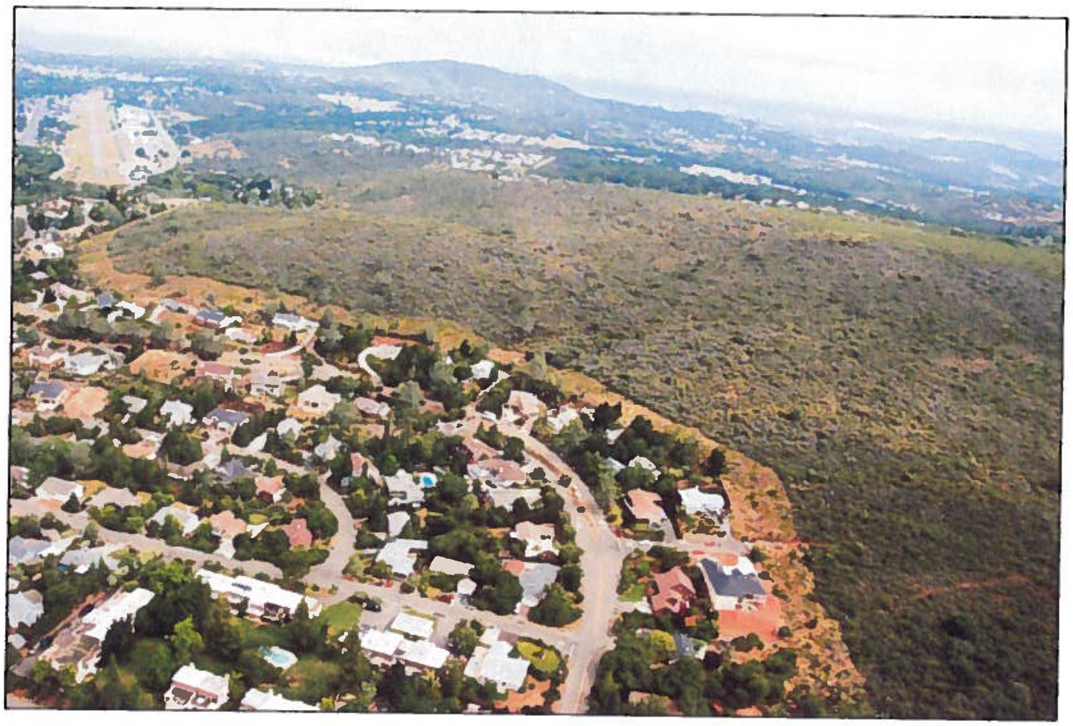
Pine Hill Preserve

The mission of the Pine Hill Preserve is to conserve in perpetuity the rare plant species and plant communities of the western El Dorado County gabbro formation

Fuels Management at the Cameron Park Unit of the Pine Hill Preserve

Final Report



Prepared by:

Graciela Hinshaw, Preserve Manager

For:

The CVPIA Habitat Restoration Program

January 31, 2011

Introduction and Background

On November 14, 2007, the Bureau of Land Management (BLM) submitted a proposal to the Bureau of Reclamation and the Fish and Wildlife Service (FWS) Central Valley Project Implementation Act (CVPIA) Habitat Restoration Program (HRP) to seek funding for fuels management activities at the Pine Hill Preserve (Preserve), in El Dorado County (EDC), California. After review and approval of the proposal the FWS entered an Interagency Agreement (IA) with the BLM on September 15, 2008. The IA 80270-8-H135 provided the BLM with funds in the amount of $70,000.00 to conduct fuels management activities in the Cameron Park unit of the Preserve.

This final report includes fuels management activities associated to the IA that were conducted from October 1, 2008 through January 31, 2011. Activities in the IA's scope of work included developing a rare plant monitoring plan and establishing monitoring plots, improving habitat for the rare plants, monitoring the response of the rare plants and their habitat, implementing fuels load reduction techniques, providing fire defensible space around structures adjacent to the Preserve and preparing and submitting periodic progress reports, a final draft report, and a final report to the CVPIA HRP. The activities described in this final report were conducted by the BLM's Fuels and Fire staff, the Preserve staff, the BLM's Hotshot crews, CalFire crews, AmeriCorps crews, volunteers and private contractors. The report also includes analyses for rare plant monitoring data collected from 2002 through 2010 in areas of the Cameron Park unit where the fuels management activities took place. Because reducing excessive fuels loads at the Preserve is a main management challenge, the BLM will continue to implement fuels projects at the Cameron Park and other Preserve units beyond the time range and scope of activities of the IA. Monitoring the response of the rare plant to fuels management activities will also continue beyond the time range of the IA.

The purpose of conducting fuels management activities at the Cameron Park unit is to help fulfill the Preserve's mission to conserve in perpetuity the rare plant species and plant communities of the western EDC gabbro soil formation. The Preserve was established to protect habitat for eight rare plants, including five that are federally listed as Endangered and/or Threatened (T&E). The rare plants and their habitat have evolved with the occurrence of fire events; however, human influences and changes in climate have altered natural fire regimes that are beneficial to the rare plants. Currently, the excessive accumulation of fuel loads at the Cameron Park unit not only threatens the existence of the rare plants but also increases the risk of uncontrolled high-intensity fire events that may affect human lives and property in areas adjacent to this unit.

The eight rare plants protected at the Preserve are Stebbins' morning glory (listed as federally and State Endangered); Pine Hill ceanothus, Pine Hill flannelbush, and El Dorado bedstraw (listed as federally Endangered and State rare); Layne's butterweed (listed as federally Threatened and State rare); Red Hills soaproot and El Dorado mule-ears (BLM Species of concern); and Bisbee Peak rush-rose (Figure 1). All eight species are included in the California Native Plant Society list as rare, threatened or endangered and, with the exception of the Pine Hill flannelbush, all of them are found in the Cameron Park unit.

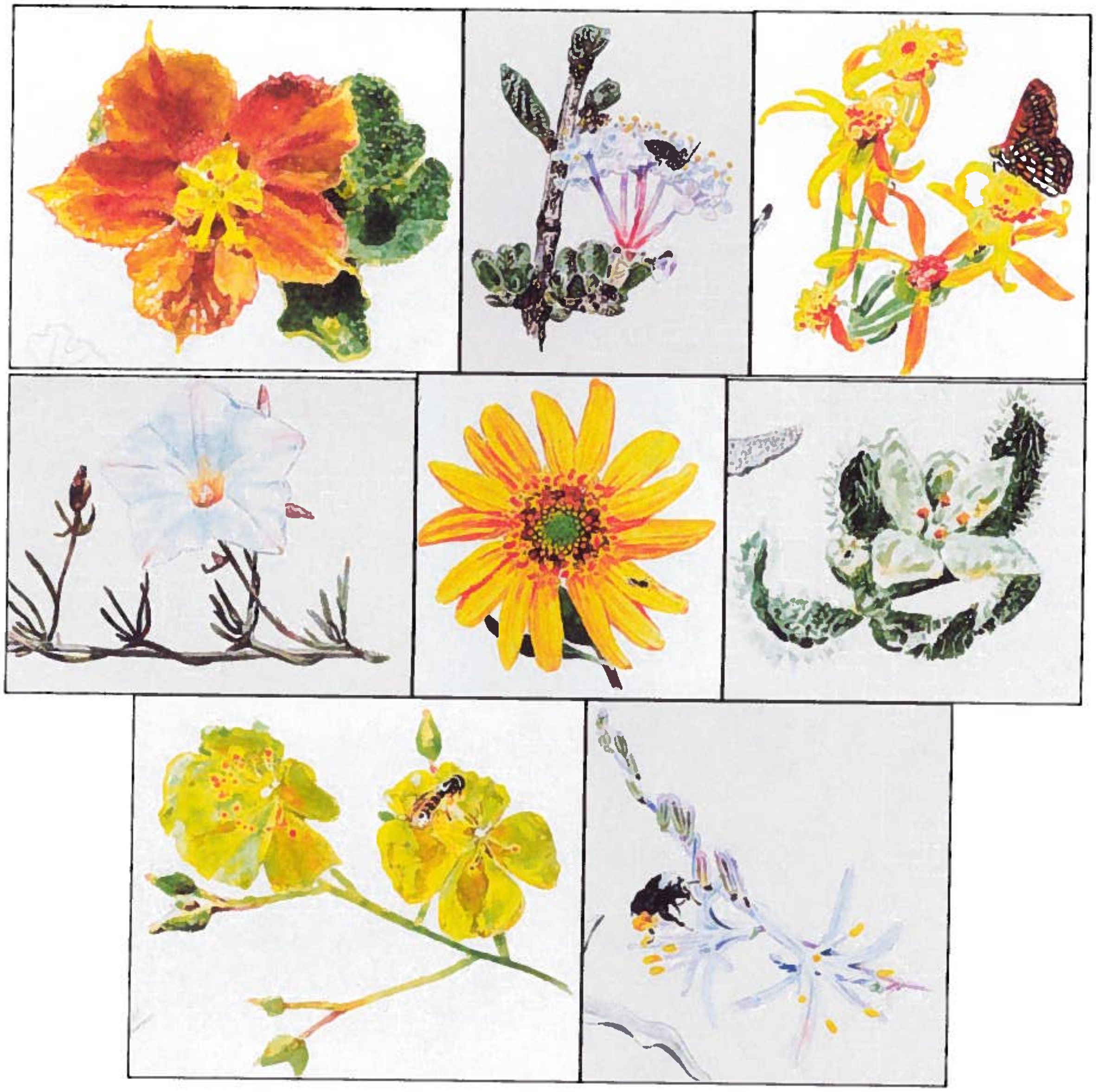


Figure 1. Gabbro soil rare plants. From left to right and from top to bottom: Pine Hill flannelbush, Pine Hill ceanothus, Layne's butterweed, Stebbins' morning glory, El Dorado mule-ears, El Dorado bedstraw, Bisbee Peak rush-rose and Red Hills soaproot.

The Cameron Park unit of the Preserve is completely surrounded by high-density development (cover photo) and the risk of an uncontrolled fire occurrence in the wildland-urban interface (WUI) is higher than in similar environments with lower densities of development (Keeley 2007). Because the occurrence of an uncontrolled fire may be detrimental to rare plant species if the fire is excessively hot or if fire-suppression activities heavily impact the habitat, decreasing excessive accumulation of fuels loads at the WUI of the Cameron Park unit is critical. In addition, decreasing the competition between rare plants and dense stands of shrubs, as a consequence of fuels reduction, is expected to result in enhancement of the habitat for the rare plants.

Because the rare plant species and other native vegetation at the Cameron Park unit have evolved under the presence of periodic fires, in the absence of natural fire regimes that diminish the amount of fuels, these species can benefit from the reduction of fuel loads using a combination of mechanic removal and piled debris burning treatments. However, the use of prescribed fire over extended areas presents risk for human lives and property, and the use of mechanical methods as a fire surrogate to reduce fuels along the Cameron Park WUI is a preferred management option. Construction and maintenance of a fuels break along the WUI will allow adequate access to Preserve lands and provide fire defensible space for private property in the event of fire. The implementation of fuels management projects at Cameron Park also allows Preserve staff to evaluate impacts of these activities on the rare plants, and provides guidance for management decisions that will benefit the rare plants in other units of the Preserve.

The unique gabbro soils and habitat types that exist at all BLM-owned Preserve parcels makes necessary that special management of these parcels be implemented to ensure the recovery of federally listed species. Implementation of fuels management activities at the Preserve not only will contribute to the recovery of the federally listed species and the conservation of other rare plants on BLM-owned parcels, but may also serve as a guide for management of adjacent public and privately-owned lands within the gabbro soil formation.

Site Description

The Preserve consists of several non-contiguous parcels and is located in western El Dorado County, about 30 miles east of Sacramento (Figure 2). The lands managed by the Preserve encompass 4,747-acres of chaparral, woodland, grassland and riparian habitat types. These lands include parcels within the Cameron Park, Pine Hill, Penny Lane, Martel Creek, Salmon Falls and Kanaka Valley areas that are owned by Federal, State and local governments. The Preserve stretches over a 25,000+ acre area of gabbro-derived soil formation in the central Sierra foothills. This biogeographic "soil island" is thought to be responsible for the high level of plant endemism found in the area. Four of the rare plant species (the Pine Hill flannelbush, Pine Hill ceanothus, El Dorado bedstraw and El Dorado mule-ears) have populations restricted to the gabbro soil formation.

The Preserve contains several parcels scattered over the gabbro soils intrusion. Individual parcels range in size from ten acres to several thousand acres and host a variety of ecological habitats. The rare plants are predominately found in the northern mixed chaparral habitat with some populations and species found in oak woodland habitat.

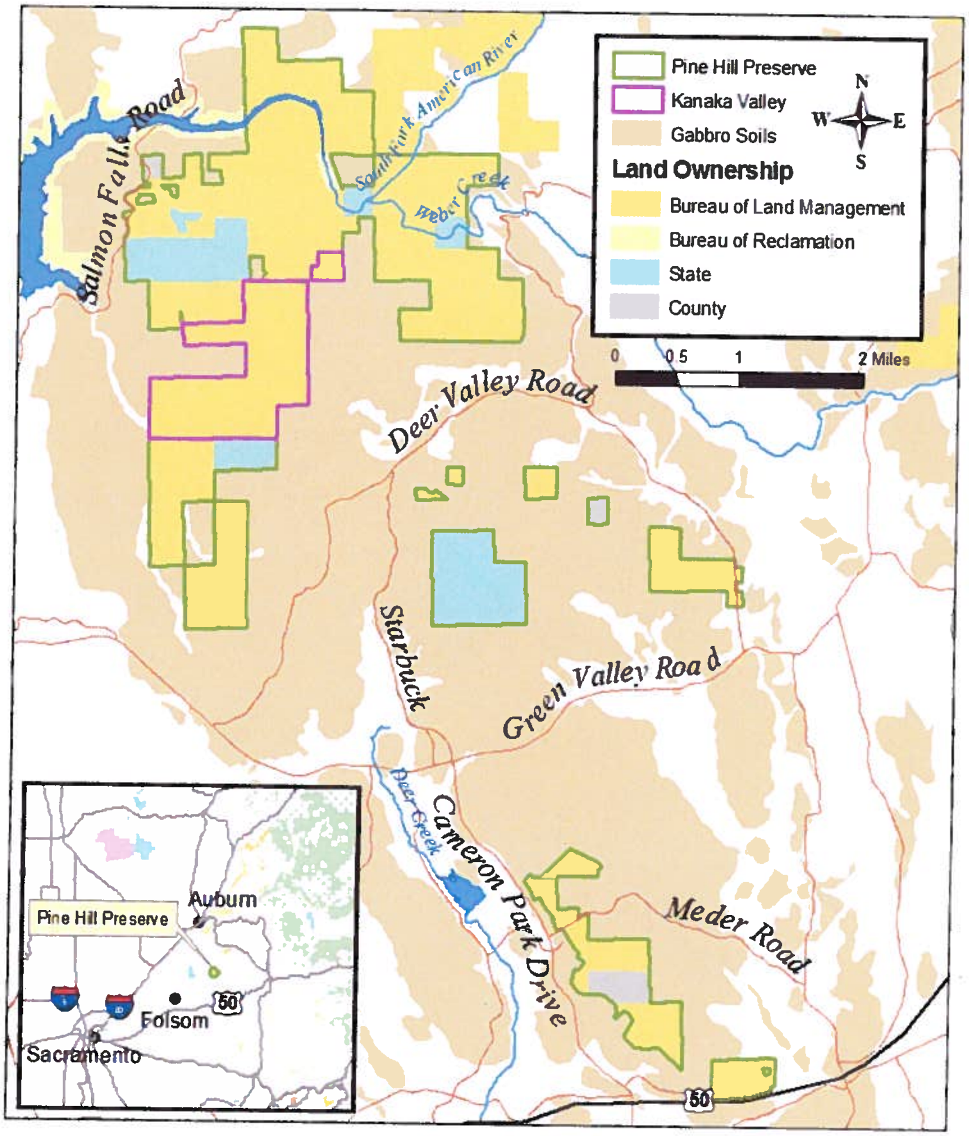


Figure 2. General location of the Pine Hill Preserve parcels. The Cameron Park unit is along Cameron Park Drive, north of Highway 50.

Elevations at the Preserve range from 480 to 2059 feet above sea level. The dominant soils are classified as sandy loams of the Rescue Soil Series. These soils are well drained with a high iron and magnesium content and naturally red color. The climate is characterized as Mediterranean with cool, wet winters and hot, dry summers. Average precipitation and temperature during a five-year period are 31 inches per year and 63° F, respectively; the average minimum and maximum temperatures are 29° F and 113° F (BLM 2008).

The Cameron Park unit of the Preserve is completely surrounded by residential and commercial development, although a few privately-owned parcels with natural habitat and significant rare plant populations remain undeveloped and help to naturally connect parcels for this unit. This 497-acre unit is comprised of a 407-acre parcel and a 90-acre parcel in the Cameron Park and

Shingle Springs areas, respectively. The largest parcel at Cameron Park is bisected in its northern portion by Meder Road (Figure 2). Vegetation at the Cameron Park unit is represented by two main types: northern mixed chaparral and oak woodland. The majority of the unit is covered with chaparral species. More than 700 plant species (approximately 10 percent of the plant species in California) are represented in the gabbro soils formation in the Preserve area; the Cameron Park unit has a high concentration of rare and endangered plants in western EDC (Wilson, 1986). The rare Stebbins' morning glory, Pine Hill ceanothus, Red Hills soaproot , El Dorado bedstraw, Layne's butterweed, Bisbee Peak rush-rose and El Dorado mule-ears are mainly found in the chaparral areas of the Cameron Park unit, although they also occur in the woodland areas. Wildlife at the Cameron Park unit includes several species of mammals, birds, reptiles and numerous insects including the different pollinators required for rare plant reproduction. Other organisms such as fungi, soil bacteria, and algae also naturally exist in the Cameron Park unit. Because the mechanisms for management and conservation of the rare plants depend upon the existence and functionality of the entire ecosystem, the reduction and modification of fuels at the Cameron Park unit will also help to protect and manage soils, hydrology and other features that help sustain all wildlife species and their interactions.

The Cameron Park unit has been identified by the BLM as a Visual Resource Management Class II and, in order to protect and enhance the overall scenic qualities and visual integrity of the characteristic landscapes, management actions in this area, including the modification of the fuels load, are adapted to retain and/or enhance the existing character of the landscape and to ensure that the level of change to the characteristics of the landscape remains low.

Implemented Activities and Results

Establishing monitoring plots and monitoring habitat and rare plants: A monitoring plan for habitat and rare plants was developed during October 2008 (Attachment A) and was included in the January 12, 2009 progress report for the IA. The plan includes protocols for habitat surveys, documentation and mapping of rare plant populations and the federally listed species present in the areas where fuels management activities took place. To evaluate habitat along the WUI Cameron Park area, reconnaissance surveys were conducted by walking along inventory lines (transects) within approximately 100 feet wide bands along the boundaries of the Cameron Park unit. To avoid large gaps in areas with dense chaparral where the inventory took place, some routes were partially determined by existing openings and a minimum standard gap size of 50 feet was used (Figure 3).

Other areas of the Cameron Park unit were surveyed to determine distribution and number of individual plants and/or size and density of patches. The method for documenting patches smaller than 300 ft^2 was a complete count of individuals (Elzinga et al. 1998) and the entire patch was mapped using polygons. If patches were rather large and dispersed, they were documented by using points and later combined into polygons. For large patches the numbers of individuals were estimated. Occupied habitat and distribution for five of the rare plants in the Cameron Unit during 1988 is shown in Figure 4.

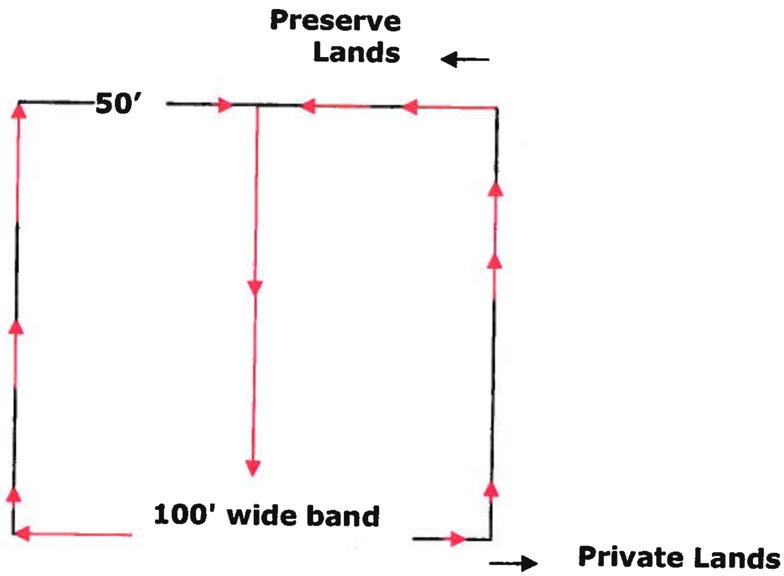


Figure 3. Example of inventory lines (transects) within the 100' wide band along the Cameron Park unit boundaries (WUI area). Red arrows indicate the direction of walking along transects. Maximum possible gap between inventory lines was 50'.

A protocol and data sheet for photo monitoring the fuels reduction activities were created during 2008 and photo points were established through 2008 and 2009. Geographical Position System (GPS) data, including points, polylines and polygons, for the rare plants were collected using computer handheld devices equipped with Geographical System Information (GIS) software ArcPad. Data were saved as electronic shapefiles in the BLM GIS server system and have been used to create distribution maps of the rare plants and to document and locate monitoring plots, transects and photo points (Figures 4 -6).

Twenty permanent plots for Pine Hill ceanothus, El Dorado mule-ears and El Dorado bedstraw established before 2008 were evaluated during July-October of 2008, 2009 and 2010, in areas where fuel management activities at the Cameron Park unit took place. Evaluation of the Pine Hill ceanothus plots started during 2002, and the El Dorado mule-ears and bedstraw plots evaluations started during 2005. Locations of these monitoring plots are illustrated in figures 5 and 6. Aerial photos in Figure 5 were taken during 2008 after fuels management activities in the Cameron Park unit WUI area took place near the Este Vista and Jackie Lane road areas. Aerial photos in Figure 6 were taken prior to fuels management activities (2005) in the Cameron Park WUI area near Jackie Lane and Chasen Lane roads area.

In addition, three 10x2 m monitoring plots for Pine Hill ceanothus, El Dorado mule-ears and Layne's butterweed were established and evaluated during December 2008; in June 2009, three 30 m transects and three 2x30m plots were established to monitor habitat and changes in cover and/or numbers for Pine Hill ceanothus, Layne's butterweed and Bisbee Peak rush-rose. During

February 2010, three 300 ft^2 macro-plots for Stebbins' morning glory were marked and distribution of patches and estimated individual numbers were documented. Evaluations of the plots and transects established after 2008 will continue to be collected and evaluated beyond the time frame of the IA. No plots or transects were exclusively established for the Red Hills soaproot, but distribution and estimated numbers of this species have been recorded at different sites in the Cameron Park unit; information for this species is also being collected in association with other species' plots and transects.

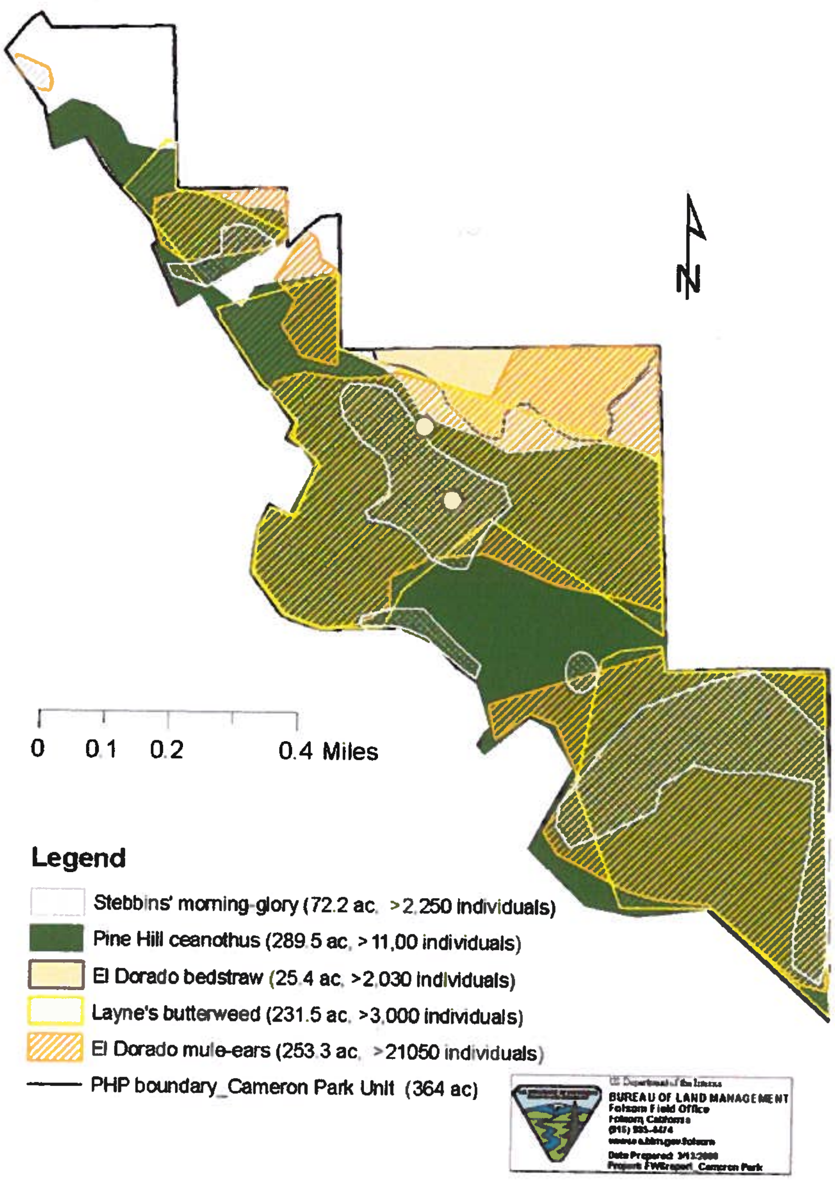


Figure 4. Occupied acreage and estimated numbers of rare plant individuals at the Cameron Park Unit of the Pine Hill Preserve.

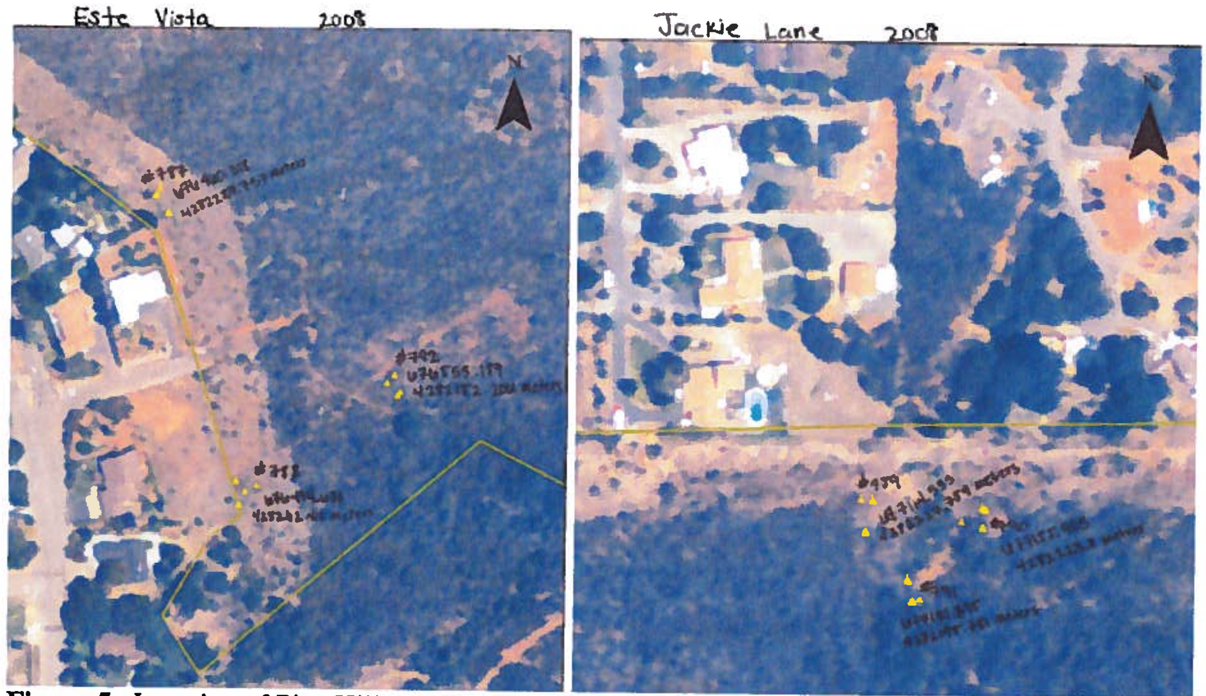


Figure 5. Location of Pine Hill ceanothus plots near Este Vista road (left) and Jackie Lane (right) in Cameron Park.

Figure 6. Location of El Dorado mule-ears plots near Jackie Lane (left) and El Dorado bedstraw plots near Chasen Lane (right) in Cameron Park.

Monitoring plots results.

El Dorado mule-ears. Permanently established plots for El Dorado mule-ears (Figure 7) were used to evaluate effects of driving over plots with a masticator (treatment) versus plots without masticator-driving effects (control). Evaluations were done by counting all individual stems of this species within the plots, and comparing the recorded values for the treatment vs. control using AOV techniques. Comparisons were made for the years 2005 (before and after

Figure 7. Evaluating monitoring plots for El Dorado mule-ears during July 2010.

Figure 8. Evaluating monitoring plots for El Dorado bedstraw during September 2010.

treatment) through 2010. The numbers of stems with reproductive structures (flowers and/or fruits) were also compared for the masticator treatment vs. the control using AOV techniques. We counted and evaluated stems with reproductive structures during the years of 2006 through 2010, and documented precipitation records during the years of 2005 through 2010. In addition, the effects of placing chips on plots with El Dorado mule-ears (chips) versus plots where chips were not deposited (no chips) were also evaluated by counting the number of stems and stems with reproductive structures. A total of six plots were evaluated for each of the masticator treatment vs. control, and two plots with two quadrants each were evaluated for the chips vs. no chips treatments.

Values for the number of stems of El Dorado mule-ears decreased after the application of the masticator driving treatment (second 2005 value of the first graphic in Table I) and remained lower than the control for the rest of the study, from 2006 through 2010. However, these values were not significantly different (P>0.05) for either the number of stems and/or the number of stems with reproductive structures (Tables II and III). Values for the number of stems of El Dorado mule-ears over a period of 5 years, from 2005 through 2010, in monitoring plots where chips were deposited (chips) were higher when compared to plots where no chips were deposited (Table IV), however not significant differences (P>0.05) for either the number of individual stems or for the stems with reproductive structures were found (Tables V and VI). We also recorded the precipitation data over the 5-year period of the study (Tables I and IV). Relative low levels of precipitation during most of the 5-year study appeared not to have a detrimental effect on the numbers of stems or reproductive structures for this species.

Possible explanations for the non-significant AOV results include the high variation on the values of the parameters evaluated (Tables II, III, V and VI). Also, for the chips vs. no chips plots the rather low intensity of the "chips" treatment may help to explain the non-significant differences: due to the lack of available materials in situ, not enough chips were deposited on the ground of the evaluated plots, and the targeted depth of at least 2 inches of accumulated chips was not reached.

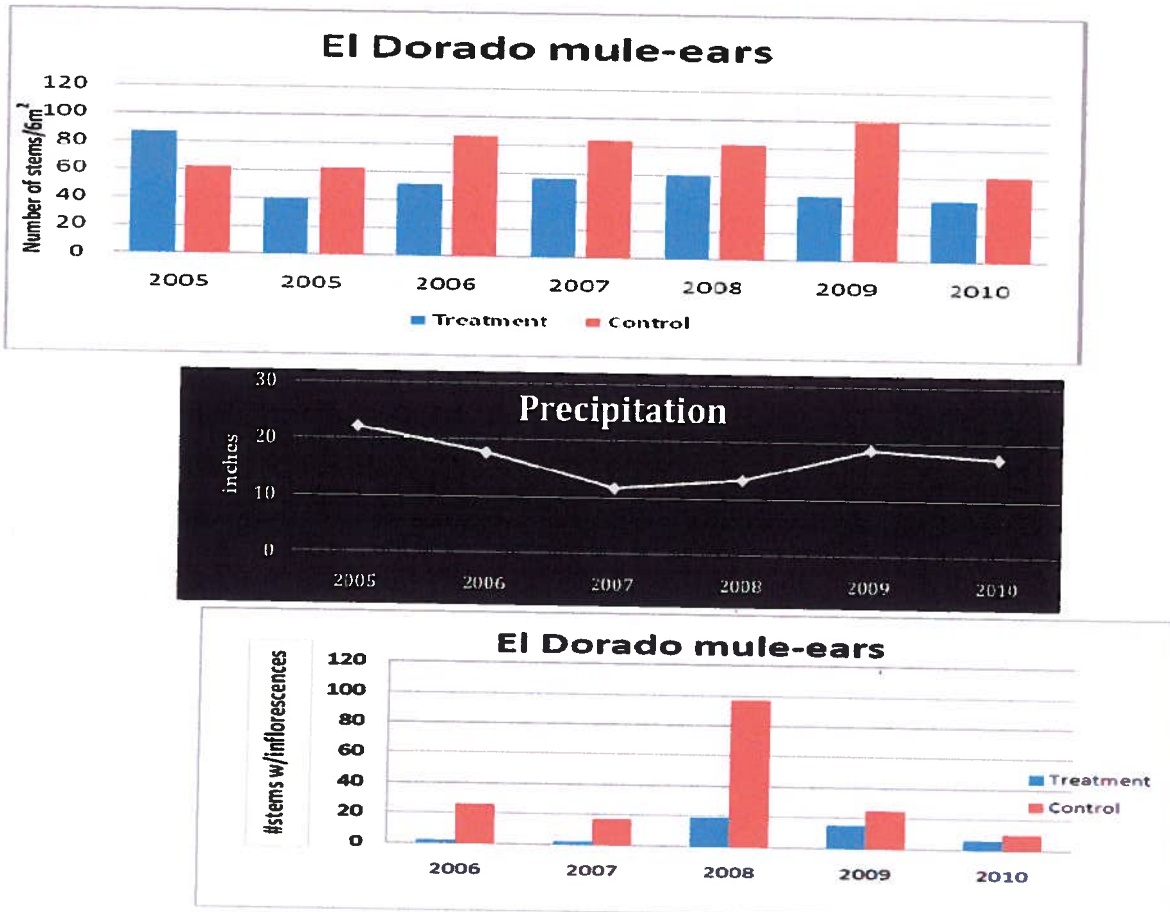


Table I. Number of stems of El Dorado mule-ears during 2005 through 2010 for both the masticator driving treatment and the control (upper graphic), precipitation records during the duration of the study (middle graphic), and number of stems of El Dorado mule-ears with reproductive structures for the masticator driving treatment and the control during 2006 through 2010 (lower graphic).

El Dorado mule-ears number of stems treatment vs. control

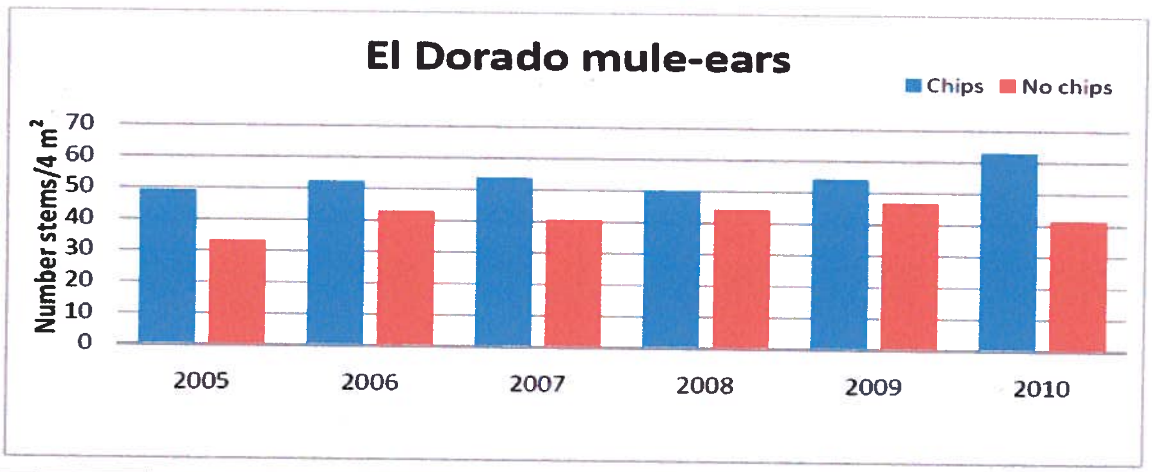
YEAR	P (α= 0.05)	SS treatments	SS error
2005pre	0.576718125	1752.083333	5263.216667
2005	0.421499108	1474.08333	2098.08333
2006	0.276540573	3640.08333	2748.01667
2007	0.397176187	2380.08333	3042.01667
2008	0.513939041	1587.0833	3465.56667
2009	0.142269901	6864.08333	2705.28333
2010	0.476509076	901.333333	1647.46667

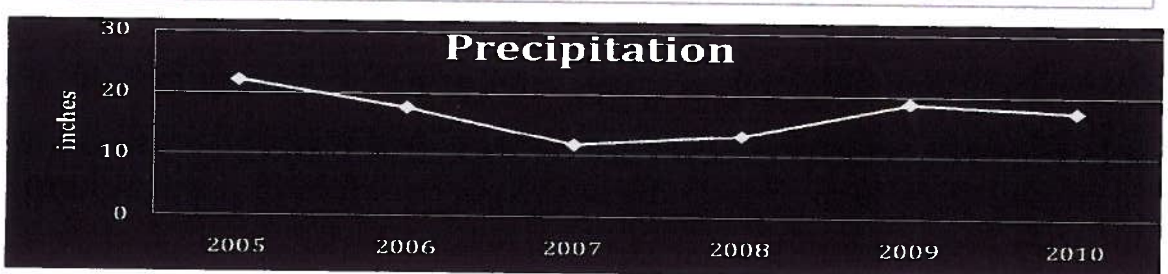
Table II. P values for the masticator driving treatment vs. the control were no significantly different ($P>0.05$) for number of stems of El Dorado mule-ears during 2005 through 2010.

El Dorado mule-ears number of inflorescences treatment vs. control

YEAR	P (α= 0.05)	SS treatments	SS error
2006	0.35695121	48	51.4666667
2007	0.06634177	18.75	4.41666667
2008	0.11088498	507	165.766667
2009	0.40924937	8.33333333	11.2333333
2010	0.48479121	1.33333333	2.53333333

Table III. P values for the masticator driving treatment vs. the control were no significantly different (P>0.05) for number of stems of El Dorado mule-ears with inflorescences during 2006 through 2010.





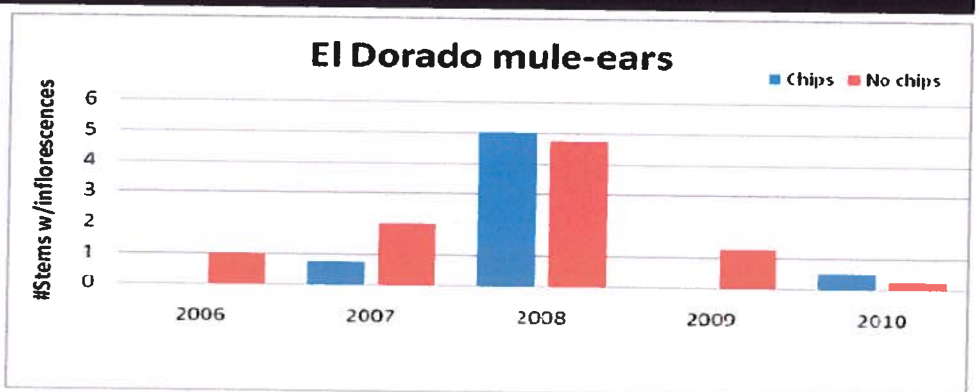


Table IV. Number of stems of El Dorado mule-ears during 2005 through 2010 for both the deposited chips (chips) vs. no chips treatments (upper graphic), precipitation records during the duration of the study (middle graphic), and number of stems of El Dorado mule-ears with reproductive structures for the deposited chips (chips) vs. no chips treatments (during 2006 through 2010 (lower graphic).

El Dorado mule-ears number of stems chips vs. no chips

YEAR	P (α= 0.05)	SS treatments	SS error
2005	0.17930244	512	221.583333
2006	0.28246903	171.125	122.791667
2007	0.22638401	351.125	193.291667
2008	0.31940225	66.125	56.125
2009	0.41013527	112.5	143.583333
2010	0.33696106	924.5	849.166667

Table V. P values for the chips vs. no chips treatments for number of stems of El Dorado mule-ears were no significantly different (P>0.05) during 2005 through 2010.

El Dorado mule-ears number of inflorescences chips vs. no chips

YEAR	P (α= 0.05)	SS treatments	SS error
2006	0.35695121	48	51.4666667
2007	0.06634177	18.75	4.41666667
2008	0.11088498	507	165.766667
2009	0.40924937	8.33333333	11.2333333
2010	0.48479121	1.33333333	2.53333333

Table VI. P values for the chips vs. no chips treatments were no significantly different (P>0.05) for number of stems of El Dorado mule-ears with inflorescences during 2006 through 2010.

El Dorado bedstraw. Permanent plots for El Dorado bedstraw were used to evaluate effects of shrub removal on the number of plants (Figure 8) from 2005 through 2010. We documented in 2006 that stems of this species were connected by their root system and learned that what we had previously considered as individual plants were stems. All individual stems for this species growing within the plots were counted. Six permanent monitoring plots for this species, each one divided in 6 quadrants, were evaluated. Half of the evaluated plots were treated by removing the shrub layer (treatment) and the shrubs on the other half of the plots were not removed (control). We also measured shrub class cover for both the control and treated plots and registered the precipitation data over a 5-year period.

Values for the number of stems of El Dorado bedstraw during 2005 through 2010 were consistently lower for the shrub removal treatment plots (Table VII), although the differences in values between the treatment and the control plots were not significantly different (P>0.05) (Table VIII). We also documented the precipitation records over a 5-year period (Table VII). The percent of shrub class cover remained more or less constant during the 5-year study (class 2 = 25-50% of cover) and the relative low levels of precipitation during most of the 5-year period appeared not to have a detrimental effect on the numbers of stems for this species (table VII).

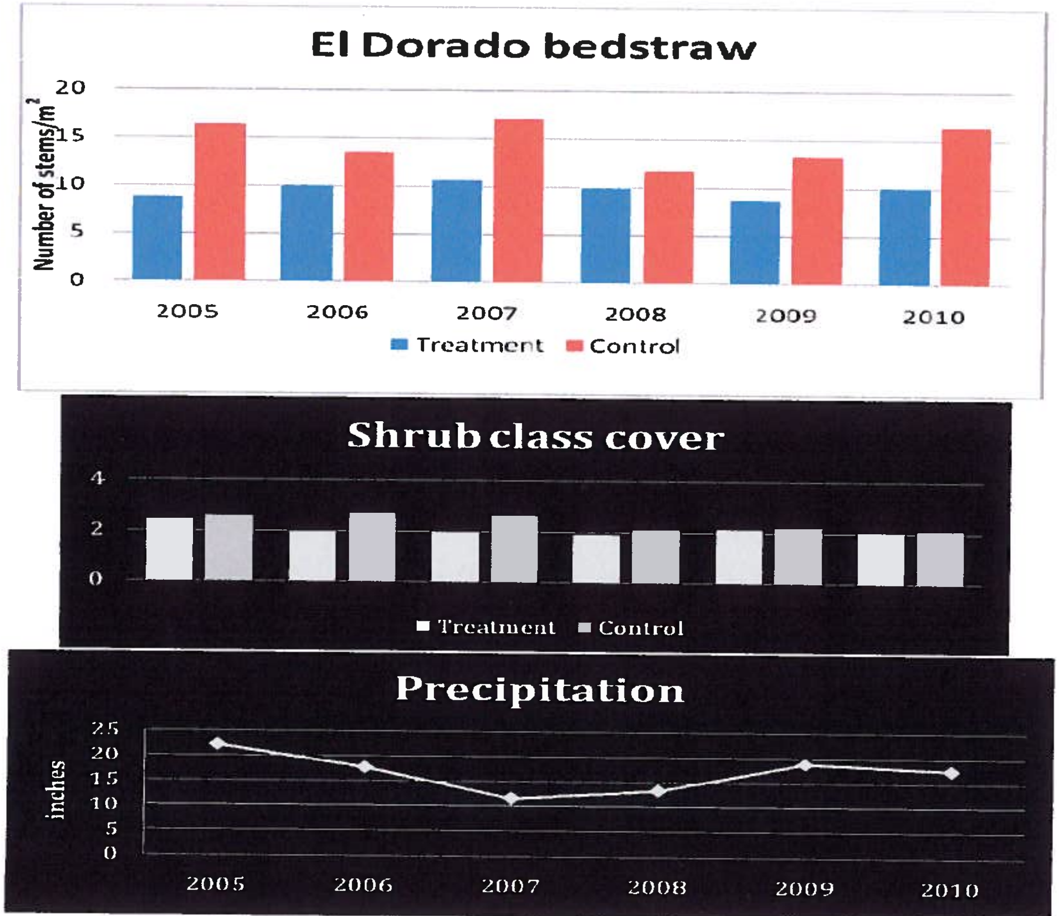


Table VII. Number of individual stems for El Dorado bedstraw recorded from 2005 through 2010 for the treatment (removal of shrubs) vs. control (upper graphic), the shrub class (middle graphic) and the precipitation records (lower graphic) during a 5-year period.

El Dorado bedstraw number of stems treatment vs. control

YEAR	P (α= 0.05)	SS treatments	SS error
2005	0.0720769	506.25	146.897059
2006	0.32233184	113.777778	112.80719
2007	0.15775858	361	173.01634
2008	0.57309258	32.1111111	99.1797386
2009	0.16042496	191.361111	92.9297386
2010	0.08949405	354.694444	116.086601

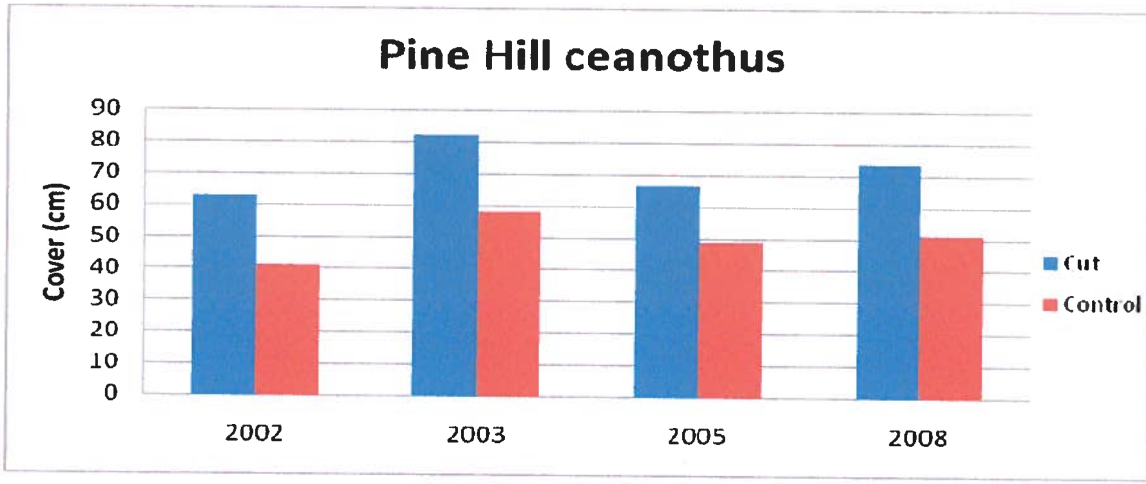
Table VIII. There were no significant differences (P>0.05) between the treated plots and the control for El Dorado bedstraw number of stems during 2005-2010.

Possible explanations for the non-significant AOV results include the high variation on the values of the parameter evaluated (Table VIII), and also to the rather low intensity of the treatment (removal of shrubs), which became almost non-noticeable during the first growing season (2006) after the removal of shrubs took place. Plots were the shrubs were removed were not re-treated during the 5-year evaluated period. The fact that El Dorado bedstraw stems appear not to be affected by low levels of precipitation could be explained by 1) this species being a perennial species and 2) this species adaptation to the Mediterranean climate of the Pine Hill area, which includes extreme fluctuations in precipitation values.

Pine Hill ceanothus. Six permanent plots for Pine Hill ceanothus were used to evaluate effects of shrub removal on the percent of cover (Figure 9) by this perennial low growing shrub from 2002 through 2010. Four of the evaluated plots were treated by removing the shrub layer (treatment) and the shrubs growing in the other two of the six plots were not removed (control). During 2009, one of the permanent treatment plots was lost due to vandalism. Data for the remaining five plots continued to be collected during 2010, although this report includes only data collected during the years 2002, 2003, 2005 and 2008. Because Pine Hill ceanothus has a very slow growth rate, it was not necessary to monitor the plots for this species every year.

Figure 9. Monitoring of percentage cover of a Pine Hill ceanothus plot during 2008, in a plot where shrubs were removed during 2002.

Values in the percent cover for the Pine Hill ceanothus were higher in the treated plots (Table IX) than in the control during all the evaluated years. However, these differences in values were not significantly different (P>0.05) (Table X). Low precipitation values during 2008 appeared not to have a detrimental effect on the percent cover for this species. Possible explanations for the non-significant AOV results include the high variation on the values of the parameter evaluated (Table X). The fact that the Pine Hill ceanothus percent of cover appeared not to be affected by low levels of precipitation could be explained by this species adaptation to the Mediterranean climate of the Pine Hill area, which includes extreme fluctuations in precipitation values.



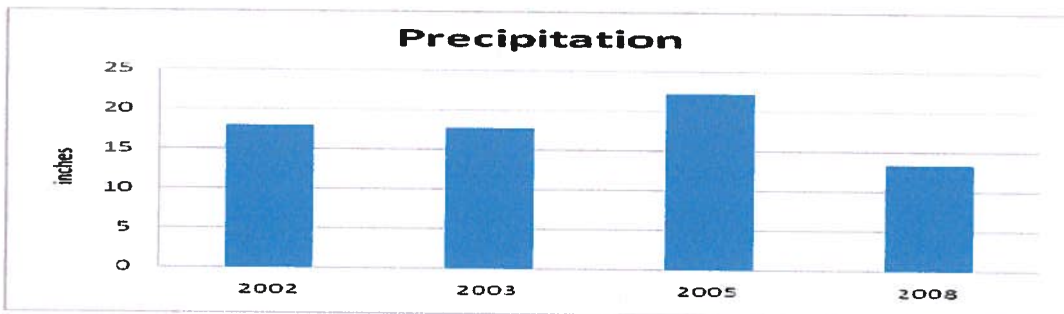


Table IX. Percent cover of Pine Hill ceanothus for the plots treated with the removal of shrubs (cut) and plots where shrubs were not removed (control) (upper graphic) and precipitation values during the years where percent cover was evaluated (lower graphic).

Pine Hill ceanothus cover (cm) treatment vs. control

YEAR	P (α= 0.05)	SS treatments	SS error
2002	0.528651	1065.34091	2669.19266
2003	0.99894946	0.00757576	4353.1866
2005	0.57022579	1273.48485	3931.12075
2008	0.31655437	4204.73485	4159.38473

Table X. There were no significant differences (P>0.05) between the treated plots (shrub removal) and the control for values of Pine Hill ceanothus percent cover during 2002, 2003, 2005 and 2008.

The overall observations confirm that the gabbro soil rare plants can respond favorably to light disturbances such as the removal of shrubs by mechanical methods. For instance, El Dorado mule-ears plots were placed in areas where shrubs had been previously removed, allowing for this species to colonize areas previously occupied by shrubs, and the values for the Pine Hill ceanothus were higher in areas where the shrubs had been mechanically removed. The removal of shrubs appears to favor in general the proliferation of most of the gabbro soil rare plants, except for the El Dorado bedstraw. However, neither positive or negative significant effects on the numbers of individuals, blooming stems and/or percent of cover for some of the rare plants was demonstrated by our evaluations.

Direct observations in the field also confirm that the rare plants respond favorably to some degree of disturbance by other methods, such as fire, roadside disturbance and grading. However, because neither positive or negative short-term responses to particular treatment, including the mechanical removal of the shrub layer, can imply the long-term survival of the rare plants, monitoring their response to fuels reduction mechanisms over extended periods of time is needed to help the Preserve's staff determine the best practices for the conservation and recovery of the gabbro soil rare plants.

***Improving habitat for seven rare plants*:** The main vegetation type in areas where fuels reduction will be conducted is northern mixed chaparral. The use of mechanical methods to remove overstory and vegetation around the rare plants decreased dense shade, diminished competition for soil resources, opened the habitat for the rare plants, and allowed the rare plants to colonize areas previously occupied by shrubs. Previous studies had also documented that gabbro soil rare plant species growing in the northern mixed chaparral vegetation benefit from the removal of shrub competition and the selective removal of tree branches to partially open aerial canopy (FWS 2002).

The rare plants at the Preserve require some kind of disturbance to proliferate; therefore it is expected that conducting fuels management activities using mechanical methods will help to decrease competition between dense shrub/tree stands and the rare plants. The seven rare plants that will benefit from the fuels reduction activities at the Preserve are Stebbins' morning glory, Pine Hill ceanothus, Red Hills soaproot, El Dorado bedstraw, Layne's butterweed, Red Hills soaproot, El Dorado mule-ears and the Bisbee Peak rush-rose. The rare Pine Hill flannelbush is not present at the Cameron Park unit.

Implementing fuels load management: From October 2008 through January 2011, the BLM Hotshot crews, Americorps crews, Calfire crews, and private contractors, led by BLM Fuels and Fire and Preserve staff and assisted by volunteers conducted shrub removal along the boundaries of the Cameron Park unit and other strategic Preserve sites. The crews disposed of cut materials by removal, masticating and/or chipping. "Small" (no wider than 6') piles of cut debris were also created and these materials will be burned during the late winter and spring of 2011. The BLM Fuels and Fire team and Preserve staff, with the assistance of CalFire and El Dorado County, conducted meetings during January 18 and 22 to address public concerns and gather public support for the proposed burning of piles in the Cameron Park area. The BLM has prepared a burn plan for this project (plan is being reviewed and approved by the BLM CenCal district) and because most of the input provided by the public was positive burning of piles is expected to begin at the end of February, 2011.

Maps of the treated areas and description of used techniques, responsible parties and rare plant mitigation measurements associated to fuels management activities are described in previous reports submitted to CVPIA-HRP (please refer to reports submitted during December 2008, June, August and December 2009, and March and August 2010). Up to date, more than 44 acres of WUI areas at the Cameron Park unit have been treated between October 2008 and January 2011.

Providing defensible space around structures adjacent to the Preserve: Conducting fuels management activities within the WUI area at the Cameron Park unit using mechanical methods has ameliorated the high risk of uncontrolled high-intensity fire events that may be detrimental to the rare plants. These activities have also provided the recommended 100 feet fire defensible space around existing structures in the Cameron Park area and special emphasis was placed around structures immediately adjacent to the Preserve boundaries. Construction and maintenance of defensible space has also provided for adequate access to a fuels break area within Preserve lands in the event of fire occurrence. The construction of the fuels break lines will minimize, and possibly eliminate, the need for bulldozing activities that would take place over valuable habitat areas in order to control wildfire events.

Preparing and submitting reports to CVPIA. Preparation and submission of this final report to CVPIA complies with the activities described in the scope of work of the FWS agreement 80270-8-H135. This final report was submitted January 31, 2010.

The BLM and the Preserve recognize the contribution of the FWS through the CVPIA Habitat Restoration Program in successfully implementing this project. For questions or comments regarding this 2010 final report, please contact Graciela Hinshaw at (916) 941-3134 or at ghinshaw@blm.gov.

Literature REVIEW

Bureau of Land Management 2008. Pine Hill Preserve Management Plan. iv+ 82 pp.

Bureau of Land Management 2008. Sierra Resource Management Plan and Record of Decision Office, California. ii+ 111 pp.

Elzinga, C. E., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM Technical Reference 1730-1. x +477 pp.

Keeley, J. E. 2005. Fire as a threat to the biodiversity n fire-types shrublands. USDA Forest Service Gen. Tech. Rep. **PSW-GTR-195**: 97-106.

U.S. Fish and Wildlife Service. 2002. Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada Foothills. Portland, Oregon. xii + 220 pp.

Wilson, J. L. 1986. A study of plant species diversity and vegetation pattern associated with the Pine Hill gabbro formation and adjacent substrata, El Dorado County, California. California State University, Sacramento. Thesis. 249 pp.

APPENDIX A

Monitoring federally listed species, *Ceanothus roderickii, Calystegia stebbinsii, Galium californicum* ssp. *sierra* and *Packera layneae* in the Cameron Park Unit, Pine Hill Preserve after mechanical fuels break creation.

L. Fety, A. Franklin and G. Hinshaw, Bureau of Land Management, Folsom Field Office, Folsom, California.

Increasingly, public safety at the wildland-urban interface is at the forefront of management concerns. However, it is imperative to ensure that fuels reduction efforts work in conjunction with conservation objectives. Disturbance theory and field observations suggest that the suite of rare gabbro plants of Pine Hill Preserve (PHP) will benefit from the removal of mature chaparral. The mechanical removal of shrubs may simulate a fire regime under which the plants evolved.

This monitoring plan has been designed to quantitatively answer questions regarding mechanical creation of fuel break and its effects on four federally listed species: 1) Does the removal of vegetation for fuels break creation increase the number of individuals in *Galium californicum* ssp. *sierra, Calystegia stebbinsii* and *Packera layneae* patches? Does the removal of vegetation for fuel break creation increase the cover of *Ceanothus roderickii*? 2) Does the removal of vegetation increase the proportion of the flowering individuals versus vegetative individuals per patch?

The study is designed to inform and direct management practices in the Pine Hill Preserve. If the rare plant species respond favorably to the techniques used to create fuels breaks, more comprehensive fuels break projects may be conducted. The ultimate goal will be to create a system of fuels breaks that may allow the implementation of prescribed fire to manage habitat for the rare plants.

<u>Introduction</u>

The Cameron Park Unit of the PHP is managed by the Bureau of Land Management (BLM) for four federally listed chaparral plants, *C. roderickii, C. stebbinsii, P. layneae* and *G. californicum* ssp. *sierrae*. This monitoring plan is associated with a project involving the creation of a fuels break by clearing and chipping vegetation around the perimeter of Cameron Park. Please refer to Fish and Wildlife Service Biological Opinion 81240-2008-F-1588-1 for specific methodology, project details, timeline and rationale.

The majority of the Cameron Park perimeter is undisturbed chaparral, though part of the perimeter was cleared and pile-burned five years ago during fuels reduction activities. The current project embarks on extensive fuels break creation and maintenance in chaparral; this monitoring project is centered on known rare plant population which will be affected by the vegetation clearing. The vegetation removal treatment of this study is also the functional fuels break.

Study Site and Methods

There will be two studies. Due to the dearth of *G. californicum* ssp. *sierrae* patches, we will combine this monitoring plan with a pertinent existing study in the Cameron Park unit. The other study being initiated is in response to the current management activities and will focus on the more prolific *C. roderickii, C. stebbinsii* and *P. layneae.*

There are only two known patches of *G. californicum* ssp. *sierrae* at the Cameron Park perimeter. In 2004, an experiment monitoring the number of *G. californicum* ssp *sierrae* individuals after selective vegetation removal was initiated; data have been collected annually. As a component of the current fuels reduction project, we will implement the study design of the 2004 project (see attached, Figure 1) at the second patch of *G. californicum* ssp *sierra*. Building on the 2004 experiment will provide a larger dataset and more widely applicable results.

Site selection will be based on the location of rare plant populations. For each of the species *C. roderickii, C. stebbinsii* and *P. layneae*, there will be six treated sites and three controls. Plots will be located within the fuels breaks and will parallel the Cameron Park perimeter. After appropriate sites have been selected, each plot will randomly be assigned the treatment level (vegetation removal or control) and marked accordingly so crews can avoid/treat appropriately.

1) Plot Location

Using permanent plots, we will gather data on the federally listed species *C. roderickii, C. stebbinsii* and *P. layneae* annually for three to five years. Plant patches are stochastically distributed throughout the Cameron Park landscape and have complex life histories. We will stratify our random sampling in the landscape to control for potentially significant abiotic influences.

We ask if there is an increase in plant populations when vegetation is mechanically removed, and answer by carefully monitoring our prescribed fuels reduction methods. The experimental treatment is vegetation removal using the techniques outlined by the Biological Opinion for areas with high densities of rare plants. Prior to fuels reduction commencement, sites containing rare plant population will be selected, permanent plots established and baseline data collected. Every effort will be made to begin with sites that have nearly identical rare plant species patches and canopy shading.

Identified patches of rare plants for evaluation at the Cameron Park Unit of the PHP are shown in Figure 1. Chaparral habitat in the red circles is free of recent disturbances, has rare plants and is slated to be part of the fuel break. Plots will be stratified among the identified areas. Orange circled X shows the patch of *G. californicum* ssp *sierrae* of a 2004 vegetation removal experiment; circled Y is a proposed site for replicating the *G. californicum* ssp *sierrae* experiment.

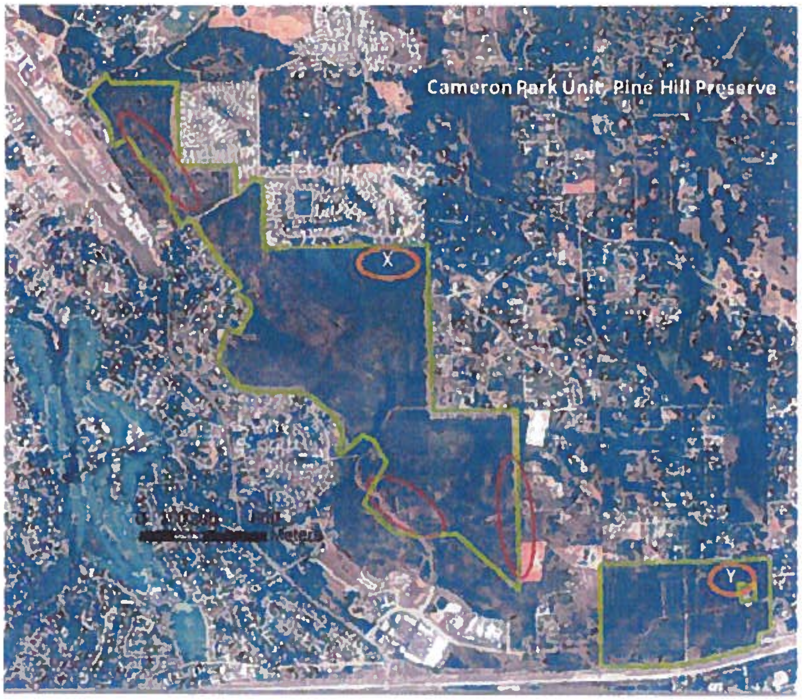


Figure 1. Rare plant areas to be monitored for effects of vegetation removal at the periphery of Cameron Park Unit, PHP.

2) Sampling

Sampled plots will include: six treated *C. roderickii, C. stebbinsii* and *P. layneae* plot sites per species and three control plot sites per species. Some species patches are expected to overlap, because rare plant species frequently occur in the same habitat. These overlapping species patches may be evaluated within the same plot thus reducing the total number of evaluated plots. Plots will be ten meters by two meters, permanently marked by rebar markers at each corner. A buffer of approximately one meter will surround each plot to decrease edge effects. GPS technology, and a narrative in field notes, will be used to relocate the sites.

We will collect data prior to treatment, and then again in the early spring post-treatment when inflorescences are visible. The spring data collection will continue annually. Canopy density measurements will also be taken prior to treatment and with annual post-treatment monitoring.

C. roderickii, C. stebbinsii, and *P. layneae* all have some degree of clonal tendencies such as underground rhizomes or branched rooting. The total number of individuals of interest (*C. stebbinsii,* and *P. layneae*) per plot will be recorded. For this study, ramets will not be distinguished from genetically distinct individuals for practical field purposes. All stems of *P. layneae* and *C. stebbinsii* that appear to originate from the same place, as viewed from the top of litter, will be called one individual. Cover measurements in $0.25m^2$ increments will be used to monitor the sprawling, evergreen shrub *C. roderickii.* Proportion of individuals flowering will also be noted using subsampling techniques if appropriate.

Discussion and Conclusion

Many questions remain unanswered about the response of the gabbro rare plants to ecosystem disturbance (USFWS 2002). Questions most pertinent to management at the Pine Hill Preserve include: do the rare plant populations of interest benefit from mechanical vegetation reduction? Are there more individuals in plots that have been treated? Is there an increase in flowering in plots that have been treated? These data will have a two-fold purpose. First, they will be applicable to future stewardship and restoration activities. Secondly, the data will help answer the outstanding public safety question: can defensible space be for public safety provided without detrimental effects to federally listed species?

This monitoring plan, we hope, is executable, reproducible and can produce conclusions that have direct application to PHP management and recovery goals for *C. roderickii, C. stebbinsii, P. layneae* and *G. californicum* ssp. *sierra*. Results from this monitoring program are applicable to management of the gabbro chaparral and creating habitat for four federally listed species. If it is determined that the rare plants flourish when vegetation is removed, vegetation removal can be used to augment habitat for the federally listed species. If only some of the species respond favorably, but others suffer a decline that is linked to the management activities, then fuel breaks can be tailored accordingly. More applications and future research topics are detailed in the Biological Opinion referred to in the introduction.

Works Cited

U.S. Fish and Wildlife Service. 2002. Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada Foothills. Portland, Oregon.

Attachment A

Monitoring Plan for *Galium californicum sierrae*, to assess impacts of shaded fuelbreak construction

Management goals:
To provide defensible space near homes at the perimeter of the Cameron Park Unit of the Pine Hill Preserve, without producing negative impacts to *Galium californicum sierrae*, a federally listed endangered species.

A secondary goal in support of the first goal:

Learn about the habitat requirements (especially sunlight/shade) of *Galium californicum sierrae.* This goal transcends the fuel break project; it is a recovery task specified in the U.S. Fish and Wildlife Service recovery plan for this species.

Monitoring objective:

Have a 75% probability (i.e., power) of detecting a 25% decline in density for *Galium californicum sierrae* in treatment plots (shrub-removed) versus control plots (shrub-retained), and allowing a 25% chance of detecting a decline when none has actually occurred (i.e., false-change error).

The above statistical analysis has a relatively high Type I error rate, but was selected in order to ensure that the probability of committing a Type II error was the same as the probability of committing a Type I error (i.e., we're just as concerned with failing to detect a true decline as we are in concluding a real decline has taken place when it has not). This design will indicate that there is high likelihood that such a decline is occurring, which can trigger management changes or more intensive monitoring.

Often data from a pilot study can be used to assess the variance of the data. With the present design (repeated measures of permanent belt transects), two years of data would be needed to assess the variance of the data. Therefore, the necessary sample size to achieve the above stated confidence and power cannot be estimated by calculations until 2005. However, the treatment (shrub removal) needs to occur sooner, for public safety reasons. Therefore, a sample size will be chosen that seems intuitively reasonable. More belt transects will be added if necessary (i.e., the desired power is not being achieved with the existing sample size) when the data has been collected to allow assessment of the variance of the data.

Other aspects of the design of this study are beyond the statistical analysis with the parameters above, for instance internal stratification within sampling units may help to reveal patterns of *Galium californicum sierrae* response to shrub removal.

Monitoring plan:

Baseline data will be collected the summer of 2004. A belt transect one meter in width, will be laid out in the fall of 2003. The belt will run parallel to the property boundary, approximately 40 feet from that boundary on the public land side. Rebar will be used to permanently mark the location of the belt.

Data will be collected for 4 meter long segments of the belt. Between each surveyed segment will be a 4 meter long or longer segment that serves to buffer each measured segment from the adjacent measured segment. In this way shrub-removed and shrub-retained segments will not influence each other. For instance, without such buffers, morning and late afternoon shade from shrub-retained segments could influence the behavior of plants in shrub-removed segments. A total of 10 belt segments will be measured, 5 treatments and 5 controls.

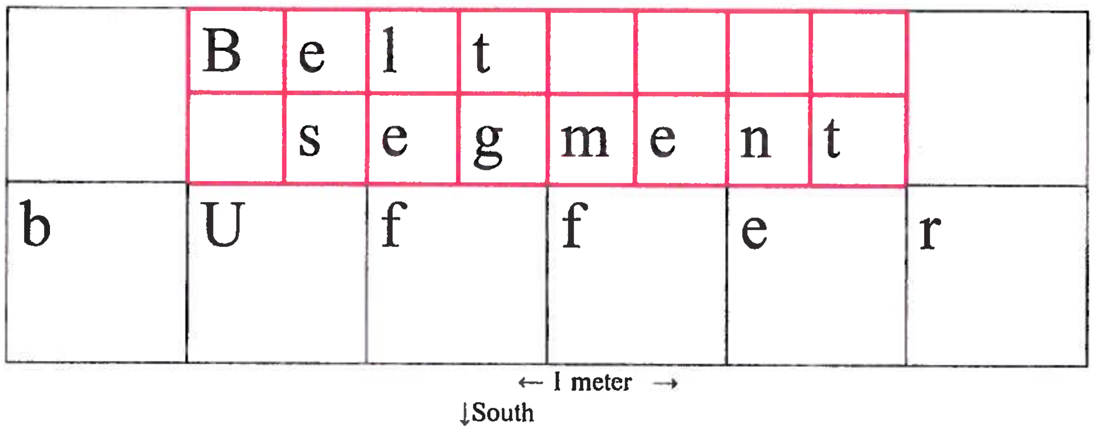
Where the belts are laid out, the crew operation cutting shrubs will be confined to thirty feet from the property line. This cutting boundary will be clearly flagged. Where there are no belts, the crew will work back to 40 feet from the property line. After baseline information is collected in the summer of 2004, the shrub removal treatment will be applied to 5 of the belt segments. Also a 2 meter wide buffer on every side of these 5 belt segments will have shrubs removed. Shrubs will be retained on the 5 other belt segments, and shrubs will be retained for a 2 meter wide buffer around those segments.

It is likely that along this single belt transect there will be an insufficient number (less than ten) of 4-meter long belt segments that meet the criteria of both *Galium* presence and shrub cover. If this is the case, one or more additional parallel belts will be laid out approximately 5 meters further south (the 5 meters will provide room for buffering treatments and controls). If a third belt is needed it will be laid out 5 meters south of the second belt. Treatment plots on this second belt (or any succeeding belt) transect will be cleared of brush like other treatment plots. But this clearing will only function experimentally; it will not connect to the fuelbreak.

Belt segments will not be placed where there are less than 3 *Galium californicum sierrae* individuals within the belt. Lesser densities would make stochastic losses of even a single individual have dramatic effects on the data. Also they will not be placed where there are no shrubs that affect the habitat and that could be removed if that belt segment were to be randomly assigned as a shrub removal treatment area. Each belt segment will be stratified internally into the portion with shrub canopy directly above, and the portion without such canopy directly above. This separation into zones within a belt segment will be used to separate *Galium californicum sierrae* plants into two groups; those that are growing directly beneath shrubs and those that are not.

For those belt segments that become treatment areas where shrubs are cut eliminating shrub shade, the stratification will make a similar separation of *Galium californicum sierrae* plants that are growing in zones that were shrub-shaded at the time of baseline data collection, and those that aren't growing in such once-shaded zones. These stratification zones within the belt segments will conform to units created by subdividing each 4-meter by 1-meter belt segment, into16 squares, each ½ meter on a side. Each of these small squares will be scored as (1) without shrub cover, (2) with partial shrub cover, (3) with 100% shrub cover. A 1 meter buffer around each belt segment on the south, east and west sides will be similarly scored for shrub cover, for a total of 12 square meters being scored for each belt segment. For the buffer, the units scored for shrub cover will each be one meter on a side. These will be scored into six ranges: 0%. 1%-25%, 26%-50%, 51%-75%, 75%-99%, 100%.

The internal stratification of the belt segments will be used to get a finer scale picture of the effects of the treatment. For instance if there is plant density reduction detected in treated belt segments, it will be useful to see if there is a spatial correlation between areas of *Galium californicum sierrae* density reduction, and areas within belt segments where shrub canopy was removed.



To pair belt segments for statistical analysis, the belts will be stratified based on 4 factors. In order of importance from most important to least these factors are:

1) Density of *Galium californicum sierrae*
2) Amount of shrub overstory
3) Proximity
4) Tree overstory

Each of these factors will be divided into 3 levels based on the data. For instance *Galium* density levels might be (1) 3-5 plants, (2) 6-10 plants, (3) >10 plants. Shrub overstory levels might be (1) 0%-25%, (2) 26%-75%, (3) 76%-100%. For proximity, the levels might be: (1) adjacent, (2) within 20 meters at closest point, (3) beyond 20 meters at closest point. For tree overstory, the levels might be (1) no tree overstory, (2) some tree overstory but not 100%, and (3) 100% tree overstory.

	Points for degree of similarity between belt segments potentially to be paired		
Factors	Match	Difference of one level	Difference of 2 levels
Density of *Galium californicum sierrae*	10	5	0
Amount of shrub overstory	10	5	0
.Proximity	8	4	0
Tree overstory	4	2	0

The specifics of this monitoring scheme will be adjusted as it is put into place. For most field studies, unanticipated field conditions affect the realities of implementation, and some degree of redesign becomes necessary.