2010 Biological Monitoring Report for Burn Units 15, 21, 32, and 34; Burn Units 14 and 19; and Ranges 43–48 Former Fort Ord

Prepared for

Department of the Army
U.S. Army Corps of Engineers

Sacramento District
1325 J Street
Sacramento, CA 95814-2922

February 2011

TETRA TECH, INC.

Q504-14

February 7, 2011

Maynardo Aala
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Subject: Transmittal of Final 2010 Biological Monitoring Report for Burn Units 15, 21, 32, and 34; Burn Units 14 and 19; and Ranges 43-48 at Former Fort Ord. Contract W91238-09-0031

Dear Mr. Aala and Mr. Collins:

Tetra Tech is pleased to submit seven copies of the Final 2010 Biological Monitoring Report at Fort Ord prepared by Tetra Tech and EcoSystems West Consulting Group for your files. One copy is being provided to Mr. Aala at the U.S. Army Corps of Engineers. All comments received from Fort Ord have been addressed in this final report.

One CD version of the full report (including appendices) is also enclosed. We are enclosing one copy of the final GIS deliverable in SDSFIE format in our submittal to Mr. Collins at Fort Ord.

If you have any questions or comments, please feel free to contact me [(925) 283-3771 or by e-mail at Ted.Donn@tetratech.com]. If you require additional assistance please contact the Program Manager, Renee Walmsley at (925) 584-0049 or by e-mail at Renee.Walmsley@tetratech.com.

Sincerely,

TETRA TECH, INC.

Dr. Theodore E. Donn
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SECTION 1

Introduction

1.1. Introduction

This report presents the results of biological monitoring conducted in Burn Units (BU) 15, 21, 32, and 34 (baseline pre-burn areas); BU 14 and 19 (Year 1 monitoring areas); and Ranges 43–48 (Year 5 monitoring area) at former Fort Ord (Figure 1-1). Monitoring was completed based on methodology presented in the Vegetation Monitoring Protocol (VMP) (Burleson, 2009a), with modifications as discussed in Sections 2.2, 3.2, and 4.2.

The 2010 biological monitoring study was conducted to satisfy the monitoring requirement of the *Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord* (HMP) [United States Army Corps of Engineers 1997] and biological opinions (BO) issued by the United States Fish and Wildlife Service (USFWS) [1999, 2002, and 2005]. This annual monitoring report presents the results of monitoring for HMP annuals, shrubs, grasses, and exotic plants. Before and after the completion of vegetation clearance, munitions removal, and other related environmental cleanup operations, baseline biological and follow-up surveys are conducted to establish whether protected species are present prior to work operations, including location and abundance. Monitoring of protected species and habitat after completion of cleanup activities is conducted to determine whether the species and habitat recovery are meeting success criteria.

Terrain over most of the sites consists of rolling hills with elevations ranging from 375 to 550 feet (ft). The vegetation type is primarily central maritime chaparral with patches of annual grasslands. Central maritime chaparral is a vegetation type protected under the HMP because of its association with significant numbers of rare, threatened, and endangered species. Central maritime chaparral is also adapted to periodic fires. These fires remove the dominant shrub species and create open space that can be colonized by annual plants. Establishment of a periodic fire regime is a key factor in establishing a diverse dynamic chaparral community.

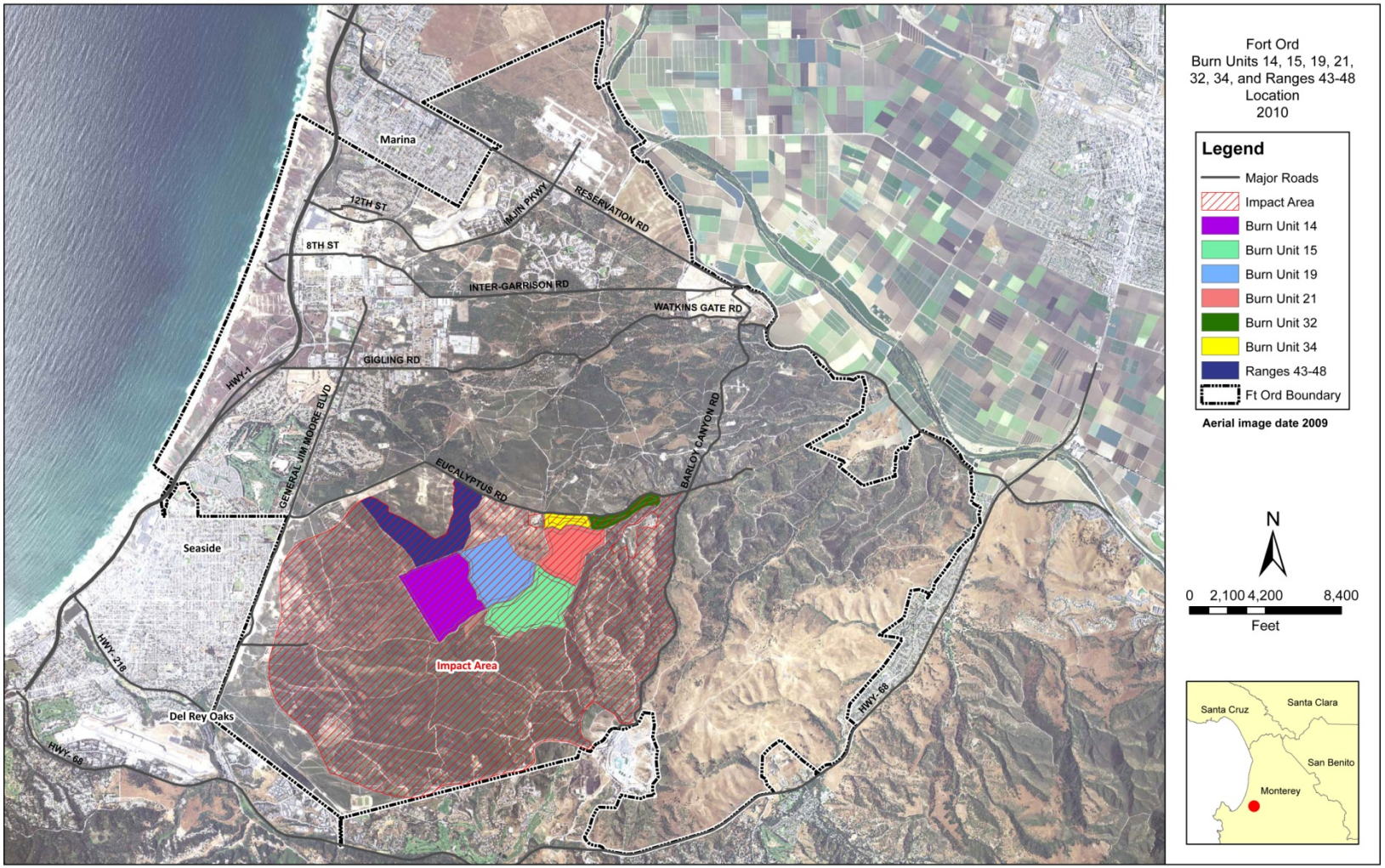

Figure 1-1 Map of former Fort Ord, Monterey California showing locations of burn units sampled in 2010.

1.2. Species Included in 2010 Habitat and Rare Species Monitoring

The primary habitat of concern at the former Fort Ord is central maritime chaparral. Plant species within central maritime chapparal include a variety of shrub and herbaceous plants (Table 1-1). These include five shrub species and three annual herbaceous species that are special-status species and, as such, are designated by the HMP as species of concern. The shrub species of concern (HMP shrubs) include sandmat manzanita (*Arctostaphylos pumila*), Monterey manzanita (*Arctostaphylos montereyensis*), Hookeer's manzanita (*Arctostaphylos hookeri* ssp. *hookeri*), Monterey ceanothus (*Ceanothus cuneatus var. rigidus*), and Eastwood's golden fleece (*Ericameria fasciculata*). The annual species of concern (HMP annuals) include sand gilia (*Gillia tenuiflora ssp. areania*), Monterey spineflower (*Chorizanthe pungens var. pungens*), and seaside bird's-beak (*Cordylanthus rigidus ssp. littoralis*). Some changes in species taxonomy were made to conform to current taxonomic treatments. Specifically, the acronym for the Monterey ceanothus (*Ceanothus cuneatus var. rigidus*) was changed from CERI to CECUR to reflect the sub-specific designation of this plant.

Table 1-1
Common and Scientific Names of Plant Species Included in the 2010 Surveys

Acronym	Scientific Name	Common Name	Life Form
ADFA	*Adenostoma fasciculatum*	Chamise	shrub
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	shrub
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	shrub
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	shrub
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	shrub
BAPI	*Baccharis pilularis*	Coyote brush	shrub
CAED	*Carpobrotus edulis*	Iceplant	perennial succulent herb
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceanothus	shrub
CEDE	*Ceanothus dentatus*	Dwarf ceanothus	shrub
CETH	*Ceanothus thyrsiflorus*	Blue blossom	shrub
CHPUP	*Chorizanthe pungens var. pungens*	Monterey spineflower	HMP annual
CORIL	*Cordylanthus rigidus ssp. littoralis*	Seaside bird's-beak	HMP annual

Acronym	Scientific Name	Common Name	Life Form
PAMPAS	*Cortaderia spp.*	Pampas grass	Invasive grass
ERER	*Ericameria ericoides*	Mock-heather	shrub
ERFA	*Ericameria fasciculata*	Eastwood's goldenbush	shrub
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	subshrub
ERAM4	*Erysimum ammophilum*	Coast wallflower	Biennial to perennial herb
GAEL	*Garrya elliptica*	Coast silk-tassel bush	shrub
GENIS	*Genista monspessulana*	French broom	Invasive grass
GITEA	*Gilia tenuiflora ssp. arenaria*	Sand gilia	HMP annual
HESC	*Helianthemum scoparium*	Peak rush-rose	subshrub
HEAR	*Heteromeles arbutifolia*	Toyon	shrub
LACO6	*Lasthenia conjugens*	Contra Costa goldfields	Annual herb
LECA	*Lepechinia calycina*	Pitcher sage, woodbalm	shrub
LOSC	*Lotus scoparius*	Deerweed	subshrub
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	shrub
MIAU	*Mimulus aurantiacus*	Sticky monkeyflower	shrub
QUAG	*Quercus agrifolia*	Coast live oak	tree
RHCA	*Rhamnus californica ssp. californica*	California coffeeberry	shrub
SAME	*Salvia mellifera*	Black sage	shrub
SOUM	*Solanum umbelliferum*	Blue witch	shrub
SYMO	*Symphoricarpos mollis*	Creeping snowberry	subshrub
TODI	*Toxicodendron diversilobum*	Poison-oak	shrub
BG		Bare ground	
HERB		Herbaceous vegetation	

1.3. Previous Surveys Conducted on the Sites

The previous surveys conducted at the specific Fort Ord sites monitored in 2010 have been summarized by Burleson (2009b), and are provided in Table 1-2.

Table 1-2
Previous Monitoring Surveys at 2010 Study Sites on Fort Ord

1999–2000	Harding Lawson Associates completed an Annual Monitoring Report, Biological Baseline Studies and Follow-Up Monitoring.
2003–2004	Parsons conducted a study of effects of fire retardant and foam on maritime chaparral in Ranges 43–48.
2004	MACTEC conducted annual monitoring, biological baseline studies, and follow-up monitoring
2005	Parson Inc. prepared the Annual Biological Monitoring Report for Ranges 43–48.
2008	Burleson Consulting sampled the non-ESCA portion of Ranges 43–48.
2009	Burleson Consulting conducted baseline vegetation surveys at Burn Units 14 and 19 for HMP and shrub species. Year 1 monitoring was conducted at Burn Units 18 and 22, and Year 3 monitoring was conducted at MRS-16.

Data from previous surveys for HMP annuals and LCTA line transects were obtained from GIS shapefiles and associated metadata provided by the Fort Ord GIS coordinator, Mr. C. Stiebel (Stiebel 2010).

SECTION 2

Baseline Vegetation Surveys—Burn Units 15, 21, 32, and 34

2.1. Burn Units 15, 21, 32, and 34—Introduction

Burn Units 15, 21, 32, and 34 were scheduled for prescribed burning and/or mechanical clearance of existing shrub cover (brush cutting) during the latter half of 2010. These treatments are being conducted prior to and in support of subsequent munitions and explosives of concern (MEC) removal. The treatment for Burn Units 32 and 34 included brush cutting in areas of mature maritime chaparral; these areas were not burned due to their small size. The treatments in Burn Units 15 and 21 included brush-cutting prior to burning within 235-foot-wide primary containment lines (fuel breaks) around the entire perimeter of each burn unit, followed by prescribed burning to the extent possible before winter rains arrived. In areas subject to brush cutting, all shrub cover was cut to a height of approximately 6 inches.

Burn Unit 15 encompasses an area of 237.6 acres; Burn Unit 21 encompasses an area of 167.5 acres; Burn Unit 32 encompasses an area of 55.4 acres; and Burn Unit 32 encompasses an area of 37.4 acres (Appendix A).

The terrain is gently rolling to locally steep. In pre-treatment condition, Burn Units 15 and 34 were vegetated primarily with mature maritime chaparral dominated by such species as shaggy-barked manzanita, sandmat manzanita, Monterey manzanita, and chamise, with some localized disturbed areas. Burn Unit 21 was also largely vegetated with mature maritime chaparral, but with more extensive areas of past disturbance, especially in the central portion which includes a large vernal pool, and a former small arms firing range (Range 37). The western portion of Burn Unit 32 (approximately 2/3 of the burn unit) and its southeastern portion was vegetated primarily with mature maritime chaparral with some localized areas of woodland dominated by coast live oak. Coast live oak woodland also predominates in the northeastern portion of this burn unit. This portion of the burn unit also includes some areas dominated by grasses and herbs, some of which may be disturbance-related, along with a vernal pool adjacent to Eucalyptus Road. Areas with evidence of past disturbance are relatively limited in Burn Unit 32. While all four burn units had some areas where vegetation had been cleared in the past, the detailed disturbance history of these areas, in particular past fire history is not known. It is presumed, however, that past fires have affected the 2010 pre-treatment species composition of the mature maritime chaparral in these areas.

Baseline vegetation surveys in these four units were conducted in the spring and early summer 2010 (24 April through 2 June), prior to any treatments being conducted. These 2010 baseline surveys consisted of the following components:

- Meandering transect surveys to locate and map herbaceous HMP species.

- Density monitoring for three HMP annual species: Monterey spineflower, sand gilia, and seaside bird's-beak.
- Line intercept transect sampling to sample shrub species composition in the mature maritime chaparral.
- Mapping of non-native annual grasses within the primary containment areas.
- Mapping of invasive species, including iceplant, pampas grass, and French broom where encountered.

2.2. Burn Units 15, 21, 32, and 34—Methods

2.2.1. Meandering Transects

Meandering transect surveys were conducted between 24 April and 11 May 2010. Species surveyed for included five HMP herbaceous species: the biennial to perennial species coast wallflower (*Erysimum ammophilum*) and the annual species Monterey spineflower, sand gilia, seaside bird's-beak, and Contra Costa goldfields (*Lasthenia conjugens*). The timing of this surveying was optimal for locating and identifying coast wallflower, Monterey spineflower, sand gilia, and Contra Costa goldfields. Seaside bird's-beak had not yet flowered when the meandering transect surveying was conducted.

Since suitable habitat for HMP herbaceous species in maritime chaparral consists only of openings, aerial photographs were used to identify areas of maritime chaparral with openings suitable to support these species. All areas within the four burn units identified on aerial photographs as containing potentially suitable habitat for HMP herbaceous species were surveyed on foot.

The base-wide system of 100×100 foot grid squares was used for mapping HMP herbaceous species. When an HMP herbaceous species was observed during the meandering surveys, the grid square within which it occurred was marked as occupied, and was subsequently sampled (see Section 2.2.2). When it was not visually obvious on the aerial photograph where the HMP herbaceous species was observed, a recreational-grade Global Positioning System (GPS) unit was used to record the location, and the GPS coordinates were then plotted onto a map of grid squares. A list was then compiled of all grid squares within the four burn units containing one or more HMP herbaceous species. All identified plots were subsequently sampled for HMP annual densities as discussed below. Maps 1, 6, 13, and 18 show all plots in which one or more HMP annual species were present.

2.2.2. HMP Annuals Monitoring

Density monitoring for three HMP annual species, Monterey spineflower, sand gilia, and seaside bird's-beak was conducted in Burn Units 15, 21, and 34 between 7 May and 2 June 2010 (no HMP annuals were observed in Burn Unit 32 during the meandering transect surveying). This time period was optimal for observing Monterey spineflower and sand gilia. Seaside bird's-beak was not yet in flower when this density monitoring was conducted.

The pre-defined 100×100 foot grid squares were used as sample plots for the density monitoring. The monitoring protocol (Burleson 2009a) specifies that 20 percent of plots occupied by HMP annuals or 38 occupied plots, whichever is larger, be sampled in each burn unit for density monitoring. In Burn Units 15 and 21, sample plots were randomly selected from all grid squares mapped as occupied by one or more of the HMP annual species during the meandering transect survey (above). Due to the small size of BU 34, nearly all plots were sampled.

Some grid squares selected for sampling straddle the boundary between Burn Units 21 and 34. These were treated as occurring within the burn unit that contained the majority of the area of the square.

Because the boundaries of the grid squares were not marked in the field in the baseline survey units, a resource grade Trimble GeoXH GPS receiver with the grid square boundaries loaded as a map layer was used to determine the boundaries of each grid square selected as a density monitoring sample plot.

The surveyors conducted an initial reconnaissance of each 100×100 foot sample plot to determine which HMP annual species were present and how they were distributed within the plot. When feasible given the numbers and distribution of HMP annual species in the plot, the entire plot was censused by counting all individuals of a given HMP annual species within the plot. When it was not feasible to conduct a complete census for a given species in a given plot, the plot was subsampled using a 2.5 meter radius circular plot. An area judged by the surveyors to be representative of the density of the species within the entire plot was selected for subsampling, and the circular plot was sampled using either a measuring tape or a length of rope marked at 2.5 meters. One surveyor held the end of the rope or measuring tape at the point selected as the center point of the circular plot, while another surveyor scribed the circle. All plants of the species being sampled were then counted within the 2.5 meter radius plot.

For all HMP annual species in all 100×100 foot sample plots, the surveyors estimated the percent suitable habitat within the plot for each HMP annual species present. In practice, “suitable habitat” was essentially treated equivalent to “occupied habitat”. Since the percent suitable habitat was used to to calculate the estimated number of individuals present within a 100×100 foot sample plot when a circular subsample plot was used, including habitat subjectively judged to be “suitable”, but not occupied, in the estimates of suitable habitat would have resulted in upwardly biased estimates of total occupied acreage as well as of numbers of individuals present in subsampled 100×100 foot plots.

When circular plots were used for subsampling, estimates of the total number of plants present in the 100×100 foot sample plot were calculated. Since the area of a 2.5 meter radius circular plot is approximately 211.34 square feet, and since the area of a 100×100 foot plot is 10,000 square feet, the estimated number of individuals in the 100×100 foot plot was calculated using the following formula, where n = the estimated number of individuals in the 100×100 foot plot; a = the number of individuals counted in the circular plot, and b = the estimated percent suitable habitat in the 100×100 foot plot:

$$n = \frac{10000a\left(\frac{b}{100}\right)}{211.34}$$

For each HMP annual species, each 100×100 foot sample plot was assigned to one of five density classes based on the number of individuals counted or estimated to be present. The density classes are as follows:

0 = 0 plants per 100 x 100 foot plot

1 = 1 to 50 plants per 100 x 100 foot plot

2 = 51 to 100 plants per 100 x 100 foot plot

3 = 101 to 500 plants per 100 x 100 foot plot

4 = >500 plants per 100 x 100 foot plot

In some cases where it was evident that a given sample plot should be assigned to density class 4 (i.e., significantly more than 500 plants were present), the surveyors assigned the plot to this density class without attempting to count or estimate numbers of plants. This was done because, for all three HMP annual species, it is difficult to get accurate counts, even within a 2.5 meter radius circular plot, when plant densities are very high.

2.2.3. Shrub Transect Monitoring

Prior to conducting shrub transect monitoring in Burn Units 15, 21, 32, and 34, areas of relatively homogenous maritime chaparral vegetation were identified using a combination of aerial photo interpretation and ground surveying. Transect locations were then selected by randomly selecting 100×100 foot grid squares within each area of homogenous vegetation. In Burn Units 15 and 21, transects were allocated separately within the 250-foot-wide primary containment lines and within the interior of the burn units beyond the containment lines (Maps 4, 9, 11, and 16). This was not necessary in Burn Units 32 and 34, since those units were to be entirely brush-cut. Portions of these burn units were blacklined where the mastication was burned in place prior to the burning of Burn Units 15 and 21. Future monitoring in Burn Units 32 and 34 will need to compare transects in these burned areas separate from transects in areas that did not get burned. Numbers of transects sampled within each burn unit were as follows:

Burn Unit 15: 7 containment area, 14 interior

Burn Unit 21: 6 containment area, 9 interior

Burn Unit 32: 5

Burn Unit 34: 4

Transect sampling in Burn Units 32 and 34 was conducted on 27 and 28 May 2010. Transect sampling in the primary containment areas of Burn Units 15 and 21 was conducted between 1 and 3 June 2010 (Maps 4 and 9). Transect sampling in the interior areas of Burn Units 15 and 21 was conducted between 9 and 23 June 2010. Transect sampling was conducted using the line intercept method along transects 50 meters in length.

The surveyors used a resource grade Trimble GeoXH GPS receiver with the grid square boundaries loaded as a map layer to locate the grid squares selected for sampling. Exact transect placement was such that the vegetation along the transect was representative of the surrounding area, and such that a substantial portion of the transect was within the grid square selected for sampling (it is impossible to include all of a 50 meter transect within a 100×100 foot grid square). In addition, containment area transects were placed such that the entire transect was within the containment area, and interior transects were placed such that the entire transect was within the interior area (i.e., did not extend into the containment area).

The transects were established by stretching out a 50 meter measuring tape between the transect start and end points. The start and end points of each transect were recorded using the resource grade GPS receiver, and the GPS data was subsequently post-processed to correct the data.

Species for which cover data was recorded separately in the transect sampling include all woody species (shrubs and subshrubs) present along the transect length. Iceplant was also recorded separately because it is an invasive species. Other herbaceous vegetation was recorded as "herb", with no breakdown by species, although the herbaceous species present along the transect were noted. Bare ground (including dead vegetation) was also recorded.

The lengths along the transect (above, below, or touching the measuring tape) occupied by each woody species, herbaceous vegetation, and bare ground were recorded in 1 decimeter intervals. Lengths less than 1 decimeter were not recorded. Absolute percent cover of each woody species, herbaceous vegetation, and bare ground along each transect were calculated by summing all the individual lengths along the transect and then calculating this length as a percentage of 50 meters.

2.2.4. Annual Grass Monitoring

Annual grasses surveys were conducted to assess whether cutting of vegetation within containment lines affects the distribution and density of annual grasses. Non-native annual grass monitoring was conducted within the 235 foot wide primary containment lines surrounding Burn Units 15, 21, 32, and 34 on 10 June 2010. This monitoring included the following non-native annual grass species: silvery hair-grass (*Aira caryophyllea*), wild oat (*Avena* spp.), rattlesnake grass (*Briza maxima*), little quaking grass (*Briza minor*), ripgut grass (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), red brome (*Bromus madritensis* ssp. *rubens*), nit grass (*Gastridium ventricosum*), Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), barnyard foxtail (*Hordeum murinum* ssp. *leporinum*), Italian ryegrass (*Lolium multiflorum*, sometimes a biennial), and rattail fescue (*Vulpia myuros*).

The annual grass monitoring was conducted by a combination of driving the perimeter roads surrounding the burn units and walking where necessary to obtain a full overview of the containment areas. Areas supporting non-native annual grass species were mapped onto aerial photographs (Maps 5, 10, 12, and 17). In each mapped area, non-native annual grass density was visually estimated and mapped by one of three density classes:

1 (low) = 1–5 percent

2 (medium) = 6–25 percent

3 (high) = >25 percent

2.2.5. Invasive Species Monitoring

Invasive species were mapped when encountered during the meandering transect survey and the HMP annuals density monitoring and shrub transect monitoring, except within the central, highly disturbed portion of Burn Unit 21. In this area, the invasive species iceplant, pampas grass, and French broom are abundant and widespread; thus, detailed mapping of these species was not conducted. Invasive species have been previously mapped by the Army and Bureau of Land Management, and the area receives invasive species treatment under a separate Services Agreement between the two agencies.

When invasive species were encountered elsewhere in Burn Units 15, 21, 32, and 34, the locations were mapped using a recreational-grade GPS unit (Maps 31 to 34). A comprehensive survey of the four burn units for invasive species was not conducted.

2.3. Burn Units 15, 21, 32, and 34—Results and Discussion

Aerial photo review and subsequent ground-truthing during the meandering transects was used to map the extent of suitable habitat for HMP annual species on each of the four burn units. The estimated areas and percent of the area that was considered occupied by HMP annual species is summarized in Table 2-1. No suitable habitat was observed in BU 32, therefore no plots were sampled. In Burn Unit 15, 41 of a total of 134 occupied grid squares (31 percent) were sampled. In Burn Unit 21, 39 of a total of 115 grid squares occupied by one or more HMP annual species (34 percent) were sampled. Because there were fewer grid squares containing HMP annuals in Burn Unit 34, all occupied grid squares in that burn unit (50 of 50, or 100 percent) were sampled. No suitable habitat was present in Burn Unit 32 (i.e., no HMP annual species were observed in meandering transects), therefore, no plots were sampled. Maps of locations of survey plots are provided in Appendix A.

Table 2-1
Percentage of Habitat Suitable for HMP Annual Species in Each Burn Unit

Burn Unit	Total Area (acres)	Suitable Area (acres)	Percentage of Burn Unit	Plots Surveyed
BU 15	237.6	234.2	98.6	41
BU 21	167.5	118.6	70.8	39
BU 32	55.4	0	0	0
BU 34	37.4	31.8	85.0	50

2.3.1. Sand Gilia

One hundred and thirty (130) plots were surveyed for HMP plants including sand gilia in 2010 on BU 15, 21, and 34 (Table 2-2; Map 1, 6, and 13). Sand gilia was present in 53 percent of the sampled plots in BU 15; 56 percent of the sampled plots in BU 21; and 62 percent of the sampled plots in BU 34.

Table 2-2
Sand Gilia – Number of Plots per Density Class

Density	Density Class	BU 15 Plots	Estimated Acres of Suitable Habitat Occupied	BU 21 Plots	Estimated Acres of Suitable Habitat Occupied	BU 34 Plots	Estimated Acres of Suitable Habitat Occupied
0 plants/grid	0	19	110.10	17	51.69	19	12.09
1–50 plants/grid	1	14	79.95	11	33.45	16	10.18
51–100 plants/grid	2	3	17.13	4	12.16	6	3.82
101–500 plants/grid	3	5	28.56	5	15.20	6	3.82
>500 plants/grid	4	0	0	2	6.08	3	1.91
Total Plots Sampled		41	–	39	–	50	–
Each plot is 100- x 100- feet or 10,000 square feet.							

2.3.2. Seaside Bird's-Beak

Only nine (6.9 percent) of the 130 plots in BU 15, 21, and 34 that were sampled supported seaside bird's-beak (Table 2-3; Maps 2, 7, and 14). Only 2.4 percent of the sampled plots on BU 15 were occupied by this species. The maximum frequency of occurrence was at BU 34, where 12 percent of the sampled plots were occupied.

Table 2-3
Seaside Bird's-Beak – Number of Plots per Density Class

Density	Density Class	BU 15 Plots	Estimated Acres of Suitable Habitat Occupied	BU 21 Plots	Estimated Acres of Suitable Habitat Occupied	BU 34 Plots	Estimated Acres of Suitable Habitat Occupied
0 plants/grid	0	40	228.44	37	112.51	44	27.99
1–50 plants/grid	1	1	0.0001	2	0.0004	5	3.18
51–100 plants/grid	2	0	0	0	0	0	0
101–500 plants/grid	3	0	0	0	0	1	0.64
>500 plants/grid	4	0	0	0	0	0	0
Total Plots Sampled		41	–	39	–	50	–

Each plot is 100- x 100- feet or 10,000 square feet.

2.3.3. Monterey Spineflower

Monterey spineflower was the most frequently occurring of the HMP species (Table 2-4; Maps 3, 8, and 15). This species occurred in 125 (96 percent) of the 130 plots surveyed. Densities of this species varied widely between plots (Table 2-4). Twenty-three percent of the plots fell in density class 1, while 44 percent of the plots fell into density class 4.

Table 2-4
Monterey Spineflower – Number of Plots per Density Class

Density	Density Class	BU 15 Plots	Estimated Acres of Suitable Habitat Occupied	BU 21 Plots	Estimated Acres of Suitable Habitat Occupied	BU 34 Plots	Estimated Acres of Suitable Habitat Occupied
0 plants/grid	0	1	5.71	1	3.04	3	1.91
1–50 plants/grid	1	13	74.24	5	15.20	12	7.63
51–100 plants/grid	2	2	11.42	4	12.16	6	3.82
101–500 plants/grid	3	9	51.40	7	21.29	10	6.36
>500 plants/grid	4	16	91.38	22	66.90	19	12.09
Total Plots Sampled		41	–	39	–	50	–
*Each plot is 100- x 100- feet or 10,000 square feet.							

2.3.4. Shrub Transect Monitoring

A total of 45 transects were sampled on the four BUs (Maps 4, 9, 11, and 15). Average total shrub cover on transects in Burn units 15, 21, 32, and 34 in 2010 was consistent between burn units, averaging 103.4 percent, and ranging from 99.0 percent in Burn Unit 34 to 105.7 percent in Burn Unit 15 (Figure 2-1). Shrub cover often exceeded 100 percent because of overlapping cover between adjacent shrubs. Bare ground averaged 10.5 percent, and herbaceous vegetation occupied 2.8 percent across the four burn units. Raw data for the shrub transects sampled in 2010 are provided in Appendix B.

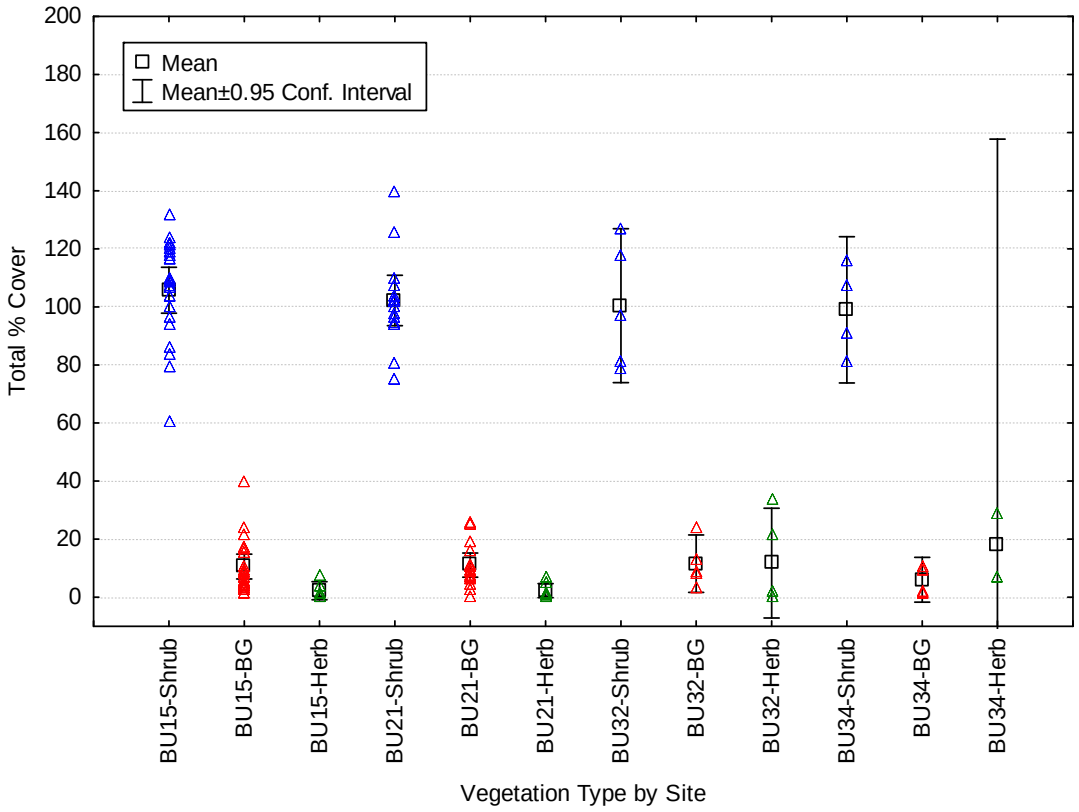

Figure 2-1 Percent cover of shrubs, bare ground, and herbaceous vegetation for pre-burn conditions on Burn Units 15, 21, 32, and 34 in 2010.

The dominant species in the pre-burn shrub community included shaggy-barked manzanita (*A. tomentosa* ssp. *tomentosa*), which averaged 53.7 percent cover, and chamise (*A. fasciculatum*) which averaged 19.7 percent cover across all transects. All other species were present at less than 8 percent cover, on average. Monterey ceoanthus (*C. cuneatus* var. *rigidus*) and black sage (*S. mellifera*) occur frequently on the transects (36 and 26 of the 45 transects, respectively), but at low percent cover.

To assess baseline conditions in community structure, several standard metrics were examined. Species richness (number of species per transect) was variable between transects, with between 4 and 12 species present on each transect (Figure 2-2). Transects sampled in BU-34 tended, on average, to have lower species richness than transects in the other burn units.

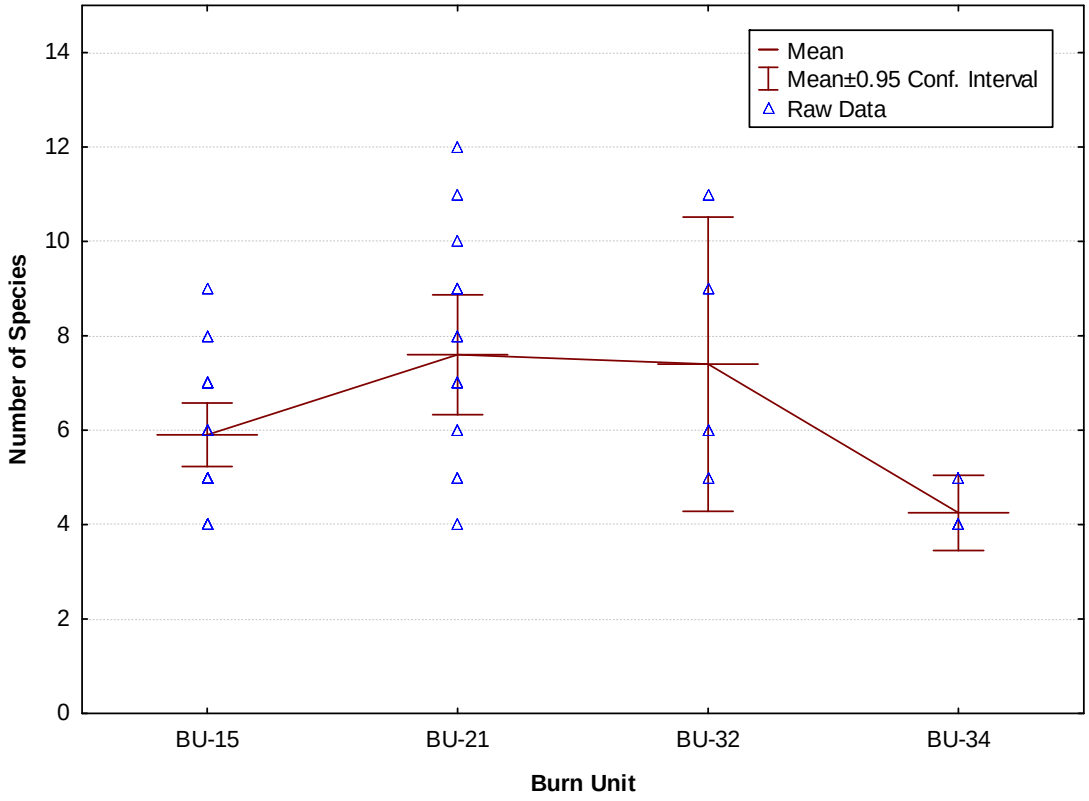

Figure 2-2 Number of shrub species per transect for pre-burn conditions on Burn Units 15, 21, 32, and 34.

The next metric examined was diversity as measured by the Shannon-Weiner metric (Pielou 1974). This metric expresses diversity as a combination of the number of species present in the community and their relative abundance (or cover) in the sample. Average diversity was similar across all burn units, with the exception that BU-34 had lower average diversity than BU-32 (Figure 2-3). The lower diversity in BU 34 transects is likely due to the lower number of plant species observed on these transects.

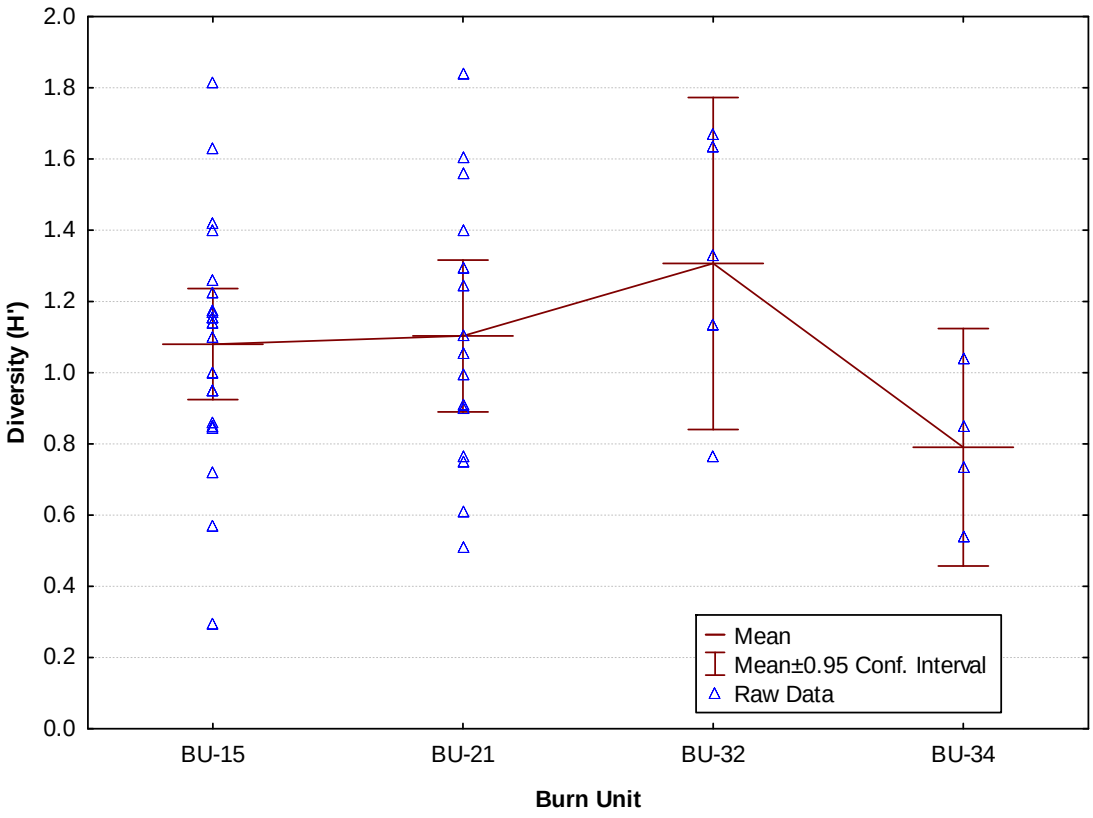

Figure 2-3 Shrub community diversity for pre-burn conditions on Burn Units 15, 21, 32, and 34.

Evenness is a measure of the equability of the relative contribution of species to the total cover in the community (Pielou 1974). Maximum evenness (value = 1) is achieved when all species are present in equal abundance. Species evenness varied widely between transects, ranging from 0.18 to 0.84 (Figure 2-4). In the pre-burn community, evenness averaged 0.59, indicating that certain species dominated the community. No differences were seen between burn units.

2.3.5. Annual Grass Monitoring

Annual grasses surveys were conducted along roadsides and within the primary containment lines to assess whether cutting of vegetation affects the distribution and density of annual grasses. Annual grasses were limited to the periphery of the burn units (Maps 5, 10, 12, and 17). Estimated areas occupied by annual grasses are summarized in Table 2-5.

Table 2-5
Estimated Area Occupied (Acres) by Annual Grasses in Baseline Surveys

Cover Class	BU-15	BU-21	BU-32	BU-34
1 (low) = 1–5 percent	0.34	1.25	0.04	0.47
2 (medium) = 6–25 percent	3.20	2.17	0.76	0.52
3 (high) = >25 percent	3.79	2.40	2.57	0.47
Total Acreage	**7.33**	**5.82**	**2.57**	**1.45**

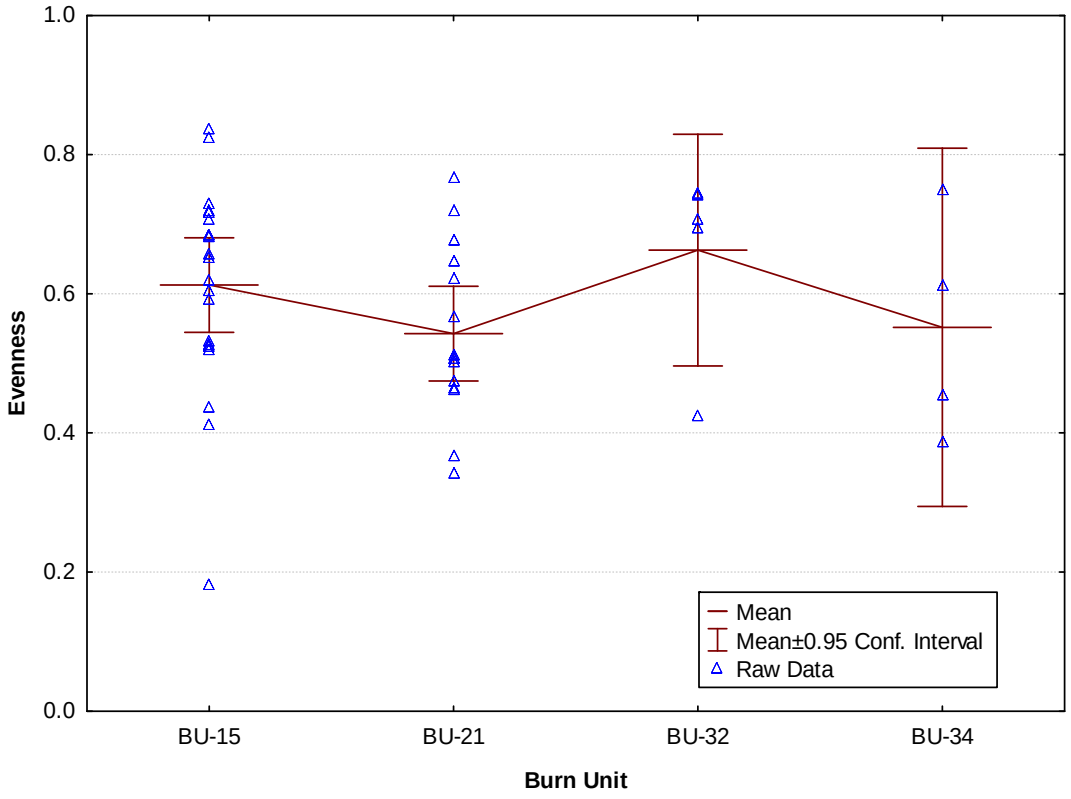

Figure 2-4 Shrub community evenness for pre-burn conditions on Burn Units 15, 21, 32, and 34.

2.3.6. Invasive Species Monitoring

Within the central, highly disturbed portion of Burn Unit 21, the invasive species iceplant, pampas grass, and French broom are abundant and widespread and are being treated under an agreement between the Army and Bureau of Land Management.

When invasive species were encountered elsewhere in Burn Units 15, 21, 32, and 34, the locations were mapped using a recreational-grade GPS unit (Maps 5, 10, and 17).

SECTION 3

Year 1 Vegetation Monitoring—Burn Units 14 and 19

3.1. Burn Units 14 and 19—Introduction

A prescribed burn was conducted in Burn Units 14 and 19 in October 2009. Prior to this prescribed burn, in the spring of 2009, Burleson Consulting conducted baseline monitoring within these two burn units (Burleson 2009b). This baseline monitoring included density monitoring for the HMP annual species Monterey spineflower, sand gilia, and seaside bird's-beak; transect monitoring to sample shrub composition in the maritime chaparral; and annual grass monitoring in the primary containment areas around the perimeters of the two burn units. First-year follow-up monitoring was conducted in the spring and early summer of 2010 in these two burn units to assess recovery of the three HMP annual species in the first season after burning as well as to assess the status of non-native annual grasses in the primary containment areas and invasive species throughout the burn units.

Burn Units 14 and 19 combined encompass a total of 522 acres. The terrain is gently rolling to locally steep. Prior to burning, mature maritime chaparral occupied the bulk of the area within the two burn units, with the principal dominant shrubs being sandmat manzanita and shaggy-barked manzanita (Burleson 2009b). Some areas, principally but not restricted to relatively low-lying "bowls" (topographic depressions surrounded by higher terrain) were (and are, following burning) vegetated primarily with grasses and herbs, with only scattered shrubs of species such as mock-heather (*Ericameria ericoides*), bush lupine (*Lupinus arboreus*), and chamise. The grasses are primarily non-native and include such species as slender wild oat (*Avena barbata*) soft chess, and ripgut grass, with the native perennial bunchgrass purple needlegrass (*Nassella pulchra*) also locally important. Herb composition is diverse and includes such native species as sky lupine (*Lupinus nanus*), tidy tips (*Layia platyglossa*), Monterey spineflower, and telegraph weed (*Heterotheca grandiflora*), as well as non-native species such as sheep sorrel (*Rumex acetosella*). A few areas support coast live oak woodland, with scattered coast live oaks and an understory of grasses and herbs.

The 2010 first-year follow-up monitoring consisted of the following activities:

- Density monitoring for three HMP annual species: Monterey spineflower, sand gilia, and seaside bird's-beak.
- Mapping of non-native annual grasses within the primary containment areas.
- Mapping of invasive species.

Transect sampling of shrub species composition was not conducted because the monitoring was conducted only a few months after the burn, and shrub component of the vegetation was only in

an early stage of re-establishment, and the vegetation monitoring protocol for shrub species does not require follow-up surveys until the third year.

3.2. Burn Units 14 and 19—Methods

3.2.1. HMP Annuals Monitoring

Density monitoring for the three HMP annual species in Burn Units 14 and 19 was conducted between 24 April and 21 May 2010. In the baseline monitoring conducted in 2009, sample plots had been randomly selected from among the 100×100 foot grid squares deemed to contain suitable habitat for the three HMP annual species based on aerial photo interpretation, without regard for whether or not those grid squares actually contained individuals of any of the three HMP annuals (Burleson 2009b). Sample plots for the 2010 density monitoring included a randomly selected 20 percent of the 2009 sample plots, plus a randomly selected 10 percent of all 100×100 foot grid squares adjacent to 2009 sample plots.

The methodology for the 2010 density monitoring in Burn Units 14 and 19 was similar to that described above for the baseline monitoring. All grid squares in these burn units were staked with wooden laths and the grid square numbers were marked on the lath at the southwest corner of each grid square, facilitating identification of the grid squares selected for sampling. Following an initial reconnaissance of the sample plot to determine which (if any) HMP annual species were present and how they were distributed, the surveyors conducted either a complete census of all individuals of HMP annual species within the 100×100 foot plot, if feasible given the numbers and distribution of individuals, or used a 2.5 meter radius circular plot to subsample the density of the HMP annual species within the sample plot, as described above for the baseline monitoring. When circular plot subsampling was conducted, an estimate of the total numbers of individuals in the 100×100 foot plot was calculated as described for the baseline monitoring.

Based on the counts or estimates of numbers of plants present, each 100×100 foot sample plot was assigned to a density class for each HMP annual species. The density classes were the same as for the baseline monitoring:

0 = 0 plants per 100 x 100 foot plot

1 = 1 to 50 plants per 100 x 100 foot plot

2 = 51 to 100 plants per 100 x 100 foot plot

3 = 101 to 500 plants per 100 x 100 foot plot

4 = >500 plants per 100 x 100 foot plot

In some cases where it was clear that the number of plants of an HMP annual species was well in excess of 500, the sample plot was assigned to density class 4 without a complete count or subsampling.

3.2.2. Annual Grass Monitoring

Non-native annual grass monitoring was conducted within the 235 foot wide primary containment lines surrounding Burn Units 14 and 19 on 23 and 24 June 2010. Annual grass species included in this survey were the same species as in the baseline areas annual grass monitoring. Annual grass monitoring was conducted by a combination of driving the perimeter roads surrounding the burn units and walking where necessary to obtain a full overview of the containment areas. Areas supporting non-native annual grass species were mapped onto aerial photographs. In each mapped area, non-native annual grass density was visually estimated and mapped by one of the same three density classes as in the baseline monitoring:

1 (low) = 1–5 percent

2 (medium) = 6–25 percent

3 (high) = >25 percent

3.2.3. Invasive Species Monitoring

Since iceplant was the only invasive species observed by the surveyors in Burn Units 14 and 19 during the HMP annuals density monitoring, and since iceplant seedlings were observed in nearly every 100×100 foot grid square traversed by the surveyors, detailed mapping of invasive species was not deemed necessary in these burn units.

3.3. Burn Units 14 and 19—Results and Discussion

Data from previous annual surveys for HMP annuals and LCTA line transects were obtained from GIS shapefiles and associated metadata provided by the Fort Ord GIS coordinator, Mr. C. Stiebel (Stiebel 2010). These data formed the basis for comparative analyses with the 2010 data.

3.3.1. Sand Gilia

Sand gilia showed a clear response to the effects of the prescribed burn in 2009. The species was present in 76 percent of the 198 plots sampled in 2010 (Table 3-1; Maps 18 and 22). In comparison, only 43 percent of the 258 plots sampled under pre-burn conditions in 2009 were occupied by sand gilia.

Table 3-1
Sand Gilia – Number of Plots per Density Class in Burn Units 14 and 19

Density Class	BU 14 Plots		BU 19 Plots	
	2009	2010	2009	2010
0 plants/grid (percent of plots)	76 (61%)	26 (28%)	70 (52%)	18 (17%)
1–50 plants/grid (percent of plots)	22 (18%)	26 (28%)	27 (20%)	20 (19%)
51–100 plants/grid (percent of plots)	6 (5%)	6 (7%)	12 (9%)	11 (10%)
101–500 plants/grid (percent of plots)	19 (15%)	15 (16%)	22 (16%)	27 (26%)
>500 plants/grid (percent of plots)	2 (2%)	19 (21%)	3 (2%)	29 (28%)
Total Plots Sampled	125	92	134	105
*Each plot is 100- x 100- feet or 10,000 square feet.				

3.3.2. Seaside Bird's-Beak

Seaside bird's-beak showed a clear response to the effects of the prescribed burn in 2009. The species was present in 13 percent of the 198 plots sampled in 2010 (Table 3-2; Maps 19 and 23). In comparison, only 3 percent of the 258 plots sampled under pre-burn conditions in 2009 were occupied by seaside bird's-beak.

Table 3-2
Seaside Bird's-Beak – Number of Plots per Density Class in Burn Units 14 and 19

Density Class	BU 14 Plots		BU 19 Plots	
	2009	2010	2009	2010
0 plants/grid (percent of plots)	118 (94%)	71 (76%)	132 (99%)	102 (97%)
1–50 plants/grid (percent of plots)	2 (2%)	10 (11%)	1 (1%)	3 (3%)
51–100 plants/grid (percent of plots)	2 (2%)	5 (5%)	0 (0%)	0 (0%)
101–500 plants/grid (percent of plots)	3 (2%)	5 (5%)	0 (0%)	0 (0%)
>500 plants/grid (percent of plots)	0 (0%)	2 (2%)	0 (0%)	0 (0%)
Total Plots Sampled	125	92	134	105
*Each plot is 100- x 100- feet or 10,000 square feet.				

3.3.3. Monterey Spineflower

The Monterey spineflower did not exhibit as strong a response to the effects of the prescribed burn in 2009 as did the previous two species. In 2010, the species was present in 88 percent of the 198 sampled plots (Table 3-3; Maps 20 and 24). However, in the 2009 pre-burn survey, this species occupied 78 percent of the 258 plots sampled. Although a slightly higher percentage of plots were occupied in 2010, the relative densities do not appear to have changed appreciably.

Table 3-3
Monterey Spineflower – Number of Plots per Density Class in Burn Units 14 and 19

Density Class	BU 14 Plots		BU 19 Plots	
	2009	2010	2009	2010
0 plants/grid (percent of plots)	31 (25%)	5 (5%)	26 (20%)	19 (18%)
1–50 plants/grid (percent of plots)	23 (18%)	30 (32%)	27 (20%)	38 (36%)
51–100 plants/grid (percent of plots)	6 (5%)	9 (10%)	14 (11%)	7 (7%)
101–500 plants/grid (percent of plots)	21 (17%)	14 (15%)	30 (23%)	15 (14%)
>500 plants/grid (percent of plots)	44 (35%)	35 (38%)	36 (27%)	26 (25%)
Total Plots Sampled	125	92	134	105
*Each plot is 100- x 100- feet or 10,000 square feet.				

3.3.4. Annual Grass Monitoring

Annual grass surveys were limited to the periphery of the burn units per the agreement with the U.S. Fish and Wildlife Service which supported the cutting of primary containment lines (Maps 21 and 25). Estimated areas occupied by annual grasses are summarized in Table 3-4 .

Table 3-4
Estimated Area Occupied (Acres) by Annual Grasses in Year 1 Surveys in BU 14 and 19

Cover Class	BU-14	BU-19
1 (low) = 1–5 percent	4.57	0.09
2 (medium) = 6–25 percent	18.20	1.64
3 (high) = >25 percent	8.06	12.10
Total acreage	**30.82**	**13.84**

3.3.5. Invasive Species Monitoring

Iceplant is present throughout the entirety of Burn Units 14 and 19. Iceplant was the only invasive species observed in Burn Units 14 and 19 during the HMP annuals density monitoring. Furthermore, since iceplant seedlings were observed in nearly every 100×100 foot grid square traversed by the surveyors, detailed mapping of invasive species was not deemed necessary in these burn units. Neither French broom nor pampas grass was observed on Burn Units 14 and 19.

SECTION 4

Year 5 Vegetation Monitoring—Ranges 43–48

4.1. Ranges 43–48 — Introduction

Vegetation monitoring in the Ranges 43–48 area began in 1999–2000, when baseline (pre-treatment) monitoring was conducted (Harding Lawson 2001). A total of 79 transects were established in those years to sample shrub species composition in the maritime chaparral using the line intercept method; 12 transects were sampled in 1999 and 67 in 2000. Density sampling for the HMP annual species Monterey spineflower, sand gilia, and seaside bird's-beak was also conducted in the Ranges 43–48 area in 2000. A prescribed burn was scheduled in the Ranges 43–48 area in 2000, but the area was not burned until October 2003. Removal of munitions and ordnance was conducted between December 2003 and September 2005.

In spring 2004, in the first season following the prescribed burn, MACTEC conducted density monitoring of the three HMP annuals (MACTEC 2005). Transect monitoring of shrub composition was not conducted in 2004, since this was only a few months after the burn, and shrub regeneration was still at an early stage.

Shrubs and non-native grasses were monitored along a 45-foot fuelbreak surrounding Ranges 43–48 in November 2003 and again at the end of the growing season in 2004 (Parsons 2004).

Vegetation monitoring was conducted in Ranges 43–48 in 2005 and 2008 (Parsons 2005; Burleson 2008). In 2005, vegetation monitoring consisted of density monitoring of the three HMP annuals over the entire original Ranges 43–48 area and resampling for shrub species composition of all of the original shrub transects sampled by Harding Lawson (2001) in 1999–2000 (Parsons 2005). The 2008 monitoring included only a portion of the original area, designated as the "Non-Environmental Services Cooperative Agreement (ESCA) Ranges 43–48 site" (Burleson 2008). The 2008 monitoring consisted of density monitoring of the three HMP annuals within this area and resampling for shrub species composition on all of the original shrub transects within this area.

The area included in the 2010 monitoring is the same as that included in the 2008 monitoring (Burleson 2008). This area encompasses approximately 273 acres of generally rolling terrain. It is divided into the Range 43 portion, here treated as the area east and northeast of the southern portion of Felix Road (south of its junction with Oscar Road), and the Range 48 portion, here treated as the area west and northwest of the southern portion of Felix Road (south of its junction with Oscar Road). Two vegetation types predominate in the area: maritime chaparral, now recovering from the 2003 burn and subsequent disturbance; and areas dominated by grasses and herbs with only scattered shrubs, similar to those described above in Burn Units 14 and 19. The 2010 monitoring is referred to as "five-year vegetation monitoring", despite the fact that the

prescribed burn was conducted in 2003, and munitions and ordnance cleanup-related disturbance continued until September 2005.

The 2010 monitoring in the Ranges 43–48 area consisted of the following activities:

- Density monitoring for three HMP annual species: Monterey spineflower, sand gilia, and seaside bird's-beak.
- Line intercept transect sampling of transects previously sampled in 1999–2000, 2005, and 2008 (Harding Lawson 2001; Parsons 2005; Burleson 2008) to sample shrub species composition in the maritime chaparral that is recovering from past disturbance (the 2003 prescribed burn and the 2003–2005 munitions and ordnance cleanup.
- Mapping of non-native annual grasses within the primary containment areas.
- Mapping of invasive species.

4.2. Ranges 43–48—Methods

4.2.1. HMP Annuals Monitoring

Density monitoring for three HMP annual species (Monterey spineflower, sand gilia, and seaside bird's-beak) in the Ranges 43–48 area was conducted between 18 May and 1 June 2010. This time period was optimal for observing Monterey spineflower and sand gilia. Seaside bird's-beak was not yet in flower when this density monitoring was conducted.

As noted in the introduction to this section, the methods for sample site selection employed in the 2010 survey differ from previous surveys. Previous surveys sampled HMP annual species using circular plots in all 100 by 100 foot plots. Sampling conducted in 2010 followed the protocols established by Burleson (2009a) which specified random selection of the plots which contained HMP annuals in previous surveys.

Twenty (20) percent of the plots at which the HMP annuals had been observed in previous surveys were randomly selected for sampling. In addition, 10 percent of the plots immediately adjacent to plots that had previously supported HMP annuals were randomly selected to assess whether the plant distribution had expanded.

The methodology for the 2010 density monitoring in the Ranges 43–48 area was similar to that described above for the baseline and first-year follow-up monitoring. The surveyors used a resource grade Trimble GeoXH GPS receiver with the grid square boundaries loaded as a map layer to locate the grid squares selected as sample plots for sampling. Generally, the corners of the grid squares were marked by wooden lath stakes, although, in some cases, the stakes were missing or lying on the ground. When present, the stakes were used to precisely determine the boundaries of the sample plot.

As in the baseline and first-year follow-up monitoring conducted in 2010, within each 100×100 foot sample plot the surveyors conducted either a complete census of all individuals of HMP annual species or used a 2.5 meter radius circular plot to subsample the density of the HMP annual species within the sample plot. When circular plot subsampling was conducted during the

2010 survey, an estimate of the total numbers of individuals in the 100×100 foot plot was calculated as described for the baseline monitoring. Each 100×100 foot sample plot was assigned to a density class for each HMP annual species. The density classes were the same as for the baseline monitoring:

0 = 0 plants per 100 x 100 foot plot

1 = 1 to 50 plants per 100 x 100 foot plot

2 = 51 to 100 plants per 100 x 100 foot plot

3 = 101 to 500 plants per 100 x 100 foot plot

4 = >500 plants per 100 x 100 foot plot

In some cases where it was clear that the number of plants of an HMP annual species was well in excess of 500, the sample plot was assigned to density class 4 without a complete count or subsampling.

4.2.2. Shrub Transect Monitoring

Monitoring of shrub species composition in the Ranges 43–48 area was conducted between 3 and 9 June 2010. The transects monitored had been previously established and monitored in 1999 or 2000 (Harding Lawson 2001) and were monitored again in 2005 and 2008 (Parsons 2005; Burleson 2008). A total of 34 transects were monitored (Map 28). This includes all of the original 1999–2000 transects that are contained within the area included in the 2010 monitoring, with five exceptions. Three transects in the Range 48 area (transects BA3, BC2, and BC4) were not monitored in 2010 because they were entirely within an accidental burn area that burned in 2009. Two additional transects at the south end of the Range 48 area were not monitored in 2010 because they are located entirely within the cleared fuel break area along the boundary of the unit, and are thus not in a comparable successional stage to the remainder of the remainder of the Range 43–48 area. The original north end of one of the transects monitored in 2010 (BH1), located at the north end of the Range 48 area, is outside the area included in the 2010 monitoring. For this transect, the start and end points were moved 10 meters south of the original start and end points, so that the transect was contained entirely within the 2010 monitoring area.

The surveyors used a resource grade Trimble GeoXH GPS receiver to locate the previously recorded start and end points of each transect monitored. In many cases, stakes or pin flags were present at the start and/or end points of the transects, confirming that the locations were correct.

Once the start and end points were located, the transects were sampled using the line intercept method in similar fashion to the transects in the baseline monitoring areas (above). A 50 meter measuring tape was stretched out between the start and end points. Species for which cover data was recorded separately in the transect sampling include all woody species (shrubs and subshrubs) present along the transect length, as well as iceplant. Other herbaceous vegetation was recorded as “herb”, and bare ground (including dead vegetation) was also recorded. The lengths along the transect (above, below, or touching the measuring tape) occupied by each woody species, herbaceous vegetation, and bare ground were recorded in 1 decimeter intervals. Lengths

less than 1 decimeter were not recorded. Absolute percent cover of each woody species, herbaceous vegetation, and bare ground along each transect were calculated by summing all the individual lengths along the transect and then calculating this length as a percentage of 50 meters.

4.2.3. Annual Grass Monitoring

Non-native annual grass monitoring was conducted within the 45–50 foot wide fuel breaks surrounding the Ranges 43–48 area on 23 and 24 June 2010. Annual grass species included in this monitoring were the same species as in the baseline areas annual grass monitoring. Annual grass monitoring was conducted by a combination of driving the perimeter roads surrounding the burn units and walking where necessary to obtain a full overview of the containment areas. Areas supporting non-native annual grass species were mapped onto aerial photographs. In each mapped area, non-native annual grass density was visually estimated and mapped by one of the same three density classes as in the baseline monitoring:

1 (low) = 1–5 percent

2 (medium) = 6–25 percent

3 (high) = >25 percent

4.2.4. Invasive Species

Invasive species were mapped when encountered during the HMP annuals density monitoring and shrub transect monitoring. When invasive species were encountered, the locations were mapped using a recreational-grade GPS unit except where the invasive species was widespread, in which case the area of occurrence was mapped onto an aerial photograph (Map 37). A comprehensive survey of the Ranges 43–48 area for invasive species was not conducted.

4.3. Ranges 43–48—Results and Discussion

Ninety-one plots were surveyed for HMP species in 2010. Both sand gilia and Monterey spineflower increased in overall density between 2008 and 2010, whereas the seaside bird's-beak decreased in density.

Data from previous annual surveys for HMP annuals and LCTA line transects were obtained from GIS shapefiles and associated metadata provided by the Fort Ord GIS coordinator, Mr. C. Stiebel (Stiebel 2010). These data formed the basis for comparative analyses with the 2010 data.

4.3.1. Sand Gilia

Sand gilia was present in 74 percent of the 91 plots surveyed in 2010, and was widely, but patchily, distributed throughout Ranges 43–48 (Map 26). This species occurred most frequently in density class 1 (44% of plots), although 4 plots supported over 500 plants (density class 4) (Table 4-1). In 2008, sand gilia was present at an average density class of 0.7; whereas in 2010, it had increased to an average density class of 1.3.

Table 4-1
Sand Gilia – Number of Plots per Density Class in Ranges 43–48

Density Class	1999–2000	2005	2008	2010
0 plants/grid (percent of plots)	0 (0)	0 (0)	32 (55)	24 (26)
1–50 plants/grid (percent of plots)	69 (93)	526 (41)	17 (29)	40 (44)
51–100 plants/grid (percent of plots)	3 (4)	184 (14)	5 (9)	9 (10)
101–500 plants/grid (percent of plots)	2 (3)	403 (32)	4 (7)	14 (16)
>500 plants/grid (percent of plots)	0	164 (13)	0 (0)	4 (4)
Total Plots Sampled	74	1277	58	91
*Each plot is 100- x 100- feet or 10,000 square feet.				

4.3.2. Seaside Bird's-Beak

Seaside bird's-beak was present in 42 percent of the 91 plots surveyed in 2010, and was present primarily on the eastern side of Ranges 43–48 (Map 27). When present, it was about equally frequent in density classes 1 through 4 (Table 4-2). In 2008, seaside bird's-beak was present at an average density class of 2.6; whereas in 2010, it had decreased to an average density class of 1.1.

Table 4-2
Seaside Bird's-Beak – Number of Plots per Density Class in Ranges 43–48

Density Class	1999–2000	2005	2008	2010
0 plants/grid (percent of plots)	0 (0)	0 (0)	2 (1)	53 (58)
1–50 plants/grid (percent of plots)	14 (47)	93 (34)	4 (9)	8 (9)
51–100 plants/grid (percent of plots)	3 (10)	34 (12)	5 (11)	7 (8)
101–500 plants/grid (percent of plots)	2 (7)	100 (37)	24 (55)	12 (13)
>500 plants/grid (percent of plots)	11 (37)	47 (17)	10 (23)	11 (12)
Total Plots Sampled	30	274	44	91
*Each plot is 100- x 100- feet or 10,000 square feet.				

4.3.3. Monterey Spineflower

Monterey spineflower was present in 98 percent of the 91 plots surveyed in 2010, and was widely distributed throughout Ranges 43–48 (Map 28). It occurred most frequently in density class 4 (67% of plots) (Table 4-3). In 2008, Monterey spineflower was present at an average density class of 2.8; whereas in 2010, it had increased to an average density class of 3.4.

Table 4-3
Monterey Spineflower – Number of Plots per Density Class in Ranges 43–48

Density Class	1999–2000	2005	2008	2010
0 plants/grid (percent of plots)	0 (0)	1,462 (100)	0 (0)	2 (2)
1–50 plants/grid (percent of plots)	4 (11)	0 (0)	10 (23)	6 (7)
51–100 plants/grid (percent of plots)	0 (0)	0 (0)	4 (9)	8 (9)
101–500 plants/grid (percent of plots)	1 (3)	0 (0)	14 (33)	14 (15)
>500 plants/grid (percent of plots)	32 (87)	0 (0)	15 (35)	61 (67)
Total Plots Sampled	37	1,462	43	91
*Each plot is 100- x 100- feet or 10,000 square feet.				

4.3.4. Shrub Transect Monitoring

Total shrub cover on shrub transects averaged 92 percent and ranged from 56 to 136 percent (Figure 4-1). Bare ground averaged 24 percent, and herbaceous vegetation occupied 4.7 percent. Raw data for the shrub transects sampled in 2010 are provided in Appendix B.

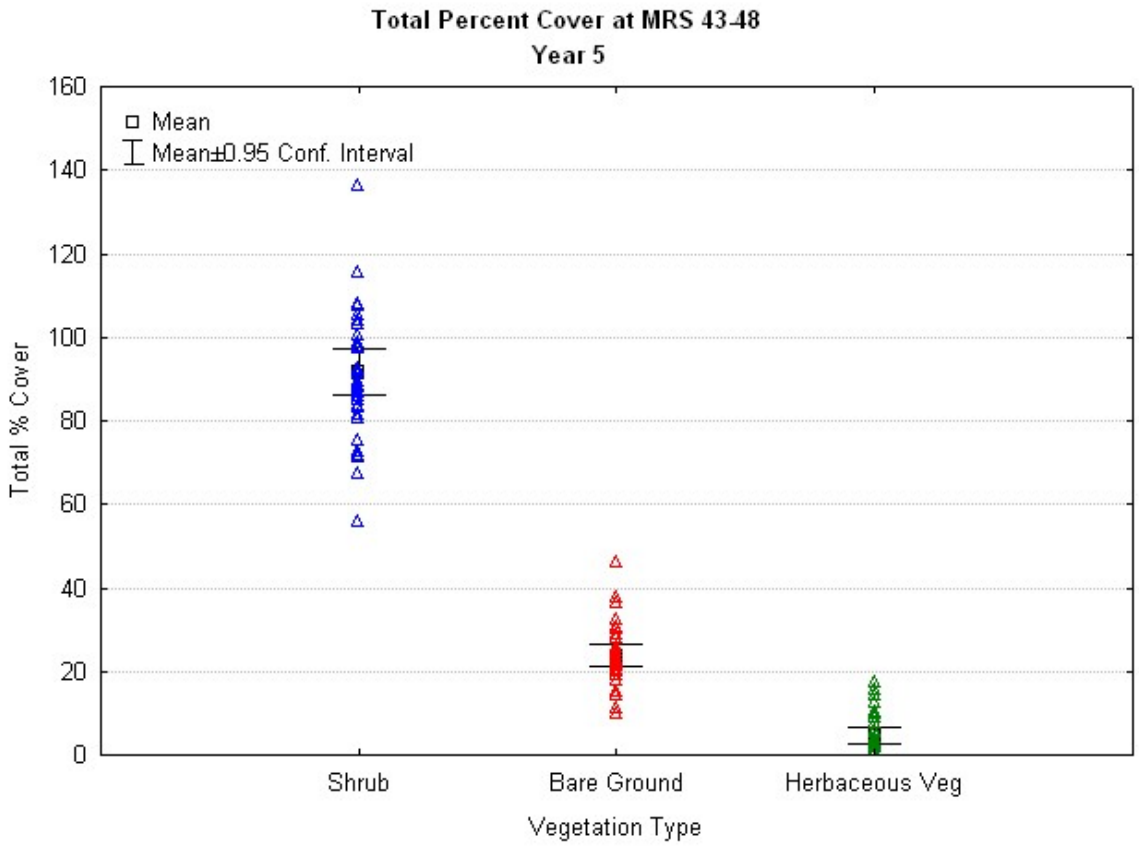

Figure 4-1 Percent cover of shrubs, herbaceous vegetation, and bare ground on transects in Ranges 43–48.

Ranges 43–48 were burned in 2003; therefore there has been sufficient time for shrub species to recolonize the area, and successional trends are likely to be observed when comparing data collected between 1999/2000 (pre-burn) and 2010 (Year 5). To assess temporal changes in community structure, several standard metrics were examined. Percent cover along the shrub transects decreased from an average of 98% pre-burn to 34% immediately after the burn (Figure 4-2). Cover has continued to increase, achieving an average of 92% in the Year 5 data.

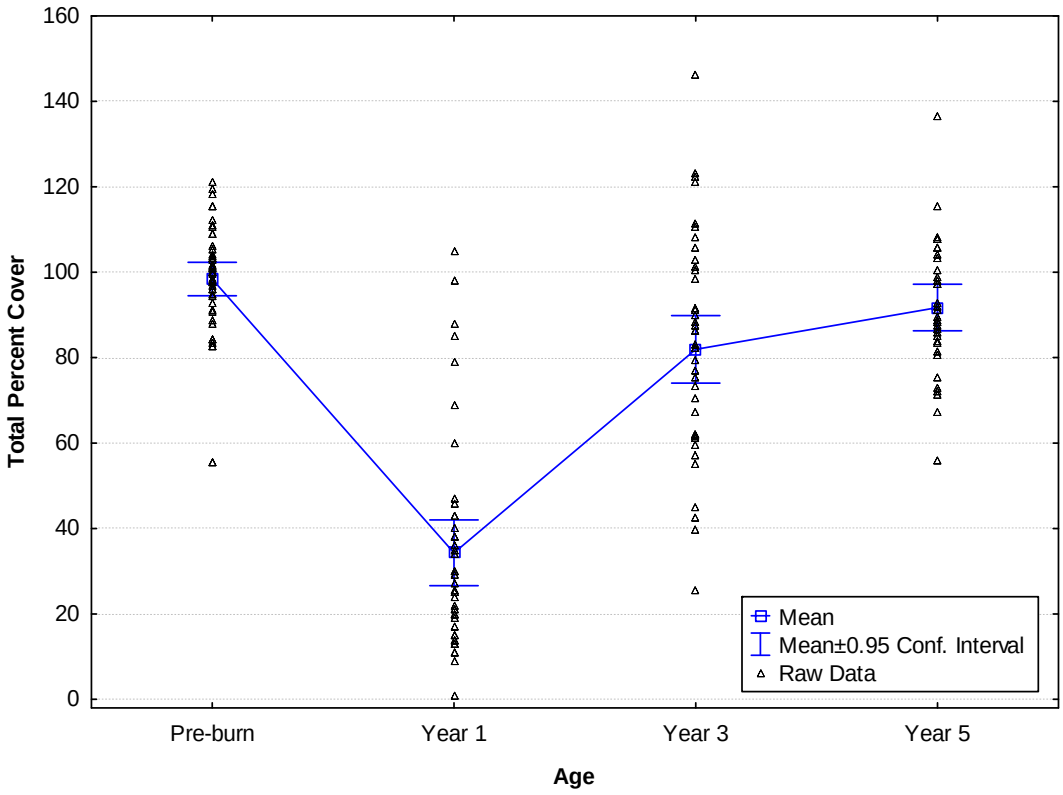

Figure 4-2 Percent cover on Range 43–48 shrub transects over time.

The next metric examined was the change in diversity as measured by the Shannon-Weiner metric (Pielou 1974). The Shannon-Weiner metric expresses diversity as a combination of the number of species present in the community and their relative abundance (or cover) in the sample. Diversity increased slightly after the burn (from an average of 1.1 to 1.2), and has continued to increase to an average of 1.7 in Year 5 (Figure 4-3). Because diversity is a mixture of the number of species and their relative abundance, this pattern reflects the reduction in cover of the dominant species and the incorporation of new early successional species into the community. As succession progresses, diversity will increase until the climax species begin to re-establish their dominance in the final community.

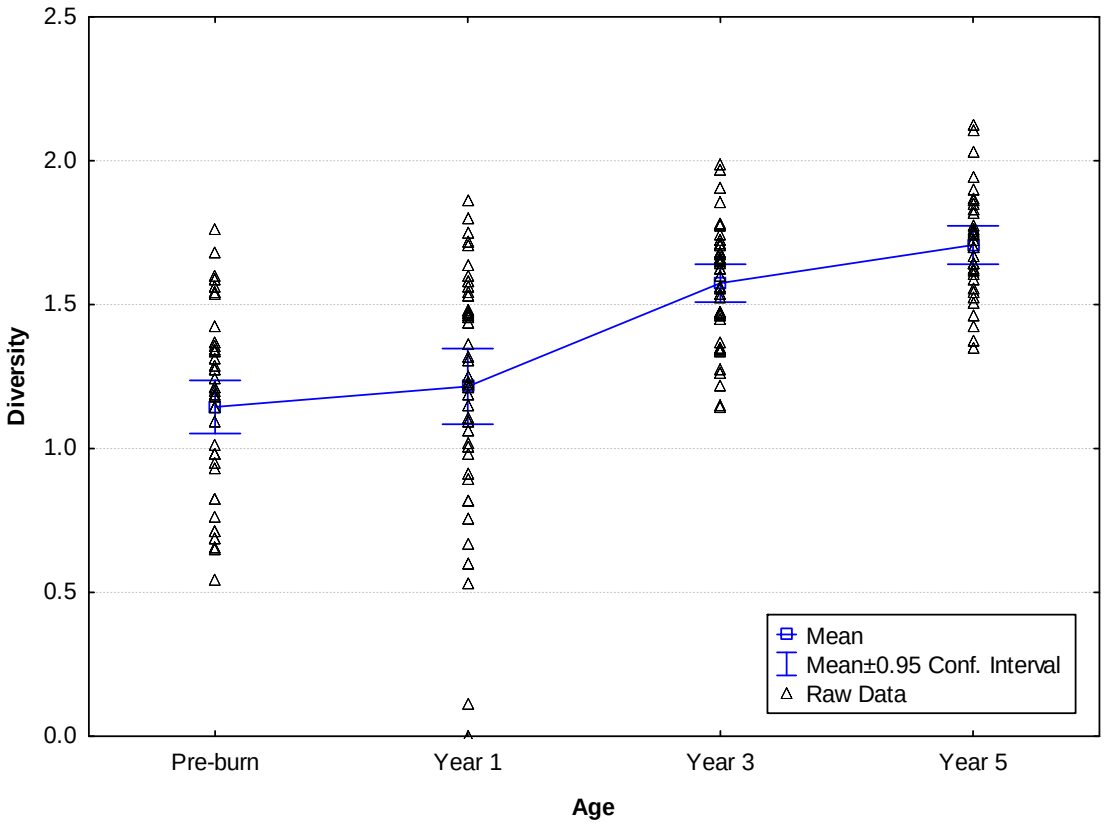

Figure 4-3 Community diversity on Range 43–48 shrub transects over time.

The pattern described above is reflected in the changes in species evenness (Figure 4-4). Evenness is the equability of the relative contribution of species to the total cover in the community (Pielou 1974). Maximum evenness (value = 1) is achieved when all species are present in equal abundance. In the pre-burn community, evenness averaged 0.66, indicating that certain species dominated the community. In Year 1, evenness increased due to the effects of the burn reducing overall cover, particularly of the dominant species. Subsequently, evenness continued to increase as new early successional species were recruited into the community.

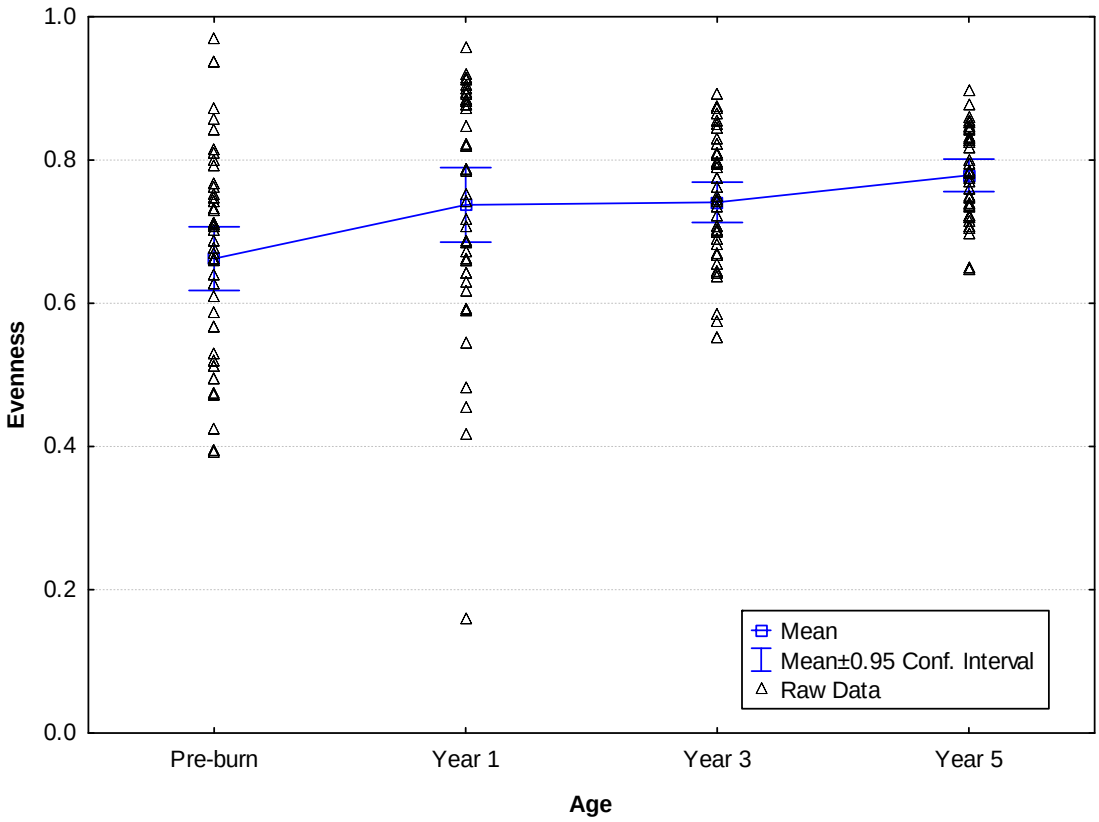

Figure 4-4 Community evenness on Range 43–48 shrub transects over time.

Multivariate statistics (ordination techniques) were used to assess whether there has been a change in species composition over time (Jongman et al. 1995). These techniques are based on measures of dissimilarity between samples (transects). This analysis was conducted using non-metric multidimensional scaling (NMDS; Jongman et al. 1995). Ordination techniques result in a multidimensional representation of samples (transects).

The results of the NMDS ordination show a community level response to the burn and subsequent recovery (Figure 4-5). In this plot, the centroid (multivariate average) of each group is indicated as a point with a radiating line extending to each individual transect in the group. The polygons are drawn to encompass all points within the corresponding group. Axis 1 of the ordination is interpreted to represent temporal patterns of recovery in the shrub community. The pre-burn conditions are shown in red on the left side of the plot (Figure 4-5). The Year 1 (2005; brown) data appear on the right side of the plot, and appear to be relatively more variable than the other age classes. Subsequent Year 3 (2008; green) and Year 5 (2010; blue) are intermediate and suggest a shift towards the pre-burn condition.

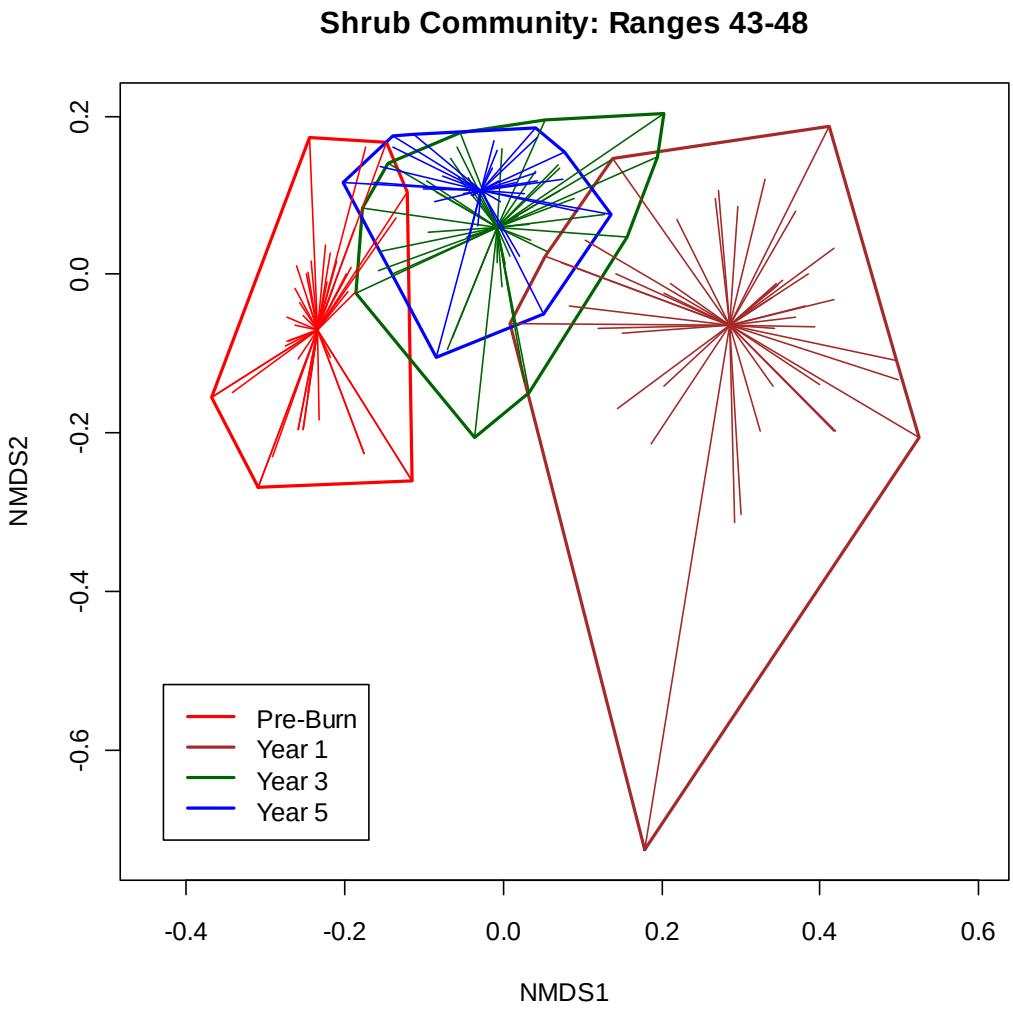

Figure 4-5 NMDS ordination plot of shrub community structure on Ranges 43–48 over time.

The results of the community metrics and the ordination suggest that there is a pattern to community succession in the data from Ranges 43–48. However, these analyses do not provide an indication of which species are important in defining the differences between the groups. Therefore, indicator species analysis (Dufrene and Legendre 1997) was applied to identify those species that tend to be found in one of the groups more frequently than in other groups (Table 4-4). The indicator value varies from 0 (no group indication) to 1 (the species is found in all samples within a single group and not in any other groups).

Overall, indicator values are relatively low, suggesting that the species are likely present in multiple surveys and in variable frequency of occurrence, which is expected in a long-term successional sequence. Shaggy-barked manzanita (*A. tomentosa ssp. tomentosa*) and sandmat manzanita (*A. pumila*) are indicative of pre-burn conditions. Shaggy-barked manzanita is also indicative of the Year 5 conditions, suggesting that this species one of the earlier climax species

to recolonize. Peak rush-rose (*H. scoparium*) is clearly an early colonizer, with chamise appearing in the community in Year 3. In addition to shaggy-barked manzanita, Monterey ceanothus and dwarf ceanothus are indicative of the Year 5 community. Other species, although present in the community, have less value as indicators of specific seral stages. These species are not included in Table 4-4. The full community data are presented in Appendix B.

Table 4-4
Results of Indicator Species Analysis[1]

Species	Pre-burn	Year 1	Year 3	Year 5
Monterey ceanothus	–	–	–	0.37
Shaggy-barked manzanita	0.39	–	–	0.30
Chamise	–	–	0.32	–
Sandmat manzanita	0.57	–	–	–
Peak rush-rose	–	0.40	–	–
Dwarf ceanothus	–	–	–	0.48

[1] Only indicator values greater than 0.3 are presented

The indicator species analysis indicated the occurrence of several species that characterize different successional stages in the maritime chaparral community at Fort Ord. To further assess the successional patterns in shrub recovery in Ranges 43–48, the percent cover of each species on each transect was plotted over time. Mean values for selected species are plotted in Figure 4-6 and Figure 4-7. Individual species plots showing individual data points, means, and 95% confidence intervals are provided in Appendix C. Clear successional patterns can be seen in both common (Figure 4-6) and rare (Figure 4-7) shrubs. All species show an immediate response in Year 1 as a result of the burn, generally a marked reduction in percent cover. However, some species, such as peak rush-rose and golden yarrow (*E. confertifolium*) increase in cover in Year 1 and subsequently decrease. The dominant shaggy-barked manzanita displays a fairly rapid rate of recovery, achieving 22 percent cover within 5 years of the burn. In contrast, the congeneric sandmat manzanita only achieves about 6 percent cover after 5 years. The Monterey ceanothus (*C. cuneatus var. rigidus*) was only present at about 6 percent cover in the pre-burn survey, declined to about 4 percent cover in Year 1, and then increased to 16 percent cover in Year 5.

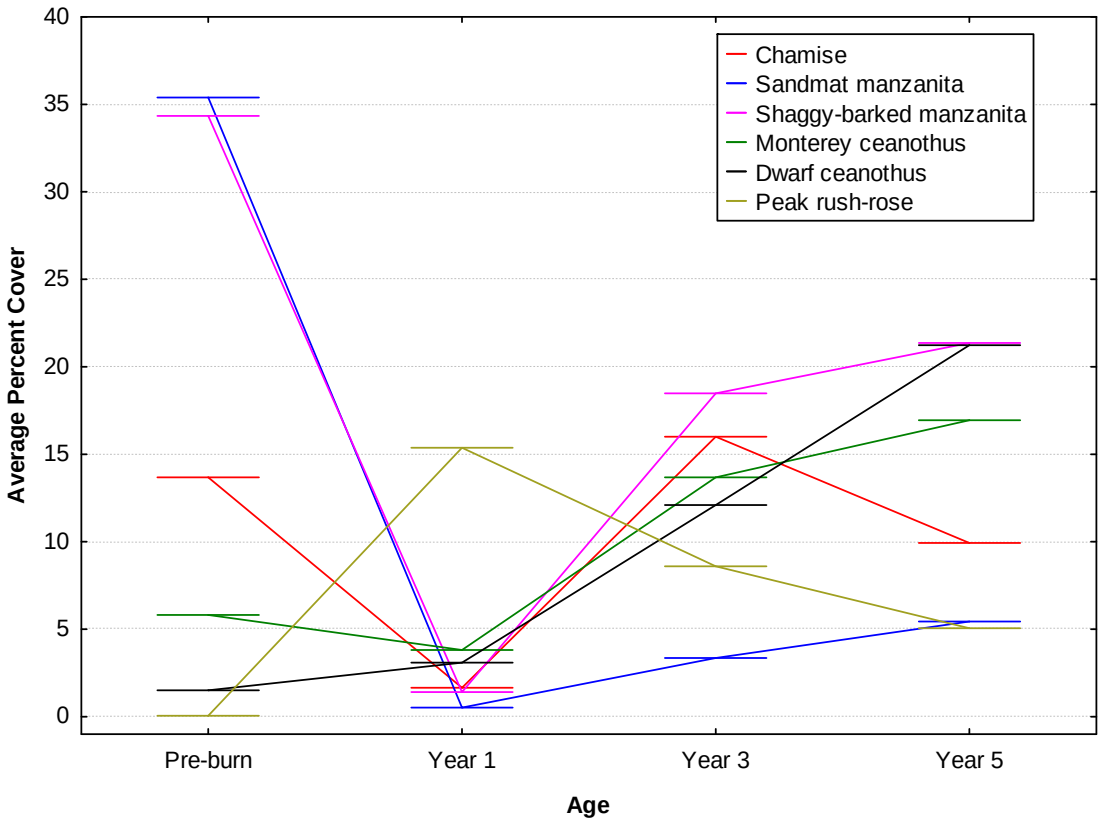

Figure 4-6 Average percent cover of common shrubs on transects in Ranges 43–48. (Year 1 is 2005, Year 3 is 2008, and Year 5 is 2010).

The rarer species show similar patterns as the common shrubs (Figure 4-7). The golden yarrow rapidly colonizes in Year 1 and then decreases to between 1 and 1.6 percent cover in Years 3 and 5. However, its cover still exceeds the pre-burn conditions. Deerweed (*L. scoparius*) shows a steady increase in percent cover over time, ranging from about 0.1 percent cover in the pre-burn community to about 3.3 percent cover in Year 5. Other species show varying degrees of suppression immediately after the burn and subsequent recovery.

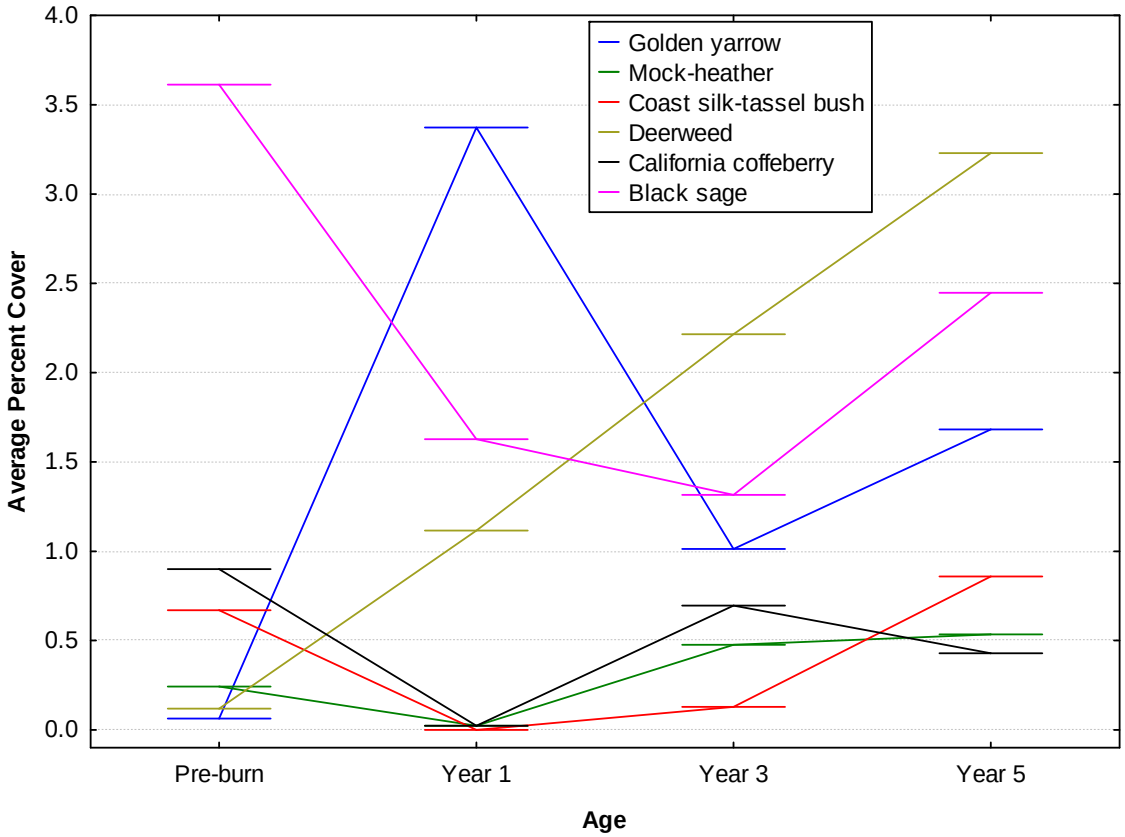

Figure 4-7 Average percent cover for rare shrubs on transects in Ranges 43–48. (Year 1 is 2005, Year 3 is 2008, and Year 5 is 2010.)

4.3.5. Annual Grass Monitoring

Annual grass surveys were limited to the periphery of Ranges 43–48 (Map 30). The estimated area occupied by annual grasses in ranges 43–48 is 39.51 acres (Table 4-5).

Table 4-5
Estimated Area Occupied (Acres) by Annual Grasses in Year 1 Surveys in BU 14 and 19

Cover Class	Ranges 43–48
1 (low) = 1–5 percent	7.59
2 (medium) = 6–25 percent	7.67
3 (high) = >25 percent	24.25
Total Acreage	**39.51**

Map 30 shows that annual grasses tend to be limited to areas along roadways. However, several areas of dense (>25% cover) grasses are present along the periphery of Ranges 43–48.

Observations by Parsons Inc. (2004) indicated that annual grasses were very limited in extent prior to the establishment of fire breaks in 2001. The effect of clearance for firebreaks on the density of annual grasses was highly variable. Mowing resulted in variable rates of encroachment of annual grasses into fire breaks. Application of fire retardants appeared to increase annual grass densities via a fertilization effect.

4.3.6. Invasive Species Monitoring

Iceplant is abundant and widespread at the extreme north end of Range 43, and was not mapped in detail in that area.

SECTION 5

Conclusions

5.1. Sand Gilia, Seaside Bird's-Beak, and Monterey Spineflower Surveys

All HMP annual species show a response to the effects of the prescribed burns. These species are typically found in areas of open vegetation with reduced shrub cover.

Sand gilia was present in between 40 and 55 percent of the plots surveyed in pre-burn areas in 2009 and 2010. In the Year 1 surveys on BU 14 and 19 (2010), this species was found in 76 percent of the plots. This pattern suggests a significant increase in frequency of occurrence of the species. The population on Ranges 43–48 was present in only 45 percent of the surveyed plots, and increased to 74 percent of the surveyed plots in Year 5 (2010) surveys. This suggests that the sand gilia will continues to increase over the first five year period after a burn.

The seaside bird's-beak is present at between 3 and 9 percent of the plots in pre-burn conditions, and increased to approximately 13 percent of the plots in Year 1 surveys at BU 14 and 19. On ranges 43–48, seaside bird's-beak was found in 88 percent of the surveyed plots in Year 3 (2008) and subsequently declined to 41 percent of the surveyed plots in Year 5 (2010). These data suggest that seaside bird's-beak reaches its maximum frequency of occurrence around three years after a burn, and subsequently decreases.

A response to fire is least evident for the Monterey spineflower as it occurs frequently in the pre-burn community (75–96 percent of surveyed plots), and was found in 88 percent of the plots in the Year 1 surveys on BU 14 and 19, and 98 percent of the plots during the Year 5 survey on Ranges 43–48.

5.2. Vegetation Transect Survey

The shrub transect surveys showed a clear successional pattern over time. Shrub cover is low in the year immediately following a burn, although some shrub species resprout from the base quickly after a burn, and seedlings of shrub species appear in the first season following the burn. Within 3 to 5 years post-burn, total shrub cover approximates pre-burn levels (Figure 4-2). However, species composition in the Year 3 and 5 communities differs from the pre-burn climax community in having a greater numbers of species, and a different array of species (Figure 4-3 and Table 4-4). Some dominant members of the climax shrub community (e.g., sandmat manzanita, 6% cover) are present at relatively low density in the Year 5 community, whereas shaggy-barked manzanita is approaching pre-burn cover (~22%). Species that appear to be relatively early successional species include dwarf ceanothus, golden yarrow, peak rush-rose, deerweed, and the HMP shrub Monterey ceanothus. The first four of these species are present at only low abundance in the climax community. Monterey ceanothus is present at moderate cover

in the climax community, but is at considerately higher cover early in the successional sequence. Late successional species (generally more abundant in the climax community) include shaggy-barked manzanita, chamise, and the HMP shrub sandmat manzanita.

Based on the analyses conducted in this report, it is apparent that shrub community structure has not fully achieved pre-burn conditions, even after 5 years of recovery. It is likely that this natural successional process will require several more years before the climax community becomes re-established.

Continued monitoring to determine the time required to achieve a mature central maritime chaparral community is recommended. Once this duration is known, an optimal fire frequency could be developed as a basis for maintaining a diverse chaparral community with multiple aged patches.

5.3. Annual Grasses

Annual grasses were limited to the edges of roads and other disturbed areas, and may extend somewhat into the interior of the study sites. Annual grasses were limited in extent prior to 2001, and may have colonized areas disturbed by mowing of shrubs to establish fire breaks (Parsons 2004). Application of fire retardants resulted in increased densities of annual grasses via a fertilization effect. Use of mowing or burning to clear fire breaks had variable and limited effects on the establishment and spread of annual grasses (Parsons 2004).

SECTION 6

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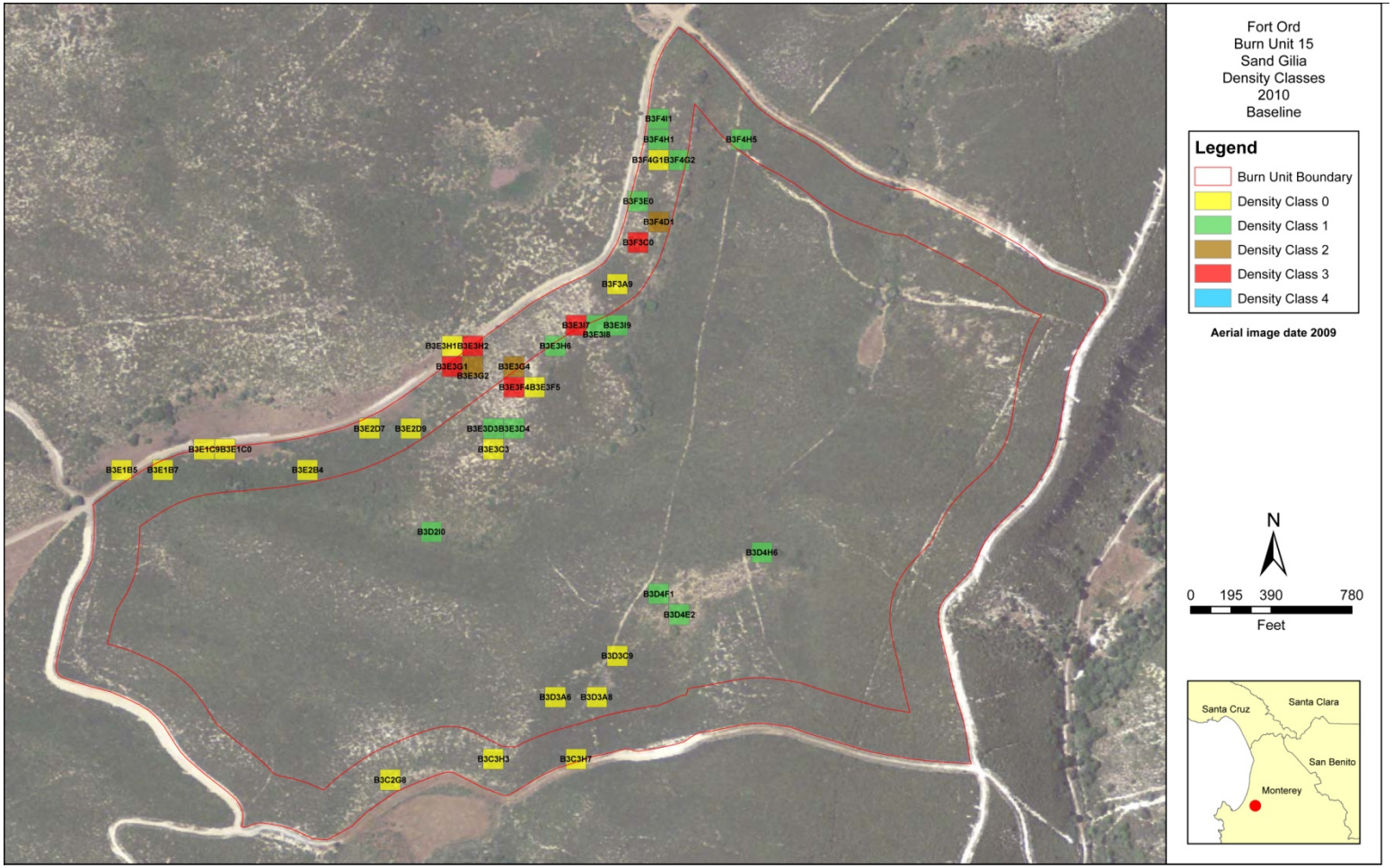
APPENDIX A

Maps

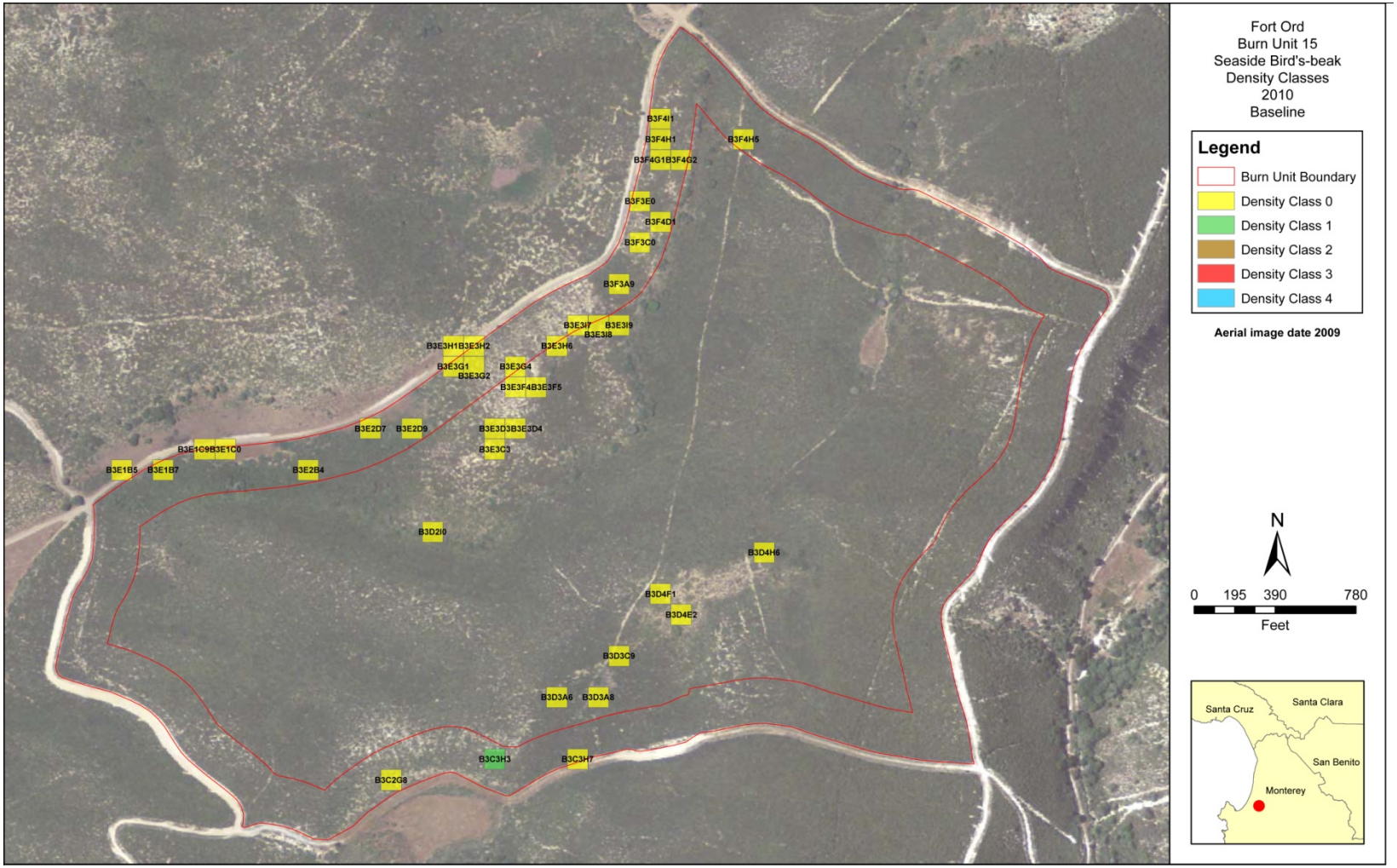
List of Maps in Appendix A

SECTION A-1

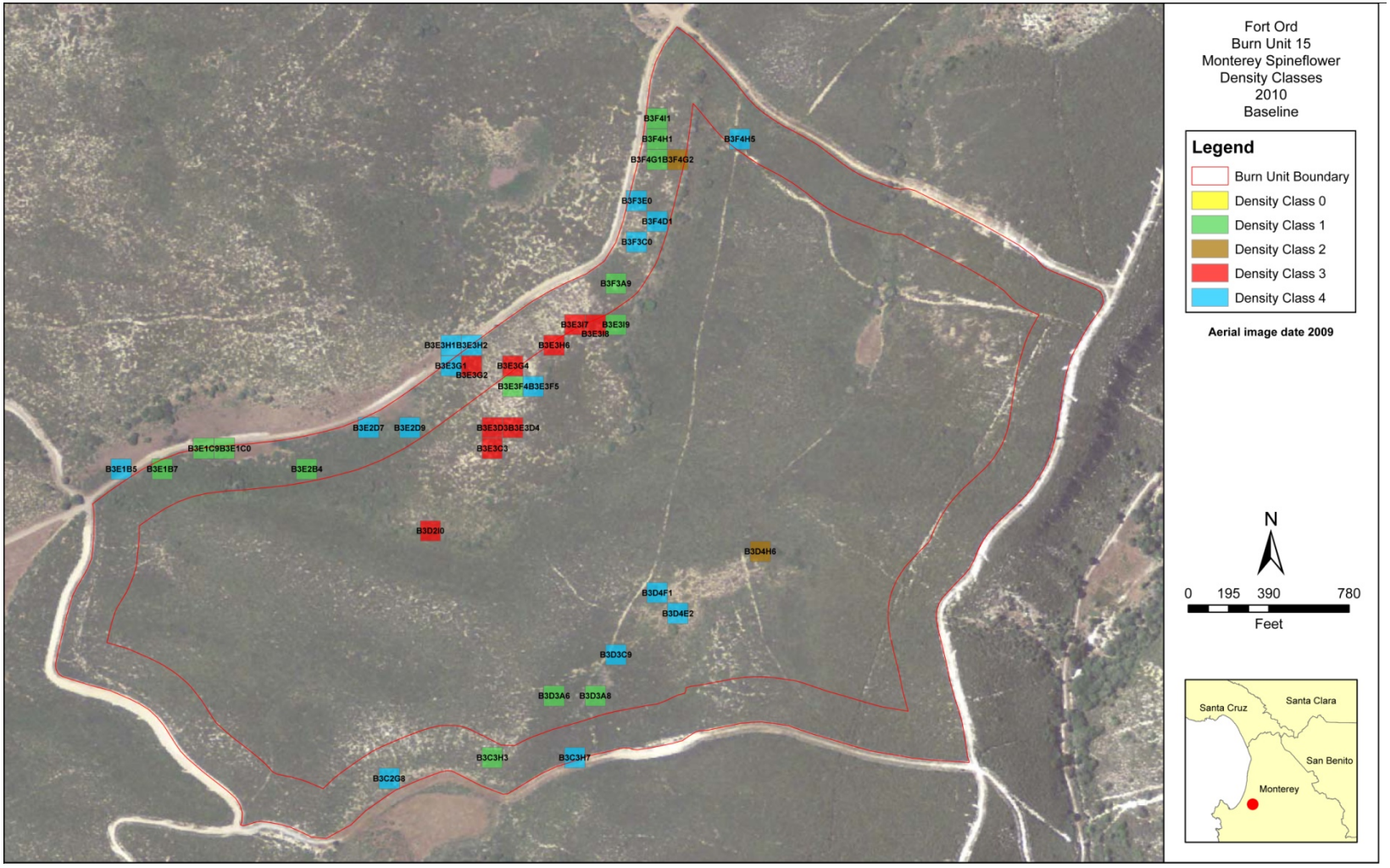
BU 15, 21, 32, and 34



Map 1 **Sand gilia densities in Burn Unit 15 in 2010.**



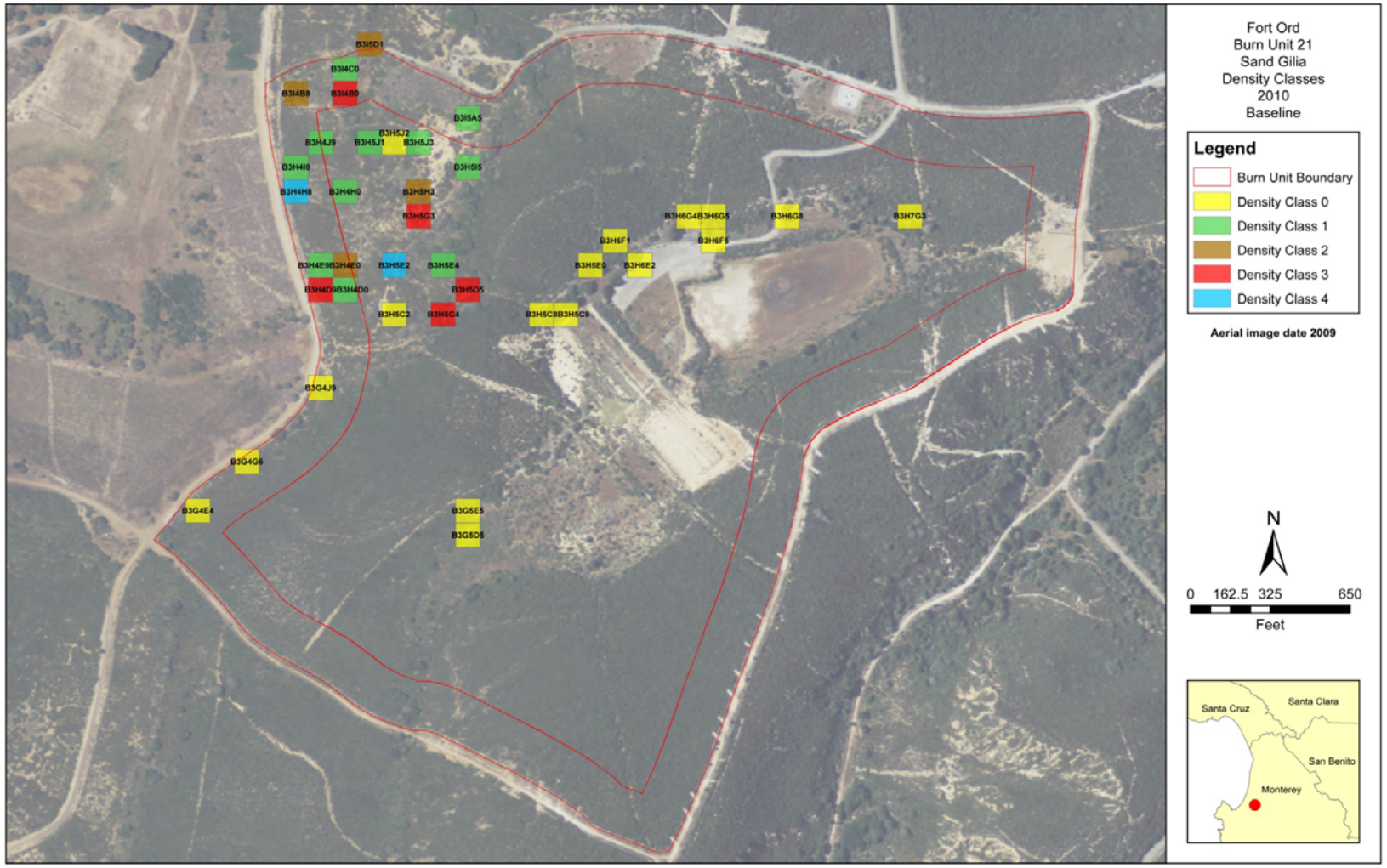
Map 2 **Seaside bird's-beak densities in Burn Unit 15 in 2010.**



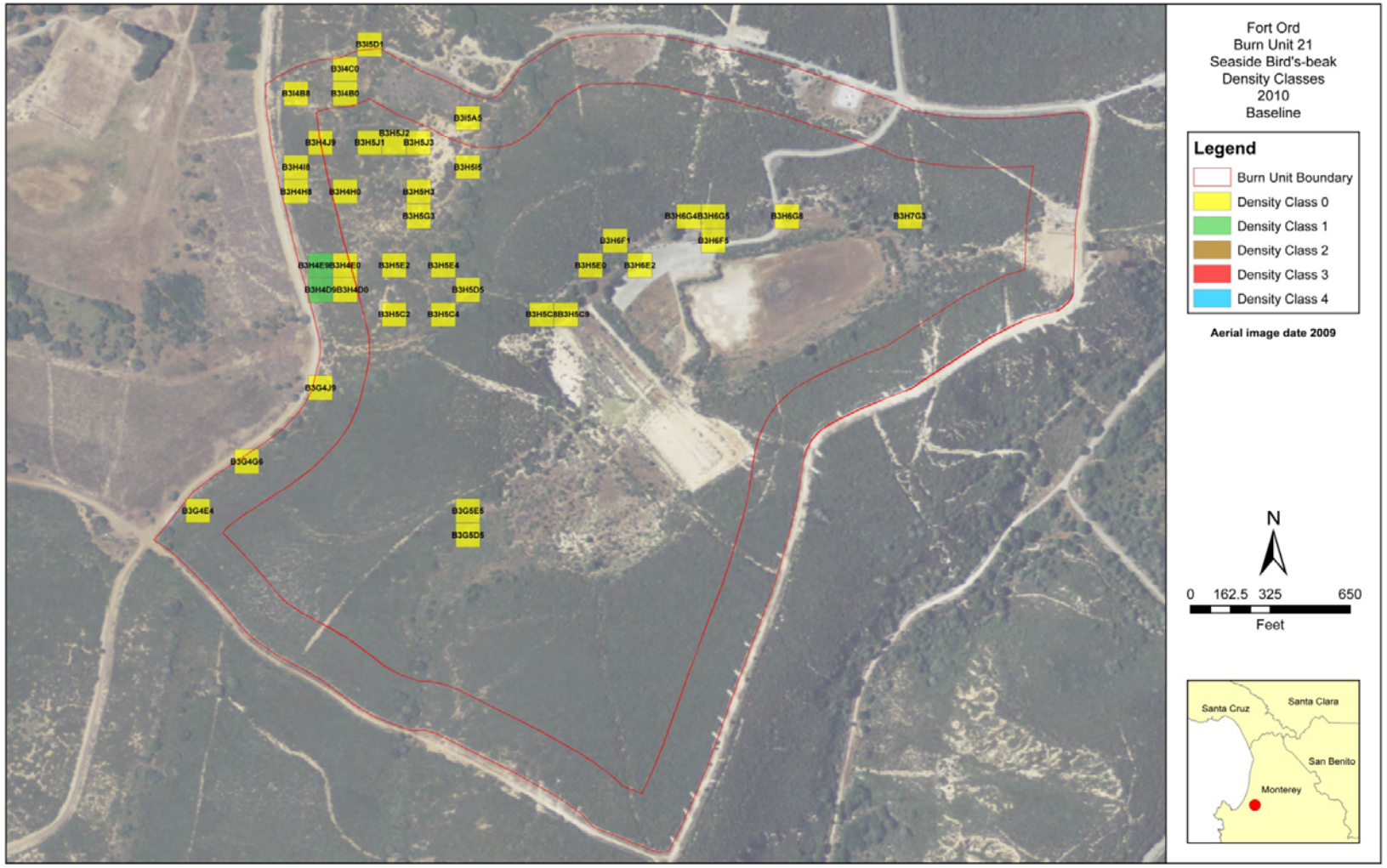
Map 3 **Monterey spineflower densities in Burn Unit 15 in 2010.**

Map 4 **Shrub transects in Burn Unit 15 in 2010.**

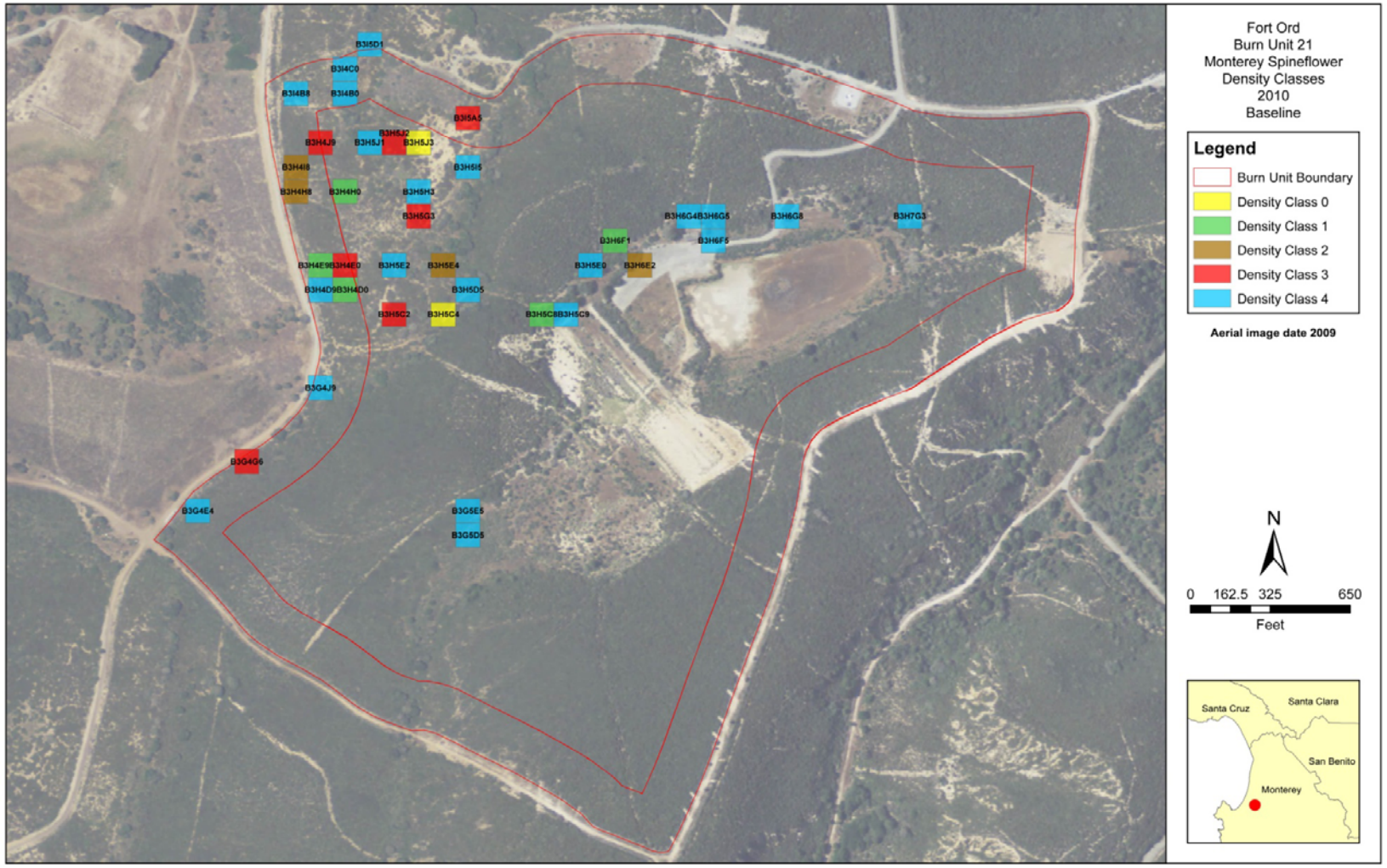
Map 5 Densities of annual grasses in Burn Unit 15 in 2010.



Map 6 **Sand gilia densities in Burn Unit 21 in 2010.**

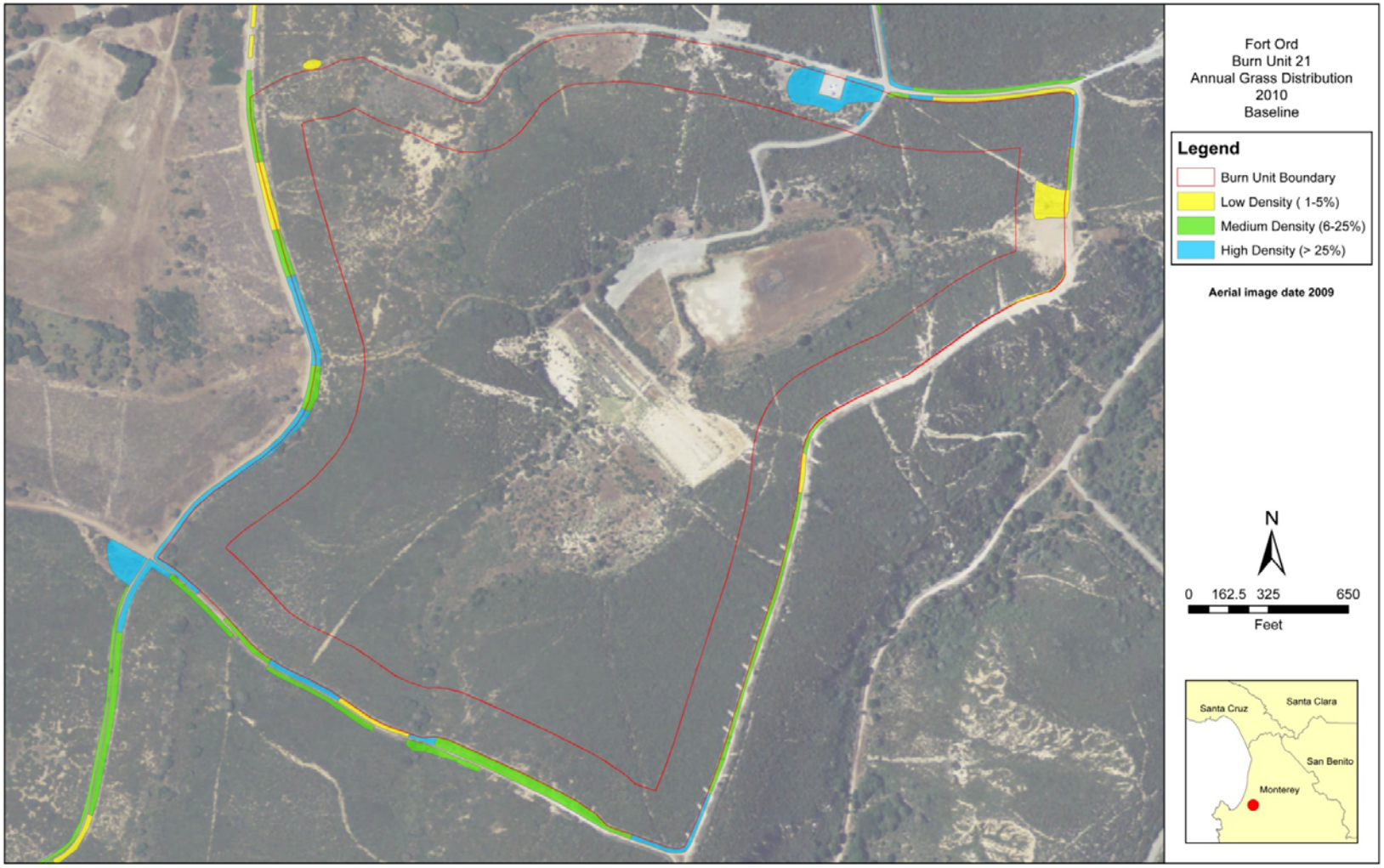


Map 7 **Seaside bird's-beak densities in Burn Unit 21 in 2010.**



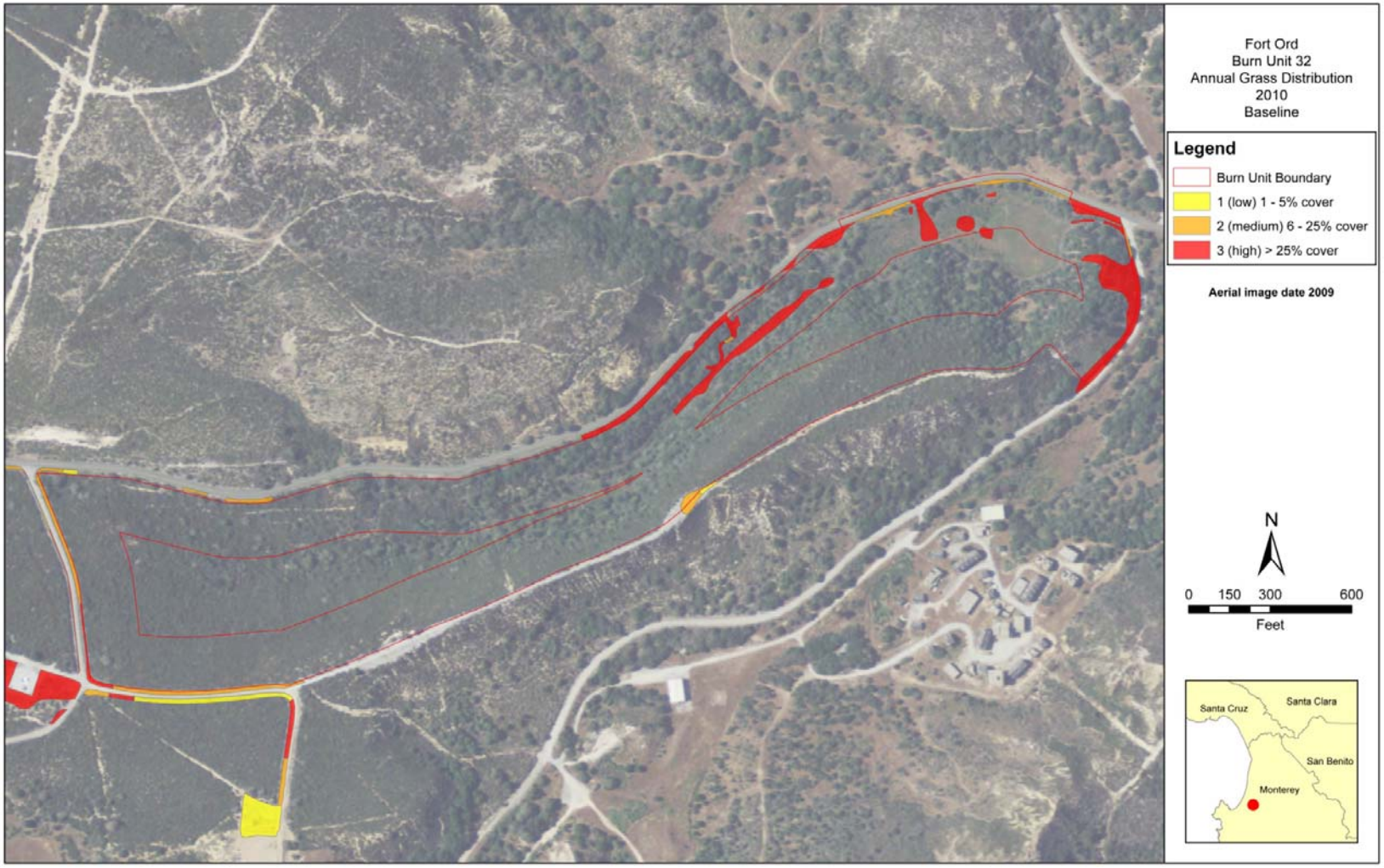
Map 8 **Monterey spineflower densities in Burn Unit 21 in 2010.**

Map 9 **Shrub transects in Burn Unit 21 in 2010.**

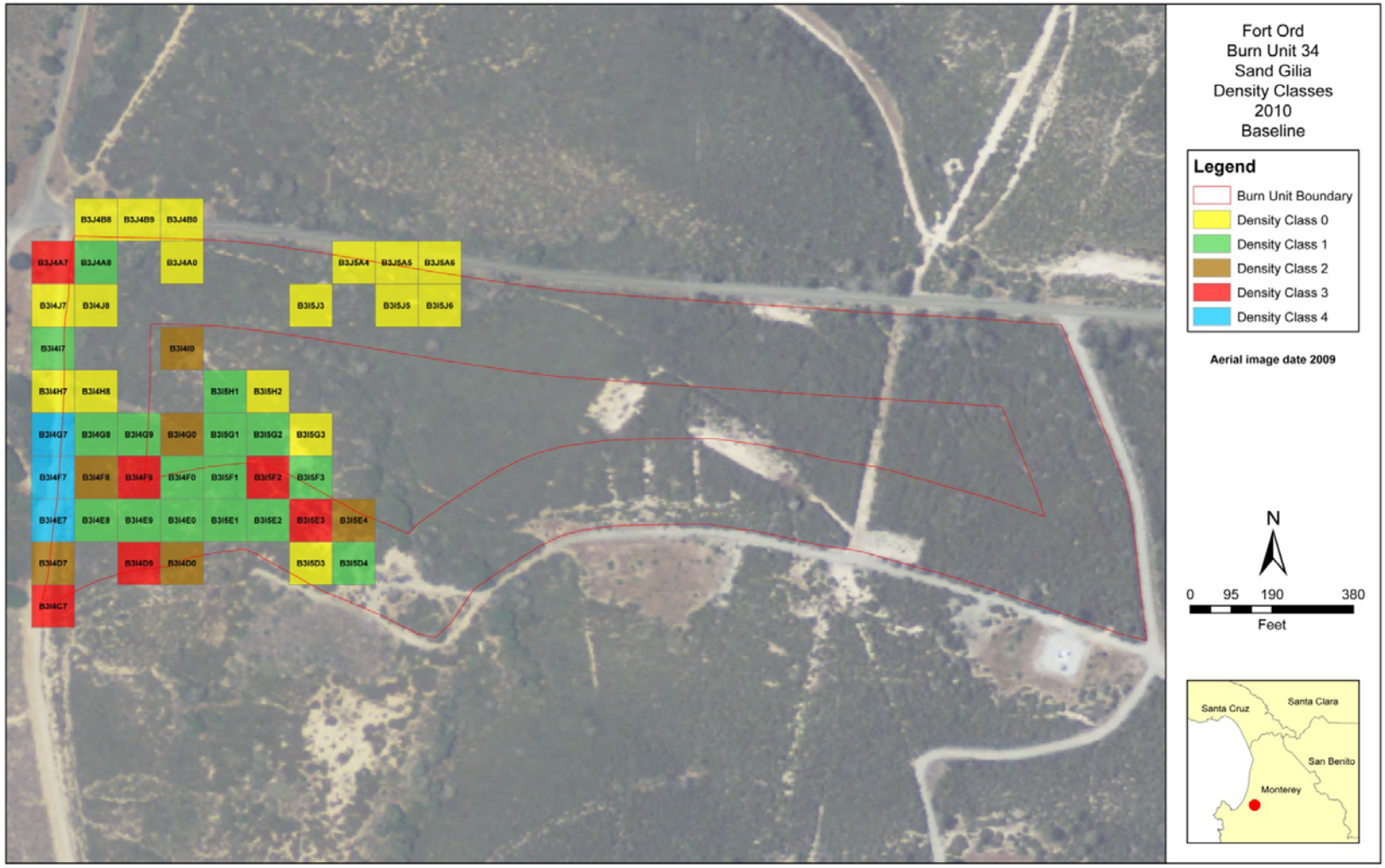


Map 10 **Densities of annual grasses in Burn Unit 21 in 2010.**

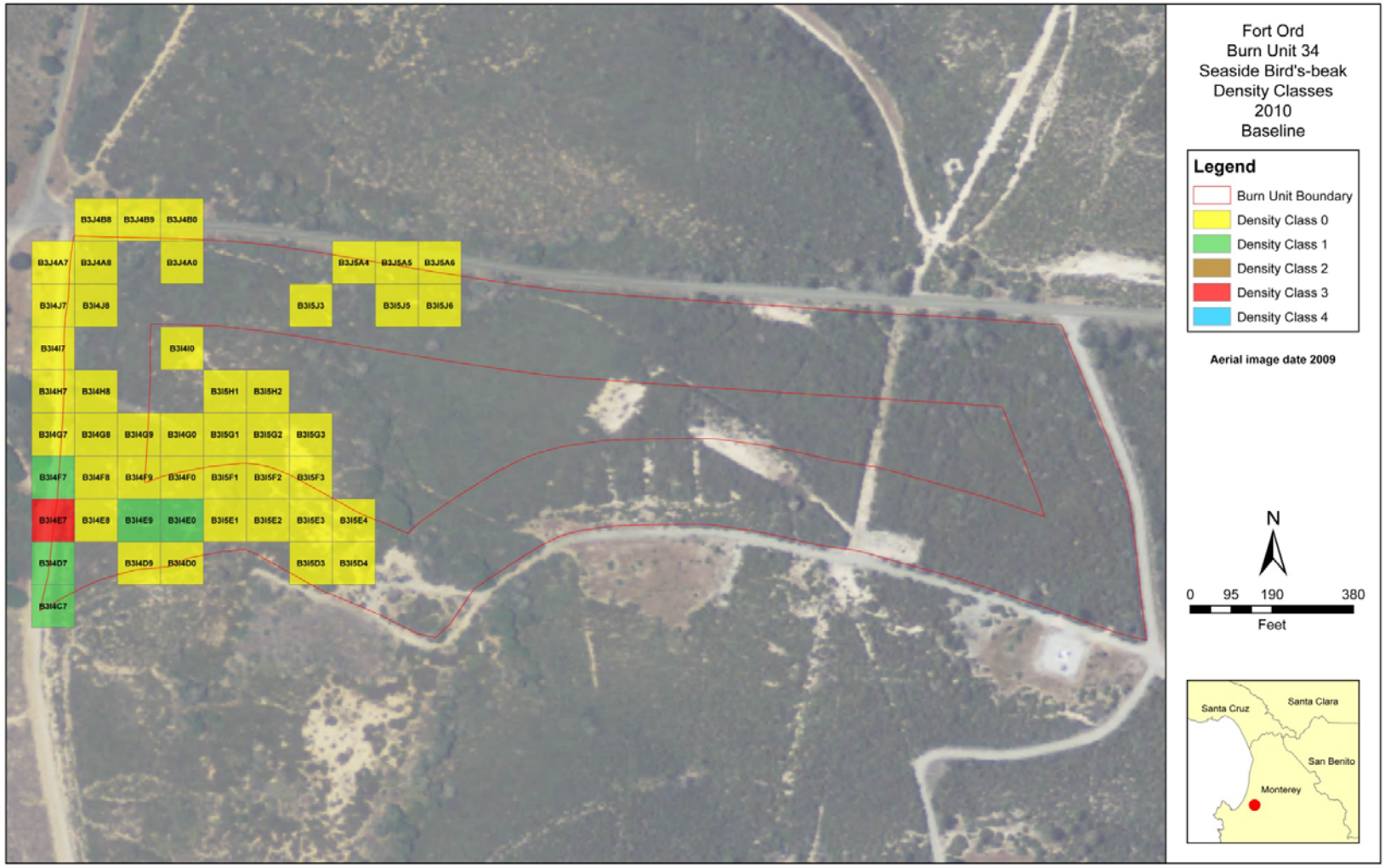
Map 11 **Shrub transects in Burn Unit 32 in 2010.**



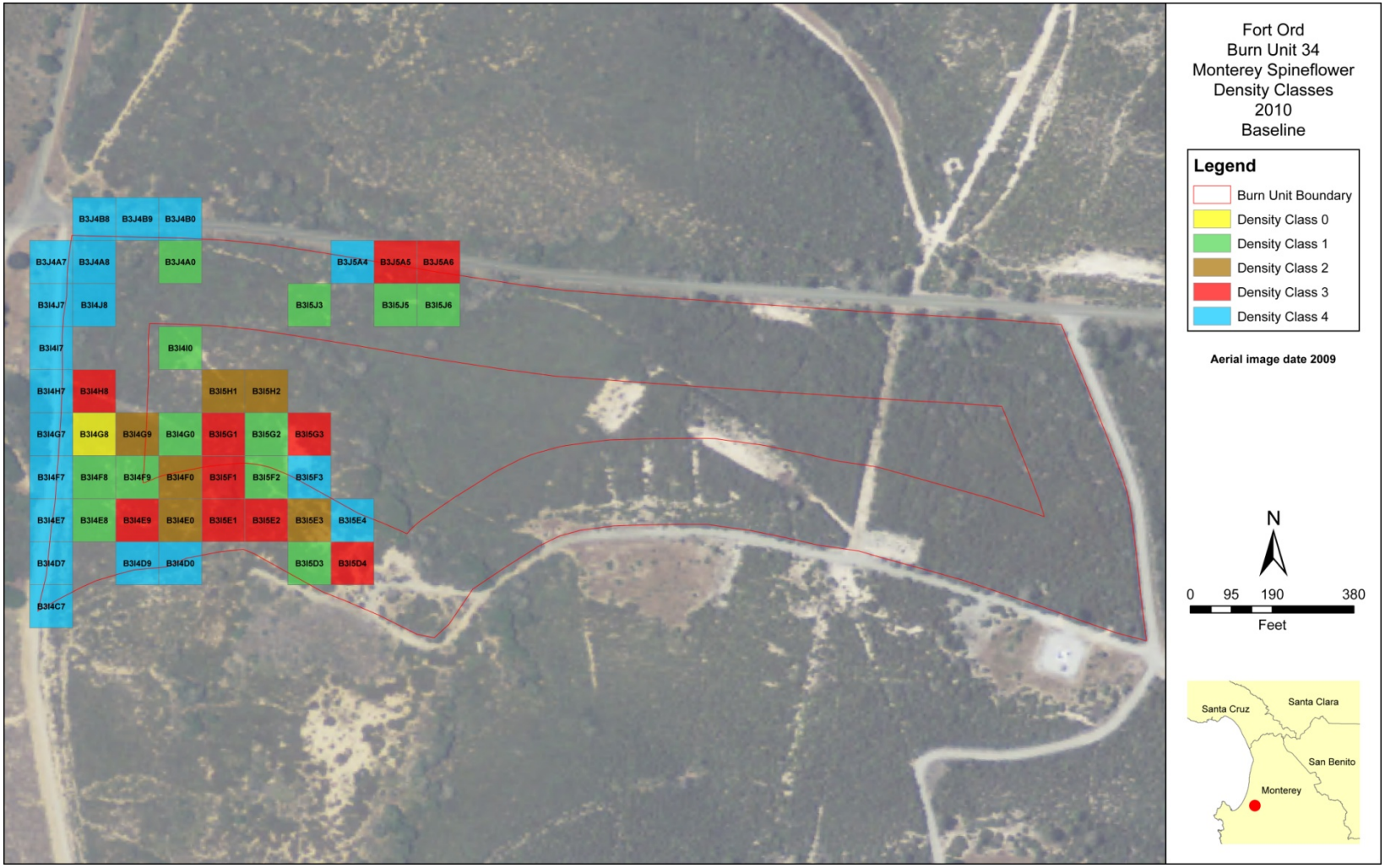
Map 12 Densities of annual grasses in Burn Unit 32 in 2010.



Map 13 Sand gilia densities in Burn Unit 34 in 2010.

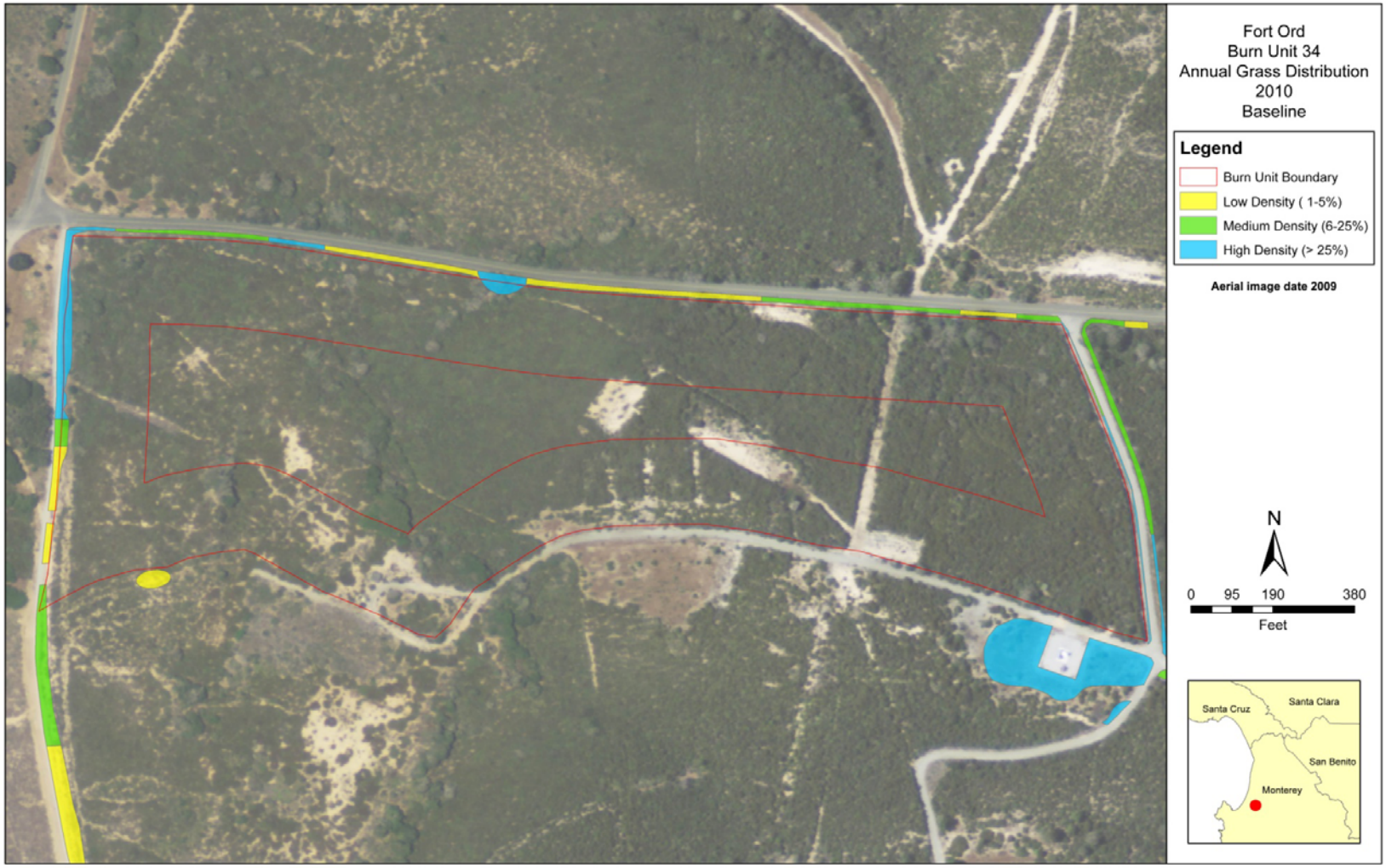


Map 14 **Seaside bird's-beak densities in Burn Unit 34 in 2010.**



zMap 15 Monterey spineflower densities in Burn Unit 34 in 2010.

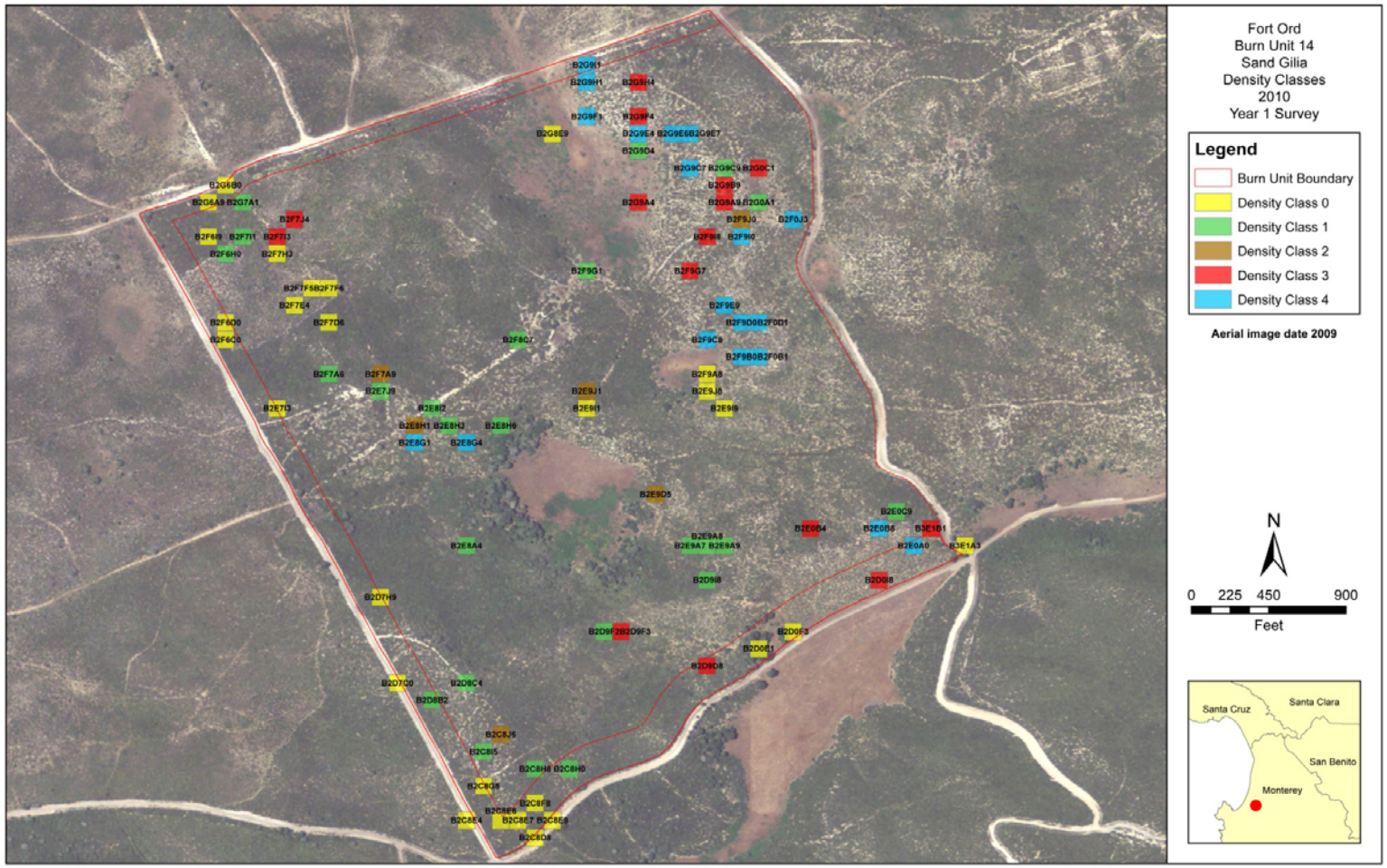
Map 16 Vegetation transects in Burn Unit 34 in 2010.



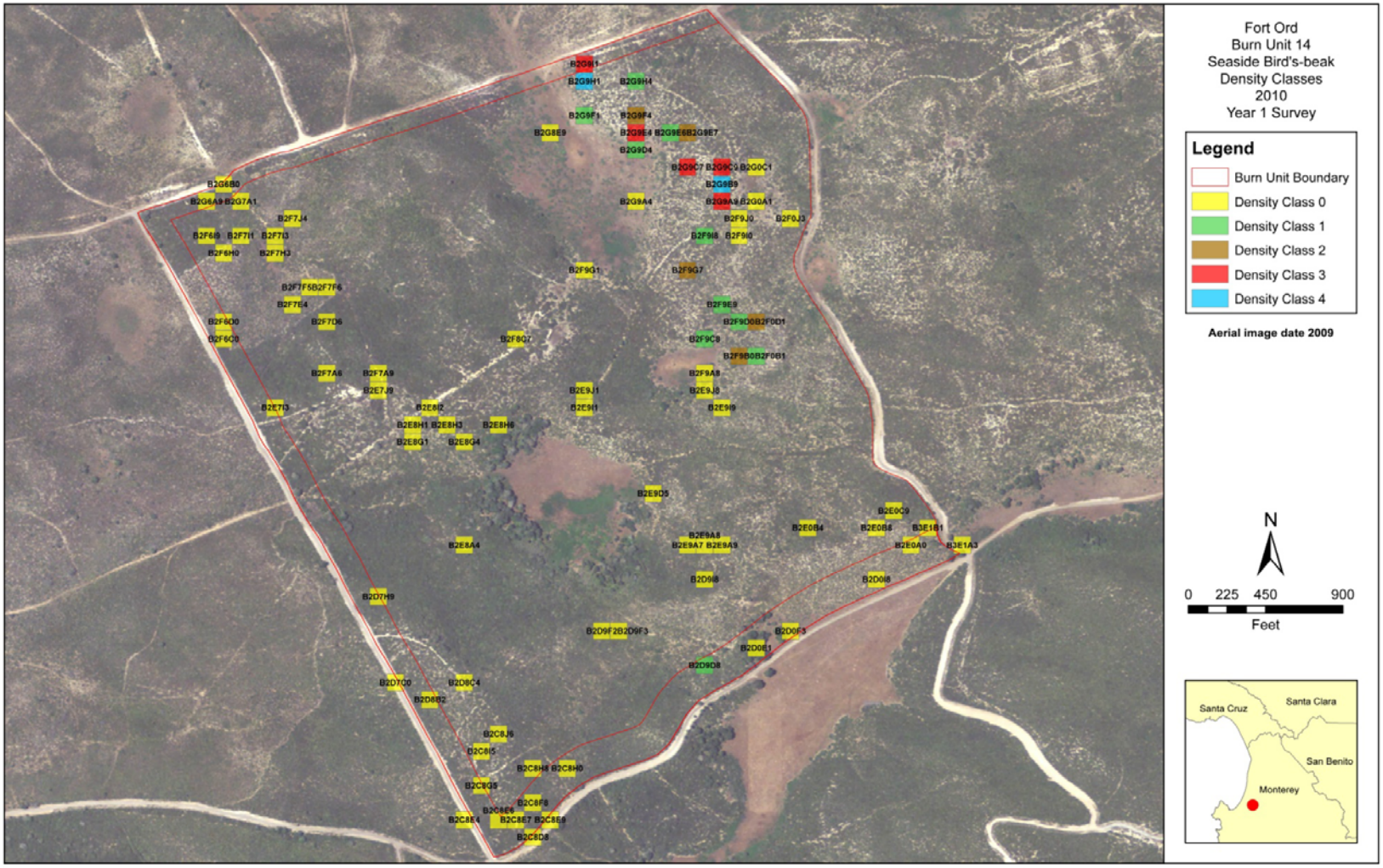
Map 17 Densities of annual grasses in Burn Unit 34 in 2010.

SECTION A-2

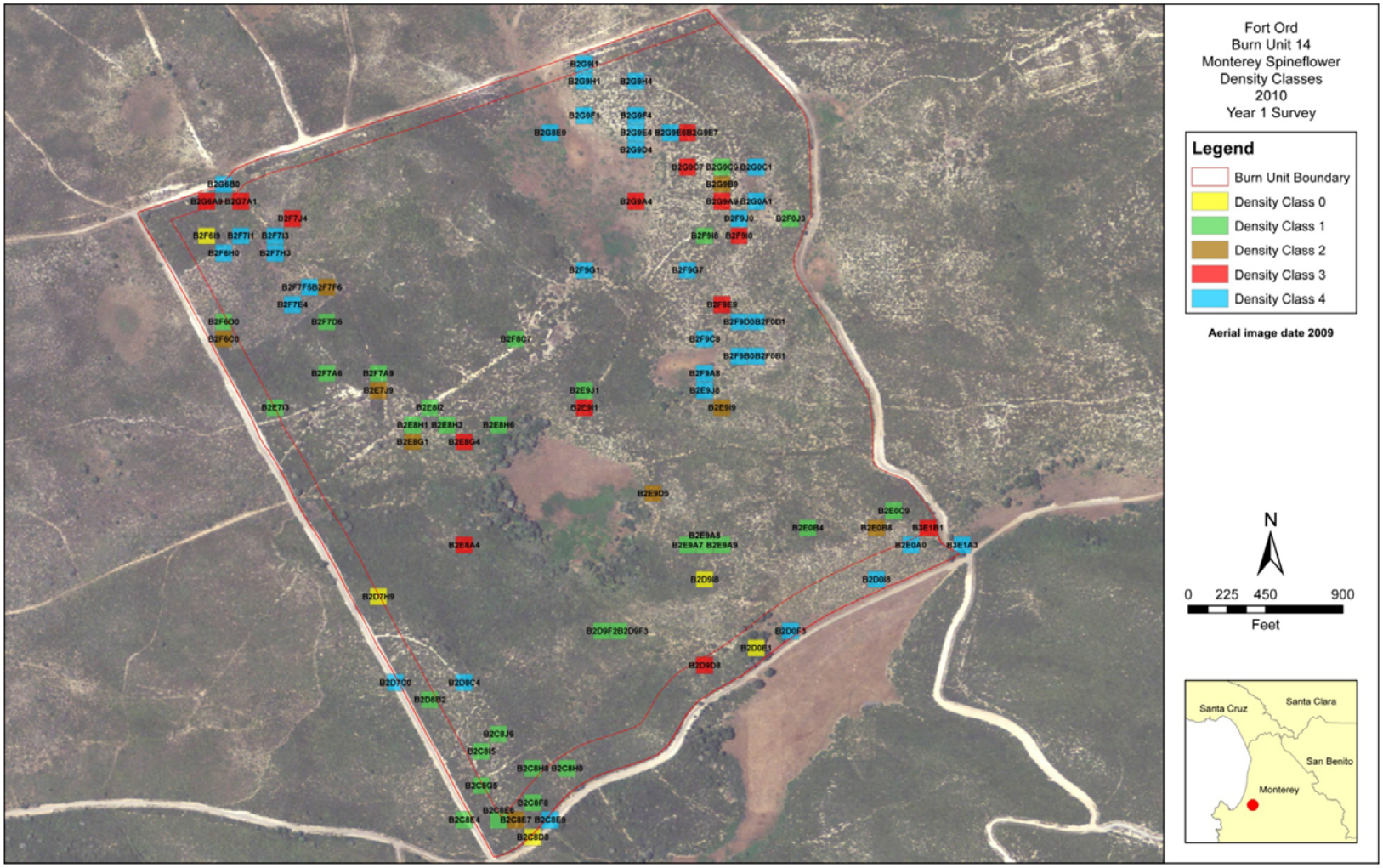
BU 14 AND 19



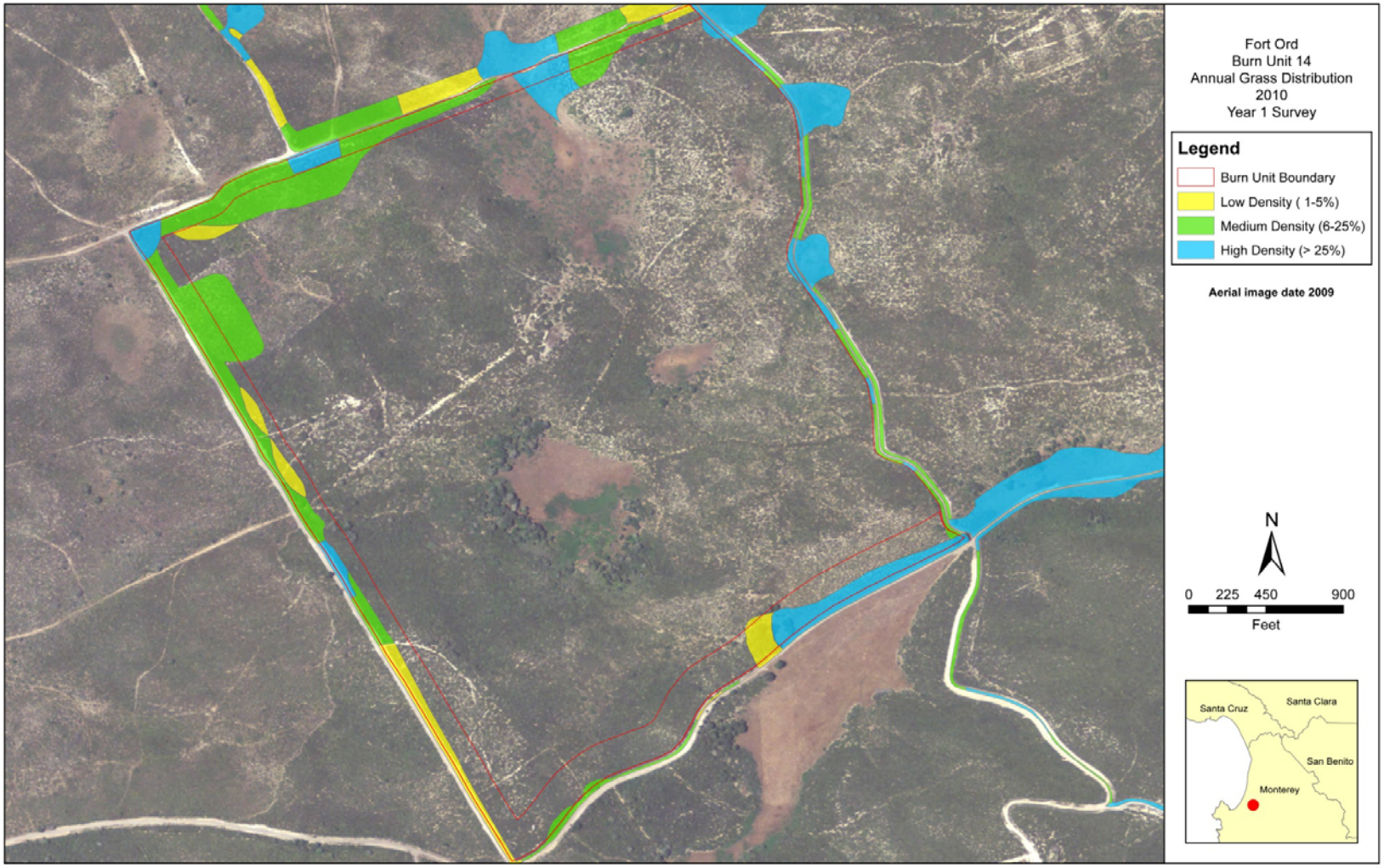
Map 18 **Sand gilia densities in Burn Unit 14 in 2010.**



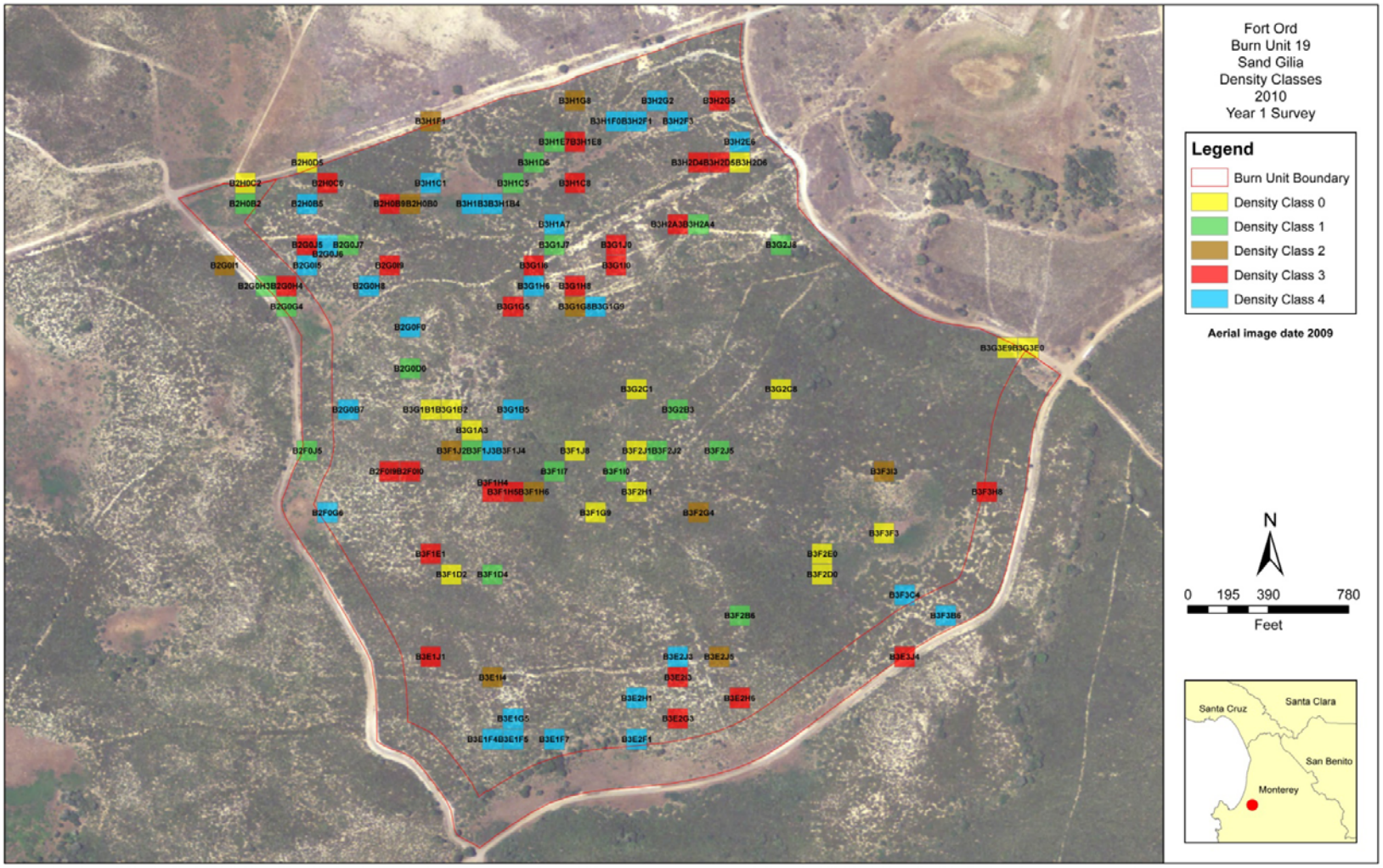
Map 19 **Seaside bird's-beak densities in Burn Unit 14 in 2010.**



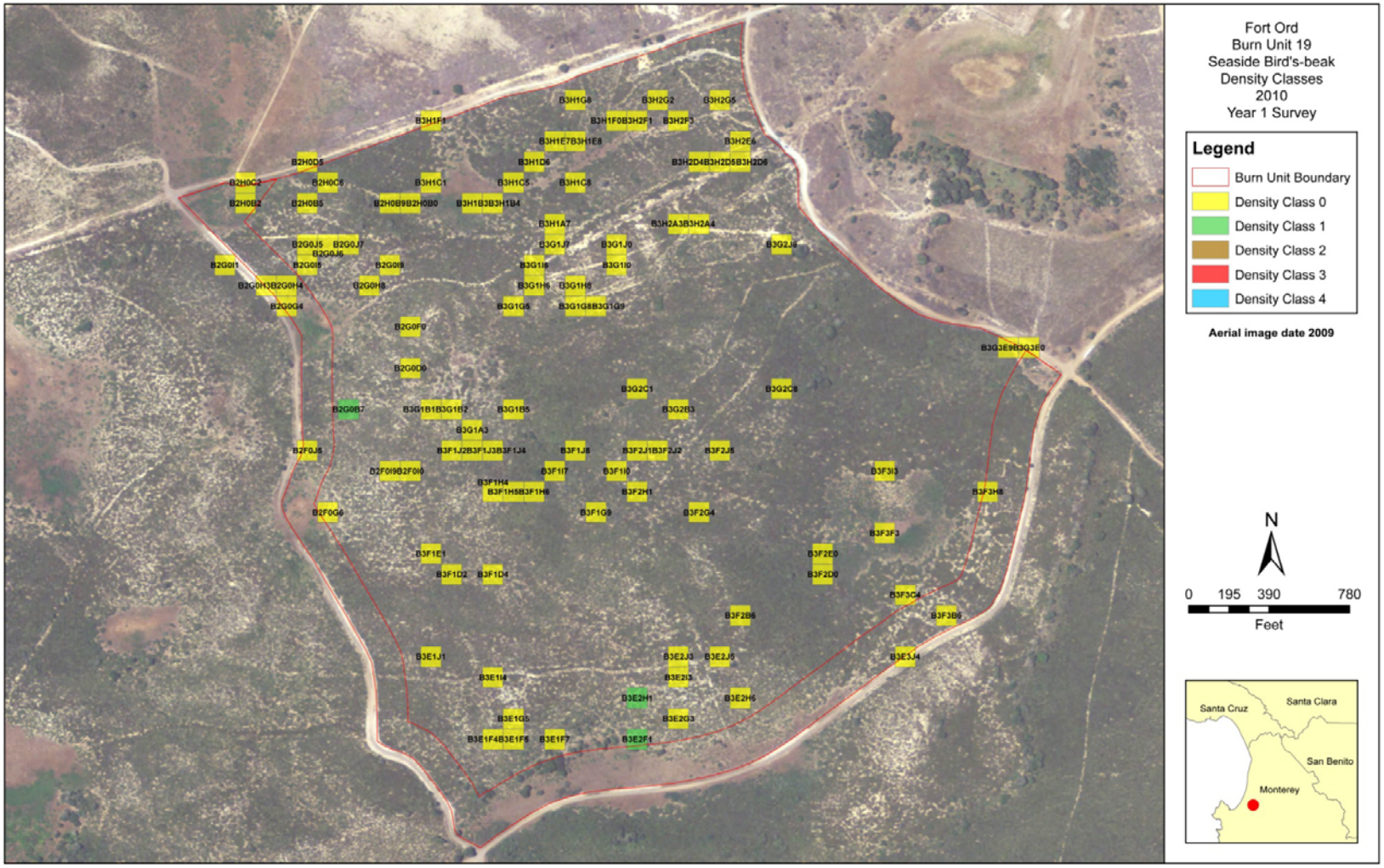
Map 20 **Monterey spineflower densities in Burn Unit 14 in 2010.**



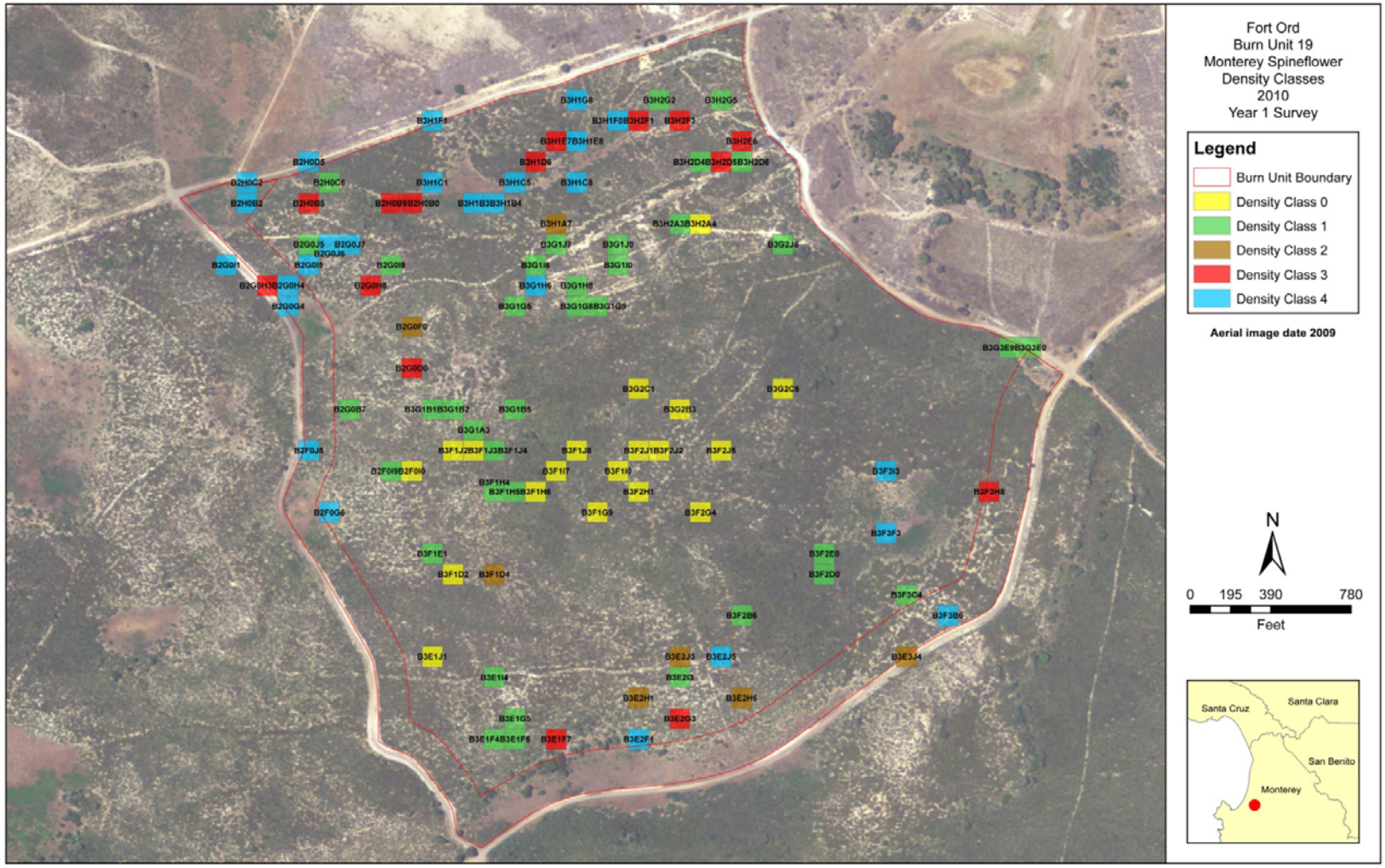
Map 21 **Densities of annual grasses in Burn Unit 14 in 2010.**



Map 22 **Sand gilia densities in Burn Unit 19 in 2010.**



Map 23 **Seaside bird's-beak densities in Burn Unit 19 in 2010.**

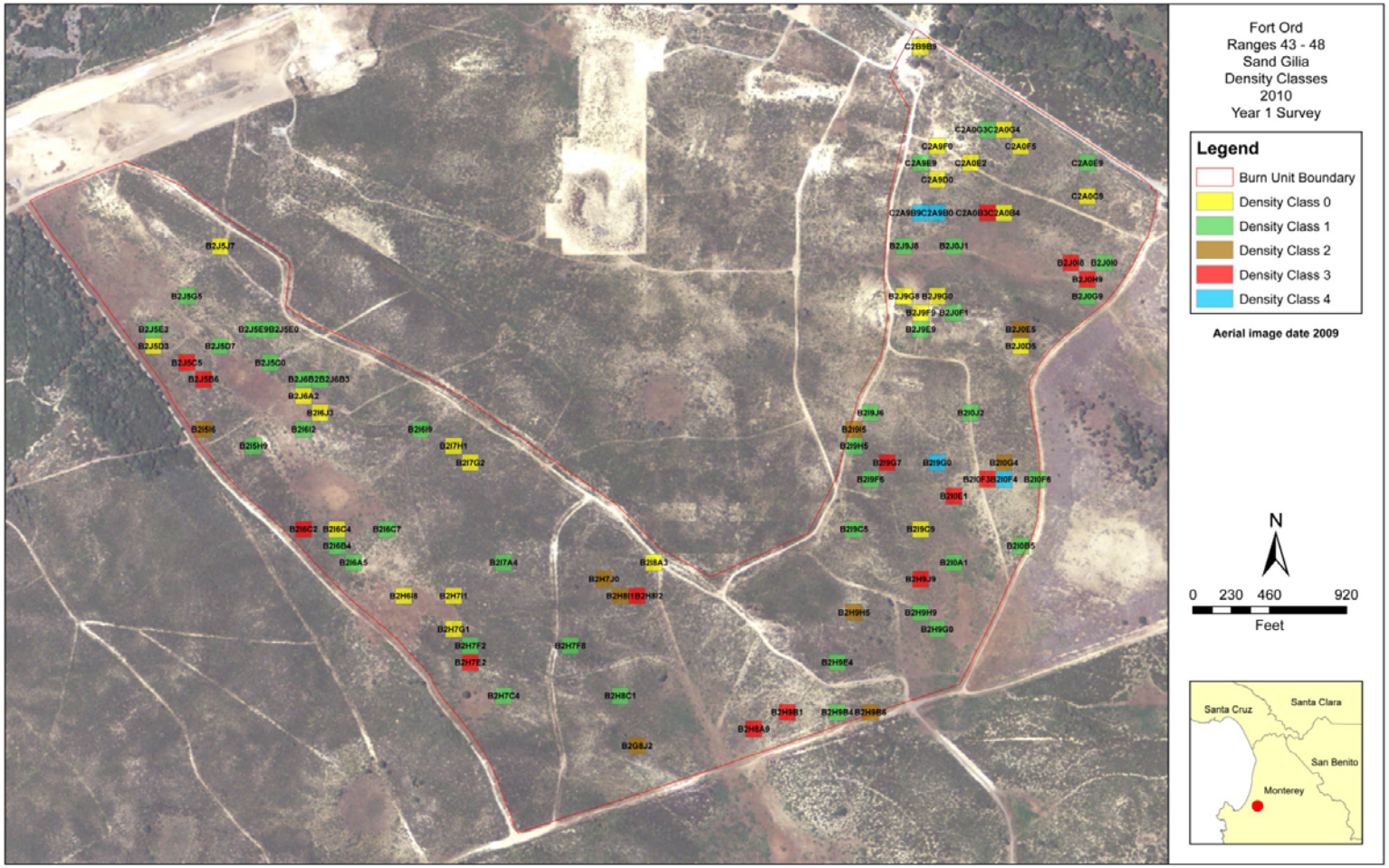


Map 24 **Monterey spineflower densities in Burn Unit 19 in 2010.**

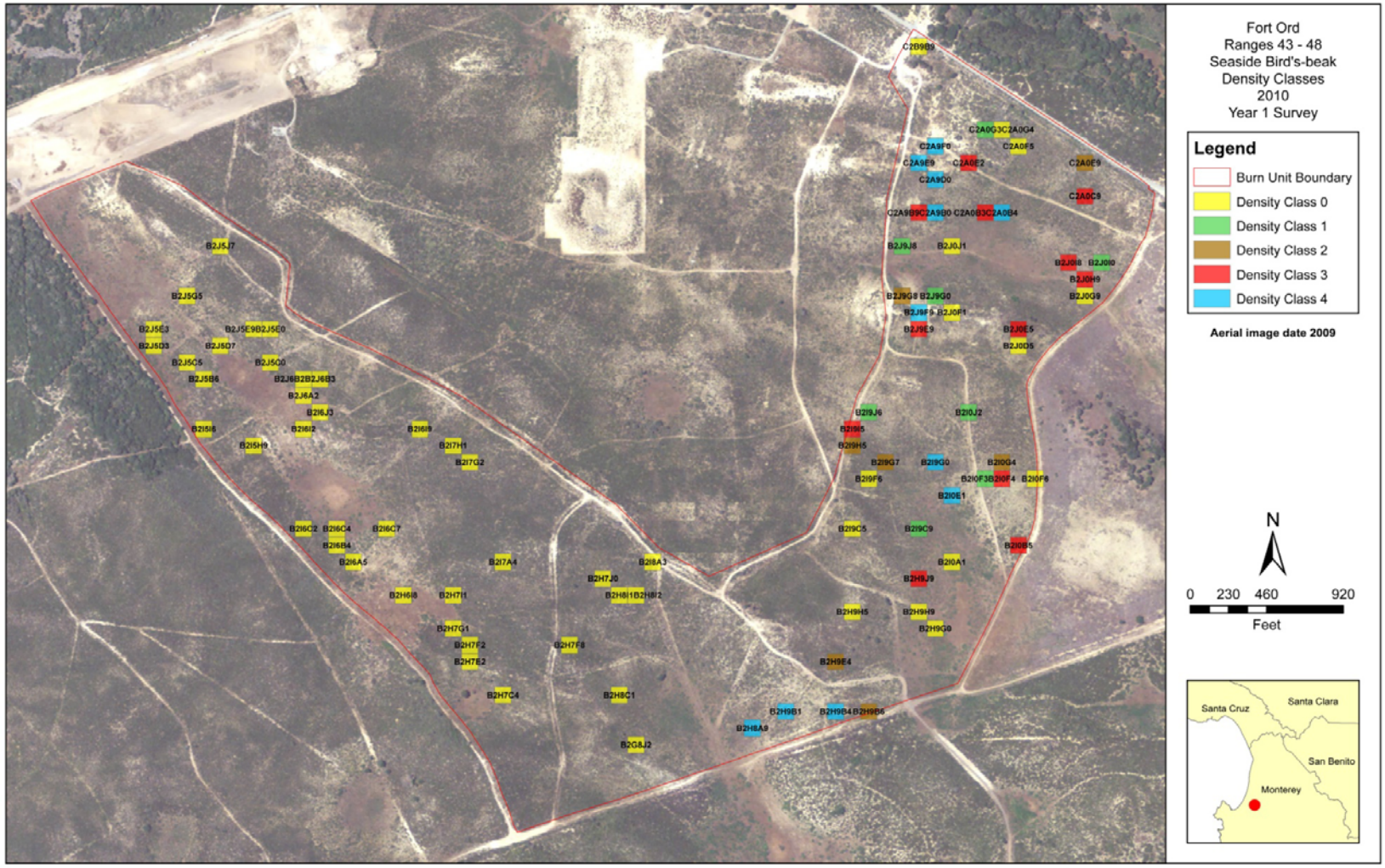
Map 25 **Densities of annual grasses in Burn Unit 19 in 2010.**

SECTION A-3

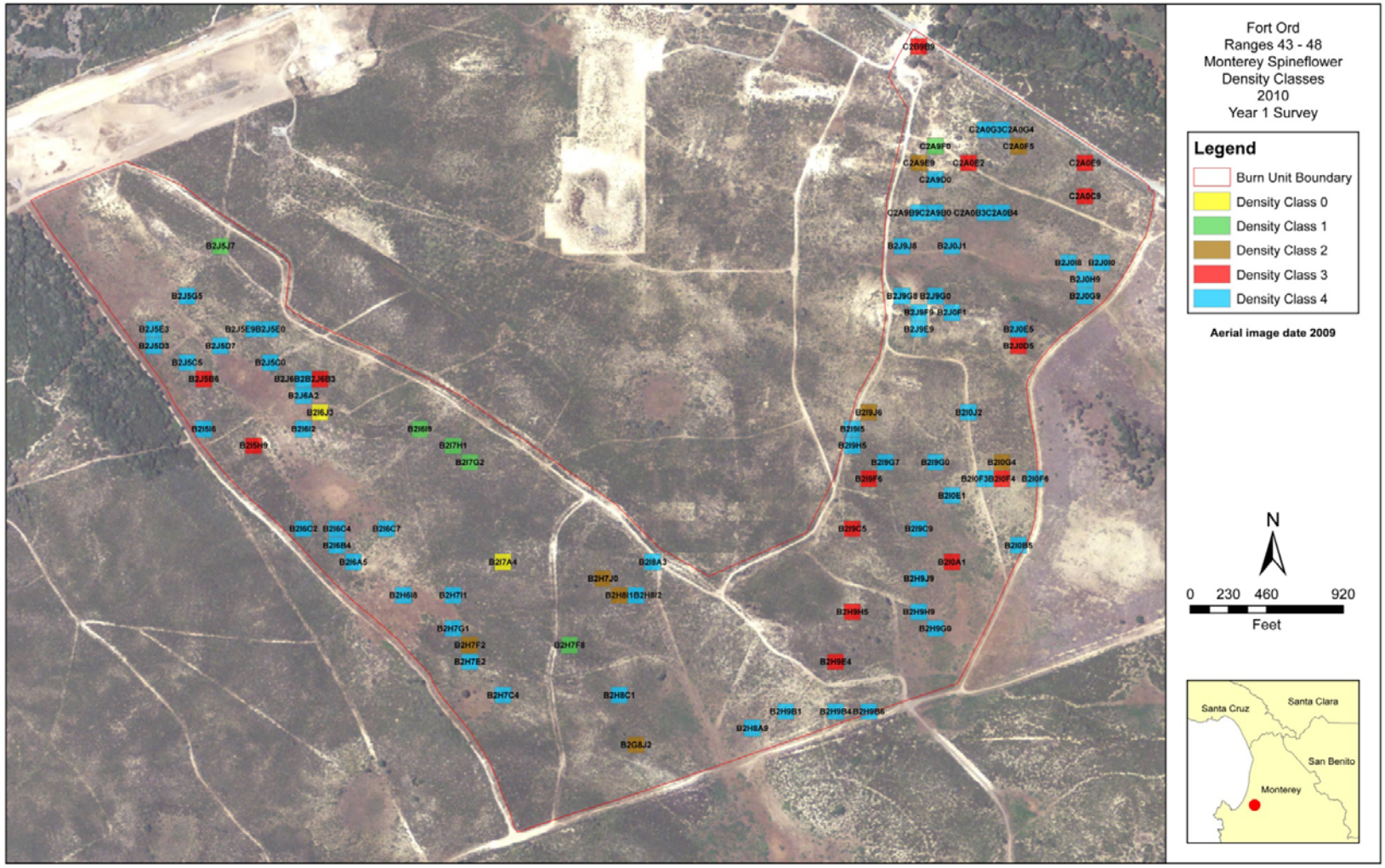
Ranges 43–48



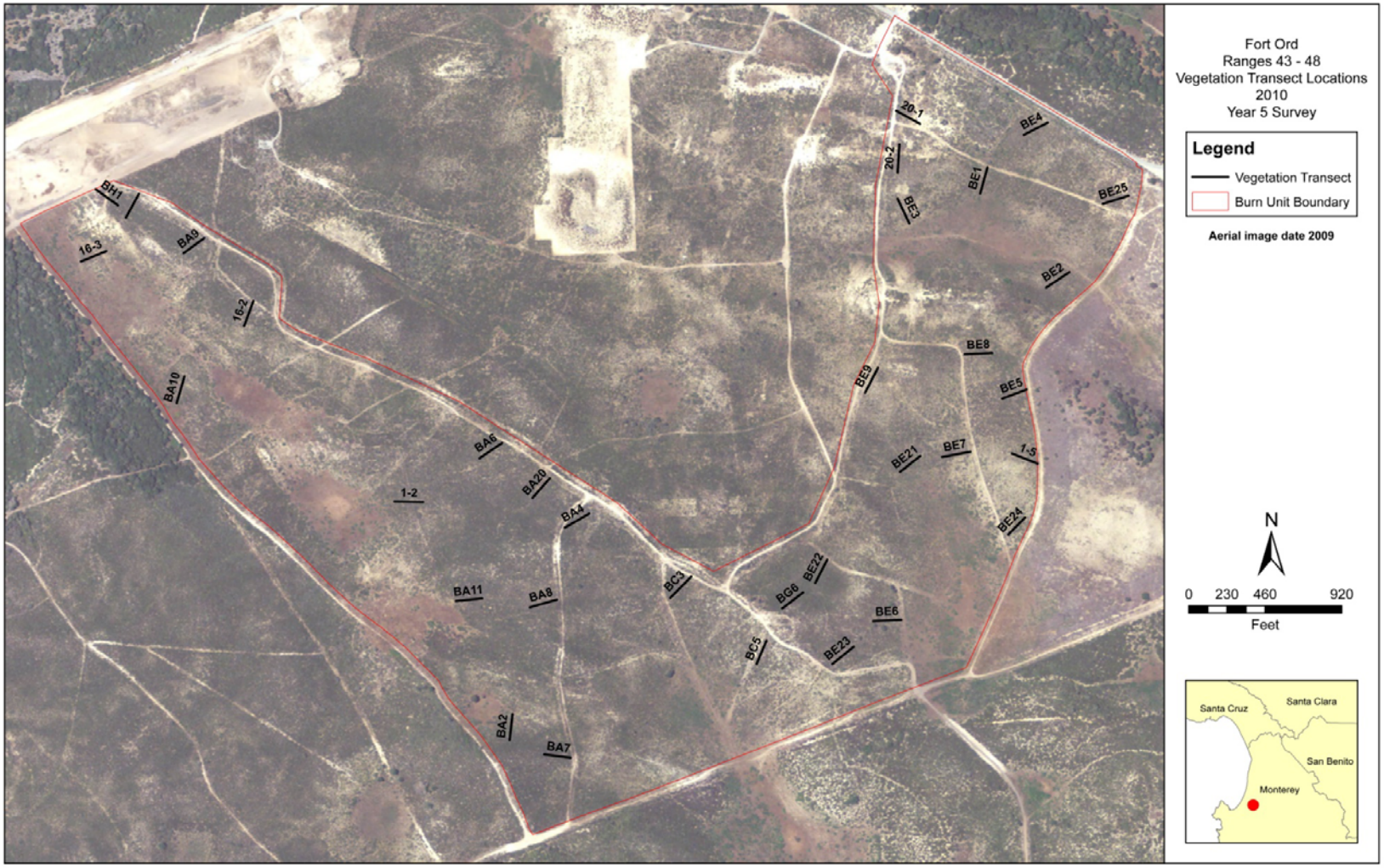
Map 26 **Sand gilia densities in Ranges 43–48 in 2010.**



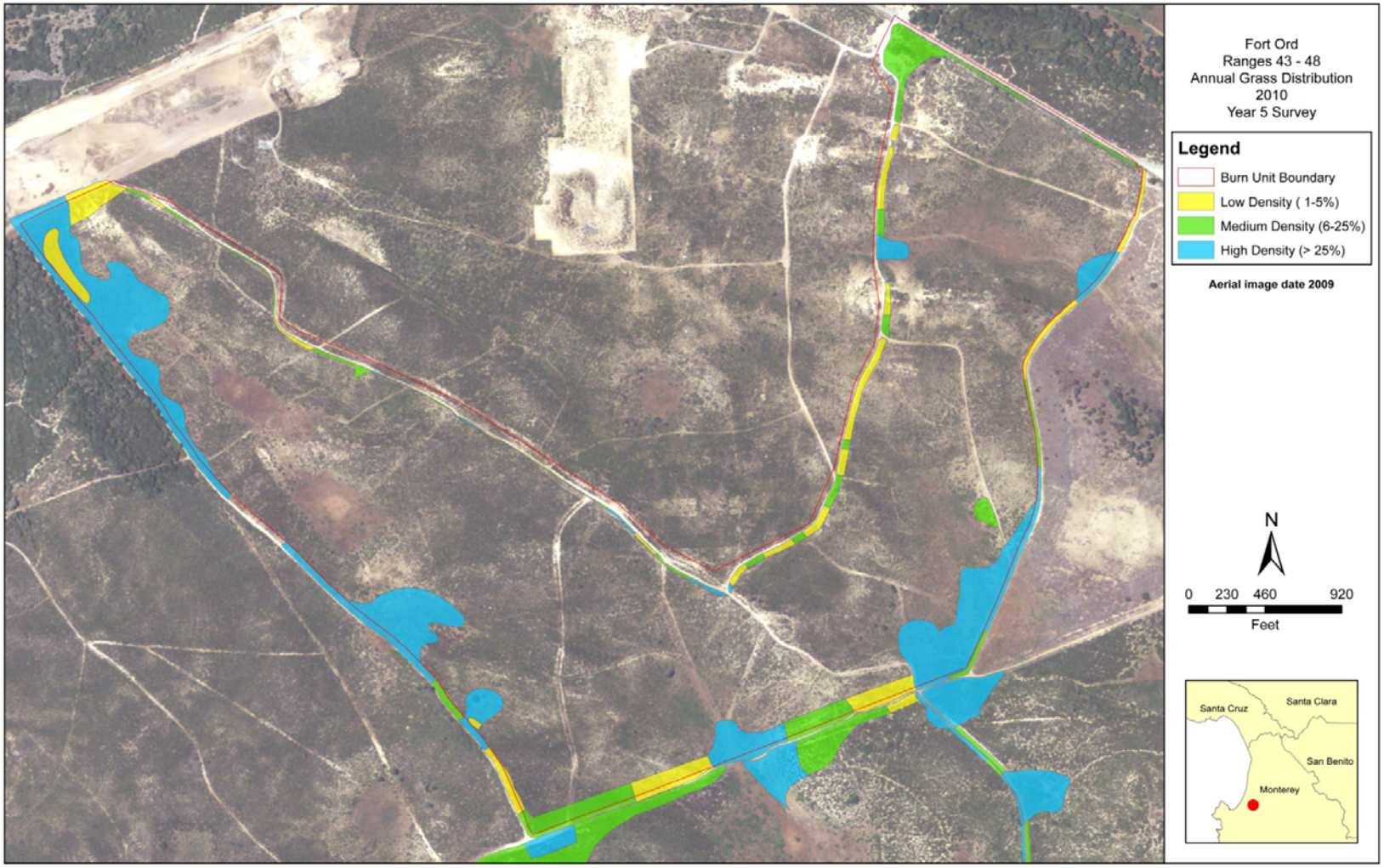
Map 27 **Seaside bird's-beak densities in Ranges 43–48 in 2010.**



Map 28 **Monterey spineflower densities in Ranges 43–48 in 2010.**



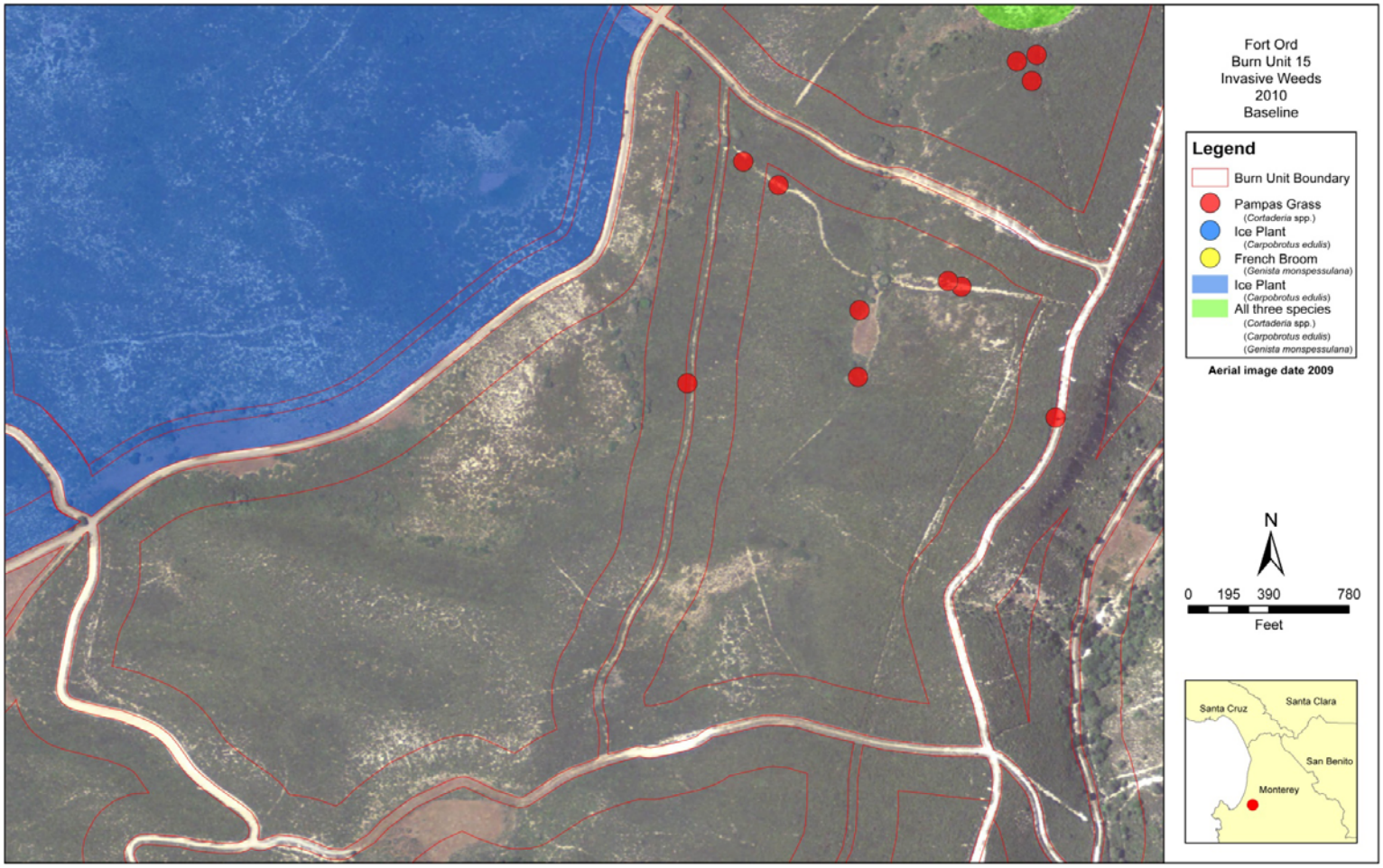
Map 29 Shrub transects in Ranges 43–48 in 2010.



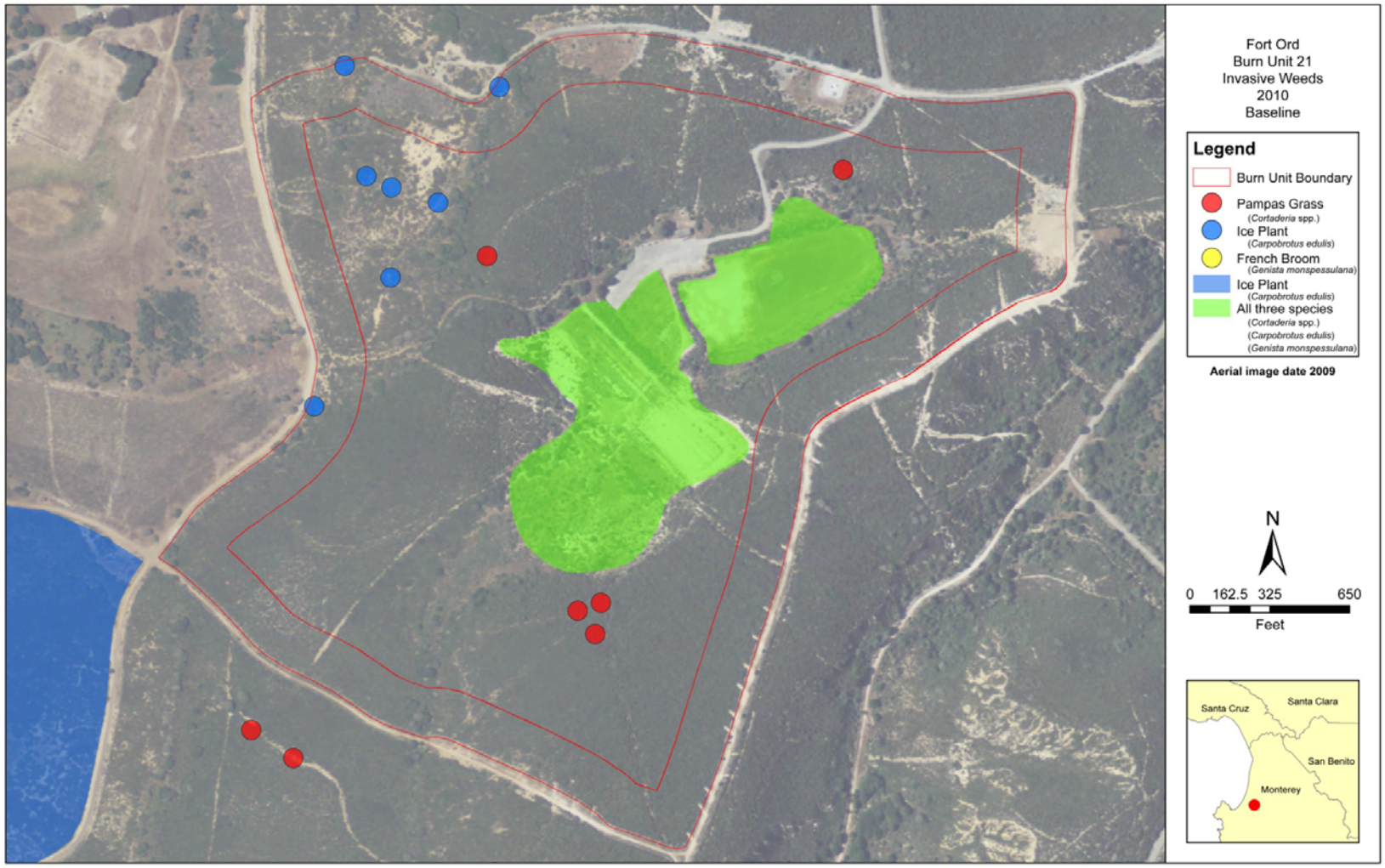
Map 30 Densities of annual grasses in Ranges 43–48 in 2010.

APPTENDIX A-4

Invasive Weeds



Map 31 Invasive weeds in BU 15 in 2010.



Map 32 Invasive weeds in BU 21 in 2010.

Map 33 Invasive weeds in BU 32 in 2010.

Map 34 Invasive weeds in BU 34 in 2010.

Map 35 Invasive weeds in BU 14 in 2010.

Map 36 Invasive weeds in BU 19 in 2010.

Map 37 Invasive weeds in Ranges 43–48 in 2010.

APPENDIX B

Shrub Transect Data

Shrub Transect Survey Results - Burn Unit 15

			Transect ID											
Species Code	Scientific Name	Common Name	15-1	15-10	15-11	15-12	15-13	15-14	15-15	15-16	15-17	15-18	15-19	15-2	15-20
ADFA	*Adenostoma fasciculatum*	Chamise	12.6	1.6	5	47.6	53.2	43	0.6	29.6	23.8	14.2	25.8	17.2	42
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	12.8	79.6	84	34.4	45	57.6	94	62.8	48	78.4	51.6	7	59.8
BAPI	*Baccharis pilularis*	Coyote bush	-	-	-	0.4	-	-	-	-	6.6	-	-	-	-
CAED	*Carpobrotus edulis*	Ice plant	-	-	-	-	-	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	Dwarf ceonothus	-	-	-	-	-	-	-	1.8	-	-	-	-	-
ERER	*Ericameria ericoides*	Mock heather	-	-	-	-	-	-	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	-	-	-	-	-	-	-	-	-	-	-	0.4	-
GAEL	*Garrya elliptica*	Silktassel	1.8	-	12.2	16.2	-	-	-	-	-	-	3.4	-	-
HESC	*Helianthemum scoparium*	Rush rose	-	-	-	-	-	-	-	-	-	-	-	-	-
LOSC	*Lotus scoparius*	Deerweed	-	-	-	-	-	-	-	-	-	-	-	-	-
LUCH	*Lupinus chamissonis*	Chamisso bush lupine	-	-	-	-	-	-	-	-	-	-	-	-	-
MIAU	*Mimulus aurantiacus*	Sticky monkey flowerr	-	-	-	-	-	-	-	-	-	-	-	-	0.2
QUAG	*Quercus agrifolia*	Coastal Live Oak	-	-	-	-	-	-	-	-	-	-	-	-	-
RHCA	*Rhamnus californica ssp. californica*	Coffeeberry	-	-	-	-	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	Black Sage	-	13.6	-	0.8	11.6	6.2	3	15.8	14.4	24.2	13.6	-	10.2
LECA	*Lepechinia calycina*	Wood balm	-	-	-	-	-	-	-	0.4	1.6	0.8	0.6	-	-
TODI	*Toxicodendron diversilobum*	Poison Oak	-	-	-	1.8	2.2	-	0.4	-	10	1	-	-	-
HEAR	*Heteromeles arbutifolia*	Toyon	-	-	-	-	-	-	-	-	-	-	-	-	7
HOCU	*Horkelia cuneata*	wedgeleaf horkelia	-	-	-	-	-	-	-	-	-	-	-	-	-
PTAQ	*Pteridium aquilinum*	western brackenfern	-	-	-	-	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	Southern California Snowberry	-	-	-	1.4	-	-	-	-	-	-	-	-	-
SOUM	*Solanum umbelliferum*	Bluewitch Nightshade	-	-	-	-	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	Eastwood's golden fleece	-	-	-	-	-	-	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	51.4	-	2.8	-	-	-	-	-	-	0.4	1.6	36.2	-
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	-	-	-	-	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	-	-	-	-	-	-	-	-	-	2.8	-	-	-
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceonothus	0.8	1.6	6.2	1.4	4.6	2.4	2	8.8	15.8	2	12	-	2.4
CETH	*Ceanothus thyrsiflorus*	Blueblossum	-	-	-	-	-	-	-	-	-	-	-	-	-
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	-	-	-	-	-	-	-	-	-	-	-	-	-
Total % cover			**79.4**	**96.4**	**110.2**	**104**	**116.6**	**109.2**	**100**	**119.2**	**120.2**	**123.8**	**108.6**	**60.8**	**121.6**
		Bare Ground	24	10.8	1.8	5.8	3.2	7.2	3.2	4.6	7.2	2.8	9.2	40.2	5
		Herbaceous vegetation	4.2	-	-	7.4	-	-	-	-	-	-	-	1.4	-

Shrub Transect Survey Results - Burn Unit 15

Species Code	Scientific Name	Common Name	15-21	15-3	15-4	15-5	15-6	15-7	15-8	15-9
ADFA	*Adenostoma fasciculatum*	Chamise	21	20.2	9.4	25	17.2	17.4	36.2	70
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	84	54.4	65.6	68.6	57.8	62.4	30.4	16.8
BAPI	*Baccharis pilularis*	Coyote bush	-	-	-	-	-	-	-	0.4
CAED	*Carpobrotus edulis*	Ice plant	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	Dwarf ceonothus	-	-	-	-	0.4	-	-	-
ERER	*Ericameria ericoides*	Mock heather	-	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	-	-	0.2	-	-	-	-	-
GAEL	*Garrya elliptica*	Silktassel	-	3.6	-	-	-	-	8.2	-
HESC	*Helianthemum scoparium*	Rush rose	-	-	-	-	-	-	-	-
LOSC	*Lotus scoparius*	Deerweed	-	-	-	-	-	-	-	-
LUCH	*Lupinus chamissonis*	Chamisso bush lupine	-	-	-	-	-	-	-	-
MIAU	*Mimulus aurantiacus*	Sticky monkey flowerr	-	-	-	-	-	-	0.2	-
QUAG	*Quercus agrifolia*	Coastal Live Oak	-	-	-	-	-	-	-	-
RHCA	*Rhamnus californica ssp. californica*	Coffeeberry	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	Black Sage	2	11.4	6.8	21.4	8	1.4	14.6	5.6
LECA	*Lepechinia calycina*	Wood balm	-	0.2	-	-	-	-	-	4.6
TODI	*Toxicodendron diversilobum*	Poison Oak	-	-	-	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	Toyon	9.8	11.8	-	-	5.6	-	5	-
HOCU	*Horkelia cuneata*	wedgeleaf horkelia	-	-	-	-	-	-	-	-
PTAQ	*Pteridium aquilinum*	western brackenfern	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	Southern California Snowberry	-	-	-	-	-	-	-	-
SOUM	*Solanum umbelliferum*	Bluewitch Nightshade	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	Eastwood's golden fleece	-	-	-	0.8	-	-	-	-
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	-	-	-	-	-	-	-	-
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	-	-	0.4	-	-	-	11	3.8
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	-	-	3.4	-	-	-	25	-
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceonothus	0.8	5.6	0.6	6.2	5.2	2.6	1.4	5.8
CETH	*Ceanothus thyrsiflorus*	Blueblossum	-	-	-	-	-	-	-	-
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	-	-	-	-	-	-	-	-
Total % cover			**117.6**	**107.2**	**86.4**	**122**	**94.2**	**83.8**	**132**	**107**
		Bare Ground	3.8	16.8	17.6	8.6	15.4	21.8	5.2	8.2
		Herbaceous vegetation	-	-	0.2	-	0.2	-	-	0.2

Shrub Transect Survey Results - Burn Unit 21

Species Code	Scientific Name	Common Name	21-1	21-10	21-11	21-12	21-13	21-14	21-15
ADFA	*Adenostoma fasciculatum*	Chamise	8.4	-	-	15	9.2	40.8	33.4
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	37.8	9.4	77.6	89	78.6	63.4	45.8
BAPI	*Baccharis pilularis*	Coyote bush	1.2	9.8	-	2.4	-	5.6	3
CAED	*Carpobrotus edulis*	Ice plant	-	8	-	-	-	-	-
CEDE	*Ceanothus dentatus*	Dwarf ceonothus	-	-	-	1.6	-	-	0.4
ERER	*Ericameria ericoides*	Mock heather	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	-	-	-	-	-	-	0.2
GAEL	*Garrya elliptica*	Silktassel	1.6	-	-	19	-	-	0.4
HESC	*Helianthemum scoparium*	Rush rose	-	-	-	-	-	-	-
LOSC	*Lotus scoparius*	Deerweed	-	-	-	-	-	-	-
LUCH	*Lupinus chamissonis*	Chamisso bush lupine	-	-	-	-	-	-	-
MIAU	*Mimulus aurantiacus*	Sticky monkey flowerr	1.8	0.4	-	1	-	2	1
QUAG	*Quercus agrifolia*	Coastal Live Oak	3	-	3.8	-	-	-	-
RHCA	*Rhamnus californica ssp. californica*	Coffeeberry	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	Black Sage	18.4	17	0.6	6.4	3.8	1	-
LECA	*Lepechinia calycina*	Wood balm	-	-	-	-	3.2	6.6	2.8
TODI	*Toxicodendron diversilobum*	Poison Oak	-	1.6	-	-	-	2.6	-
HEAR	*Heteromeles arbutifolia*	Toyon	-	-	-	-	-	-	-
HOCU	*Horkelia cuneata*	wedgeleaf horkelia	-	-	-	-	-	-	-
PTAQ	*Pteridium aquilinum*	western brackenfern	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	Southern California Snowberry	1.4	-	-	-	-	3.8	5.8
SOUM	*Solanum umbelliferum*	Bluewitch Nightshade	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	Eastwood's golden fleece	-	-	-	-	0.6	-	-
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	-	50.6	-	1.6	-	-	-
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	7.2	-	-	-	-	-	9.8
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	9.2	-	2.4	-	3	-	4.4
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceonothus	4.6	-	17.4	3.8	3.6	-	2.8
CETH	*Ceanothus thyrsiflorus*	Blueblossum	-	-	-	-	-	-	-
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	-	-	-	-	-	-	-
Total % Cover			**94.6**	**96.8**	**101.8**	**139.8**	**102**	**125.8**	**109.8**
		Bare Ground	16.2	11	11.6	0.4	9.4	2.6	9
		Herbaceous vegetation	0.8	6.8	-	-	1	-	-

Shrub Transect Survey Results - Burn Unit 21

			ansect ID							
Species Code	**Scientific Name**	**Common Name**	**21-2**	**21-3**	**21-4**	**21-5**	**21-6**	**21-7**	**21-8**	**21-9**
ADFA	*Adenostoma fasciculatum*	Chamise	25.4	4.2	8	41	68.8	-	7	8.6
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	4.2	10.2	89.2	28.6	6.2	80	83	74.8
BAPI	*Baccharis pilularis*	Coyote bush	-	-	-	0.4	0.4	-	-	4
CAED	*Carpobrotus edulis*	Ice plant	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	Dwarf ceonothus	-	-	-	-	-	-	-	-
ERER	*Ericameria ericoides*	Mock heather	0.4	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	-	-	-	0.4	-	-	-	-
GAEL	*Garrya elliptica*	Silktassel	-	-	1.8	-	-	13.6	1	-
HESC	*Helianthemum scoparium*	Rush rose	1.2	-	-	-	-	-	-	-
LOSC	*Lotus scoparius*	Deerweed	-	2.6	-	-	-	-	-	-
LUCH	*Lupinus chamissonis*	Chamisso bush lupine	-	-	-	-	-	-	-	-
MIAU	*Mimulus aurantiacus*	Sticky monkey flowerr	-	0.2	-	-	1.6	-	-	-
QUAG	*Quercus agrifolia*	Coastal Live Oak	-	-	-	-	-	-	-	-
RHCA	*Rhamnus californica ssp. californica*	Coffeeberry	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	Black Sage	-	-	-	-	-	-	2.2	-
LECA	*Lepechinia calycina*	Wood balm	-	-	-	2.8	1	0.6	-	0.6
TODI	*Toxicodendron diversilobum*	Poison Oak	-	-	-	5.4	0.2	5.4	-	-
HEAR	*Heteromeles arbutifolia*	Toyon	-	-	-	3.6	-	-	-	-
HOCU	*Horkelia cuneata*	wedgeleaf horkelia	-	-	-	-	-	-	-	-
PTAQ	*Pteridium aquilinum*	western brackenfern	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	Southern California Snowberry	-	-	-	3.2	3	-	-	-
SOUM	*Solanum umbelliferum*	Bluewitch Nightshade	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	Eastwood's golden fleece	-	-	-	-	-	-	0.2	-
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	48	58	-	-	4.8	5	4.4	1.2
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	-	-	-	2.8	-	-	-	5
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	-	-	3.6	-	-	-	-	1.4
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceonothus	0.4	-	-	6.2	14.2	3.2	-	8.2
CETH	*Ceanothus thyrsiflorus*	Blueblossum	-	-	-	-	-	-	-	-
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	1	-	-	-	-	-	-	-
Total % Cover			**80.6**	**75.2**	**102.6**	**94.4**	**100.2**	**107.8**	**97.8**	**103.8**
		Bare Ground	25.2	25.8	4.4	19	7.4	6.2	7.2	10.8
		Herbaceous vegetation	0.2	5.2	-	0.4	-	-	-	1.6

Shrub Transect Survey Results - Burn Unit 32

			Transect ID				
	Scientific Name	**Common Name**	**32-1**	**32-2**	**32-3**	**32-4**	**32-5**
ADFA	*Adenostoma fasciculatum*	Chamise	5.8	8.2	10	14.2	11
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	40.8	10.8	62	43.8	66.6
BAPI	*Baccharis pilularis*	Coyote bush	-	-	-	0.6	3
CAED	*Carpobrotus edulis*	Ice plant	-	-	-	-	-
CEDE	*Ceanothus dentatus*	Dwarf ceonothus	-	-	-	-	-
ERER	*Ericameria ericoides*	Mock heather	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	-	-	-	-	-
GAEL	*Garrya elliptica*	Silktassel	8.4	-	-	1.8	-
HESC	*Helianthemum scoparium*	Rush rose	-	-	-	-	-
LOSC	*Lotus scoparius*	Deerweed	-	-	-	-	-
LUCH	*Lupinus chamissonis*	Chamisso bush lupine	-	-	-	-	-
MIAU	*Mimulus aurantiacus*	Sticky monkey flowerr	-	-	-	-	0.4
QUAG	*Quercus agrifolia*	Coastal Live Oak	-	-	-	4.8	7
RHCA	*Rhamnus californica ssp. californica*	Coffeeberry	-	-	3.8	8	4.8
SAME	*Salvia mellifera*	Black Sage	-	-	-	-	-
LECA	*Lepechinia calycina*	Wood balm	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	Poison Oak	-	-	-	-	3
HEAR	*Heteromeles arbutifolia*	Toyon	3	-	-	-	-
HOCU	*Horkelia cuneata*	wedgeleaf horkelia	-	-	-	-	-
PTAQ	*Pteridium aquilinum*	western brackenfern	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	Southern California Snowberry	-	-	-	-	4.6
SOUM	*Solanum umbelliferum*	Bluewitch Nightshade	-	-	-	-	-
ERFA	*Ericameria fasciculata*	Eastwood's golden fleece	-	-	0.2	0.8	-
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	-	-	-	-	-
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	52.4	52	1.6	15	11.8
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceonothus	7.2	5.2	1.4	8.2	12.4
CETH	*Ceanothus thyrsiflorus*	Blueblossum	-	5.2	-	-	2.2
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	-	-	-	-	-
Total % Cover			**117.6**	**81.4**	**79**	**97.2**	**126.8**
		Bare Ground	8.6	24.4	13.2	8.2	3.4
		Herbaceous Vegetations	2.2	0.6	21.4	34	0.6

Shrub Transect Survey Results - Burn Unit 34

			Transect ID			
Species Code	**Scientific Name**	**Common Name**	**34-1**	**34-2**	**34-3**	**34-4**
ADFA	*Adenostoma fasciculatum*	Chamise	3.2	12.6	3.2	15.8
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	55.6	21	85	97
BAPI	*Baccharis pilularis*	Coyote bush	-	-	-	-
CAED	*Carpobrotus edulis*	Ice plant	-	-	-	-
CEDE	*Ceanothus dentatus*	Dwarf ceonothus	-	-	-	-
ERER	*Ericameria ericoides*	Mock heather	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	-	-	-	-
GAEL	*Garrya elliptica*	Silktassel	-	-	-	2.8
HESC	*Helianthemum scoparium*	Rush rose	-	-	-	-
LOSC	*Lotus scoparius*	Deerweed	-	-	-	-
LUCH	*Lupinus chamissonis*	Chamisso bush lupine	-	-	-	-
MIAU	*Mimulus aurantiacus*	Sticky monkey flowerr	-	-	-	-
QUAG	*Quercus agrifolia*	Coastal Live Oak	-	-	-	0.6
RHCA	*Rhamnus californica ssp. californica*	Coffeeberry	3	-	-	-
SAME	*Salvia mellifera*	Black Sage	-	3.2	-	-
LECA	*Lepechinia calycina*	Wood balm	-	-	-	-
TODI	*Toxicodendron diversilobum*	Poison Oak	-	-	-	-
HEAR	*Heteromeles arbutifolia*	Toyon	-	-	-	-
HOCU	*Horkelia cuneata*	wedgeleaf horkelia	-	-	-	-
PTAQ	*Pteridium aquilinum*	western brackenfern	-	-	-	-
SYMO	*Symphoricarpos mollis*	Southern California Snowberry	-	-	-	-
SOUM	*Solanum umbelliferum*	Bluewitch Nightshade	-	-	-	-
ERFA	*Ericameria fasciculata*	Eastwood's golden fleece	-	-	-	-
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	19.4	54.2	-	-
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	-	-	10	-
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	-	-	9.2	-
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceonothus	-	-	0.2	-
CETH	*Ceanothus thyrsiflorus*	Blueblossum	-	-	-	-
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	-	-	-	-
Total % Cover			**81.2**	**91**	**107.6**	**116.2**
		Bare Ground	9.6	10.8	1.4	2.4
		Herbaceous vegetation	29	7	-	-

Shrub Transect Survey Results - Ranges 43-48

Species Code	Scientific Name	Common Name	1-5	20-1	20-2	BC5	BE1	BE2	BE21	BE22	BE23	BE24	BE25	BE3	BE4
ADFA	*Adenostoma fasciculatum*	Chamise	7.6	0.8	1.8	17	9.2	20.2	14.2	26.6	5.2	4.6	4.6	12.8	0.8
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	20.6	5	1.6	24.6	14	20.2	6.6	25.2	25	44	10.2	16	16.2
BAPI	*Baccharis pilularis*	Coyote bush	0.8	-	-	-	-	-	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	Ice plant	-	-	-	-	-	-	-	-	-	-	9.8	-	-
CEDE	*Ceanothus dentatus*	Dwarf ceonothus	15.2	3	17.6	4.8	3.2	0.8	1.2	6.2	26.6	22.4	16.4	25.8	35.8
ERER	*Ericameria ericoides*	Mock heather	-	-	-	-	-	1.6	2.8	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	8.6	-	0.2	1	0.8	1.2	0.8	1	4	3.2	0.4	0.2	0.2
GAEL	*Garrya elliptica*	Silktassel	-	-	-	-	1	-	-	-	2.6	9.2	-	-	-
HESC	*Helianthemum scoparium*	Rush rose	4.4	0.4	5	2.8	-	-	-	4.4	11.2	1.8	15.2	3.2	1.2
LOSC	*Lotus scoparius*	Deerweed	9.2	0.8	-	13	0.4	-	-	5	2.8	1.8	4.6	-	0.2
LUCH	*Lupinus chamissonis*	Chamisso bush lupine	-	-	-	-	-	-	-	-	-	-	-	-	-
MIAU	*Mimulus aurantiacus*	Sticky monkey flowerr	-	-	-	-	-	-	-	-	-	-	1	-	-
QUAG	*Quercus agrifolia*	Coastal Live Oak	-	-	-	-	-	-	-	-	-	-	-	-	-
RHCA	*Rhamnus californica ssp. californica*	Coffeeberry	-	-	1.4	-	1.2	0.6	2.6	-	-	-	0.4	-	-
SAME	*Salvia mellifera*	Black Sage	0.2	6.4	4.4	2.4	-	-	-	1	1.4	5.4	4.6	3	0.6
LECA	*Lepechinia calycina*	Wood balm	-	-	-	-	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	Poison Oak	-	-	-	-	2.4	-	-	10	1.6	-	-	-	-
HEAR	*Heteromeles arbutifolia*	Toyon	-	-	-	-	-	-	-	-	-	-	-	-	-
HOCU	*Horkelia cuneata*	wedgeleaf horkelia	-	-	-	-	-	-	-	-	-	-	-	-	-
PTAQ	*Pteridium aquilinum*	western brackenfern	-	-	-	-	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	Southern California Snowberry	-	-	-	-	0.4	4.4	-	-	-	-	-	-	-
SOUM	*Solanum umbelliferum*	Bluewitch Nightshade	-	-	-	-	0.2	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	Eastwood's golden fleece	-	-	-	-	-	-	-	-	-	-	-	1.4	-
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	-	26.6	15	2.8	10.8	8.4	3.4	4	3.4	-	15	1.2	21.8
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	-	-	-	-	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	-	-	-	-	-	-	-	-	-	-	-	-	-
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceonothus	5.4	6.8	20.4	13.2	32.2	28	47.8	20.6	10.6	8.2	3	9.6	23.6
CETH	*Ceanothus thyrsiflorus*	Blueblossum	-	-	-	-	-	-	-	-	-	-	-	-	-
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	-	6	-	-	8.2	1.4	4	-	3	-	-	2	5.2
Total % Cover			**72**	**55.8**	**67.4**	**81.6**	**84**	**86.8**	**83.4**	**104**	**97.4**	**100.6**	**85.2**	**75.2**	**105.6**
		Bare Ground	28	46	37.6	30.6	19.4	25.8	22.6	24.2	25	25.8	21.4	30.2	20.2
		Herbaceous Vegetation	17.6	6.2	12.6	2	14.2	6.2	5.4	2	1	1.8	7.8	9	0.6

Shrub Transect Survey Results - Ranges 43-48

Species Code	Scientific Name	Common Name	Transect ID											
			BE5	**BE6**	**BE7**	**BE8**	**BE9**	**BG6**	**1-2**	**16-1**	**16-2**	**16-3**	**BA10**	**BA11**
ADFA	*Adenostoma fasciculatum*	Chamise	9.2	18	13	11.4	5	8.6	24.4	6.2	3.4	6.2	26.4	16.6
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	13.8	32.4	20.2	12.2	8.2	27.2	12.8	42.8	31.8	0.4	8.6	19.2
BAPI	*Baccharis pilularis*	Coyote bush	-	-	-	-	-	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	Ice plant	-	-	-	-	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	Dwarf ceonothus	26.4	-	19.4	18.8	19.8	32	17.4	41	36.2	33.4	18.6	19
ERER	*Ericameria ericoides*	Mock heather	-	-	-	-	-	-	4	-	-	-	-	4
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	3.6	2.8	3	1.6	1.8	5	0.8	-	0.4	1.8	4.2	1.2
GAEL	*Garrya elliptica*	Silktassel	8.6	-	1	-	-	-	-	-	-	-	-	-
HESC	*Helianthemum scoparium*	Rush rose	4.6	2.4	-	5.6	19.8	7.2	1.4	0.4	8.4	0.8	3.6	10.2
LOSC	*Lotus scoparius*	Deerweed	12.8	25	-	1	-	-	-	0.6	-	-	1.2	-
LUCH	*Lupinus chamissonis*	Chamisso bush lupine	-	-	-	-	-	-	-	-	-	-	-	-
MIAU	*Mimulus aurantiacus*	Sticky monkey flowerr	-	-	-	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	Coastal Live Oak	-	-	-	-	-	-	-	-	-	-	-	-
RHCA	*Rhamnus californica ssp. californica*	Coffeeberry	-	-	-	3.2	-	-	5.2	-	-	-	-	-
SAME	*Salvia mellifera*	Black Sage	8	1.8	-	0.8	5.6	3.2	-	-	7.6	-	-	-
LECA	*Lepechinia calycina*	Wood balm	-	-	-	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	Poison Oak	0.8	-	-	1.6	-	1.6	-	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	Toyon	-	-	-	-	-	-	-	-	-	-	-	-
HOCU	*Horkelia cuneata*	wedgeleaf horkelia	-	-	-	-	-	-	-	-	-	-	-	-
PTAQ	*Pteridium aquilinum*	western brackenfern	-	-	-	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	Southern California Snowberry	-	-	5.6	0.4	-	-	-	-	-	-	-	-
SOUM	*Solanum umbelliferum*	Bluewitch Nightshade	-	-	-	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	Eastwood's golden fleece	-	-	-	-	-	-	-	-	0.2	-	-	-
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	1	1	9.4	0.4	1	2	3.2	4.2	3.2	8.2	-	9.8
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	-	-	-	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	-	-	-	-	-	-	-	-	-	-	-	-
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceonothus	8.6	2.6	36.6	14.4	19.6	5.8	19.4	41.2	16.6	15.6	19.8	27.6
CETH	*Ceanothus thyrsiflorus*	Blueblossum	-	-	-	-	-	-	-	-	-	-	-	-
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	-	-	-	-	-	-	-	-	-	6.4	5	-
Total % Cover			**97.4**	**86**	**108.2**	**71.4**	**80.8**	**92.6**	**88.6**	**136.4**	**107.8**	**72.8**	**87.4**	**107.6**
		Bare Ground	22	23.4	14.4	36.6	32.4	21.8	22.4	15.4	22.8	30.6	20.6	19.4
		Herbaceous Vegetation	-	3.4	15.8	4.2	2.4	2.8	1.2	0.8	0.4	10.2	0.8	1

Shrub Transect Survey Results - Ranges 43-48

Species Code	Scientific Name	Common Name	BA2	BA20	BA4	BA6	BA7	BA8	BA9	BC3	BH1
ADFA	*Adenostoma fasciculatum*	Chamise	9.6	10.6	6	15.4	4.6	10	3.2	2	2.4
ARTO	*Arctostaphylos tomentosa ssp. tomentosa*	Shaggy-barked manzanita	32.4	34	33.2	28.2	26.4	24.6	60.8	8.8	19.2
BAPI	*Baccharis pilularis*	Coyote bush	-	-	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	Ice plant	-	1.4	-	-	-	-	-	1.6	-
CEDE	*Ceanothus dentatus*	Dwarf ceonothus	9.8	37.4	35	28.2	43.6	20.4	3.8	48.6	34.2
ERER	*Ericameria ericoides*	Mock heather	5.8	-	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	-	-	1.6	-	-	-	0.6	7.2	-
GAEL	*Garrya elliptica*	Silktassel	-	-	6.6	0.2	-	-	-	-	-
HESC	*Helianthemum scoparium*	Rush rose	-	7	20.6	3.4	5.8	0.8	1.6	17	1.6
LOSC	*Lotus scoparius*	Deerweed	1.6	1.8	0.6	-	-	-	9.8	3.6	14
LUCH	*Lupinus chamissonis*	Chamisso bush lupine	-	-	-	-	-	-	-	-	-
MIAU	*Mimulus aurantiacus*	Sticky monkey flowerr	-	-	-	-	0.2	-	-	-	-
QUAG	*Quercus agrifolia*	Coastal Live Oak	-	-	-	-	-	-	-	-	-
RHCA	*Rhamnus californica ssp. californica*	Coffeeberry	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	Black Sage	-	2.6	9.2	2	2	-	7.8	3.2	-
LECA	*Lepechinia calycina*	Wood balm	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	Poison Oak	-	-	-	-	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	Toyon	-	-	-	-	-	-	-	-	-
HOCU	*Horkelia cuneata*	wedgeleaf horkelia	-	-	-	-	-	-	-	-	-
PTAQ	*Pteridium aquilinum*	western brackenfern	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	Southern California Snowberry	-	-	-	-	-	-	-	-	-
SOUM	*Solanum umbelliferum*	Bluewitch Nightshade	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	Eastwood's golden fleece	-	-	-	0.8	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	Sandmat manzanita	2.6	0.2	-	2.6	1.6	6.8	-	4.4	11
ARHO	*Arctostaphylos hookeri ssp. hookeri*	Hooker's manzanita	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	Monterey manzanita	-	-	-	-	-	-	-	-	-
CECUR	*Ceanothus cuneatus var. rigidus*	Monterey ceonothus	29.4	8.4	2.8	11.2	14.8	25.6	18	1.6	7.2
CETH	*Ceanothus thyrsiflorus*	Blueblossum	-	-	-	-	-	-	-	-	-
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	-	-	-	-	-	-	-	-	-
Total % Cover			**91.2**	**103.4**	**115.6**	**92**	**99**	**88.2**	**105.6**	**98**	**89.6**
		Bare Ground	24.2	22.8	11.2	19.2	18	29	19.4	10	18
		Herbaceous Vegetation	0.4	0.2	1.2	0.4	-	-	-	10	0.4

APPENDIX C

Shrub Succession in Ranges 43–48

List of Figures in Appendix C

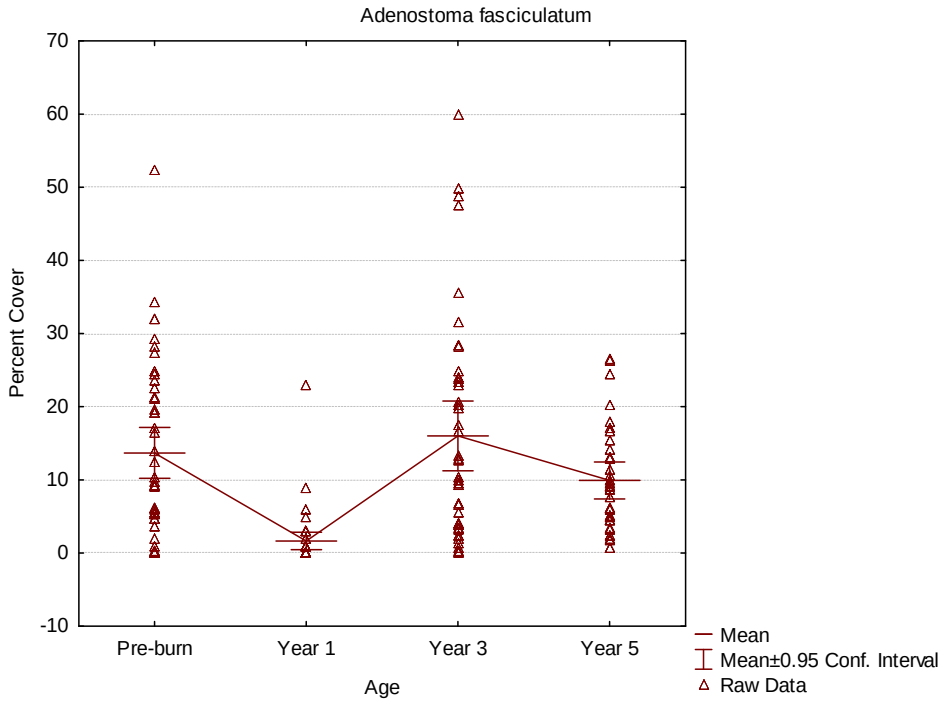


Figure C-1 Temporal patterns in percent cover of Chamise on shrub transects in Ranges 43–48

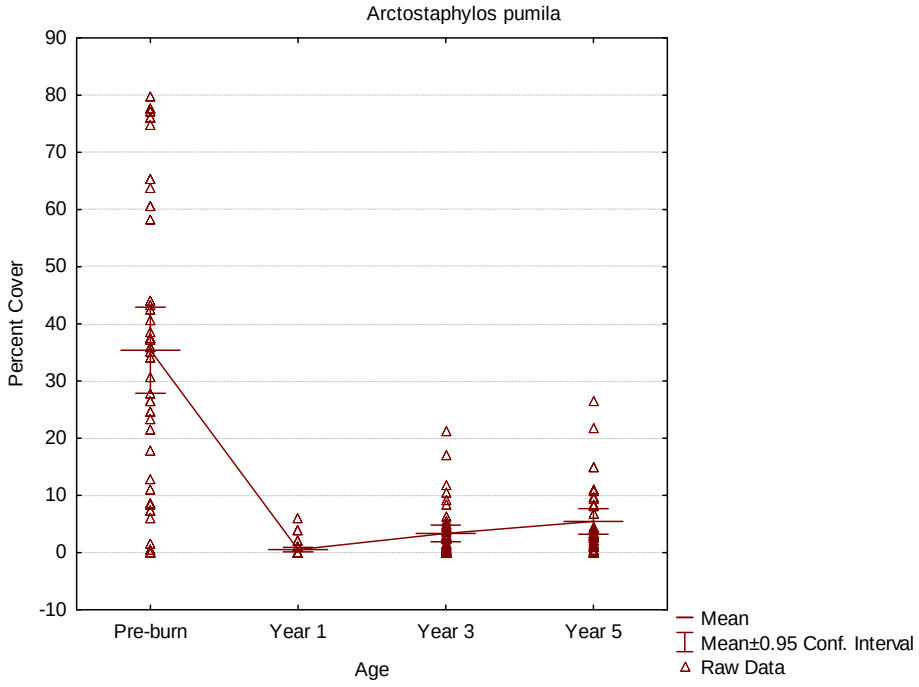


Figure C-2 Temporal patterns in percent cover of Sandmat manzanita on shrub transects in Ranges 43–48

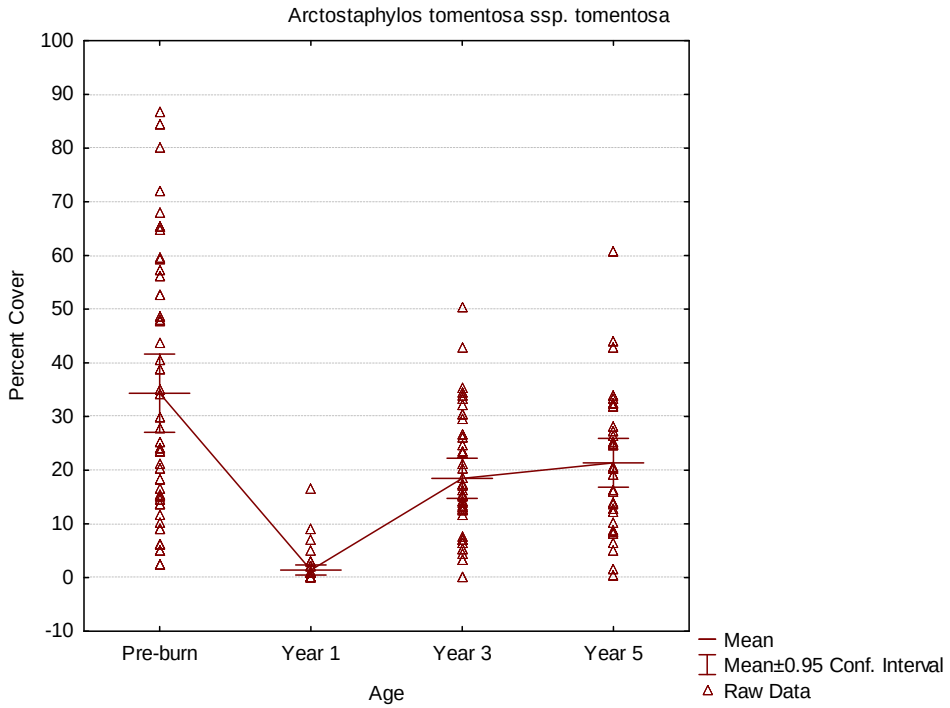


Figure C-3 Temporal patterns in percent cover of Shaggy-barked manzanita on shrub transects in Ranges 43–48

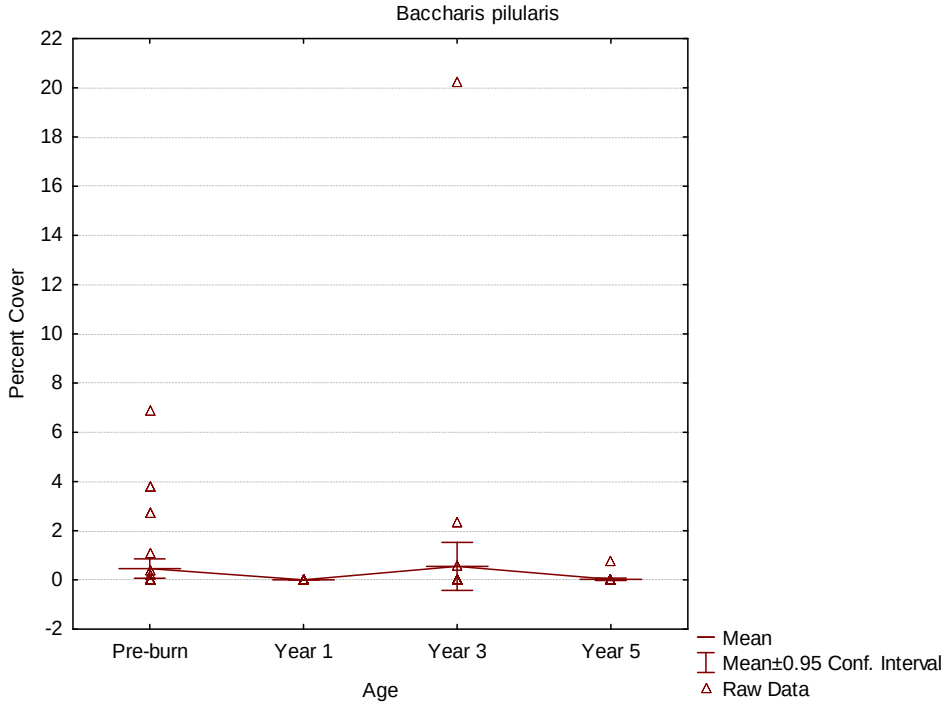


Figure C-4 Temporal patterns in percent cover of Coyote brush on shrub transects in Ranges 43–48

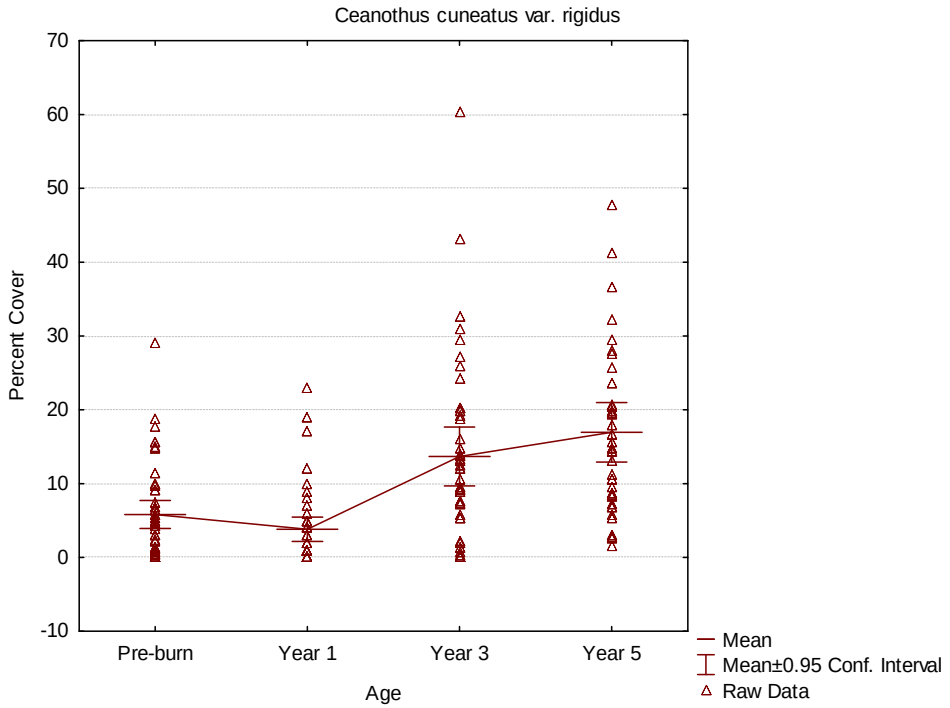


Figure C-5 **Temporal patterns in percent cover of Monterey ceanothus on shrub transects in Ranges 43–48**

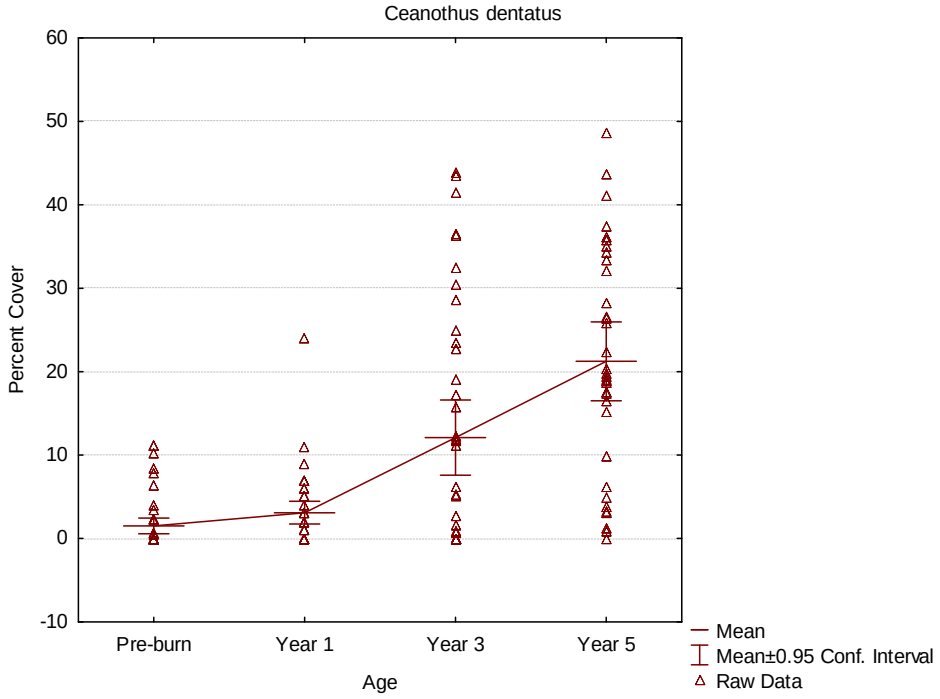


Figure C-6 **Temporal patterns in percent cover of Dwarf ceanothus on shrub transects in Ranges 43–48**

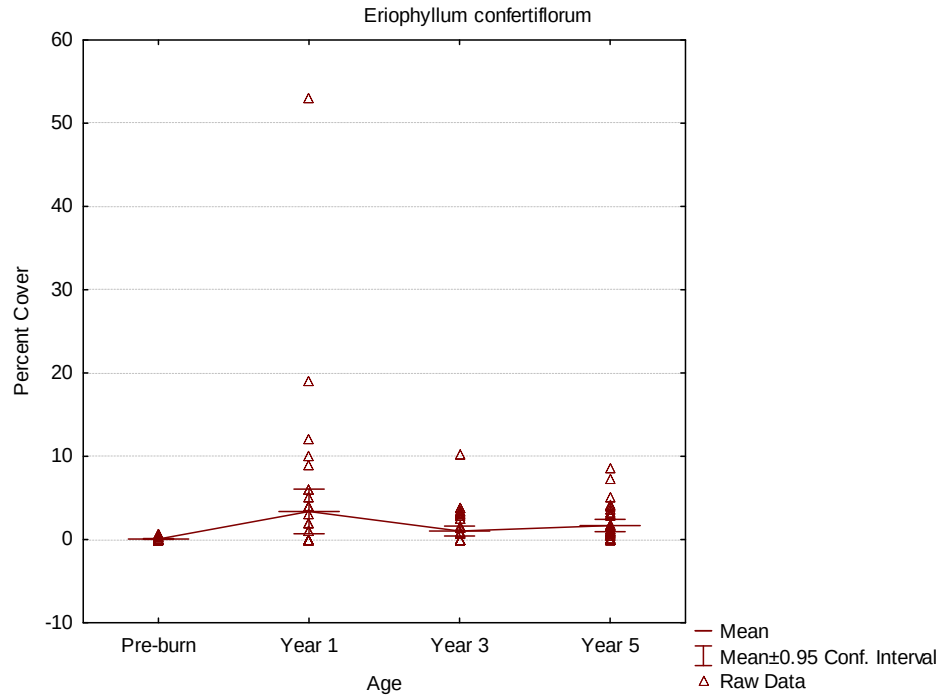


Figure C-7 Temporal patterns in percent cover of Golden yarrow on shrub transects in Ranges 43–48

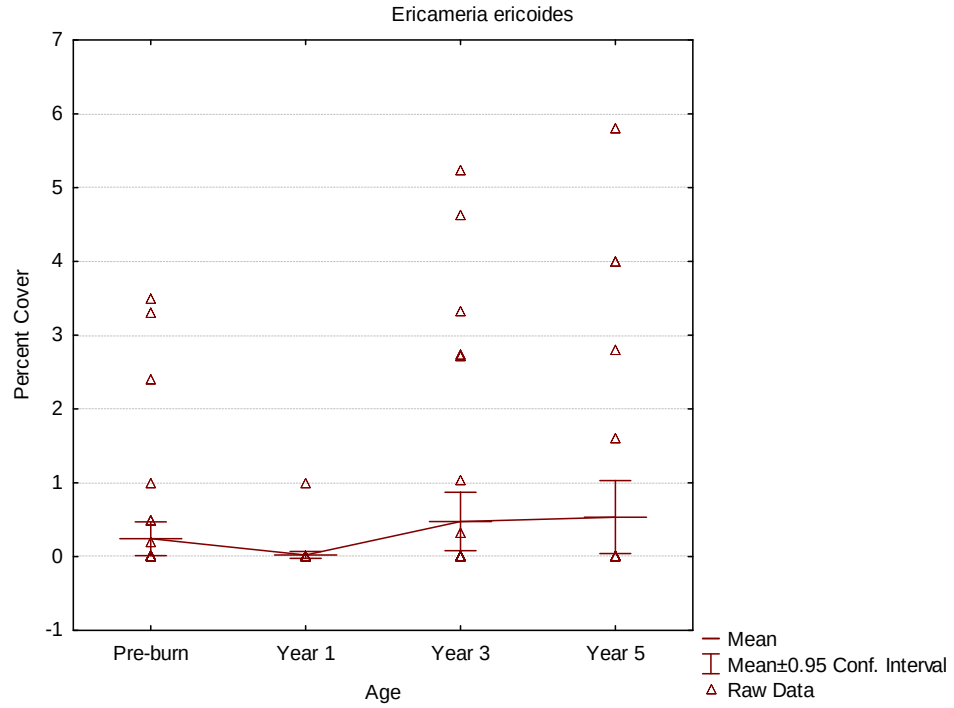


Figure C-8 Temporal patterns in percent cover of Mock-heather on shrub transects in Ranges 43–48

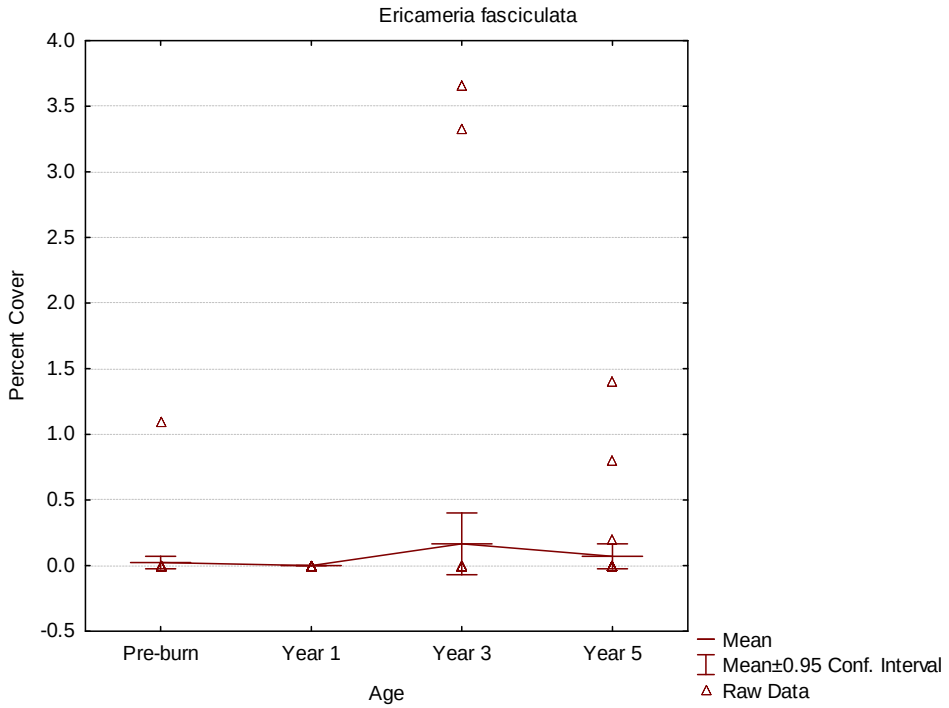


Figure C-9 Temporal patterns in percent cover of Eastwood's goldenbush on shrub transects in Ranges 43–48

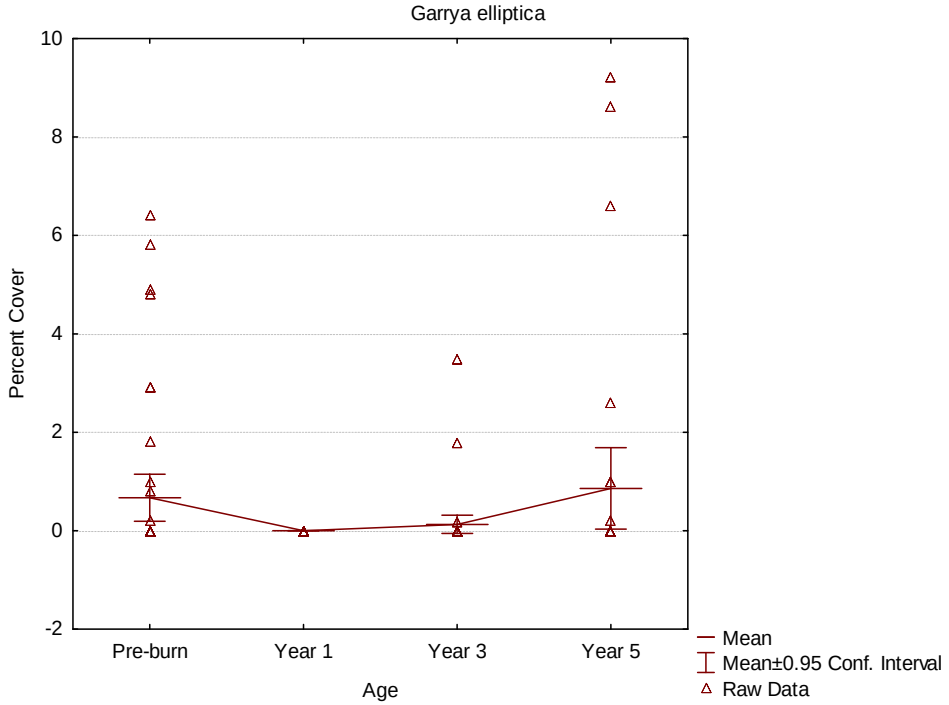


Figure C-10 Temporal patterns in percent cover of Coast silk-tassel bush on shrub transects in Ranges 43–48

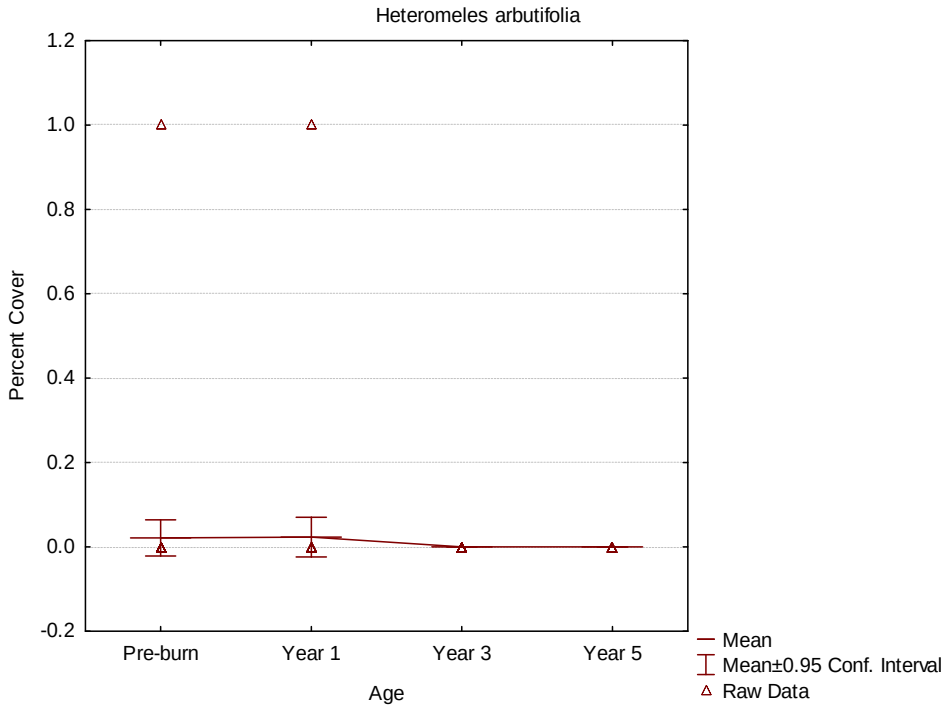


Figure C-11 Temporal patterns in percent cover of Toyon on shrub transects in Ranges 43–48

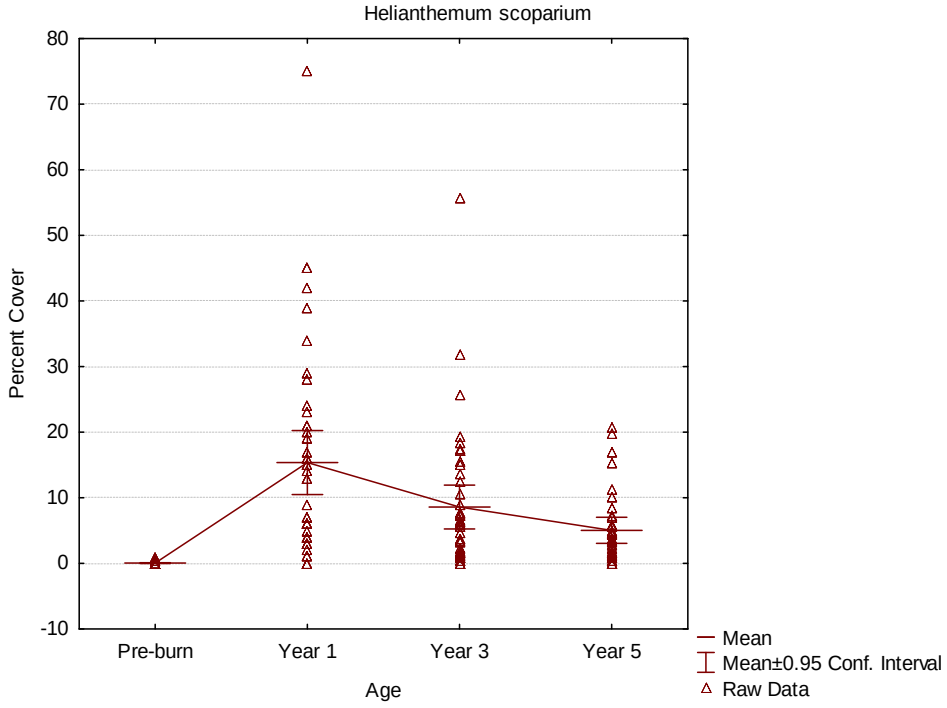


Figure C-12 Temporal patterns in percent cover of Peak rush-rose on shrub transects in Ranges 43–48

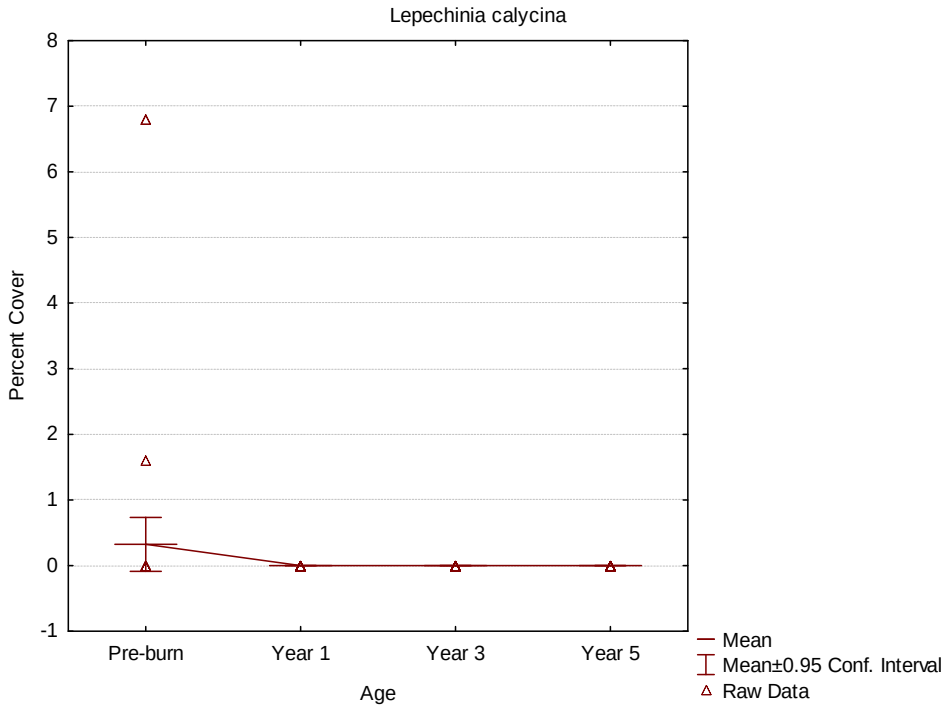


Figure C-13 Temporal patterns in percent cover of Pitcher sage on shrub transects in Ranges 43–48

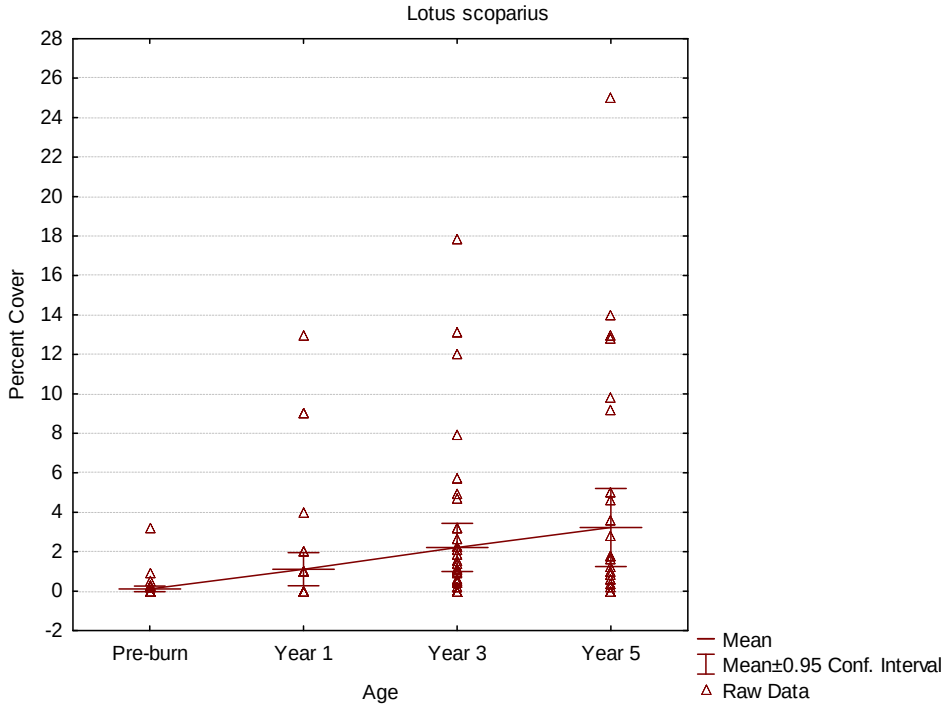


Figure C-14 Temporal patterns in percent cover of Deerweed on shrub transects in Ranges 43–48

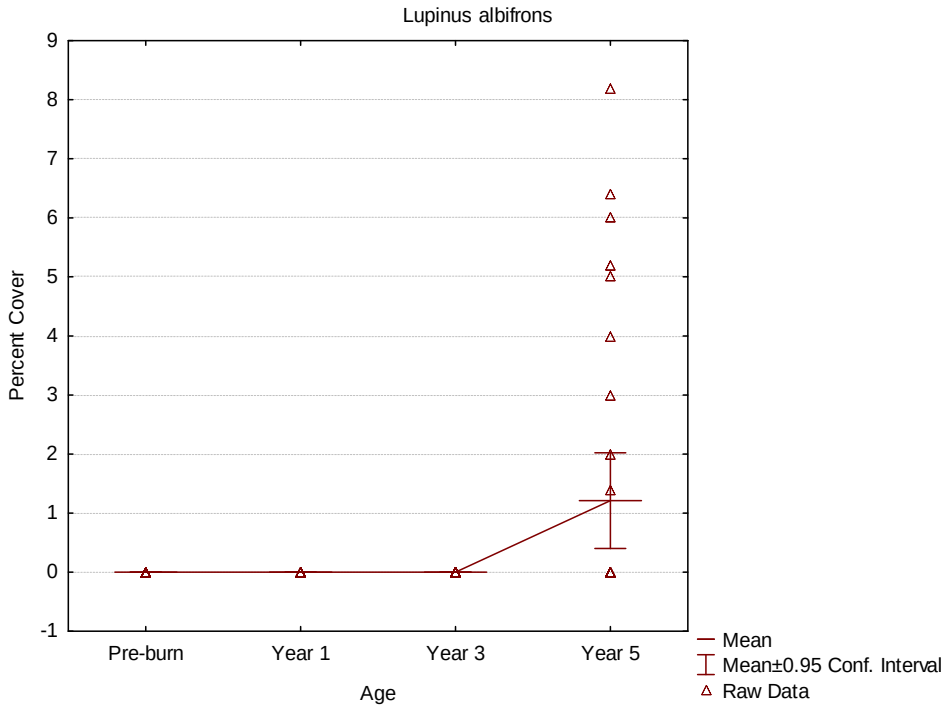


Figure C-15 Temporal patterns in percent cover of Silver bush lupine on shrub transects in Ranges 43–48

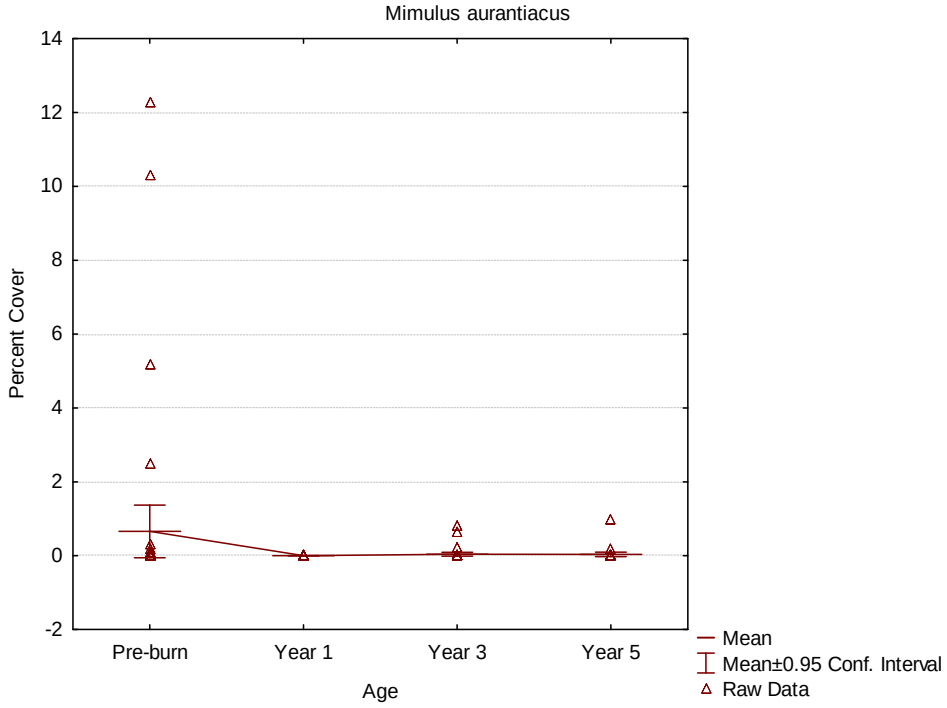


Figure C-16 Temporal patterns in percent cover of Sticky monkeyflower on shrub transects in Ranges 43–48

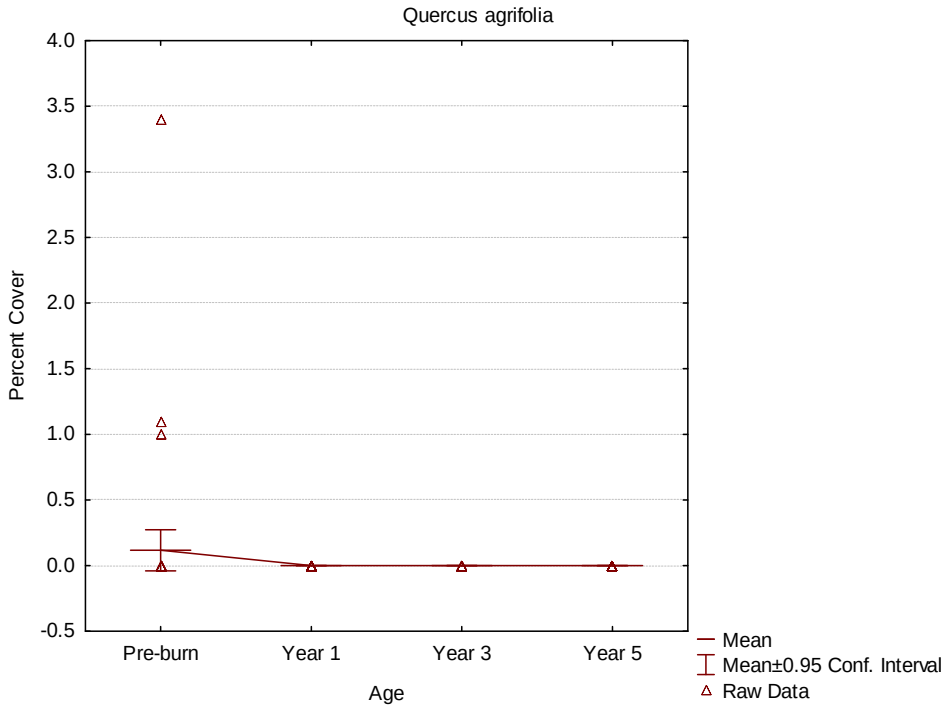


Figure C-17 Temporal patterns in percent cover of Coast live oak on shrub transects in Ranges 43–48

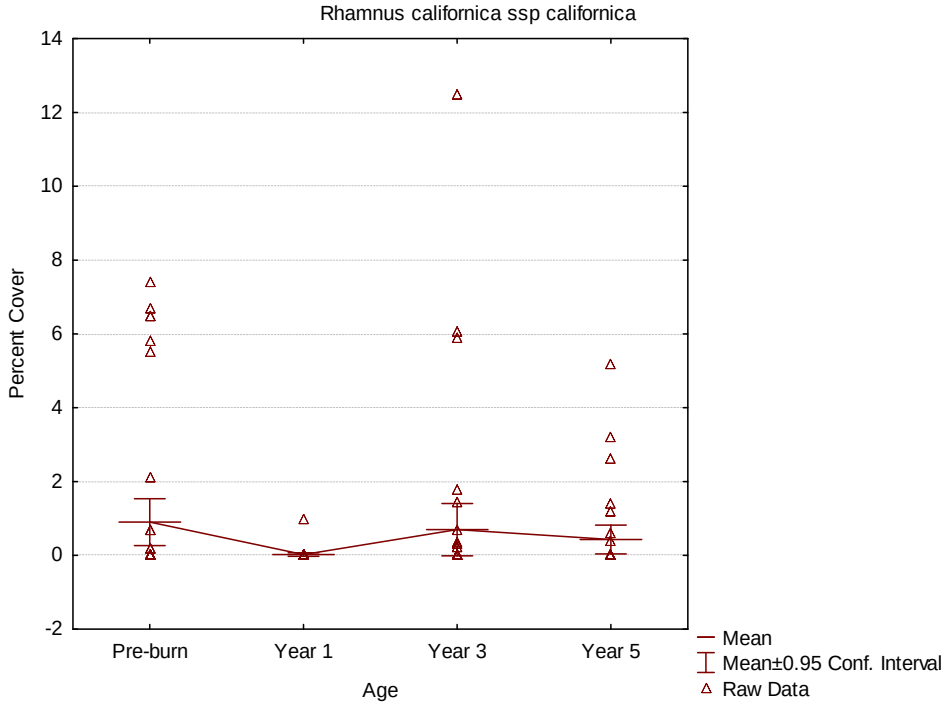


Figure C-18 Temporal patterns in percent cover of California coffeeberry on shrub transects in Ranges 43–48

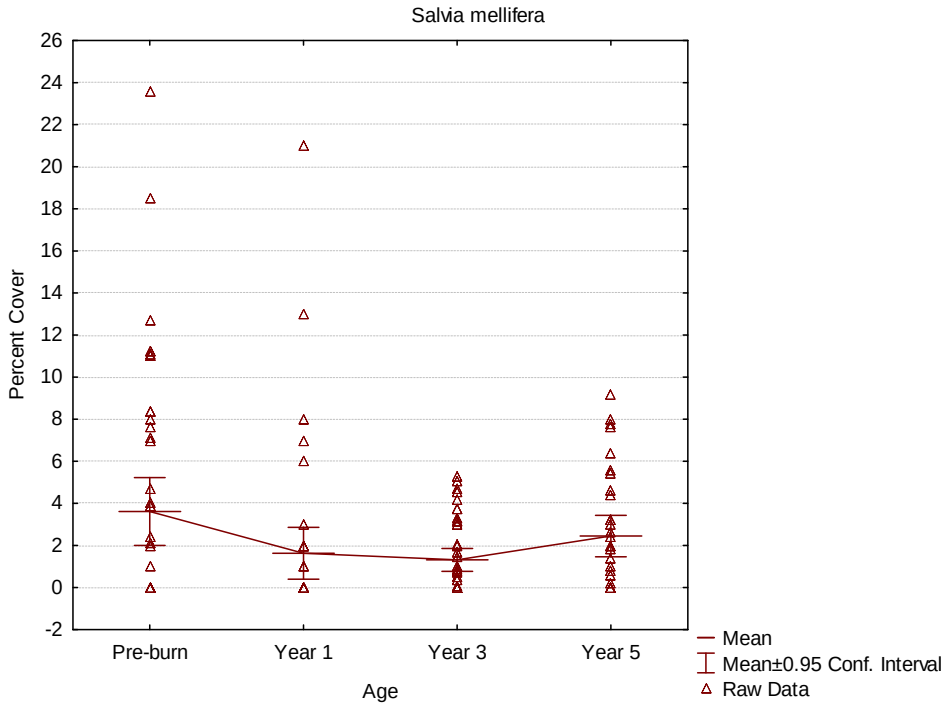


Figure C-19 Temporal patterns in percent cover of Black sage on shrub transects in Ranges 43–48

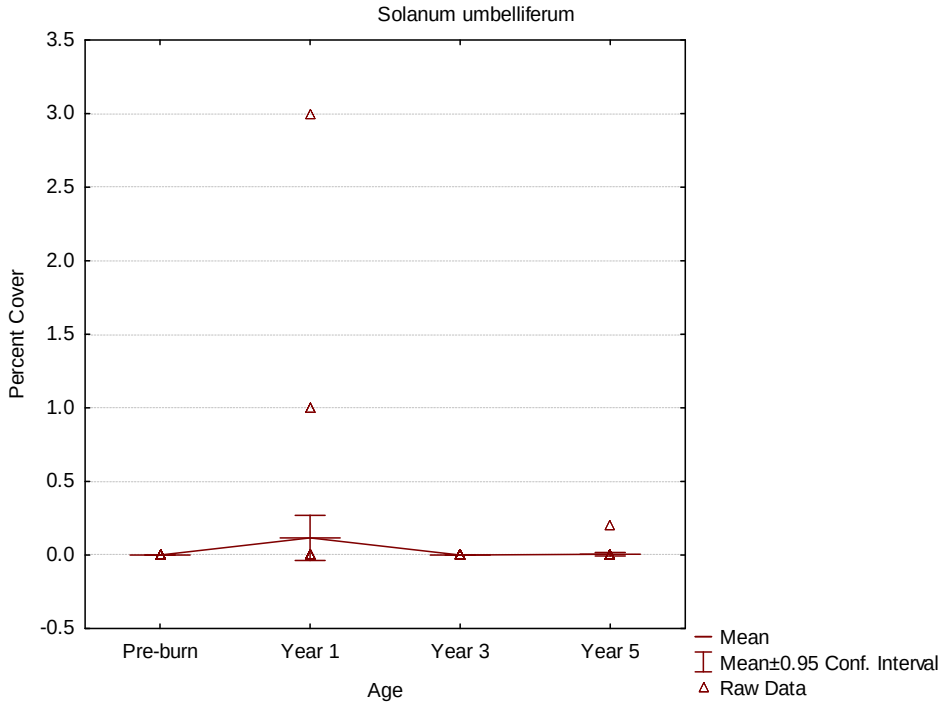


Figure C-20 Temporal patterns in percent cover of Blue witch on shrub transects in Ranges 43–48

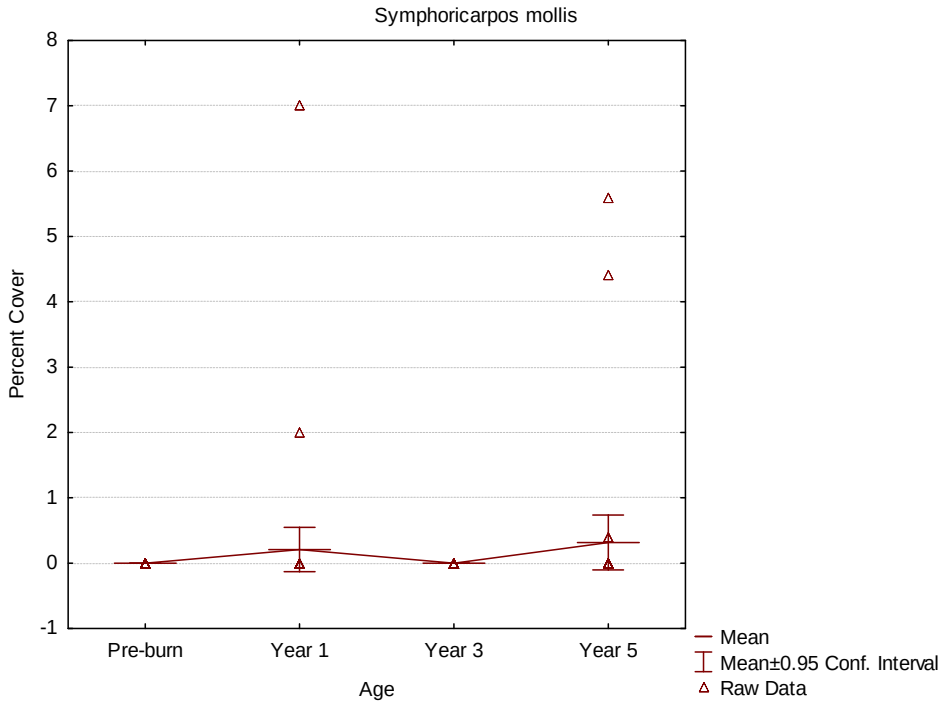


Figure C-21 Temporal patterns in percent cover of Creeping snowberry on shrub transects in Ranges 43–48

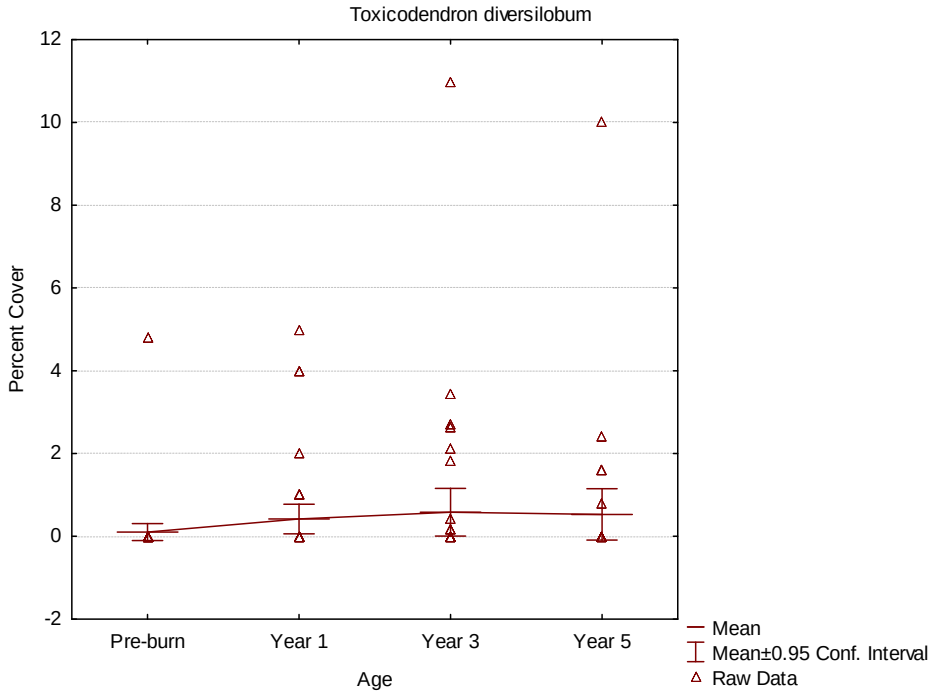


Figure C-22 Temporal patterns in percent cover of Poison oak on shrub transects in Ranges 43–48

APPENDIX D

Photographs

Photo Description	Photo
1. Typical view of mature maritime chaparral in pre-burn area.	

Photo Description	Photo
2. First-year burn area (Burn Unit 19, foreground) and mature maritime chaparral in pre-burn area (Burn Unit 15, background).	

Photo Description	Photo
3. First-year burn area showing habitat supporting all three HMP annual species.	

Photo Description	Photo
4. First-year burn area showing habitat not suitable for HMP annuals. *Note dense cover of woody debris*.	

Photo Description	Photo
5. First-year burn area showing habitat not suitable for HMP annuals. *Note dense accumulation of ash on soil surface.*	

Photo Description	Photo
6. 2.5-meter radius circular plot sampling for HMP annuals in year 5 monitoring area.	

Photo Description	Photo
7. Year 5 monitoring area showing maturing maritime chaparral (foreground and background) and herbland in low-lying area (middle).	

Photo Description	Photo
8. Close-up of herbland habitat in year 5 monitoring area. This habitat often supports Monterey spineflower in large numbers, and sometimes also sand gilia.	

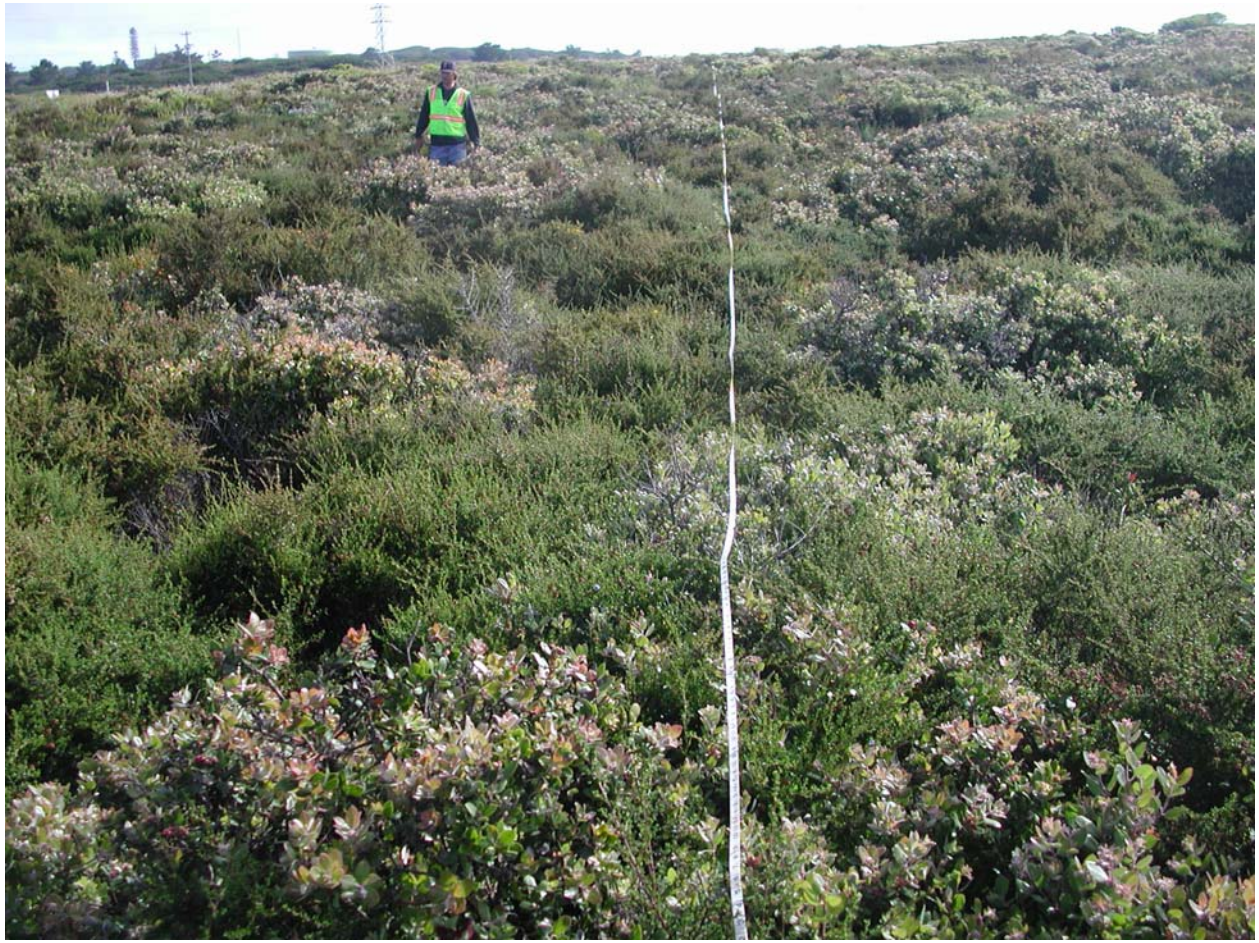
Photo Description	Photo
9. 50-meter shrub transect in typical maturing maritime chaparral in year 5 monitoring area.	

Photo Description	Photo
10. Small opening in maturing maritime chaparral in year 5 monitoring area that supports Monterey spineflower and sand gilia.	

Photo Description	Photo
11. Hooker's manzanita (left), sandmat manzanita (center and right), and Monterey manzanita (right) growing together in pre-burn area.	

Photo Description	Photo
12. Dense mat of Monterey spineflower in opening in maritime chaparral in pre-burn area.	

Photo Description	Photo
13. Dense colony of large plants of sand gilia in first-year burn area (Burn Unit 19).	

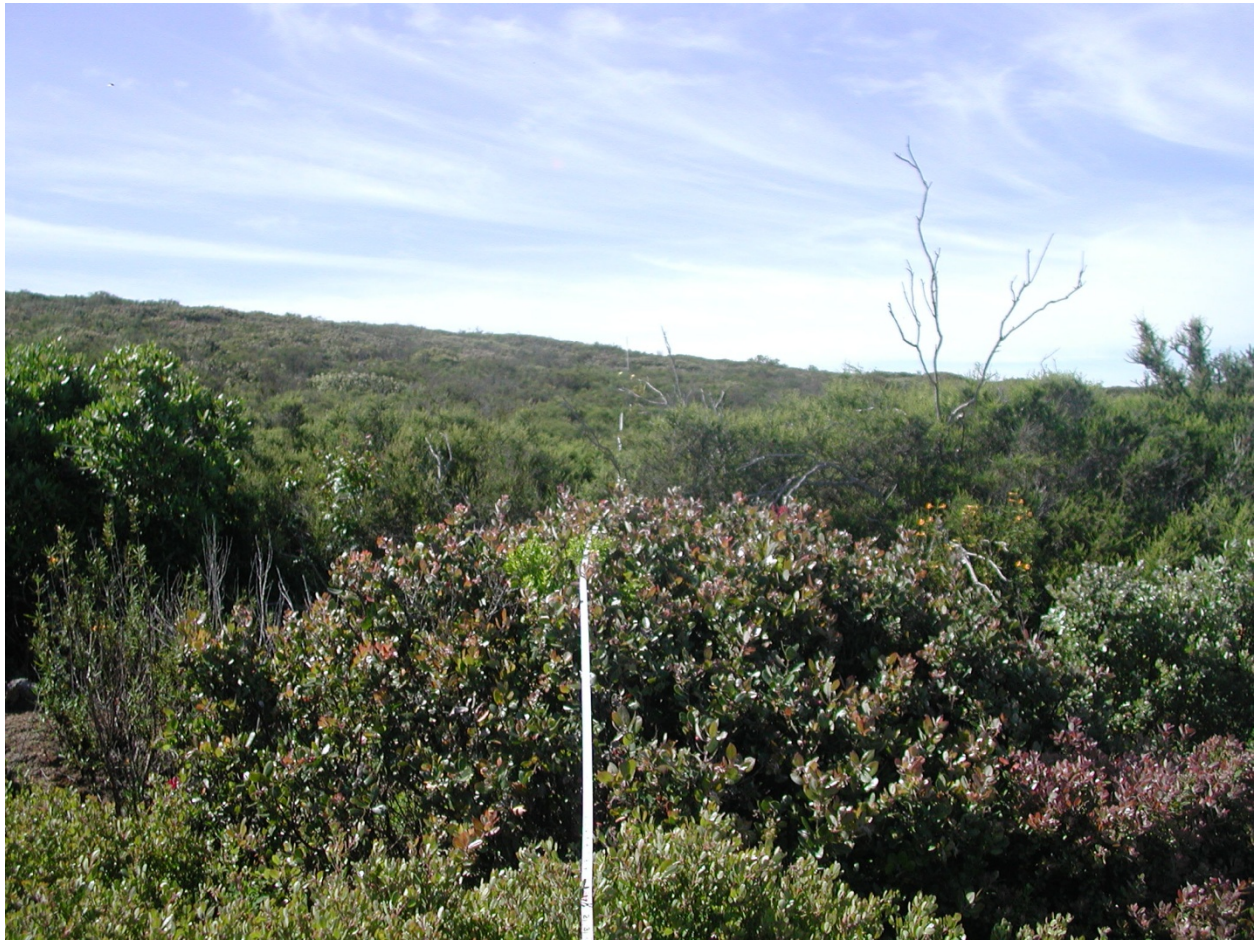
Photo Description	Photo
14. 50-meter shrub transect in typical mature maritime chaparral in pre-burn area (Burn Unit 21).	

Photo Description	Photo
15. Surveyor establishing 50-meter shrub transect in typical mature maritime chaparral in pre-burn area.