We established new transects in the same general area for those.

In order to make locating the transects easier in the future, we recorded detailed directions to the sites, distance and direction of the zero end of the primary transect from the reference point trees (RP), distance and direction of the zero end of transects a and b from the zero end of the primary transect, and azimuth of each transect (see Appendix XIII, Directions to Transects). We also GPSed the end points of each transect and photographed the reference trees. We added a fence post at the zero end of each primary transect, and taller rebar with red caps next to the existing rebar at each other transect end (Figure 9). We hope that this will make locating transects easier in the future.

Figure 8. Old rebar hidden beneath log

Figure 9. New rebar with red cap

The major difference between methods used in 2003 to 2007 and those used in 2011 is the use of actual cover (to nearest 5%) in 2011 versus seven cover classes previously. We believe that this method will give us much better information, since changes of up to 24% can be missed with the former method. Also, in 2011 more plants were identified to the species level, as opposed to genus previously. This may account for some of the increase in species richness. In 2007, Gambel oak was not listed in any transects. In 2011, we included oak (understory) if it was rooted inside the frame, and oak (overhead) if it was rooted outside but overhanging the frame. Comparisons cannot be made between oak cover in 2007 and 2011, except by comparing photos.

We recommend repeating the study in four to five years. Other questions that could be addressed in the future are long-term changes in understory due to succession, and responses to seeding (comparing seeded with non-seeded areas).

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