2014 Biological Monitoring Report
for Units 25 and 31;
Units 06, 07, 10, 33, WGBA and MOUT;
Units 04, 11, 12 and 23N;
Units 14 and 19;
and MRS-16
Former Fort Ord

Prepared for

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

Sacramento District
1325 J Street
Sacramento, CA 95814-2922

January 2015

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SECTION 1

Introduction

This report presents the results of biological monitoring conducted in Units 25 and 31 (baseline pre-burn areas); Units 6, 7, 10, 33, Watkins Gate Burn Area (WGBA) and the Military Operations Urban Terrain (MOUT) buffer (Year 1 monitoring areas); Units 4, 11, 12, and 23N (Year 3 monitoring areas); Units 14 and 19 (Year 5 monitoring areas), and MRS 16 (Year 8 monitoring area) during spring and summer of 2014 (Figure 1-1). Monitoring was completed based on methodology presented in the *Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at Former Fort Ord* (VMP) (Burleson 2009a), with modifications as discussed in Sections 0, 3.3, 4.3 5.3, and 6.3.

The 2014 biological monitoring program was conducted to satisfy the monitoring requirements 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, 2005, and 2011). This annual monitoring report presents the results of monitoring for HMP annuals, shrubs, grasses, and exotic plants. Before the completion of vegetation clearance, munitions removal, and other related environmental cleanup operations, biological baseline monitoring is conducted to establish whether protected species are present prior to work operations, including their location and abundance. Prior to cleanup activities, the vegetation is burned and/or masticated to remove standing vegetation and allow access to the soil surface (Figure 1-2). 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 as established in the VMP. Density of the annual HMP plants is monitored at 1, 3, 5, and 8 years after completion of vegetation clearance. Shrub communities are monitored at 3, 5, 8, and 13 years after completion of vegetation clearance.

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 and coast live oak (*Quercus agrifolia*) woodlands. Central maritime chaparral is protected under the HMP because of its restricted geographic range and 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. A periodic fire regime is a key management tool for establishing a diverse dynamic chaparral community.

A significant mitigating factor affecting the response of vegetation at the former Fort Ord is the 2012 to 2014 drought. This drought is considered to be the most severe 3-year drought in the past 1200 years, with 2014 having the highest moisture deficit of any previous span of dry years (Griffin and Anchukatis 2014).

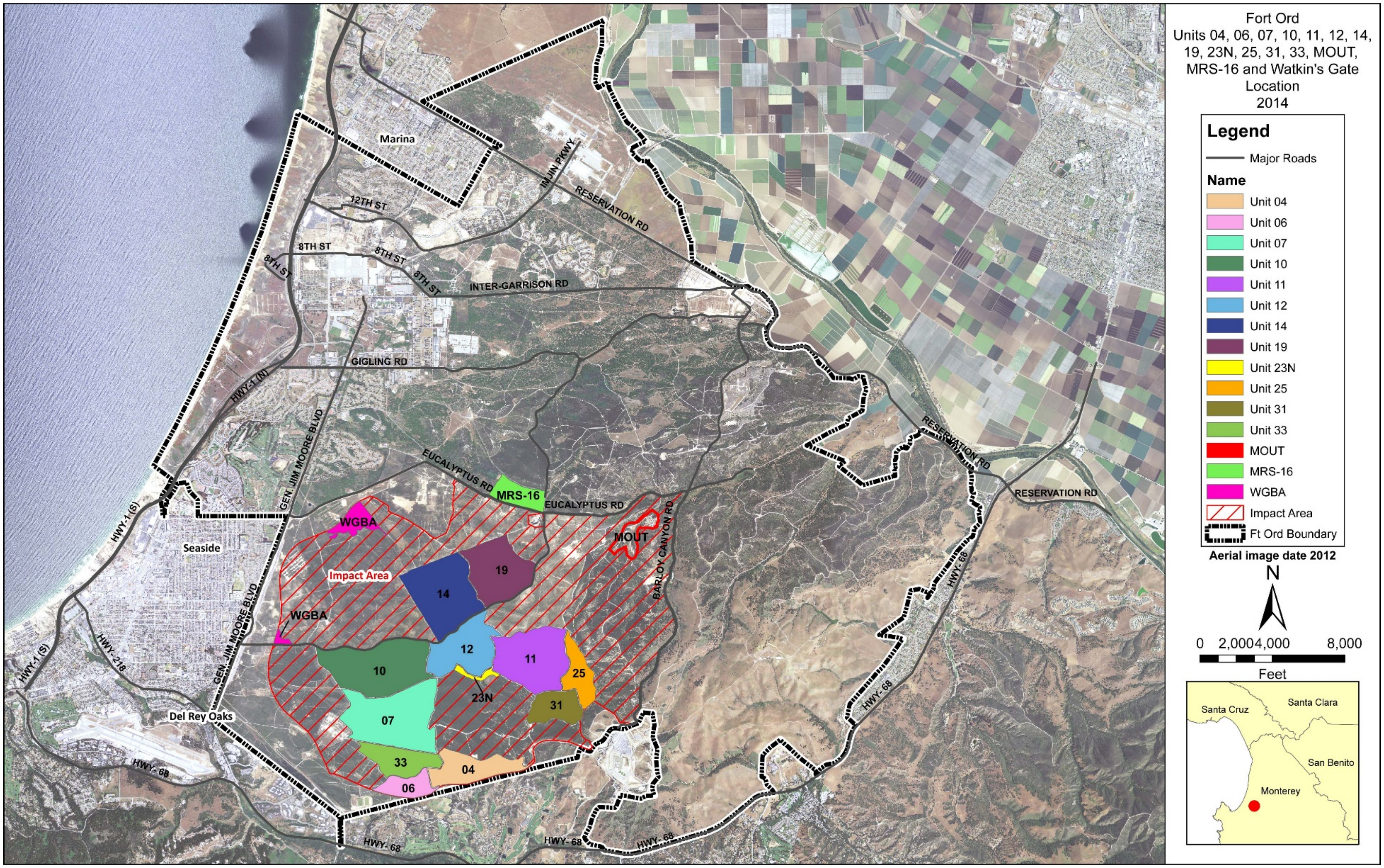

Figure 1-1 Map of former Fort Ord, Monterey California showing locations of Units sampled in 2014.

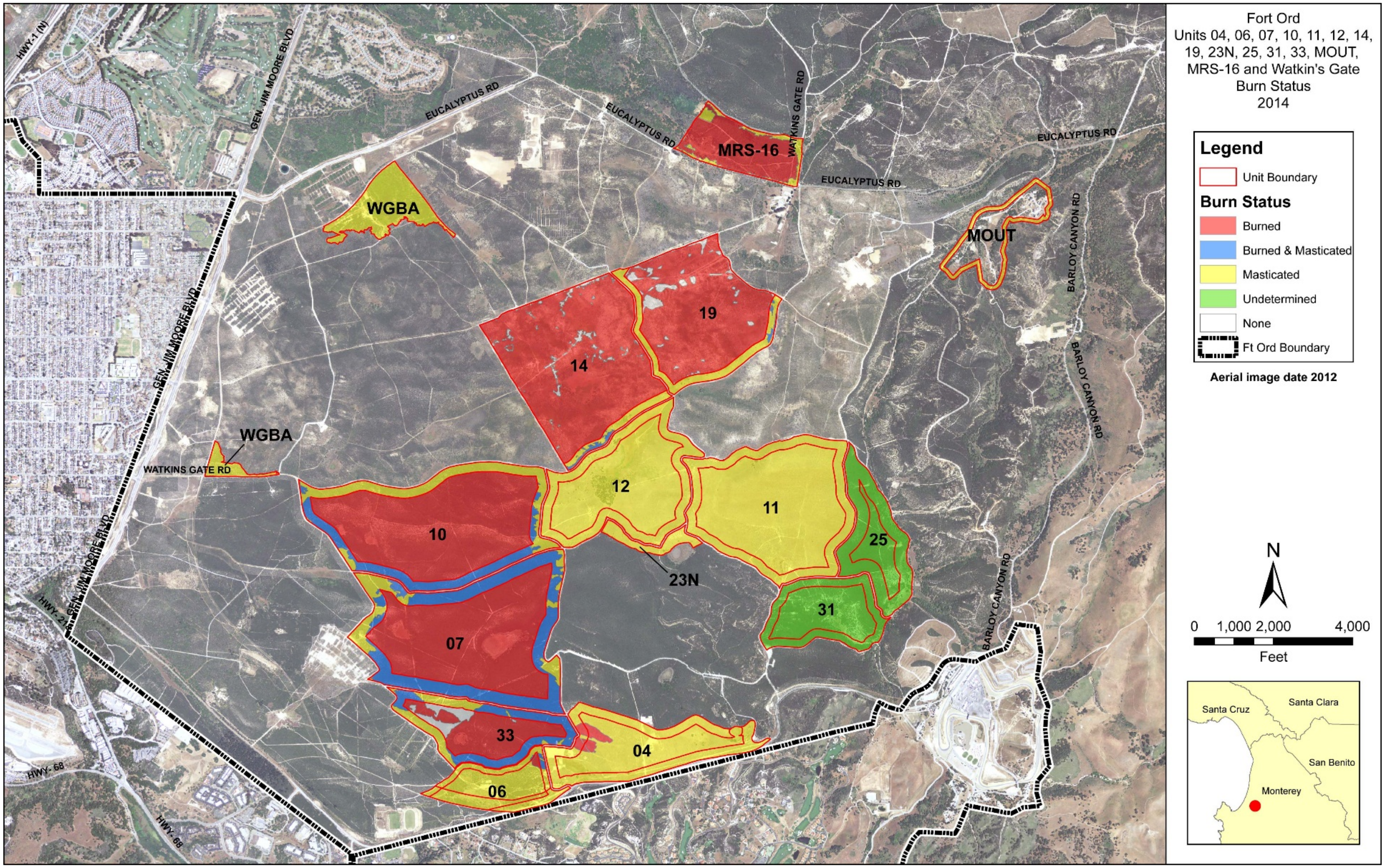

Figure 1-2 **Burn units surveyed in 2014 showing actual burn status for those units. Burn plan for Units 25 and 31 is undetermined at the time of report preparation.**

1.1. Species Included in 2014 Habitat and Rare Species Monitoring

The primary habitat type within the Army's portion of the former Fort Ord is central maritime chaparral. Plant species within central maritime chaparral 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*), Hooker's manzanita (*Arctostaphylos hookeri* ssp. *hookeri*), Monterey ceanothus (*Ceanothus cuneatus var. rigidus*), and Eastwood's goldenbush (*Ericameria fasciculata*). The annual species of concern (HMP annuals) include sand gilia (*Gilia tenuiflora* ssp. *arenaria*), 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 (Baldwin et al. 2012). Specifically, the acronym for the Monterey ceanothus (*Ceanothus cuneatus var. rigidus*) was changed from CERI to CECUR in 2010 to reflect the sub-specific designation of this plant at that time. However, prior to the 2013 survey, the accepted species designation was changed back to *Ceanothus rigidus* (Baldwin et al. 2012). Therefore, the code has been changed back to CERI.

1.2. Previous Surveys Conducted on the Sites

The previous surveys conducted at the specific Fort Ord sites monitored in 2014 are referenced in Table 1-2. The Year 1 units (6, 7, 10, 33, WGBA, and MOUT) were sampled by Tetra Tech and EcoSystems West (2011; 2012). Baseline sampling in Year 3 Units (4, 11, 12, 23N) was conducted by Tetra Tech and EcoSystems West (2011; 2012), and Year 1 surveys by Tetra Tech and EcoSystems West (2011; 2012). Baseline sampling on the Year 5 Units (14 and 19) was conducted by Shaw Environmental (2009), with Year 1 sampling conducted by Burleson (2009b), and Year 3 sampling by Tetra Tech and Ecosystems-West (2011). Multiple teams surveyed the Year 8 site (MRS 16) including Harding Lawson (2001), MACTEC (2005), Parsons (2004, 2005), Shaw (2008), and Tetra Tech and EcoSystems West (2011).

Data from previous surveys for HMP annuals and shrub line transects were obtained from GIS shapefiles and associated metadata provided by the Army), and from the results of previous surveys in 2010 through 2014 (Tetra Tech and EcoSystems West 2011, 2012, 2013, 2014).

Data were also transcribed from the electronic versions of previous monitoring reports when available. In addition to the incorporation of past line transect data into the database, adjustments were made to the "density" class field in the vegetation monitoring data table to correspond to the density classes defined by Burleson (2009a).

Table 1-1
Common and Scientific Names of Plant Species Included in the 2013 and Previous Vegetation Surveys[1]

Acronym	Scientific Name	Common Name	Life Form
CHPUP	***Chorizanthe pungens var. pungens***	**Monterey spineflower**	**HMP annual**
CORIL	***Cordylanthus rigidus ssp. littoralis***	**Seaside bird's-beak**	**HMP annual**
GITEA	***Gilia tenuiflora ssp. arenaria***	**Sand gilia**	**HMP annual**
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
CERI	***Ceanothus rigidus (=Ceanothus cuneatus var. rigidus)***	**Monterey ceanothus**	**shrub**
CEDE	*Ceanothus dentatus*	Dwarf ceanothus	shrub
CETH	*Ceanothus thyrsiflorus*	Blue blossom	shrub
COJU	*Cortaderia jubata*	Jubata grass	large, robust perennial grass
COXX	*Cortaderia sp. (C. jubata or C. selloana)*	Jubata grass, pampas grass	large, robust perennial grass
ERAM4	*Erysimum ammophilum*	Coast wallflower	Biennial to perennial herb
ERCA	*Eriodictyon californicum*	Yerba santa	shrub
ERCO	*Eriophyllum confertiflorum*	Golden yarrow	subshrub

[1] **Bolded** species are identified as species of concern in the HMP.

Table 1-1 (continued)
Common and Scientific Names of Plant Species Included in the 2013 and Previous Vegetation Surveys[1]

Acronym	Scientific Name	Common Name	Life Form
ERER	*Ericameria ericoides*	Mock-heather	shrub
ERFA	***Ericameria fasciculata***	**Eastwood's goldenbush**	**shrub**
GAEL	*Garrya elliptica*	Coast silk-tassel bush	shrub
GEMO	*Genista monspessulana*	French broom	Invasive grass
HEAR	*Heteromeles arbutifolia*	Toyon	shrub
HESC	*Helianthemum scoparium*	Peak rush-rose	subshrub
LACO6	*Lasthenia conjugens*	Contra Costa goldfields	Annual herb
LECA	*Lepechinia calycina*	Pitcher sage, woodbalm	shrub
LOSC	*Acmispon glaber (=Lotus scoparius)*	Deerweed	subshrub
LUAL	*Lupinus albifrons (var. albifrons?)*	Silver bush lupine	shrub
LUAR	*Lupinus arboreus*	Bush lupine	shrub
MIAU	*Mimulus aurantiacus*	Sticky monkeyflower	shrub
QUAG	*Quercus agrifolia*	Coast live oak	tree
QUPAS	*Quercus parvula var. shrevei*	Shreve oak	tree or shrub
QUWIF	*Quercus wislizenii var. frutescens*	Interior live oak	shrub
RHCA	*Frangula californica (= Rhamnus californica ssp. californica)*	California coffeeberry	shrub
RISA	*Ribes sanguineum*	Redflower currant	shrub
RISP	*Ribes speciosum*	Fuchsiaflower gooseberry	shrub
ROCA	*Rosa californica*	California wild rose	shrub
ROGY	*Rosa gymnocarpa*	Wood rose	shrub
RUUR	*Rubus ursinus*	Pacific blackberry	woody vine

Table 1-1 (continued)
Common and Scientific Names of Plant Species Included in the 2013 and Previous Vegetation Surveys[1]

Acronym	Scientific Name	Common Name	Life Form
SALA	*Salix lasiolepsis*	Arroyo willow	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
VAOV	*Vaccinium ovatum*	Huckleberry	shrub
BG		Bare ground	
HERB		Herbaceous vegetation	

[1] **Bolded** species are identified as species of concern in the HMP.

Nomenclature conforms to *The Jepson Manual, Second Edition* (Baldwin et al. 2012); names used in previous monitoring reports and in the first edition of *The Jepson Manual* (Hickman 1993) are given in parentheses.

Table 1-2
Previous Monitoring Surveys at 2013 Study Sites on Fort Ord

Year	Survey
1996, 1998	Harding Lawson (1996, 1998) performed baseline HMP annual plant and shrub surveys on MRS 16
2006	Shaw Environmental (2010) performed baseline HMP annual plant and shrub surveys in fuel break areas surrounding MRS 16.
2008	Shaw Environmental (2008) performed Year 1 HMP annual plant surveys in MRS 16.
2009	Burleson (2009a) revised the monitoring program approach.
2009	Burleson (2009b) performed baseline monitoring of HMP annual plants and shrubs on Units 14 and 19, and Year 3 monitoring of HMP annual plants and shrubs in MRS-16
2010	Tetra Tech and Ecosystems-West (2011) performed Year 1 HMP annual plant surveys on Units 14 and 19.
2011	Tetra Tech and Ecosystems-West (2012) performed baseline HMP annual plant and shrub surveys on Units 4, 11, 12, 23N, MOUT, and WGBA; and Year 5 monitoring on MRS 16.
2012	Tetra Tech and Ecosystems-West (2013) performed baseline HMP annual plants and shrub surveys on Units 6 and 10, Year 1 HMP annual plant surveys on Units 11, 12, 4, and 23N; and Year 3 monitoring on Units 14 and 19.
2013	Tetra Tech and Ecosystems-West (2014) performed baseline HMP annual plants and shrub surveys on Unit 7.

A new data field, “treatment”, was added in 2011 to the line transect and Vegetation Monitoring data tables. This field was incorporated to enable a comparison to be conducted between treatment classes. Three treatment classes were identified based on treatments applied:

- Masticated – Vegetation was cut and masticated in place;
- Masticate&Burn – Vegetation was cut and then burned in place; and
- Burn – Vegetation was burned in place without being cut first. This method most closely mimics a natural fire.

In addition, two other treatment classes were identified for grids and transects which could not be assigned to one of the three primary treatment classes:

- Mixed – A portion of the grid cell was masticated and a portion was burned. These grids are generally located on the border between two treatments.

- Unspecified – This class was applied to those grid cells that were cleared prior to 2010 and which could not be assigned a treatment type.

Treatments were identified based on the activities reported in previous reports and using data from the “flora_fire_area” shapefile obtained from the Army. The 2014 baseline survey locations were classified based on the anticipated position relative to the primary containment area.

SECTION 2

Baseline Vegetation Surveys – Units 25 and 31

2.1. Units 25 and 31 – Introduction

Units 25 and 31 (Figure 2-1) are scheduled for prescribed burning and/or mechanical clearance of existing shrub cover (mastication) as part of the 2015-16 environmental cleanup operations involving munitions and explosives removal. The specific preparations for a prescribed burn in Units 25 and 31 are still in a planning phase. However, for the purposes of allocating HMP annual plant grids and shrub transects it was assumed that 316 and 213 foot-wide primary containment lines will be masticated, respectively, followed by a prescribed burn of the interior of the units. In mastication areas shrub cover is mowed to a height of approximately 6 inches.

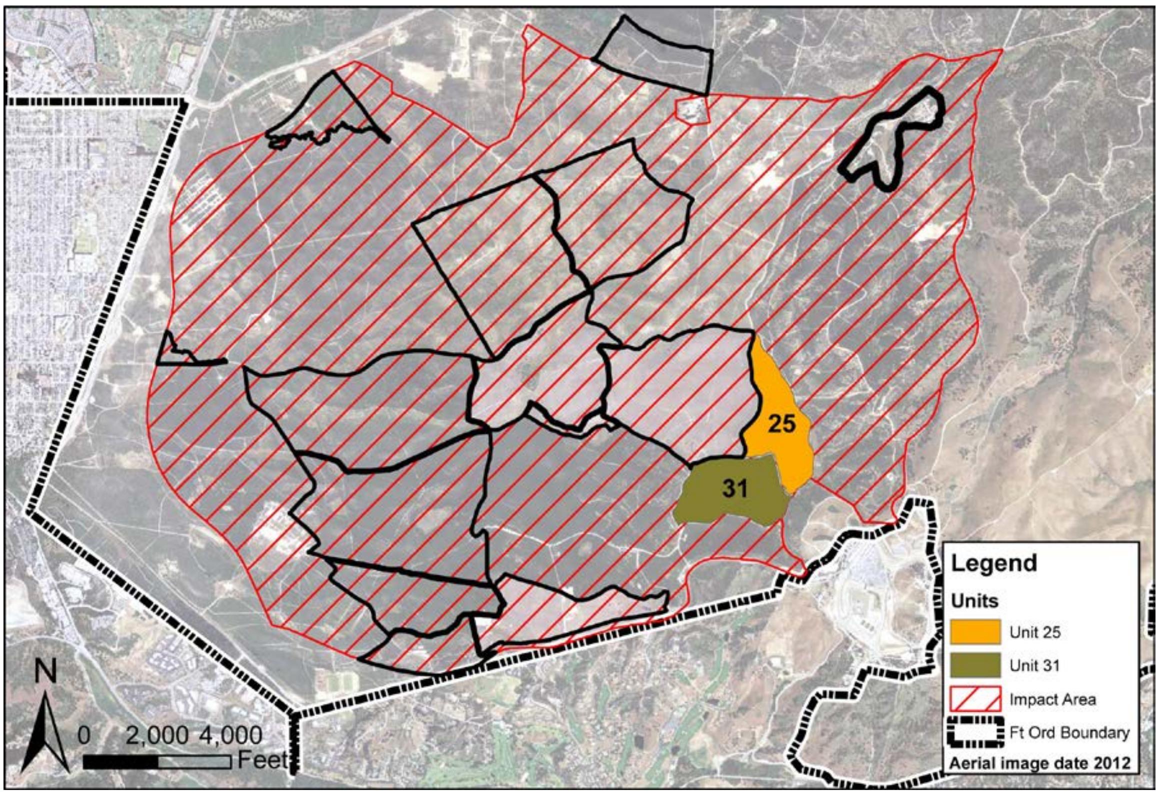

Figure 2-1 Baseline (Year 0) Units surveyed in 2014.

2.2. Units 25 and 31 – Setting

Unit 25 encompasses an area of 95 acres, of which 67 acres are within the 316 foot-wide primary containment mastication area and the remaining 28 acres are in the interior of the unit for which prescribed burning only, without mastication, is the vegetation clearing prescription. The unit is located east of Riso Ridge Road and west of Impossible Canyon Road in the southeast portion of former Fort Ord. Unit 25 has gently rolling topography in the western portion, with a steep, east-facing slope dominated by coast live oak woodland in the eastern portion bordering Impossible Canyon Road. Abandoned roads with varying amounts of vegetative overgrowth cross the unit along ridgelines providing some degree of unobstructed access to the interior portions of the unit.

Unit 25 is dominated by mature maritime chaparral vegetation varying considerably in physiognomy and species composition. Non-meadow annual grassland and disturbed areas occur in the southeast portion of the unit along Impossible Canyon Road. The chaparral shrubs range from low (3-4 feet) to tall (12-15 feet), and shrub density ranges from relatively open, with numerous openings of various sizes, to essentially 100 percent areal cover. Relatively open chaparral is most extensive on south and east facing slopes in areas that appeared to be more recently disturbed.

As in maritime chaparral throughout Fort Ord, shaggy-barked manzanita is the most characteristic dominant, and is generally overwhelmingly dominant where the shrub cover is tall and dense. Other characteristic shrubs that are often dominant or co-dominant include chamise, black sage, Monterey ceanothus, and poison-oak. One sizable area of contiguous grassland habitat dominated by native and non-native grasses and forbs occurs in the unit and supports high densities of Monterey spineflower. No mesic meadows or wetlands, including vernal pools, are located in Unit 25. A steep east facing slope along Impossible Canyon Road is comprised on coast live oak woodland with a sparse to locally dense herbaceous understory.

Unit 31 encompasses an area of 103 acres, of which 40 acres are within the 213 foot-wide primary containment area and the remaining 63 acres are in the interior of the unit for which prescribed burning only, without mastication, is the vegetation clearing prescription. The unit is located east of Riso Ridge Road and west of Impossible Canyon Road in the southeast portion of the area of former Fort Ord.

Unit 31 is dominated by mature maritime chaparral, coast live oak woodland, and disturbed non-native grassland. The unit is situated as a southeast facing bowl sloping down to a narrow valley that was evidenced to have been heavily used for infantry training when the base was active. The relatively flat valley is bordered by dense coast live oak woodland on a steep north facing slope immediately to the south and comprised of patchy non-native grassland with sparse to locally dense coyote brush.

The U.S. Department of Agriculture (USDA 2014) maps two soil types as occurring in the baseline areas. Arnold-Santa Ynez complex is mapped as occurring in all of Unit 25 and the northern and southernmost portions of Unit 31. Xerothents, dissected are mapped as occurring in throughout the central portion of Unit 31. Characteristics of these soil types are presented in Table 2-1.

Table 2-1
Distribution of Soil Types in the Fort Ord Biological Monitoring Areas

Soil Type	Description	Units Where Found
Aquic Xerofluvents	Texture variable; somewhat poorly drained; derived from alluvium derived from sedimentary rock	Year 1: MOUT Buffer Area
Arnold-Santa Ynez complex	Arnold: Loamy fine sand; somewhat excessively drained; derived from residuum weathered from sandstone Santa Ynez: Fine sandy loam; moderately well drained; derived from residuum weathered from sandstone	Baseline: Units 25 and 31 Year 1: Units 4, 6, 7, 10, 33, WGBA Unburned Area-north portion Year 3: Units 11, 12, 23N Year 5: Units 14 and 19 Year 8: MRS-16
Arnold loamy sand, 9-15 percent slopes	Loamy fine sand; somewhat excessively drained; derived from residuum weathered from sandstone.	Year 1: MOUT Buffer Area
Arnold loamy sand, 15 to 50 percent slopes	Loamy fine sand; somewhat excessively drained; derived from residuum weathered from sandstone	Year 1: MOUT Buffer Area
Baywood sand, 2 to 15 percent slopes	Sand; somewhat excessively drained; derived from stabilized sandy eolian sands	Year 1: Unit 10, WGBA Unburned Area-north and south portions
Xerothents, dissected	Loam, clay loam; well drained; derived from mixed unconsolidated alluvium	Baseline: Units 25 and 31 Year 1: MOUT Buffer Area Year 3: Unit 11

MOUT: Military Operations, Urban Terrain buffer area

WGBA: Watkins Gate Burn Area

Source: USDA (2014)

At least two distinct types of soil occur in the areas where the soil is mapped as Arnold-Santa Ynez complex as well as elsewhere in the portion of the base in which munitions and explosives removal are currently being conducted. One type of soil consists primarily of relatively coarse, loose sand, generally without gravel. The other soil type consists of finer, harder-packed sand with finer material, and typically contains large numbers of small, reddish, rounded pebbles. The HMP annual species Monterey spineflower, sand gilia, and seaside bird's-beak occur almost exclusively on the former soil type. In Unit 25, this soil variant is located almost entirely in and along the margins of the annual grassland and oak woodland in the east and southeastern portion of the unit, extending slightly into maritime chaparral. In Unit 31, loose, sandy soils occur in the low-lying valley and slopes immediately north of the valley dominated by relatively open maritime chaparral.

2.3. Units 25 and 31 – Methods

Baseline vegetation monitoring surveys were conducted in spring 2014, prior to any treatment in these units. These 2014 baseline monitoring 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.

2.3.1. Meandering Transects

Meandering transect surveys of the baseline areas were conducted between 14 and 17 April 2014. Species surveyed for included six HMP herbaceous species: the biennial to perennial species coast wallflower and Yadon's piperia, and the annual species Monterey spineflower, sand gilia, seaside bird's-beak, and Contra Costa goldfields. The timing of these surveys was optimal for locating and identifying coast wallflower, Monterey spineflower, sand gilia, and Contra Costa goldfields, as the surveys were conducted during the flowering period of these species. Seaside bird's-beak and Yadon's piperia had not yet flowered when the meandering transect survey was conducted. However, they could be identified from their vegetative characteristics.

When an HMP herbaceous species was observed during meandering transect surveying, a recreational-grade Global Positioning System (GPS) unit (Garmin 62S) was used to record the location. The HMP species present in the vicinity of each point were also recorded. The base-wide system of 100×100 foot grids was then used for mapping HMP herbaceous species. All GPS coordinates for HMP herbaceous species observed during meandering transect surveying were plotted onto a map of the grids. A list was then compiled of all grids within the baseline areas that contained one or more HMP herbaceous species. This list of grids was used as the basis for selection of grids to be monitored.

2.3.2. HMP Annuals Density Monitoring

Density monitoring for three HMP annual species, Monterey spineflower, sand gilia, and seaside bird's-beak, was conducted in the baseline areas between 7 and 11 May 2014. This time period was optimal for observing Monterey spineflower and sand gilia, as these species were in flower throughout this period. Seaside bird's-beak was not yet in flower when this density monitoring was conducted, but was readily identifiable by its vegetative characteristics. Yadon's piperia is not monitored for density as individual plants are often widely scattered and difficult to locate during meandering surveys. Instead, individuals are mapped using GPS and occurrences are noted for comparison with future monitoring efforts. Coast wallflower has not been observed within areas currently being cleared of munitions, but nearby occurrences are known to the north and west in aeolian, sandy soils.

The pre-defined 100×100 foot grids were used as sample grids for the density monitoring. In Units 25 and 31 a stratified random sample of 100×100 foot grids consisting of 38 grids identified during meandering transect surveying as occupied by one or more HMP annual species were selected for sampling. The monitoring protocol (Burleson 2009a) states that 20 percent of occupied grid squares or 38 total grids, whichever is greater, be selected for HMP annual density monitoring. Sampling was stratified by species, to ensure adequate representation of both Monterey spineflower and sand gilia (the only HMP annual species mapped in the units), and by mastication area vs. interior. The baseline grids were not marked in any way in the field; we therefore used a resource grade Trimble GeoXH GPS receiver with the grid boundaries loaded as a map layer to determine the boundaries of the grids to be sampled. Grid corners were temporarily marked in the field using pink flagging tape tied to the tallest point of vegetation to assist with navigation during HMP annual species monitoring.

The methods specified in the monitoring protocol (Burleson 2009a) were followed in 2014 for the density monitoring, with the exception that for one or more HMP annual species, a complete census of the entire grid was conducted rather than subsampling (below). The surveyors conducted an initial reconnaissance of each 100×100 foot sample grid to determine which HMP annual species were present and how they were distributed within the grid. When feasible given the numbers and distribution of individuals of HMP annual species in the grid, the entire grid was censused by counting all individuals of a given HMP annual species within the grid using a hand counter. In previous monitoring years, when it was determined to be time intensive or infeasible to conduct a complete census of a given species in a given grid, the grid was subsampled using a 2.5-meter radius circular plot. This technique was not used in 2014 but the methodology is presented to demonstrate the alternative method for estimating density in previous monitoring years as these figures are used for inter-annual comparisons. For this technique, an area judged by the surveyors to be representative of the density of the species within the entire grid was selected for subsampling, and the circular plot was sampled using a measuring tape. One surveyor held the end of the 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 grids, the surveyors estimated the percent suitable habitat within the grid for each HMP annual species present. In practice, “suitable habitat” was essentially treated as equivalent to “occupied habitat”. Since the percent suitable habitat was used to calculate the estimated number of individuals present within a 100×100 foot sample grid 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 numbers of individuals present in subsampled 100×100 foot grids.

When circular plots were used for subsampling, estimates of the total number of plants present in the 100×100 foot sample grid 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 grid is 10,000 square feet, the estimated number of individuals in the 100×100 foot grid was calculated using the following formula:

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

where,

n = the estimated number of individuals in the 100×100 foot grid;

a = the number of individuals counted in the circular plot, and

b = the estimated percent suitable habitat in the 100×100 foot grid

For each HMP annual species, each 100×100 foot sample grid 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 when the entire 100×100 foot sample grid was sampled:

0 = 0 plants

1 = 1 to 50 plants

2 = 51 to 100 plants

3 = 101 to 500 plants

4 = >500 plants

When only a portion of the grid was sampled due to recent disturbance or interception by roads, the density classes were scaled proportional to the percentage of the total grid sampled.

In some cases where it was evident that a given sample grid should be assigned to density class 4, the surveyors assigned the grid to this density class without attempting to count or estimate numbers of plants. This was done because, for all 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. In some cases, grids were assigned to density class 4 after a partial census indicated that considerably more than 500 plants were present in a 100×100 foot sample grid, or after it became apparent that the number of plants within a circular plot considerably exceeded the minimum number required for an estimate of greater than 500 plants within the 100×100 foot sample grid.

2.3.3. Shrub Transect Monitoring

Shrub transect monitoring in the baseline areas was conducted in areas supporting maritime chaparral without obvious recent or heavy large-scale disturbance. In all baseline units, areas supporting habitat types other than maritime chaparral (e.g. coast live oak woodland, grassland), and extensively disturbed areas (roads, lead remediation sites, abandoned military infrastructure), were mapped and excluded from transect sampling. Locations for all newly established transects were then selected by randomly selecting 100×100 foot grids within the areas of maritime chaparral vegetation in each baseline unit. One baseline transect was allocated for each approximately 11 acres. In Units 25 and 31, transects were allocated separately within the primary containment lines (areas to be masticated) and within the interior of the Units beyond the containment lines. Numbers of transects sampled within each unit were as follows:

- Unit 25: 9 total (6 containment, 3 interior. No transects sampled previously)
- Unit 31: 10 total (4 containment, 6 interior. No transects sampled previously)

Transect sampling in the primary containment areas of Unit 25 was conducted on 11 and 12 June 2014 and in the interior areas of the unit on 12 and 16 June 2014. In Unit 31, sampling in containment areas was conducted on 10 June 2014 and in the interior areas of the unit on 11 June 2014.

Transect sampling was conducted using the line intercept method along transects 50 meters in length. For transects not sampled in any previous year, the surveyors used a resource grade Trimble GeoXH GPS receiver with the grid boundaries loaded as a map layer to locate the grids selected for sampling. The end point of each transect was located on or near one of the boundaries of the 100×100 foot grid selected as the basis for transect placement. 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 selected for sampling (it is impossible to include all of a 50-meter transect within a 100×100 foot grid). In Units 25 and 31, 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).

All transects were established by stretching out a 50-meter measuring tape between the transect start and end points. For transects not sampled in a previous year, the start and end points of each transect were recorded using the resource grade GPS receiver, and the GPS data was post-processing corrected.

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 and pampas grass were also recorded separately because they are invasive species. Other herbaceous vegetation was recorded as “herb”, with no breakdown by species, although the herbaceous species present along the transect were noted on the datasheets. Bare ground (including dead vegetation) was also recorded.

The continuous 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.

2.3.4. Annual Grass Monitoring

Non-native annual grass monitoring was conducted within the planned primary containment lines surrounding Units 25 and 31 on 25 and 26 June 2014. 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 (*Festuca perennis*, sometimes a biennial), and rattail fescue (*Festuca myuros*).

The annual grass monitoring was conducted by a combination of driving the perimeter roads surrounding the 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 in one of three density classes:

1 (low) = 1–5 percent

2 (medium) = 6–25 percent

3 (high) = >25 percent

2.3.5. Invasive Species

Invasive species, including iceplant, pampas grass, and French broom, were encountered incidentally during the meandering transect survey and the HMP annuals density monitoring and shrub transect monitoring. When invasive species were encountered, the locations were mapped using a recreational-grade GPS unit. A comprehensive survey for invasive species was not conducted.

2.4. Units 25 and 31 – Results and Discussion

The estimated areas and percent of the area that was considered occupied by HMP annual species (i.e. suitable habitat) is summarized in Table 2-2. In Unit 25, 34 grids were mapped as having HMP annuals present. Therefore, all 34 grids were sampled in Unit 25. The total suitable area from the 34 grids sampled (0.56 acres) was divided by the total area of the Unit to determine the percent suitable area in Unit 25 of 0.59 percent of the Unit.

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

Unit	Total Area (acres)	Suitable Area (acres)	Percentage of Unit	Grids Surveyed
Unit 25	95	0.56	0.59%	34
Unit 31	103	0.36	0.35%	38

In Unit 31, 46 grids were mapped as having HMP annuals present. Therefore, the minimum required number of 38 grids were sampled. To estimate the total suitable area for HMPs in Unit 31, the observed suitable area in the 38 sampled grids was scaled upwards to account for the unsampled grids. In Unit 31, HMP annuals occupied 0.35 percent of the Unit.

Maps of locations of survey grids are provided in Appendix A1.

2.4.1. Sand Gilia

A total of seventy-two (72) grids were surveyed for HMP plants including sand gilia in 2014 on Units 25 and 31 (Table 2-3; Map A1-1). A total of 31 grids were located in the proposed prescribed burn areas in the Units and 41 grids were located within the primary containment areas. Sand gilia was present in only 6 (8%) and was absent (density class 0) in 92 percent of the 72 grids sampled in Units 25 and 31. Sand gilia was only observed in disturbed areas near the south-east corner of Unit 31. The average density class for sand gilia was 0.08 in areas of suitable habitat across both Units. Sand gilia was present at an average density class of 0.3 in the prescribed burn area of Unit 31.

2.4.2. Seaside Bird’s-Beak

Seaside bird’s-beak was not observed in any grids in either Unit 25 or Unit 31 during the meandering transects, and was not present in any of the 72 grids sampled for HMP annual species (Map A1-2).

2.4.3. Monterey Spineflower

Monterey spineflower was present at moderate to high densities in all 72 of the grids sampled in Units 25 and 31 (Table 2-4; Map A1-3). Across the two Units, Monterey spineflower was present at an average density class of 3.2 in areas of suitable habitat. There is no apparent difference in density class between prescribed burn or primary containment areas between the two Units.

Table 2-3
Sand Gilia – Number of Grids per Density Class in Units 25 and 31

	Unit 25		Unit 31	
Density	**Prescribed Burn Area[1]**	**Primary Containment Area**	**Prescribed Burn Area[1]**	**Primary Containment Area**
0 plants/grid (percent of total grids)	5 (100%)	29 (100%)	20 (77%)	12 (100%)
1–50 plants/grid (percent of total grids)	0 (0%)	0 (0%)	6 (23%)	0 (0%)
51–100 plants/grid (percent of total grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
101–500 plants/grid (percent of total grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
> 500 plants/grid (percent of total grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Average Density Class	**0.0**	**0.0**	**0.3**	**0.0**
Total Occupied Grids	**0**	**0**	**6**	**0**
Total Grids Sampled	**5**	**29**	**26**	**12**

[1] Prescribed burn area is the area planned for the prescribed burn, and the primary containment area is the area planned to be masticated prior to the prescribed burn. Each grid is 100- x 100- feet, or 10,000 square feet, or 0.23 acre.

Table 2-4
Monterey Spineflower – Number of Grids per Density Class in Units 25 and 31

Density	Unit 25		Unit 31	
	Prescribed Burn Area[1]	**Primary Containment Area**	**Prescribed Burn Area[1]**	**Primary Containment Area**
0 plants/grid (percent of total grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
1–50 plants/grid (percent of total grids)[1]	0 (0%)	0 (0%)	7 (27%)	1 (8%)
51–100 plants/grid (percent of total grids)[2]	1 (20%)	0 (0%)	4 (15%)	1 (8%)
101–500 plants/grid (percent of total grids)[3]	1 (20%)	4 (14%)	8 (31%)	6 (50%)
> 500 plants/grid (percent of total grids)[4]	3 (60%)	25 (86%)	6 (23%)	4 (33%)
Average Density Class	**3.8**	**3.9**	**2.5**	**3.1**
Total Occupied Grids	**5**	**29**	**26**	**12**
Total Grids Sampled	**5**	**29**	**26**	**12**

1 Prescribed burn area is the area planned for the prescribed burn, and the primary containment area is the area planned to be masticated prior to the prescribed burn.

Each grid is 100- x 100- feet, or 10,000 square feet, or 0.23 acre.

2.4.4. Shrub Transect Monitoring

A total of 19 transects were sampled in the two Units (Map A1-4 and Map A1-8), with 9 transects located in Unit 25, and 10 transects located in Unit 31. Average total shrub cover on transects 25 and 31 in 2014 averaged 110.8 percent and ranged from 78.4 to 131.0 percent (Figure 2-2). Shrub cover often exceeded 100 percent because of overlapping cover between adjacent shrubs. Bare ground averaged 8.24 percent, and herbaceous vegetation occupied 0.11 percent in these two units. Raw data for the shrub transects sampled in 2014 are provided in Appendix B.

To assess baseline conditions in association structure, several standard metrics were examined; total percent cover, species richness, diversity, and evenness (Table 2-5).

The dominant species in the pre-burn shrub association included shaggy-barked manzanita (*A. tomentosa ssp. tomentosa*), which averaged 64 percent cover and occurred on all transects, and chamise (*A. fasciculatum*) which averaged 31 percent cover and occurred on all transects. All other species were present at less than 10 percent cover across all transects. Monterey ceanothus

(*C. rigidus*) and black sage (*S. mellifera*) occur frequently on transects (95 percent and 63 percent of the transects, respectively), but at low percent cover. These results are consistent with baseline transects on Units 2, 3, 6, and 10 that were sampled in 2012 (Tetra Tech and EcoSystems West 2013a) and in Units 7, 5E, and 23E that were sampled in 2013 (Tetra Tech and EcoSystems West 2014).

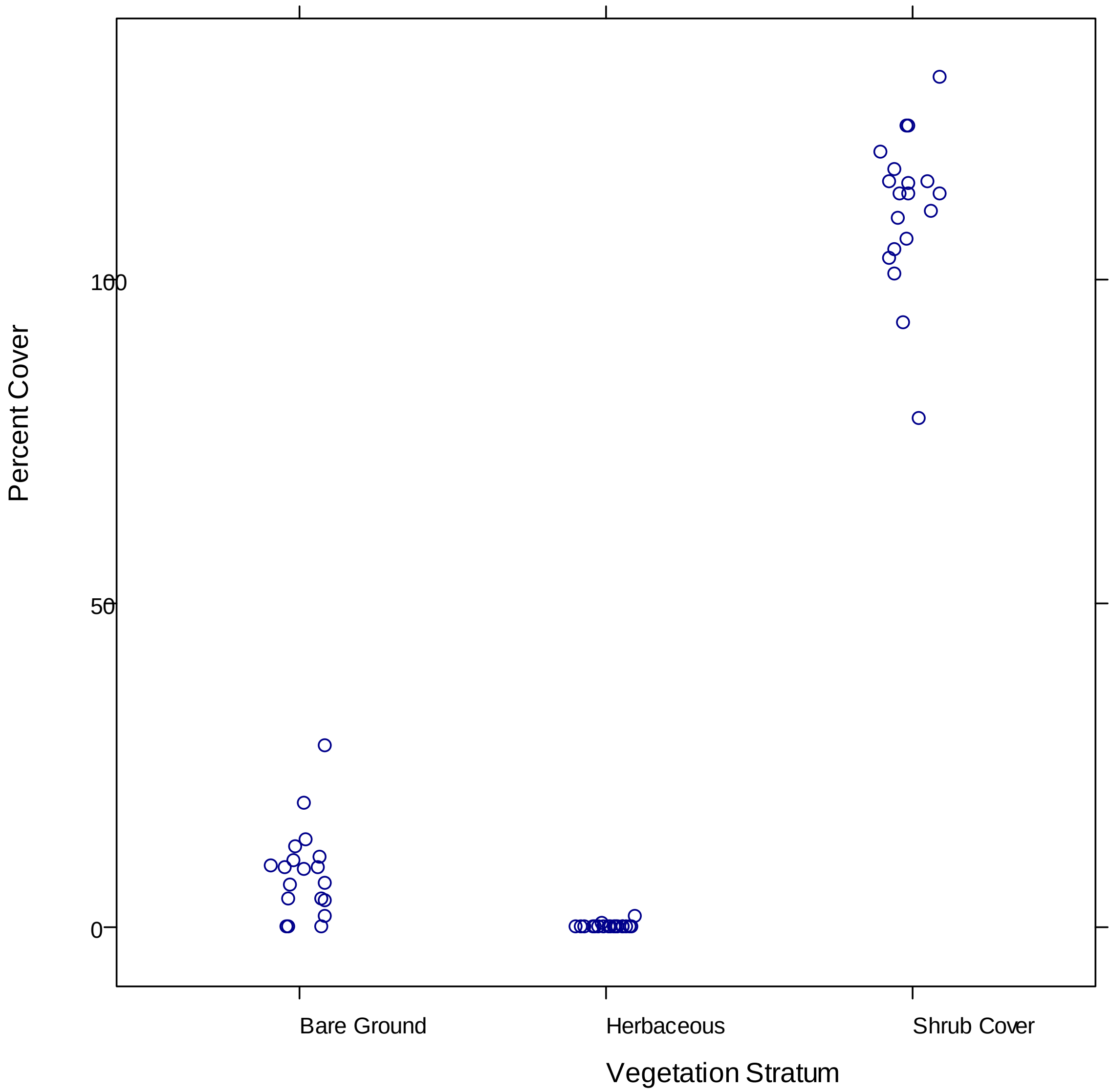

Figure 2-2 **Percent cover of bare ground, herbaceous plants, and shrubs on transects in Units 25 and 31. Points in each stratum are horizontally offset to allow results from individual transects to be seen.**

Table 2-5
Community Structure Parameters for Baseline Transects in Units 25 and 31

	Parameter			
	Total Cover (%)	**Species Richness (S)**	**Diversity (H')**	**Evenness (J')**
Minimum	78.4	3	0.59	0.45
25 percentile	105.3	4	0.96	0.55
Median	113.0	5	1.11	0.63
Mean	110.8	6	1.05	0.62
75 percentile	115.9	7	1.17	0.68
Maximum	131.0	10	1.45	0.80

Species richness (number of species per transect) was variable between transects, with between 3 and 10 species present on each transect. Species richness was similar to that observed in baseline transects in 2012 and 2013 (Tetra Tech and EcoSystems West 2013a; Tetra Tech and EcoSystems West 2014).

Diversity was measured by the Shannon-Weiner H' metric (Pielou 1974). This metric expresses diversity as a combination of the number of species present in the association and their relative abundance (or cover) in the sample. Diversity increases with increasing number of species, and with increasing equitability of species abundance. For a given number of species, diversity is highest when all species are present in equal abundance. Diversity index is calculated as:

$$H' = -\sum_{i=1}^{S} p_i \ ln\, p_i$$

where,

p_i = proportion of the i^{th} species $= \frac{n_i}{N}$

Diversities were low ranging from 0.58 to 1.45 in the shrub transects.

Evenness is a measure of the equability of the relative contribution of species to the total cover in the association (Pielou 1974). Evenness is the ratio of the observed diversity to the maximum diversity possible for a sample with the same number of species. Maximum evenness (value = 1) is achieved when all species are present in equal abundance in the sample. Species evenness varied between transects, ranging from 0.45 to 0.80.

All community structure parameters (i.e., total percent cover, species richness, dominant species, diversity and evenness) exhibited similar means and ranges as the results from baseline transects in Units 2, 3, 6, and 10, sampled in 2012 and Units 7, 5E, and 23E sampled in 2013 (Tetra Tech and EcoSystems West 2013a; Tetra Tech and EcoSystems 2014).

Multivariate statistics (cluster and ordination analyses) were used to assess whether there is a difference in species composition among transects (Jongman et al. 1995). These techniques are based on measures of dissimilarity between samples (transects). This analysis was conducted using the R vegan package (Oksanen 2011; R Development Core Team 2012).

The results of the cluster and ordination analyses indicate that there are structural patterns in the shrub community. Three major groups of transects are evident in the cluster analysis (Figure 2-3). The first group consists of four Unit 31 transects (group 1, red shading) and the second group includes six Unit 25 transects (group 2, green shading). The third group is represented by transects in both Unit 25 and Unit 31 (group 3, blue shading) with three Unit 25 transects and six Unit 31 transects.

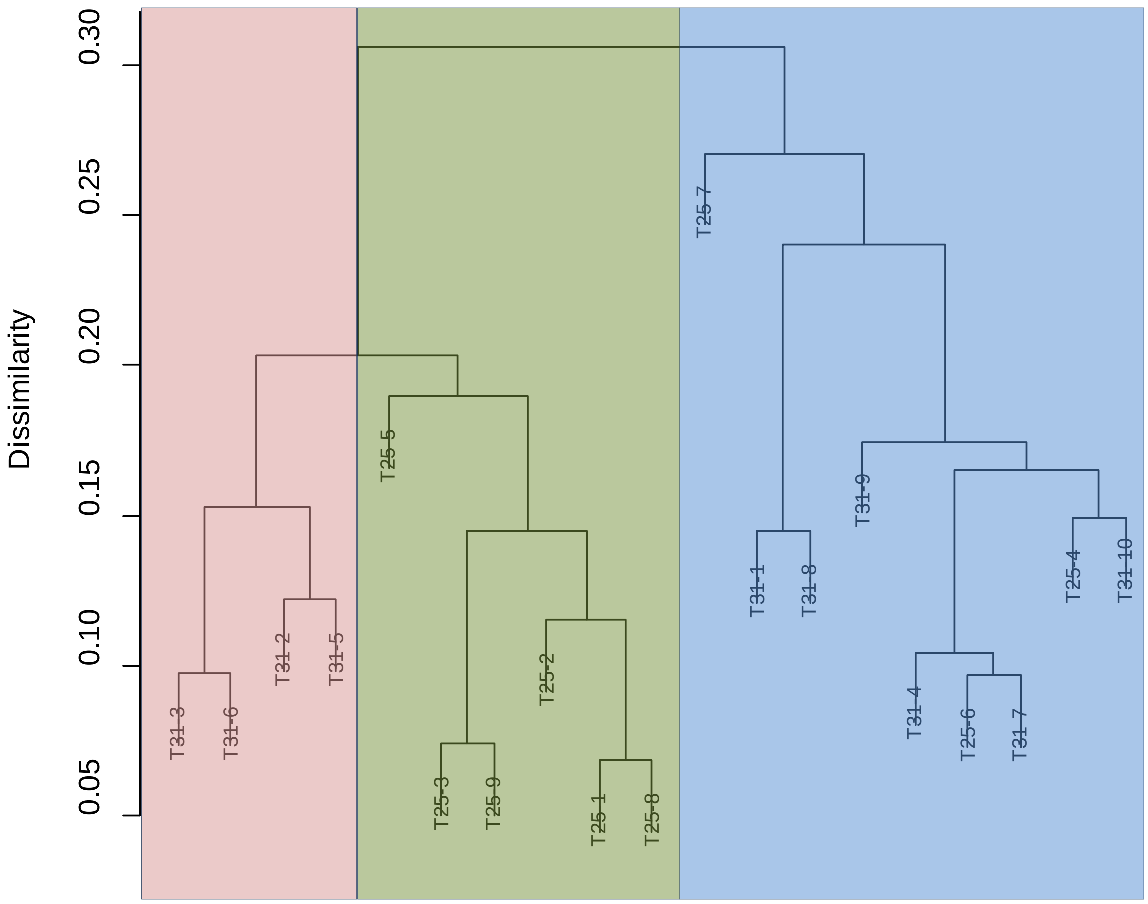

Figure 2-3 Cluster dendrogram of shrub transects on baseline Units. Groups 1 (rose shading) and 2 (green shading) are likely part of Association A, whereas Group 3 (blue shading) is part of Association B.

Analysis of variance (ANOVA) was conducted on the community structure metrics to test for differences between the three groups (Table 2-6). ANOVA indicated that there were significant differences in diversity and evenness between groups whereas there was no significant differences in species richness or total cover. This indicates that differences between the groups is due to changes in dominance of the species.

Table 2-6
Summary of Analysis of Variance Analyses of Community Structure Metrics among Identified Groups

Metric	df(Groups)	df(error)	F	p
Total cover	2	16	0.22	0.81
Species richness	2	16	0.92	0.42
Diversity	2	16	5.25	0.018
Evenness	2	16	6	0.011

Dominant shrubs in these groups included chamise, shaggy-barked manzanita, black sage, and Monterey ceanothus (Figure 2-4). In each group, shrub communities are primarily dominated by shaggy-barked manzanita and chamise with smaller proportions of black sage and Monterey ceanothus. It appears that groups 1 and 2 are part of Association A described for baseline communities in Tetra Tech (2013b) which is dominated by shaggy-barked manzanita with an average percent cover of 68.4% and chamise with an average percent cover of 18.7% with small proportions of other species. In contrast, group 3 may be similar to Association B based on a high average percent cover of Chamise and lower cover of shaggy-barked manzanita. However, the percent cover of shaggy-barked manzanita is approximately twice that expected for Association B. These sub-groups are distinguished by differing proportions of shrub species.

In group 1, median percent cover values for shaggy-barked manzanita and chamise are approximately 66 and 24, respectively. Black sage and Monterey ceanothus were also present with median percent cover values of 7.5 and 7.5, respectively.

In group 2, median percent cover values for shaggy-barked manzanita and chamise are approximately 80 and 20, respectively. Black sage and Monterey ceanothus were also present in very low proportions with median percent cover values of 1 and 2.5, respectively.

In group 3, median percent cover values for shaggy-barked manzanita and chamise are approximately 55 and 45, respectively. Black sage and Monterey ceanothus were also present in very low proportions with median percent cover values of 2 and 4, respectively. The higher percent cover of chamise and lower percent cover of shaggy-barked manzanita in these transects as compared to groups 1 and 2 provides some indication that these transects may fit with the previously defined Association B (Tetra Tech 2013b).

2.4.5. Annual Grass Monitoring

Annual grass 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 Units (Map A6-1 and Map A6-3). There was a large area of moderate to high density grasses near the southern end of Unit 25 where it abuts Unit 31. Estimated areas occupied by annual grasses are summarized in Table 2-7.

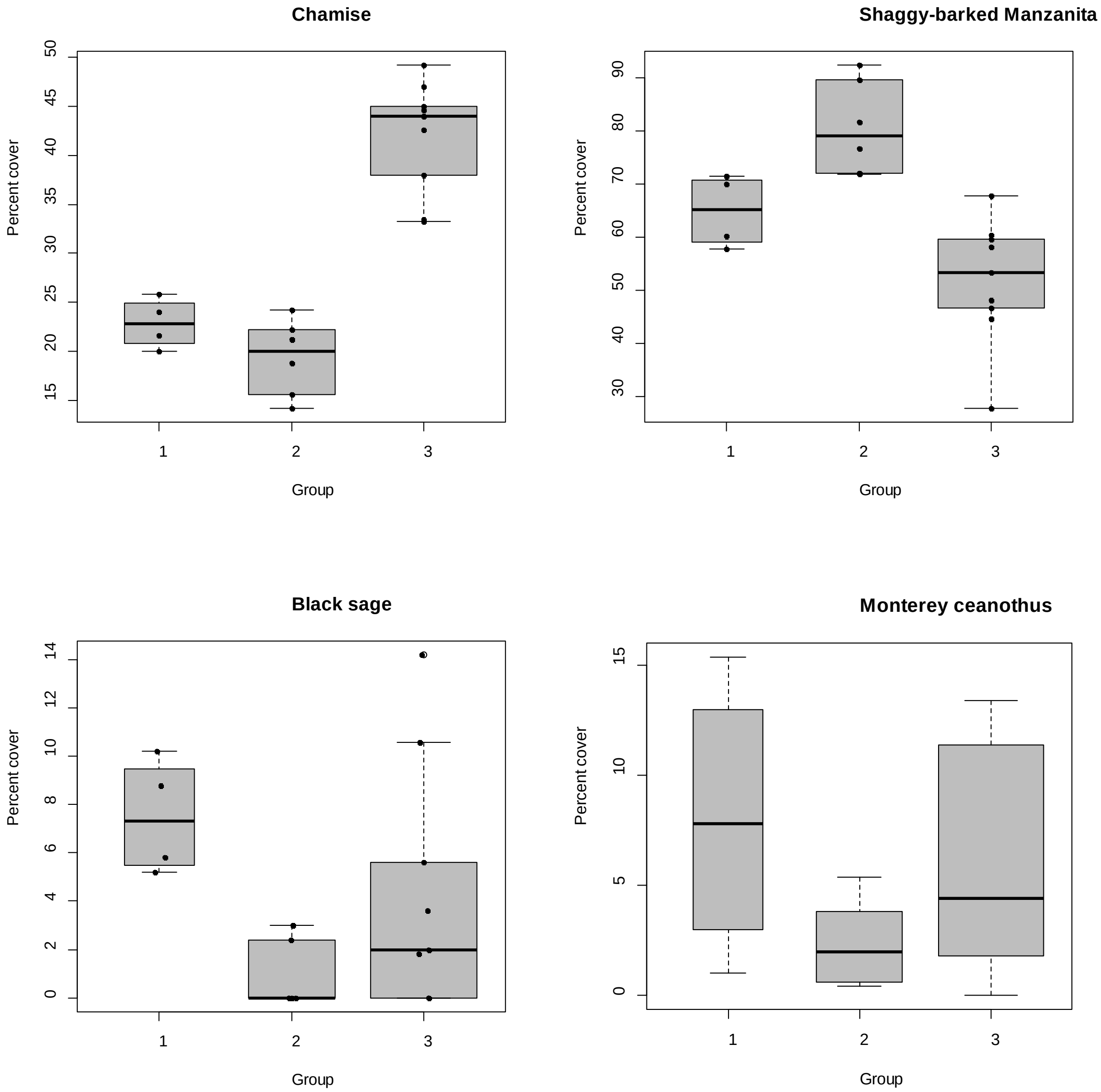

Figure 2-4 **Percent cover of chamise, shaggy-barked manzanita, black sage, and Monterey ceanothus in identified shrub associations. Black lines represent the median value and the grey boxes represent the 25th to 75th percentiles of the data. The whiskers represent the non-outlier range of the data.**

Table 2-7
Estimated Area Occupied (Acres) by Annual Grasses in Baseline Surveys

Cover Class	Unit 25	Unit 31
1 (low) = 1–5 percent	2.63	1.81
2 (medium) = 6–25 percent	2.12	1.43
3 (high) = >25 percent	7.32	1.42
Total Acreage	**12.07**	**4.65**

2.4.6. Invasive Species Monitoring

Pampas grass was observed at 8 locations within Unit 25 (Map A6-2). Iceplant was identified at a single location at the southern end of Unit 25. No invasive species were observed in Unit 31.

SECTION 3

Year 1 Vegetation Monitoring – Units 6, 7, 10, 33, MOUT Buffer, and Watkins Gate Burn Area

3.1. Units 6, 7, 10, 33, MOUT Buffer, and Watkins Gate Burn Area – Introduction

In fall 2013, all of Unit 6, a buffer around the Military Operations, Urban Terrain (MOUT) area, and the unburned portions of the Watkins Gate Burn Area (WGBA Unburned Area) were masticated in their entirety (Figure 3-1). A controlled burn was not conducted on these Units.

A prescribed burn of Units 7 and 10 was conducted on 14 and 15 October 2013. During the afternoon of 15 October, the controlled burn briefly jumped the fuel break and unintentionally burned approximately 92.7 acres of Unit 33 and 8.5 acres of Unit 4. The fire was brought under control several hours later without serious incident. Although baseline data was not gathered for Unit 33, the remaining non-burned portion of this unit was masticated in its entirety and monitored in 2014 as Year 1 post-treatment. Baseline monitoring of Units 6 and 10 was performed in 2012. Baseline monitoring was conducted in Unit 7 in 2013. The baseline monitoring included meandering transect surveys to map occurrences of HMP herbaceous species; conduct density monitoring for the HMP annual species Monterey spineflower, sand gilia, and seaside bird's-beak; perform transect surveys to sample shrub composition in the maritime chaparral; and annual grass monitoring in the primary containment areas around the perimeters of these units, where applicable. Baseline monitoring of the MOUT and WGBA was performed in 2011.

The Year 1 follow-up monitoring was conducted in the spring of 2014 in these six Units in order 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. Shrub transect monitoring was not conducted in 2014 because the shrub cover was only beginning to recover from the disturbance.

3.2. Units 6, 7, 10, 33, MOUT Buffer, and Watkins Gate Burn Area – Setting

Unit 6 encompasses an area of 70 acres, and is located at the south end of the former Fort Ord, with the base boundary forming part of the southern boundary of the unit (Figure 3-1). The topography consists of portions of two parallel east-west-trending ridges along the northern and southern periphery of the unit, with a broad lower-lying area – the upper headwaters of a west-draining canyon – in the central portion. In baseline condition, the vegetation of Unit 6 consisted of a mosaic of mature maritime chaparral and extensive disturbed areas, with limited areas of coast live oak woodland in the southern third of the unit. Mature maritime chaparral occupied much of the eastern half of the unit, and was of lesser extent in the extreme western portion. Shaggy-barked manzanita was the principal dominant in this chaparral. Other dominants included chamise and black sage (Tetra Tech and EcoSystems-West 2014). Much of Unit 6, especially the central and south-central portions, has a history of extensive heavy disturbance. Vegetation of disturbed areas in baseline condition ranged from areas dominated by non-native annual grasses and associated herb species, also largely non-native, to a sizable area near the center of the unit that was largely bare, with only sparse vegetation. A large area in the south-central portion of the unit was heavily infested with large clumps of the invasive, non-native perennial grass pampas grass (*Cortaderia* sp.), although the density of pampas grass in the area had been considerably reduced in recent years by eradication efforts. The northwestern portion of the unit was vegetated with maritime chaparral that had been subject to considerable past disturbance, consisting of clumps of chaparral shrubs interspersed with open areas vegetated with mostly non-native grasses and herbs.

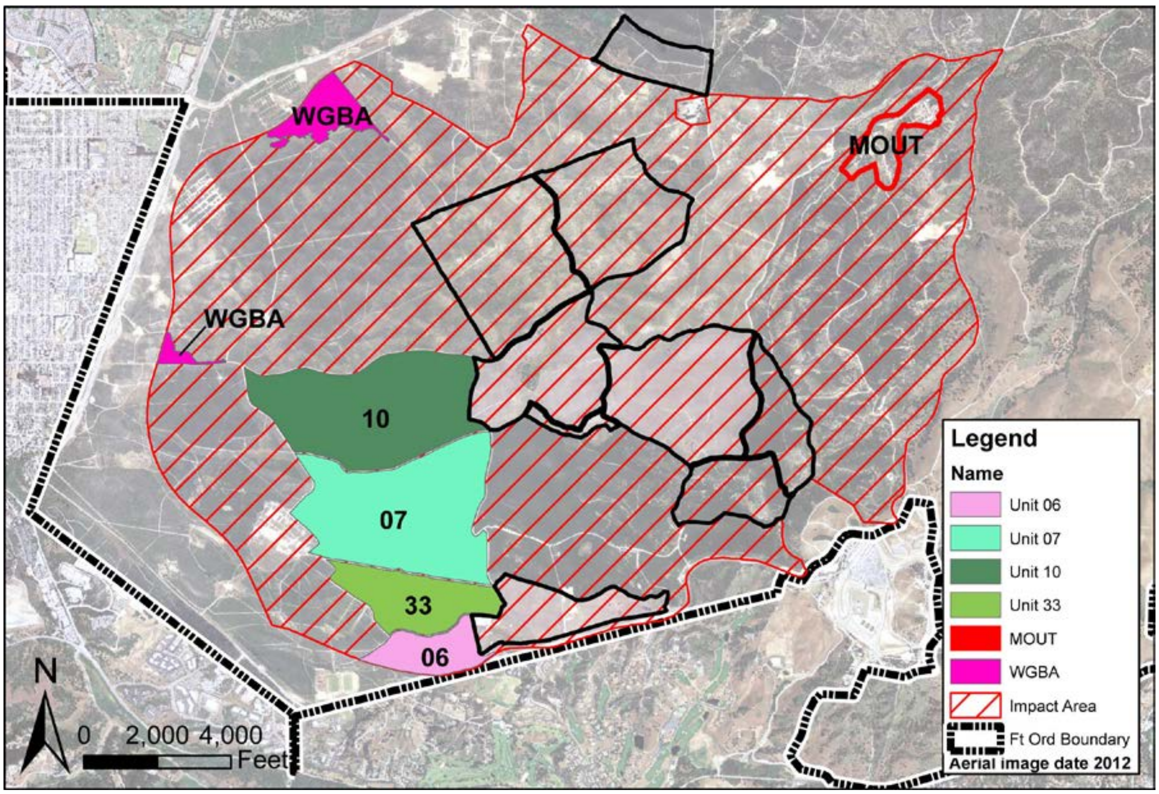

Figure 3-1 Year 1 Units surveyed in 2014.

Unit 7 encompasses an area of 340 acres, of which 124 acres are within the 300-foot-wide primary containment mastication area and the remaining 216 acres are in the interior of the unit for which prescribed burning only, without mastication, was conducted (Figure 3-1). The unit is located south of Nowhere Road and north of Phoenix Road in the southwest portion of former Fort Ord. In general, Unit 7 slopes down from east to west with several prominent north-south trending ridges. Abandoned roads with varying amounts of vegetative overgrowth follow these ridgelines providing some degree of unobstructed access to the interior portions of the unit.

Under baseline conditions, Unit 7 was almost entirely vegetated with mature maritime chaparral varying considerably in physiognomy and species composition with the exception of a few meadow grasslands in lowland basins throughout the unit (Tetra Tech and EcoSystems-West 2014). Relatively open chaparral was most extensive in the southeast along ridgelines and south facing slopes in areas that appeared to be more recently disturbed, during active use of the range by the military. As in maritime chaparral throughout Fort Ord, shaggy-barked manzanita was the most characteristic dominant. Other characteristic shrubs that were often dominant or co-dominant included chamise, black sage, sandmat manzanita, Monterey ceanothus, and poison-oak. Three sizable areas of meadow grassland habitat, dominated by native and non-native grasses and forbs, occur in the unit. The largest meadow, located in the east-central portion of Unit 7, is dominated primarily by a mix of upland and wetland herbaceous vegetation. In years of average to above average rainfall, standing water typically forms a contiguous seasonal pond lasting into spring; however, due to below average precipitation over the past several years, this feature was completely dry during the 2013 and 2014 monitoring. Although numerous individual coast live oak trees are scattered throughout the unit and small stands occur surrounding the meadow margins, well developed coast live oak woodland does not occur elsewhere in this unit. Disturbed areas are of limited extent in this unit, and mostly occur along old roads and fuel breaks. However, a large lead remediation area encroaches on the southwest corner of Unit 7 near the intersection of Austin Road and Phoenix Road. This area remains largely denuded of vegetation and topsoil and is currently planned for future restoration and revegetation activities.

Unit 10 encompasses a total area of 327 acres, of which 87 acres are within the 239-foot-wide primary containment mastication area and the remaining 240 acres are in the interior of the unit where prescribed burning was conducted. The unit is located south of Watkins Gate Road in the west-central portion of the area of the base (Figure 3-1). The unit is dominated by a prominent ridge (presumably a fossil dune ridge) running east-west across the center of the unit. Elsewhere in the unit the terrain is gently rolling.

In baseline condition, Unit 10 was almost entirely vegetated with mature maritime chaparral varying considerably in physiognomy and species composition (Tetra Tech and EcoSystems-West 2013). The chaparral shrubs ranged from low (3-4 feet) to tall (12-15 feet), and shrub density ranged from relatively open, with numerous openings of various sizes, to essentially 100 percent areal cover. Relatively open chaparral was most extensive on the upper parts of the main ridge, where chaparral with this physiognomy was continuous almost all the way across the unit. Similar to Unit 7, shaggy-barked manzanita is the most characteristic dominant where vegetation is tall and dense. Other shrubs such as chamise, black sage, sandmat manzanita, Monterey ceanothus, and poison-oak are dominant or co-dominant elsewhere in the unit. Two sizable areas of meadow habitat, dominated by native and non-native grasses and herbs, occur in the southwestern portion of the unit. One sizable stand of coast live oak woodland occurs in the north-central portion of the unit. Although numerous individual coast live oak trees are scattered throughout the remainder of the unit, and small stands occur in the southwestern portion of the unit, well developed coast live oak woodland does not occur elsewhere in this unit. Disturbed areas are of limited extent in this unit, and mostly occur along old roads and fuel breaks.

Unit 33 comprises 124 acres and consists of rolling to locally steep topography (Figure 3-1). In general the unit slopes down from south to north and is bisected by narrow east-west trending valley. The unit is located south of Phoenix Road and west of Evolution Road. As mentioned previously, a prescribed burn in October 2013 in Units 7 and 10 accidentally jumped a fuel break and burned 92.7 acres of Unit 33. It was decided that this unit should be included in its entirety for ongoing munitions clearance and the remaining approximately 31.3 acres were masticated later that year.

Unit 33 was not observed in detail in baseline condition due to the accidental circumstances under which it was initially burned and eventually masticated. Incidental observations in previous monitoring years and a review of historic aerial photographs indicate the unit was dominated almost entirely by mature maritime chaparral with fairly homogeneous physiognomy. It appears the unit was comprised primarily of tall, dense shrubs most likely dominated by shaggy bark manzanita. One sizeable vernal pool is located in the west central portion of the unit although due to below average precipitation, it was completely dry during the 2014 monitoring. Coast live oaks are present within the unit along the margins of the vernal pool as well as one relatively small stand in the north-central portion of the unit.

The MOUT Buffer Area encompasses an area of 22 acres (Figure 3-1). This area consists of a zone approximately 99 feet wide encircling the periphery of the MOUT area containing the Impossible City training facility in and east of Impossible Canyon. The terrain within the MOUT Buffer Area ranges from nearly level to steep. In baseline conditions, the area was vegetated with a mosaic of mature maritime chaparral, non-meadow grassland, and coast live oak woodland, with some localized areas of heavy disturbance (Tetra Tech 2012). A portion of this area was burned in an accidental fire in 2003.

The unburned portions of the Watkins Gate Burn Area (WGBA Unburned Area) encompass 72 acres, divided into two non-contiguous portions (Tetra Tech and EcoSystems-West 2012) (Figure 3-1). The larger northern portion (61 acres) is in the northeast corner of the Watkins Gate Burn Area, west of the north end of Evolution Road; the smaller southern portion (11 acres) is in the southwest corner of the Watkins Gate Burn Area, north of Watkins Gate Road. The terrain is level to gently rolling, with mostly low local relief. In baseline condition, the southern area was vegetated primarily with mature maritime chaparral in its western portion, with smaller areas of coast live oak woodland interspersed; the eastern portion of the WGBA was vegetated primarily with about 28 acres of dense coast live oak woodland, interspersed with areas of maritime chaparral of varying sizes (Tetra Tech 2012). Sizable disturbed areas occur in the westernmost area of the northern portion; some areas of maritime chaparral in the eastern portion were also subject to soil remediation activities that removed or reduced the coast live oak canopy. The southern area was vegetated in baseline condition almost entirely with mature maritime chaparral with numerous openings, with the exception of a small seasonal wetland adjacent to Blueline Road.

The U.S. Department of Agriculture (USDA 2014) maps the Arnold-Santa Ynez complex as occurring in all of Units 6, 7, 33, as well as most of Unit 10 and a small portion of the WGBA Unburned Areas. The soil in the northwest corner of Unit 10 and remaining portions of WGBA

Unburned Areas is mapped as Baywood sand, 2 to 15 percent slopes. A more complex mosaic of unique soil types occurs in the MOUT Buffer Area. The distribution of soils in the Year 1 survey areas and characteristics of these soils are presented in Table 2-1.

3.3. Units 6, 7, 10, 33, MOUT Buffer, and Watkins Gate Burn Area – Methods

The 2014 Year 1 follow-up monitoring consisted of the following:

- Meandering transect surveys in Unit 33 to locate and map herbaceous HMP species.
- Repeat density monitoring for three HMP annual species: Monterey spineflower, sand gilia, and seaside bird's-beak on Units 6, 7, 10, MOUT buffer, and WGBA.
- Mapping of non-native annual grasses within the primary containment areas.
- Mapping of invasive species, including iceplant, pampas grass, and French broom, where encountered.

3.3.1. Meandering Transects

Meandering transect surveys were conducted in Unit 33 on 14 and 21 April 2014. These surveys were conducted similarly to those for baseline units (Section 2.3.1) as none were conducted prior to treatment for this unit. Species surveyed for included six HMP herbaceous species: the biennial to perennial species coast wallflower and Yadon’s piperia, well as the annual species Monterey spineflower, sand gilia, seaside bird’s-beak, and Contra Costa goldfields. The timing of this surveying was optimal for locating and identifying coast wallflower, Monterey spineflower, sand gilia, and Contra Costa goldfields, as the surveying was conducted during the flowering period of these species. Seaside bird’s-beak and Yadon’s piperia had not yet flowered when the meandering transect survey was conducted but the species were readily identifiable by their vegetative characteristics.

When an HMP herbaceous species was observed during meandering transect surveying, a recreational-grade Global Positioning System (GPS) unit (Garmin 62S) was used to record the location. The HMP species present in the vicinity of each point were also recorded. The base-wide system of 100×100 foot grids was then used for mapping HMP herbaceous species. All GPS coordinates for HMP herbaceous species observed during meandering transect surveying were plotted onto a map of the grids. A list was then compiled of all grids within the baseline areas that contained one or more HMP herbaceous species and used as the basis for selection of grids to be monitored.

3.3.2. HMP Annuals Density Monitoring

Year 1 follow-up density monitoring for the three HMP annual species in Units 7, 10, MOUT Buffer Area, and WGBA Unburned Areas was conducted between 29 April and 12 May 2014. 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 but was readily identifiable by its vegetative characteristics. In the baseline monitoring conducted in 2011

(MOUT, WGBA), 2012 (Unit 10), and 2013 (Unit 7), sample grids were selected by stratified random sampling from among all 100×100 foot grids mapped during meandering transect surveying as containing one or more of the three HMP annual species, with the sampling stratified to ensure adequate representation of both Monterey spineflower and sand gilia (the only HMP annual species mapped in the unit during meandering transect surveying in 2011). Because there were fewer than 38 grid squares containing HMP annuals in the MOUT Buffer Area, all four occupied grid squares in that unit were sampled in 2014. No HMP herbaceous species other than Yadon's piperia were located in Units 6 and 33. Yadon's piperia is not monitored for density, but rather mapped a unique occurrences at every location found.

All grids in Units 7, 10, MOUT Buffer Area, and WGBA Unburned Areas that were sampled in the baseline year were resampled in 2014 following the procedures described in Section 2.3.2 for baseline monitoring. Following treatment, the corners of all grids in these burn units were staked with wooden laths and the grid numbers were marked on the lath at the southwest corner of each grid, facilitating identification of the grids sampled. For some of the grids in these units, only a portion of the grid was sampled because part of the grid extended into a road, a permanently cleared fuel break area, or was outside the unit.

Once the grids to be sampled were located, sampling was conducted as described for the baseline monitoring (Section 2.3.2), and the same density classes were used. When only a portion of the grid was sampled, the density classes were scaled proportional to the percentage of the total grid sampled.

3.3.3. Annual Grass Monitoring

Non-native annual grass monitoring was conducted within the primary containment lines surrounding Units 7 and 10. All of Units 6, 33, and the MOUT Buffer Area were monitored for non-native annual grasses as they were masticated in their entirety or accidentally burned with no plans for additional prescribed burning. WGBA was not monitored for annual grasses in 2014 due to access restrictions and uneven mastication treatments. Annual grass monitoring in these areas occurred between 24 and 26 June 2014. Annual grass species included in this monitoring were the same species as in the baseline areas annual grass monitoring. Annual grass monitoring was conducted using the same methodology and density classes as those used in the baseline monitoring.

3.3.4. Invasive Species

Invasive species, including iceplant, pampas grass, and French broom, were encountered incidentally during the meandering transect survey and the HMP annuals density monitoring and shrub transect monitoring. When invasive species were encountered, the locations were mapped using a recreational-grade GPS unit. A comprehensive survey for invasive species was not conducted.

3.4. Units 6, 7, 10, 33, MOUT Buffer, and Watkins Gate Burn Area – Results and Discussion

Density monitoring was not conducted in Units 6 or 33 because no HMP annuals were observed during the baseline meandering transect surveys. Maps of survey grids for the sampled Units are provided in Appendix A3.

3.4.1. Sand Gilia

Overall, sand gilia was present in 22 (16 %) of the 135 grids sampled in the baseline survey and 44 (33 %) of the 135 grids sampled in 2014 (Table 3-1; Maps A2-1, A2-6, and A2-13) predominantly due to a doubling in frequency of occurrence in Unit 10. In Unit 10, sand gilia increased from an average density class of 0.3 to an average density class of 1.5. Frequency of occurrence and average density class did not change significantly in Unit 7 or in the MOUT or WGBA areas.

3.4.2. Seaside Bird's-Beak

Seaside bird's-beak did not show a response to the effects of the 2014 prescribed burn in either density or frequency of occurrence. The species was absent in all of the baseline grids. However, it was found in 3 of the 135 grids sampled in Units 7 and 10 in 2014 (Table 3-2; Maps A2-2, A2-7, and A2-14) at very low densities.

3.4.3. Monterey Spineflower

The Monterey spineflower is the most frequently occurring and has the highest densities of the three species considered in this monitoring program. In the baseline surveys, the species was present in 134 of the 135 grids sampled (Table 3-3; Maps A2-3, A2-8, and A2-15). In 2014 (post-treatment), the species was present in 128 of the 135 sampled grids. Densities declined slightly in Units 7 and 10, and in the WGBA, but increased slightly in the MOUT.

3.4.4. Yadon's Piperia

Yadon's piperia was observed on the eastern side of Unit 6 (Map A2-13), and at five locations along the southwest boundary of Unit 23 (Map A2-14).

Table 3-1
Sand Gilia – Number of Grids per Density Class in Units 7, 10, MOUT and WGBA

Density	Unit 7 Grids		Unit 10 Grids		MOUT grids		WGBA Grids	
	Baseline	**2014**	**Baseline**	**2014**	**Baseline**	**2014**	**Baseline**	**2014**
0 plants/grid (percent of grids)	36 (95%)	35 (92%)	39 (71%)	17 (31%)	1 (25%)	2 (50%)	37 (97%)	37 (97%)
1–50 plants/grid (percent of grids)	2 (5%)	2 (5%)	16 (30%)	19 (35%)	2 (50%)	2 (50%)	1 (3%)	1 (3%)
51–100 plants/grid (percent of grids)	0 (0%)	1 (3%)	0 (0%)	3 (5%)	1 (25%)	0 (0%)	0 (0%)	0 (0%)
101–500 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	6 (11%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>500 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	10 (18%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Average Density Class	**0.05**	**0.1**	**0.3**	**1.5**	**1.0**	**0.5**	**0.03**	**0.03**
Number of Occupied Grids	**2**	**3**	**16**	**38**	**3**	**2**	**1**	**1**
Total Grids Sampled	**38**	**38**	**55**	**55**	**4**	**4**	**38**	**38**

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

Table 3-2
Seaside Bird's-Beak – Number of Grids per Density Class in Units 7, 10, MOUT and WGBA

	Unit 7 Grids		Unit 10 Grids		MOUT grids		WGBA Grids	
Density	**Baseline**	**2014**	**Baseline**	**2014**	**Baseline**	**2014**	**Baseline**	**2014**
0 plants/grid (percent of grids)	38 (100%)	37 (97%)	55 (100%)	53 (96%)	4 (100%)	4 (100%)	38 (100%)	38 (100%)
1–50 plants/grid (percent of grids)	0 (0%)	1 (3%)	0 (0%)	2 (4%)	0 (0%)	0 (0%)	0 (3%)	0 (3%)
51–100 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
101–500 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>500 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Average Density Class	**0.0**	**0.03**	**0.0**	**0.04**	**0.0**	**0.0**	**0.0**	**0.0**
Number of Occupied Grids	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**0**
Total Grids Sampled	**38**	**38**	**55**	**55**	**4**	**4**	**38**	**38**

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

Table 3-3
Monterey Spineflower – Number of Grids per Density Class in Units 7, 10, MOUT and WGBA

Density	Unit 7 Grids		Unit 10 Grids		MOUT grids		WGBA Grids	
	2013	2014	2013	2014	2013	2014	2013	2014
0 plants/grid (percent of grids)	1 (3%)	2 (5%)	0 (0%)	4 (7%)	0 (0%)	0 (0%)	0 (0%)	1 (3%)
1–50 plants/grid (percent of grids)	4 (11%)	12 (31%)	18 (33%)	30 (55%)	2 (50%)	1 (25%)	9 (24%)	16 (42%)
51–100 plants/grid (percent of grids)	0 (0%)	3 (8%)	8 (15%)	7 (13%)	0 (0%)	0 (0%)	2 (5%)	5 (13%)
101–500 plants/grid (percent of grids)	3 (8%)	8 (21%)	17 (31%)	11 (20%)	2 (50%)	3 (75%)	9 (24%)	8 (21%)
>500 plants/grid (percent of grids)	30 (81%)	13 (34%)	12 (22%)	3 (6%)	0 (0%)	0 (0%)	18 (47%)	8 (21%)
Average Density Class	**3.5**	**2.5**	**2.4**	**1.6**	**2.0**	**2.5**	**2.9**	**2.2**
Number of Occupied Grids	**37**	**36**	**55**	**51**	**4**	**4**	**38**	**37**
Total Grids Sampled	**38**	**38**	**55**	**55**	**4**	**4**	**38**	**38**

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

3.4.5. Effect of Treatment on HMP Density

To assess whether treatment had an effect on the subsequent density of the HMP annual plants, the average density class for each species, treatment, and Unit was determined for each of the two monitoring years (Figure 3-2). No consistent pattern in response to treatment was observed among species or within Units.

Seaside bird's-beak showed no response to any of the treatments as it was present infrequently and a very low densities if present.

The MOUT and WGBA were masticated only. Sand gilia decreased in the MOUT and showed no response in the WGBA. In contrast, Monterey spineflower increased in density in the MOUT but decreased in density in the WGBA in response to mastication.

Units 7 and 10 included both masticated and burned areas. Sand gilia increased in density in Unit 10 and showed no response in Unit 7. Monterey spineflower decreased in density in response to burning in both units.

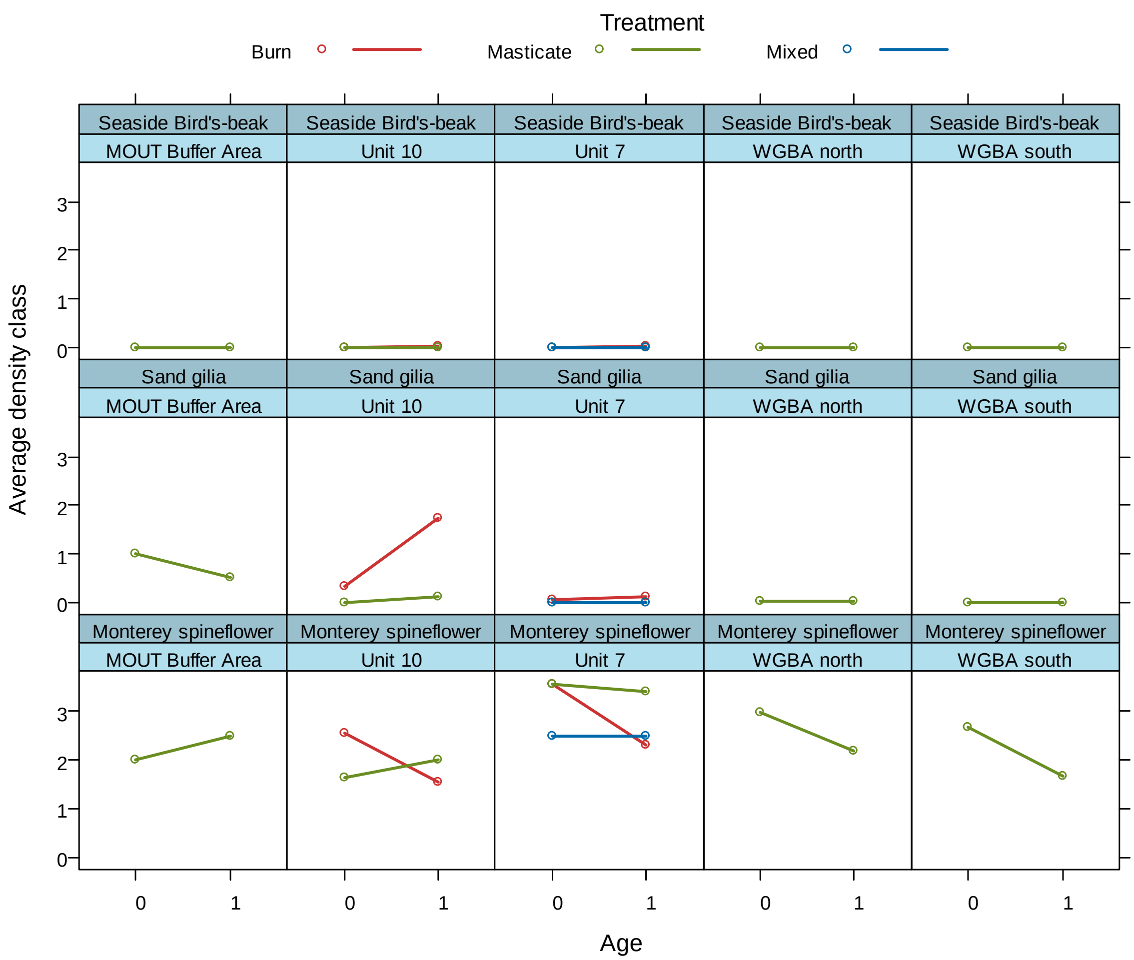

Figure 3-2 Average density class of each HMP annual species plotted by Unit and age.

3.4.6. Annual Grass Monitoring

Annual grass surveys were limited to the periphery of the Units. Estimated areas occupied by annual grasses in Year 1 are summarized in Table 3-4. The area occupied by annual grasses ranged from 0 acres in WGBA to nearly 59 acres in Unit 10. In Unit 6 annual grasses occupy the western half of the Unit (Map A6-4). In Unit 7, grasses are limited to the periphery of the Unit adjacent to the roads (Map A6-6). In Unit 10, grasses are present throughout the primary containment lines along the northern and western boundaries (Map A6-7). Grasses can be found along the northern and portions of the western boundary of Unit 33 (Map A6-8). In the MOUT, grasses are found throughout the primary containment lines (Map A6-11). No annual grasses were observed in the WGBA (Map A6-10).

Table 3-4
Estimated Area Occupied (Acres) by Annual Grasses in Year 1 Surveys in Units 6, 7, 10, 33, WGBA, and MOUT

Cover Class	Unit 6	Unit 7	Unit 10	Unit 33	MOUT	WGBA
1 (low) = 1–5 percent	9.82	3.95	39.50	3.20	5.76	0.00
2 (medium) = 6–25 percent	13.51	1.97	10.50	2.62	5.04	0.00
3 (high) = >25 percent	16.27	4.77	8.97	1.83	8.62	0.00
Total Acreage	**39.60**	**10.69**	**58.98**	**7.65**	**19.42**	**0.00**

3.4.7. Invasive Species Monitoring

French broom was observed at one location along the southern boundary of Unit 6 (Map A6-5). Pampas grass was observed at eight locations at the western end of Unit 33 (Map A6-9).

SECTION 4

Year 3 Vegetation Monitoring – Units 4, 11, 12, and 23 North

4.1. Units 4, 11, 12, and 23 North – Introduction

All of Units 4, 11, and 12 and a small portion of Unit 23 (Unit 23 North) located adjacent to the southeastern end of Unit 11 and the southwestern end of Unit 12, were masticated in late summer and early fall 2011 (Figure 1-2). No controlled burns were conducted on any of these units. Baseline monitoring was conducted in spring and early summer 2011, prior to mastication of these four units (Tetra Tech and EcoSystems West 2012), and included meandering transect surveys to map areas of occurrence of HMP herbaceous species; density monitoring for the HMP annual species Monterey spineflower, sand gilia, and seaside bird's-beak; transect surveys to sample shrub composition in the maritime chaparral; and annual grass monitoring in the primary containment areas around the perimeters of Units 11, 12, and the portion of Unit 23 included in the 2011 monitoring (Tetra Tech and EcoSystems West 2012).

Year 1 follow-up monitoring was conducted in the spring and early summer of 2012 in these four units in order 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. Year 3 follow-up monitoring was conducted in these units in spring 2014.

4.2. Units 4, 11, 12, and 23 North – Setting

Unit 4 encompasses an area of 145 acres (Figure 4-1). This unit is located at the south end of former Fort Ord, adjacent to Unit 6 to the east. The terrain is mostly gently rolling to moderately steep. In baseline condition, this unit was vegetated primarily with mature maritime chaparral largely dominated by shaggy-barked manzanita. Other dominants sometimes include such species as sandmat manzanita, Monterey manzanita, chamise, and black sage. Sizable areas of coast live oak woodland and grassland occur in the eastern portion of the unit. Scattered individual trees or small clumps of coast live oak occur elsewhere in the unit. Disturbed areas of various sizes occur in the unit, including several areas in the extreme western portion where soil had been removed for lead remediation at some time prior to the 2011 baseline monitoring. In October 2014, a prescribed burn in Units 7 and 10 jumped the fuel break and burned approximately 8.5 acres of the northwest corner of Unit 4 near the intersection of Phoenix Road and Evolution Road.

Unit 11 encompasses an area of 273 acres and Unit 12 encompasses an area of 203 acres (Figure 4-1). These Units are adjacent to each other in the south-central portion of the area of the. A small portion of Unit 23 (23 North) adjacent to the southeastern portion of Unit 12, encompassing 15.5 acres, was also included in the 2011 and 2012 monitoring. The terrain is gently rolling to locally steep. In baseline condition, these units were vegetated primarily with mature maritime chaparral.

Limited areas of coast live oak woodland occur in Units 11 and 12, more extensively in Unit 12. A large area of dry meadow habitat occurs in the northeastern portion of Unit 12, a sizable wetland occurs in the north-central portion of Unit 11, and a large vernal pool is located immediately south of Unit 23 North. Substantial areas of indurated sandstone outcrops occur in the south-central portion of Unit 11. Disturbed areas of various sizes occur on Unit 11 and, less extensively, on Unit 12.

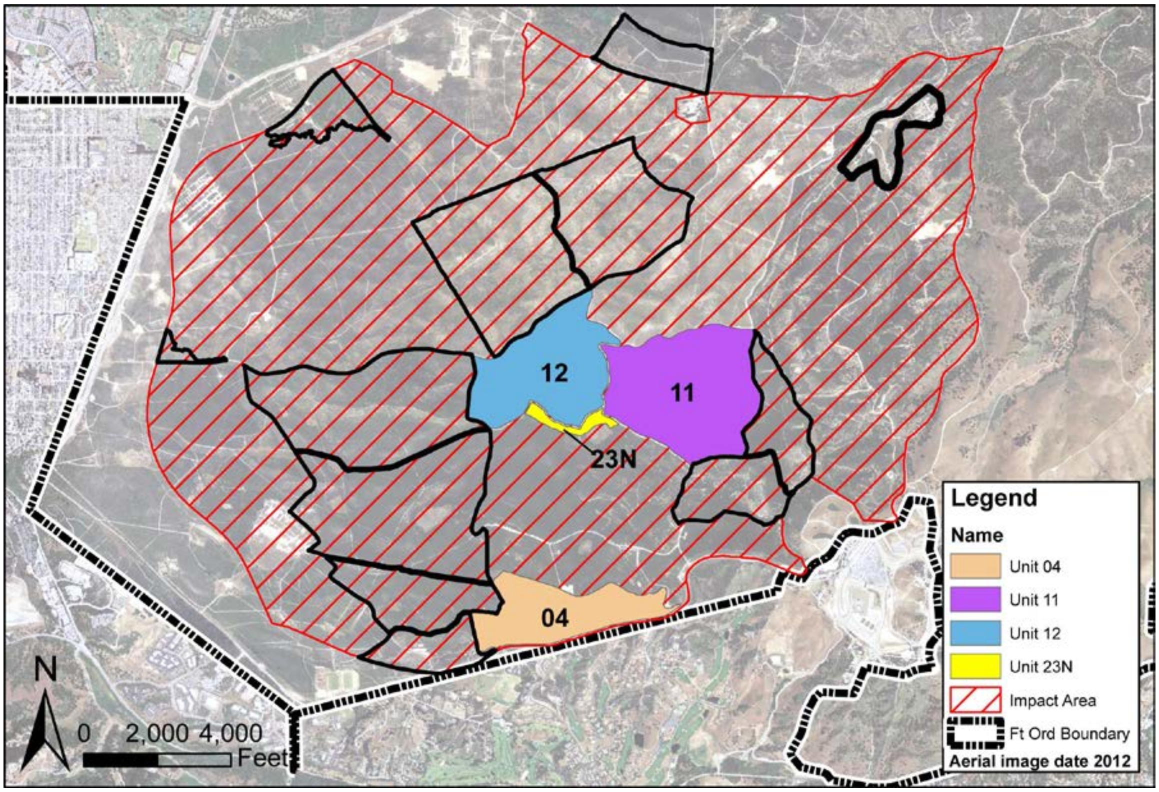

Figure 4-1 Year 3 Units surveyed in 2014.

According to the USDA (2012), the soil in all of Units 4, 12, and 23N included in 2014 Year 3 monitoring, and most of Unit 11 is Arnold-Santa Ynez complex. One small area in the southern portion of Unit 11 is mapped as Xerorthents, dissected soil. Characteristics of these soils are presented in Table 2-1. As in the baseline areas (Section 2.2), it is apparent in the field that two distinct variants of the Arnold-Santa Ynez complex soil type occur in these units, with the HMP annual species almost entirely confined to the variant characterized by coarser, looser sand mostly without pebbles.

4.3. Units 4, 11, 12, and 23 North– Methods

The 2014 Year 3 follow-up monitoring consisted of the following:

- 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 2011 (Tetra Tech and EcoSystems West 2012) to sample shrub species composition in the maritime chaparral that is recovering from past disturbance.
- Mapping of non-native annual grasses within portions of the units that will be primary containment areas when burning is conducted per USFWS (2011) requirements.
- Mapping of invasive species.

4.3.1. HMP Annuals Density Monitoring

Density monitoring for the three HMP annual species in Units 4, 11, 12 and 23N was conducted between 24 April and 6 May 2014. 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 but was readily identifiable by its vegetative characteristics. In the baseline monitoring conducted in 2011 (Tetra Tech and EcoSystems West 2012), sample plots in Unit 12 were selected by stratified random sampling from among all 100×100 foot grids mapped during meandering transect surveying as containing one or more of the three HMP annual species, with the sampling stratified to ensure adequate representation of both Monterey spineflower and sand gilia (the only HMP annual species mapped in the unit during meandering transect surveying in 2011). A total of 38 grids were sampled in Unit 12 in 2011. Because Unit 4 contained only two grids occupied by HMP annuals, Unit 11 contained only seven occupied grids, and 23N contained only three occupied grids, all occupied grids were sampled in 2011 baseline monitoring in these units. All grids sampled in the baseline monitoring were resampled in 2012 as part of Year 1 follow-up monitoring efforts.

All grids in Units 4, 11, 12, and 23N that were sampled in 2011 and 2012 were resampled in 2014. The methodology for the 2014 density monitoring in Units 4, 11, 12, and 23N was similar to that described above in Section 2.3.2 for the baseline monitoring. Following treatment, the corners of all grids in these burn units were staked with wooden laths and the grid numbers were marked on the lath at the southwest corner of each grid, facilitating identification of the grids sampled. For some of the Unit 11 and 23N grids, only a portion of the grid was sampled because part of the grid extended into a road, a permanently cleared fuel break area, a wetland, or outside the unit.

Once the grids to be sampled were located, sampling was conducted as described for the baseline monitoring (Section 2.3.2), and the same density classes were used. When only a portion of the grid was sampled, the density classes were scaled proportional to the percentage of the total grid sampled.

4.3.2. Shrub Transect Monitoring

Baseline shrub transect monitoring was conducted in Units 4, 11, 12 and 23 North in 2011 (Tetra Tech and EcoSystems West 2012). In 2014, a total of 14 transects in Unit 4, 23 transects in Unit 11, 18 transects in Unit 12, and 2 transects in Unit 23 North that were sampled in 2011 were resampled. Transect sampling in these units was conducted between 19 May and 9 June 2014.

All transects sampled in 2014 within Units 11, 12 and 23N were 50 meters in length. One transect in Unit 4 was not sampled in its entirety due to recent clearing and remediation work. The disturbed area was removed from sampling. When only a portion of a transect was sampled, the absolute percent cover of species and bare ground intersecting the transect were scaled proportional to the total length of the transect sampled. Additionally, one transect was located in the area accidentally burned in fall 2013. Since this area no longer represents Year 3 post-treatment, the transect was removed from sampling.

The surveyors used a resource grade Trimble GeoXH GPS receiver to locate the previously recorded start and end points of each transect sampled in the baseline monitoring. Once the start and end points were located, the transects were sampled using the line intercept method following the same methodology as in the baseline monitoring areas (Section 2.3.3).

If the herb cover recorded along a transect exceeded 20 percent, quadrat sampling was used to sample the herb composition along the transect, as specified by the monitoring protocol (Burleson 2009a). A 0.25 m^2 (0.5×0.5 m) quadrat frame was used for the quadrat sampling. The frame was placed next to the transect tape at 0–0.5 m from the start (right side of the transect tape), at 9.75–10.25 m (left side), at 19.75–20.25 m (right side), at 29.75–30.25 m (left side), at 39.75–40.25 m (right side), and at 49.5–50 m (left side). Percent cover of each shrub and herb species in each quadrat was estimated and recorded. For shrubs and HMP annual species, the number of individuals entirely or partly in the quadrat was also recorded. Mean percent cover for each species recorded in one or more quadrats along a transect was calculated for each transect from the data. Herb cover marginally exceeded 20 percent on only transect Unit 11-2 Therefore quadrat data were obtained for this transect.

4.3.3. Annual Grass Monitoring

Non-native annual grass monitoring was conducted within the proposed primary containment lines surrounding Units 4, 11, 12, and 23 North on 24 and 25 June 2014. However, all of the units were masticated in their entirety in fall 2011.

Annual grass species included in this monitoring were the same species as in the baseline areas annual grass monitoring (Section 2.3.4). Annual grass monitoring was conducted using the same methodology and density classes as those used in the baseline monitoring.

4.3.4. Invasive Species

Invasive species were mapped when encountered incidentally 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. A comprehensive survey for invasive species in Units 4, 11, 12, and 23 North was not conducted.

4.4. Units 4, 11, 12, and 23 North – Results and Discussion

These four Units were masticated in their entirety. No prescribed burning was conducted. Maps of survey grids for the sampled Units are provided in Appendix A3.

4.4.1. Sand Gilia

Sand gilia was present only in Unit 12, and did not show any change in average density class over time (Table 4-1; Map A3-10). Temporal changes in average density class in each Unit are shown in Figure 4-2. Frequency of occurrence (number of grids occupied) in Unit 12 declined in 2014 (Year 3) as compared to baseline (2011) and Year 1 (2012) conditions. This response may be due to the effects of the 2011-2014 drought.

4.4.2. Seaside Bird's-Beak

Seaside bird's-beak was absent in all grids sampled in Units 4, 11, 12, and 23N in 2011 (baseline), 2012, and 2014 (Table 4-2; Map A3-2, Map A3-6, Map A3-11, Map A3-15).

4.4.3. Monterey Spineflower

The Monterey spineflower is the most frequently occurring and has the highest densities of the three species considered in this monitoring program. In 2014, the species was present in 42 (84 %) of the 50 sampled grids (

Table 4-3; Map A3-3, Map A3-7, Map A3-12, Map A3-16). There is a slight reduction in frequency of occurrence as compared to the 2011 and 2012 surveys in which this species was present in 94 percent of the grids. In three of the four Units, the average density class declined in 2014 as compared to the previous surveys (Figure 4-2). This reduction in frequency of occurrence and average density in 2014 may be a result of the drought conditions occurring over the 2012-2014 period.

4.4.4. Yadon's Piperia

Yadon's piperia was observed in the middle portion of the eastern boundary of Unit 11 (Map A3-8).

4.4.5. Effect of Treatment on HMP Density

These four Units were masticated in their entirety. Therefore, the effect of treatment cannot be assessed.

Table 4-1
Sand Gilia – Number of Grids per Density Class in Units 4, 11, 12, and 23N

Density	Unit 4 Grids			Unit 11 Grids			Unit 12 Grids			Unit 23N Grids		
	2011	**2012**	**2014**	**2011**	**2012**	**2014**	**2011**	**2012**	**2014**	**2011**	**2012**	**2014**
0 plants/grid (percent of grids)	2 (100%)	2 (100%)	2 (100%)	7 (100%)	7 (100%)	7 (100%)	27 (71%)	25 (66%)	32 (84%)	3 (100%)	3 (100%)	3 (100%)
1–50 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (29%)	13 (34%)	6 (16%)	0 (0%)	0 (0%)	0 (0%)
51–100 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
101–500 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>500 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Average Density Class	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**0.3**	**0.2**	**0.0**	**0.0**	**0.0**
Number of Occupied Grids	**0**	**0**	**0**	**0**	**0**	**0**	**11**	**13**	**6**	**0**	**0**	**0**
Total Grids Sampled	**2**	**2**	**2**	**7**	**7**	**7**	**38**	**38**	**38**	**3**	**3**	**3**

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

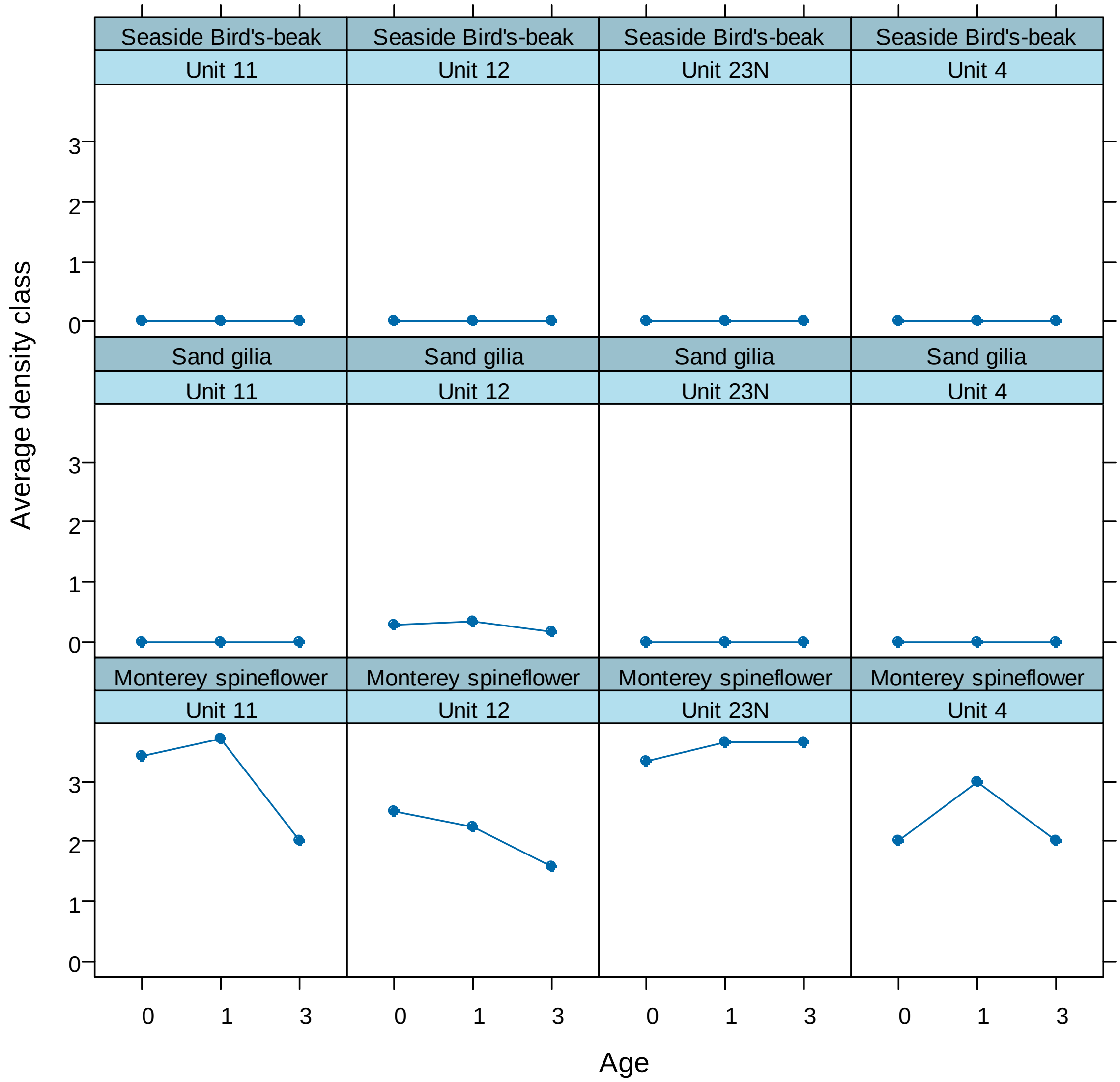

Figure 4-2 **Temporal changes in average density class of each HMP annual species in each Unit. These Units were masticated in their entirety.**

Table 4-2
Seaside Bird's-Beak – Number of Grids per Density Class in Units 4, 11, 12, and 23N

Density	Unit 4 Grids			Unit 11 Grids			Unit 12 Grids			Unit 23N Grids		
	2011	**2012**	**2014**	**2011**	**2012**	**2014**	**2011**	**2012**	**2014**	**2011**	**2012**	**2014**
0 plants/grid (percent of grids)	2 (100%)	2 (100%)	2 (100%)	7 (100%)	7 (100%)	7 (100%)	38 (100%)	38 (100%)	38 (100%)	3 (100%)	3 (100%)	3 (100%)
1–50 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
51–100 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
101–500 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>500 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Average Density Class	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Number of Occupied Grids	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Grids Sampled	**2**	**2**	**2**	**7**	**7**	**7**	**38**	**38**	**38**	**3**	**3**	**3**

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

Table 4-3
Monterey Spineflower – Number of Grids per Density Class in Units 4, 11, 12, and 23N

Density	Unit 4 Grids			Unit 11 Grids			Unit 12 Grids			Unit 23N Grids		
	2011	2012	2014	2011	2012	2014	2011	2012	2014	2011	2012	2014
0 plants/grid (percent of grids)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (0%)	3 (0%)	8 (0%)	0 (0%)	0 (0%)	0 (0%)
1–50 plants/grid (percent of grids)	1 (50%)	0 (0%)	1 (50%)	1 (0%)	0 (0%)	3 (0%)	9 (0%)	12 (0%)	14 (0%)	0 (0%)	0 (0%)	0 (0%)
51–100 plants/grid (percent of grids)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	2 (0%)	5 (0%)	5 (0%)	7 (0%)	1 (33%)	0 (0%)	0 (0%)
101–500 plants/grid (percent of grids)	1 (50%)	0 (0%)	1 (50%)	1 (0%)	2 (0%)	1 (0%)	8 (0%)	9 (0%)	4 (0%)	0 (0%)	1 (33%)	1 (33%)
>500 plants/grid (percent of grids)	0 (0%)	1 (50%)	0 (0%)	5 (0%)	5 (0%)	1 (0%)	13 (0%)	9 (0%)	5 (0%)	2 (67%)	2 (67%)	2 (67%)
Average Density Class	**2.0**	**3.0**	**2.0**	**3.4**	**3.7**	**2.0**	**2.5**	**2.2**	**1.6**	**3.3**	**3.7**	**3.7**
Number of Occupied Grids	**2**	**2**	**2**	**7**	**7**	**7**	**35**	**35**	**30**	**3**	**3**	**3**
Total Grids Sampled	**2**	**2**	**2**	**7**	**7**	**7**	**38**	**38**	**38**	**3**	**3**	**3**

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

4.4.6. Shrub transects

A total of 53 transects were sampled in Units 4, 11, 12, and 23N during 2014 (Maps A3-4, A3-9, A3-13, and A3-17). Total shrub cover for all Units and transects averaged 62.8 percent and ranged from 38.6 to 110.8 percent (Figure 4-3). Herbaceous cover averaged 2.3 percent and ranged from 0 to 21.8 percent (Figure 4-4). Bare ground averaged 42.7 percent and ranged from 0 to 61.4 percent (Figure 4-5). Total cover decreased to approximately half of the baseline cover in Year 3, while herbaceous cover and bare ground increased.

Raw data for shrub transects sampled in 2014 are provided in Appendix B.

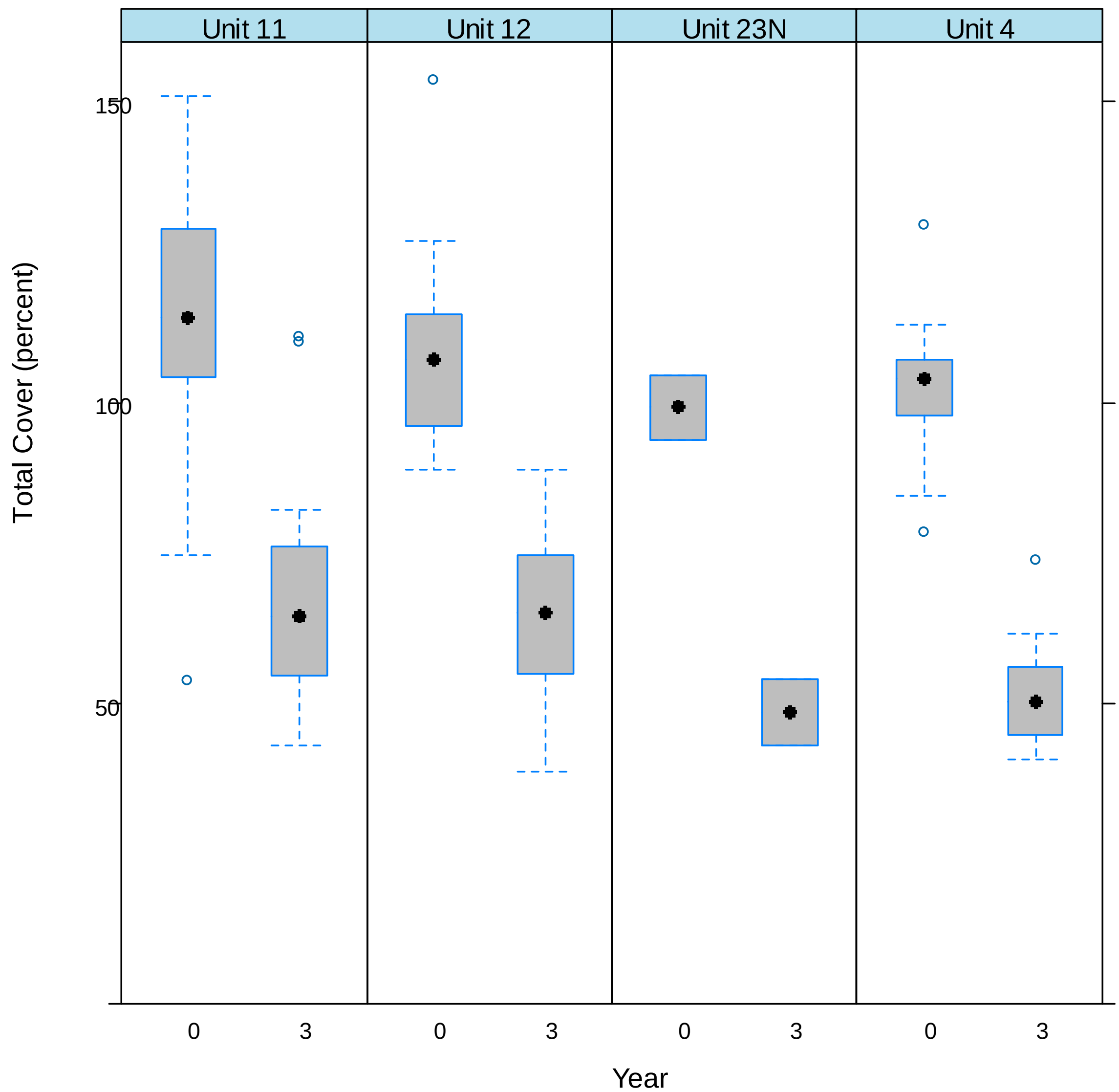

Figure 4-3 Total percent cover on transects in Units 4, 11, 12 and 23N between 2011 and 2014. Black dots represent the median value and the grey boxes represent the 25th to 75th percentiles of the data. The whiskers represent the non-outlier range of the data.

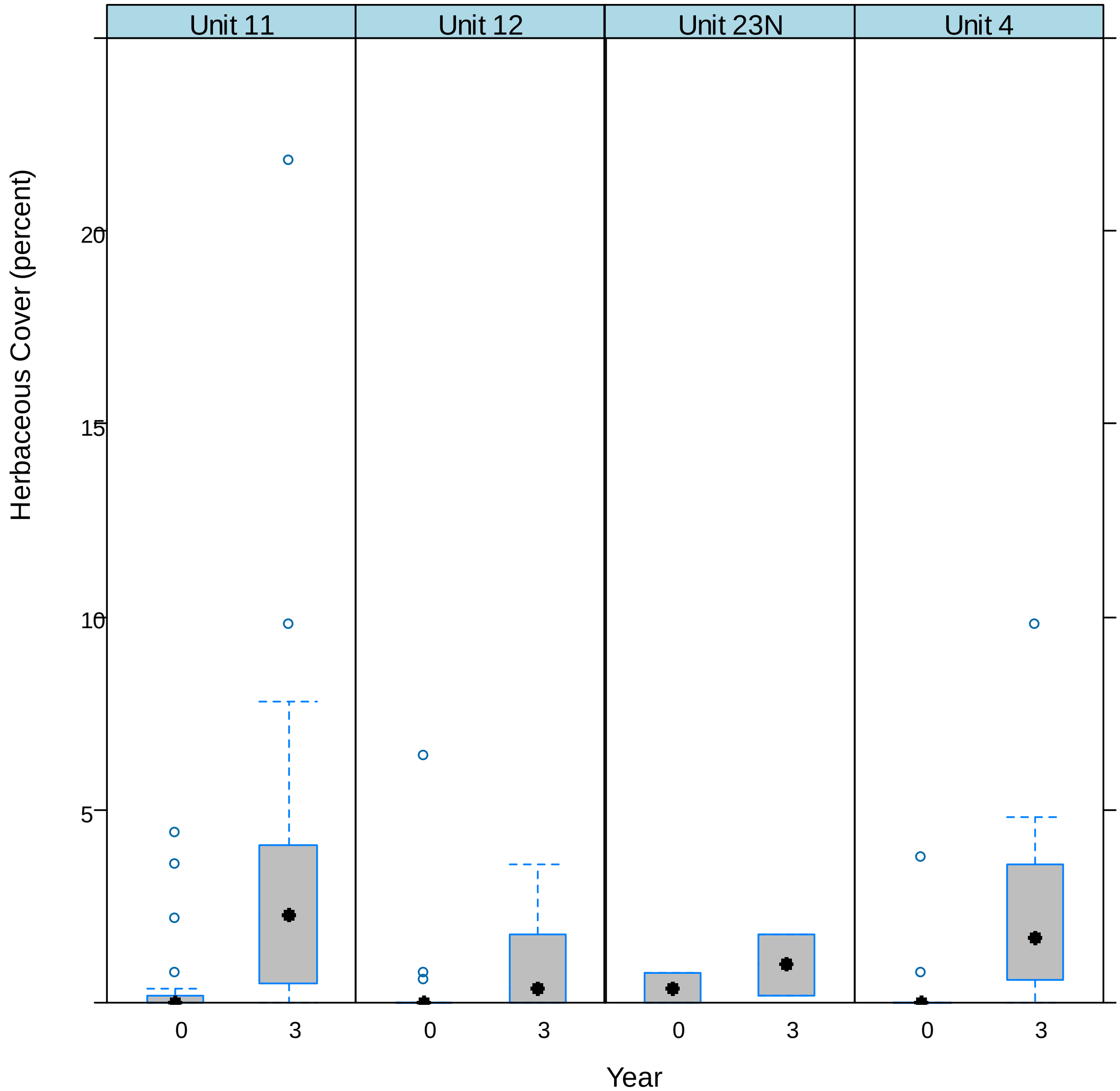

Figure 4-4 **Percent cover of herbaceous vegetation on transects in Units 4, 11, 12 and 23N between 2011 and 2014. Black dots represent the median value and the grey boxes represent the 25th to 75th percentiles of the data. The whiskers represent the non-outlier range of the data.**

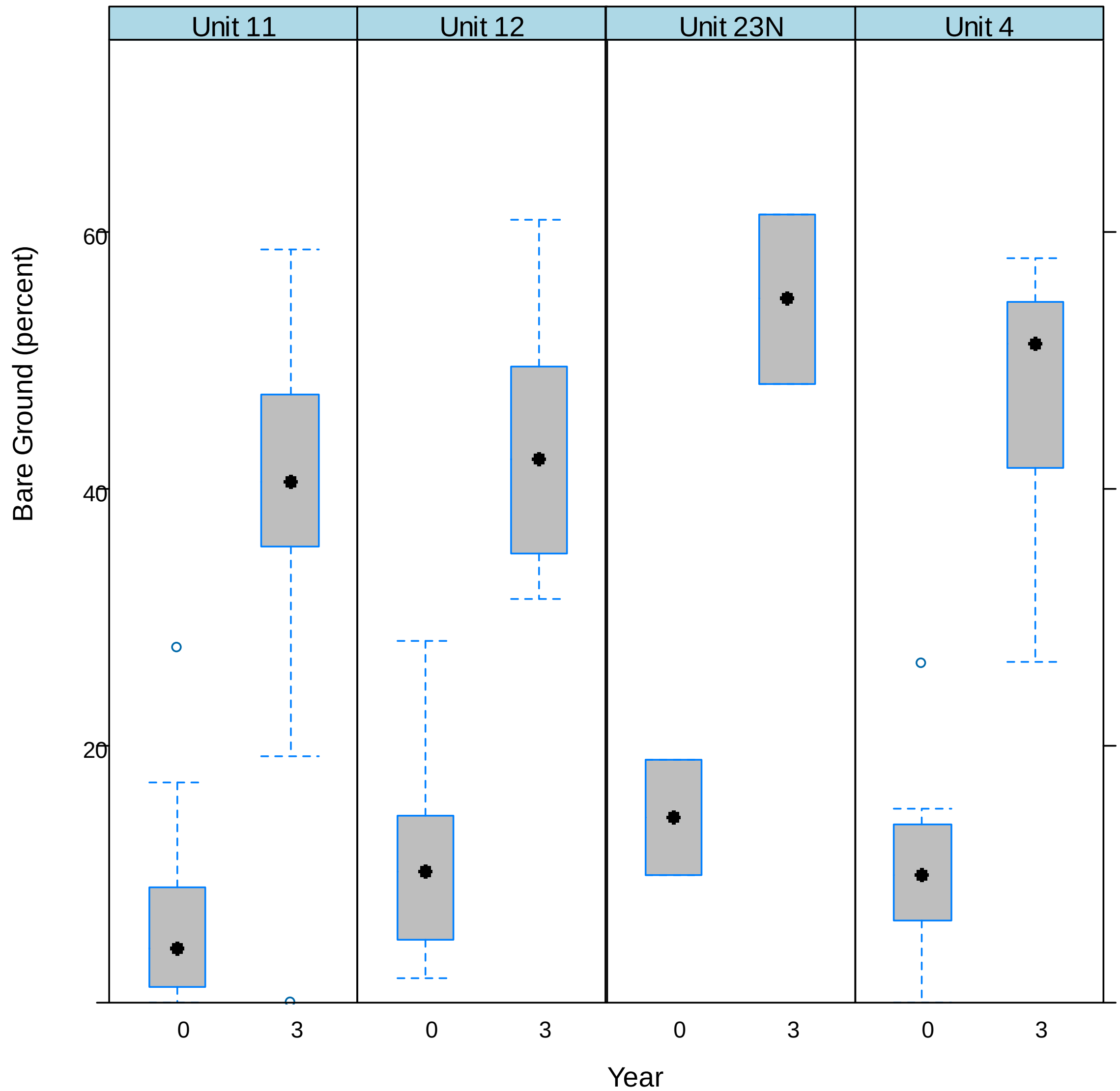

Figure 4-5 **Percent cover of bare ground on transects in Units 4, 11, 12 and 23N between 2011 and 2014. Black dots represent the median value and the grey boxes represent the 25th to 75th percentiles of the data. The whiskers represent the non-outlier range of the data.**

Units 4, 11, 12, and 23N were masticated in 2011. 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 baseline and 2014 (Year 3) monitoring these units.

To test whether time had an effect on community structure (i.e., species composition), multivariate statistics (ordination) were used. These techniques are based on measures of dissimilarity between samples (transects). This analysis was conducted using non-metric multidimensional scaling (NMDS) as implemented in function “metaMDS” in the “vegan” package in R (Oksanen 2011).

The results of the NMDS ordination show a community level response relative to Year and Unit (Figure 4-6). In this plot, 2011 data are grouped separately in green to the left, and the 2014 (Year 3) data are shown in brown to the right. The 95 percent confidence ellipsoids are shown for each Unit and age class. In both years, the confidence ellipsoids for Units 11 and 12 overlap significantly indicating similar community structure. However, the confidence ellipsoids for Units 11 and 12 show little overlap with the ellipsoids for Unit 4 in both Year 0 and Year 3. This difference is likely due to the geographic separation of Unit 4 from the other three units (Figure 4-1).

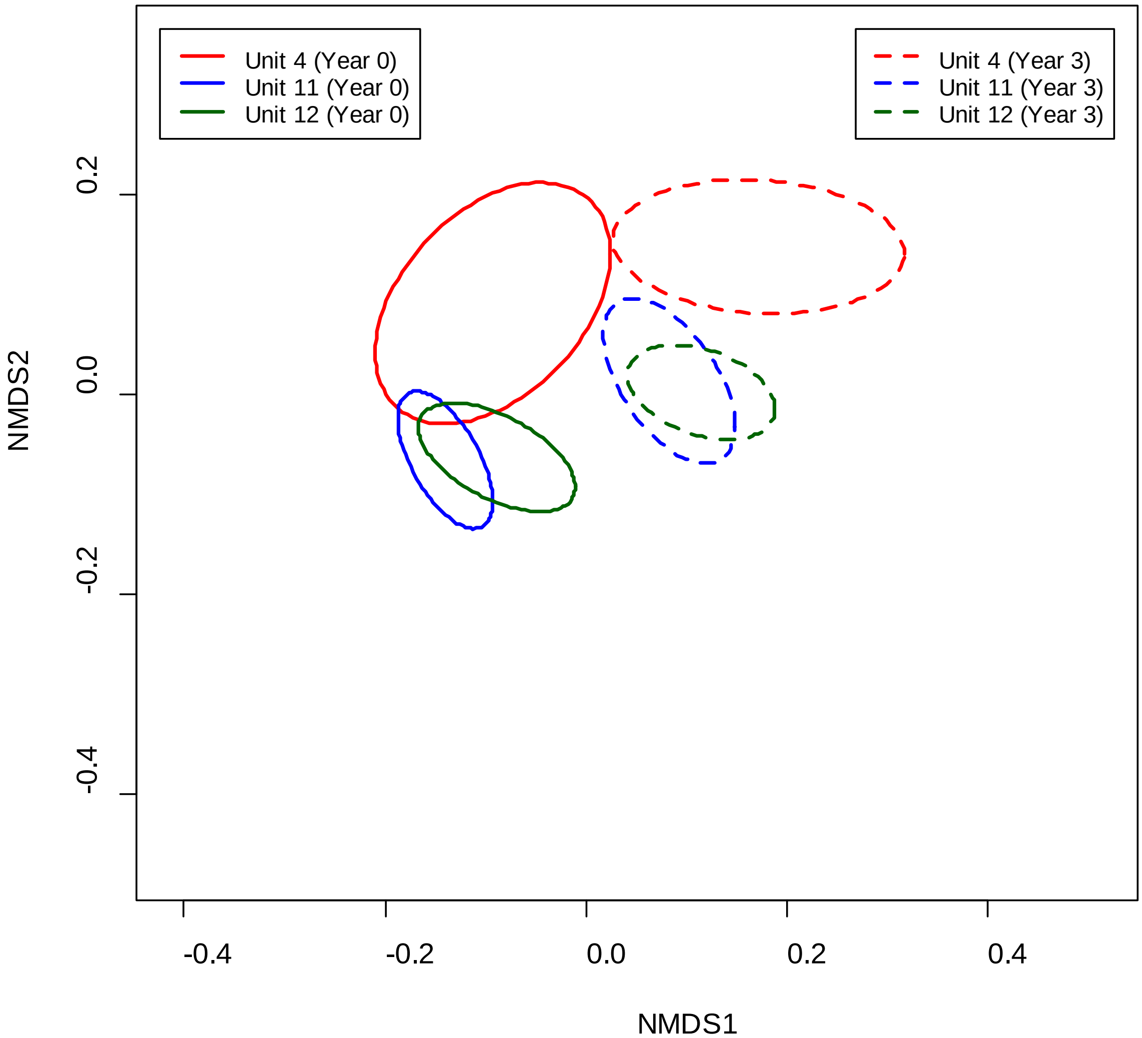

Figure 4-6 NMDS ordination plot of shrub community structure in Units 4, 11, and 12 in Year 0 and Year 3. Unit 23N only had two transects and is not plotted.

To identify which species most effectively discriminated between the pre-masticated and 2014 communities, indicator species analysis (Dufrene and Legendre 1997) was employed. For this analysis, 2011 data for transects in Units 11, 12, and 23N were combined; 2014 data for transects in Units 11, 12, and 23N were combined; 2011 data for transects in Unit 4 were grouped together; and 2014 data for transects in Unit 4 were grouped together. 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). Strong indicator species were identified by this analysis (Table 4-4). Monterey ceanothus was an indicator species for Units 11, 12, and 23N in 2011. For Unit 4, sandmat manzanita was an indicator species in year 2011 whereas deerweed was an indicator species in 2014. Plants such as the Monterey ceanothus and sandmat manzanita are commonly dominant in climax communities while subshrubs such as deerweed are often dominant during successional stages (Tetra Tech 2011).

Table 4-4
Indicator Species in the 2011 and 2014 Shrub Communities in Units 4, 11, 12, and 23N

Species	2011	2014	Unit 4 (2011)	Unit 4 (2014)
Monterey Ceanothus	0.71	-	-	-
Deerweed	-	-	-	0.69
Sandmat manzanita	-	-	0.75	-

4.4.7. Annual Grass Monitoring

Annual grass surveys were limited to the periphery of the Units. Estimated areas occupied by annual grasses in Year 3 are summarized in Table 4-5. Acreages of annual grasses ranged from 2.11 acres in Unit 23N to 70.97 acres in Unit 11. Within Unit 4, grasses are present along the southern and western boundaries (Map A6-12). In Units 11 (Map A6-13) and 12 (Map A6-15), grasses were present within and beyond the primary containment lines along the northern border, and portions of the eastern and southern margins. In Unit 23N, annual grasses are present within the primary containment lines along the eastern and northern boundaries (Map A6-16). In addition, there is a portion of the western end of Unit 23N that exhibits a high density of annual grasses.

Table 4-5
Estimated Area Occupied (Acres) by Annual Grasses in Year 3 Surveys in Units 4, 11, 12, and 23N

Cover Class	Unit 4	Unit 11	Unit 12	Unit 23N
1 (low) = 1–5 percent	22.94	50.16	23.59	0.10
2 (medium) = 6–25 percent	4.93	10.26	7.98	0.29
3 (high) = >25 percent	18.24	10.55	21.15	1.72
Total Acreage	**46.11**	**70.97**	**52.72**	**2.11**

4.4.8. Invasive Species Monitoring

Pampas grass was observed at one location on the eastern boundary of Unit 11 near its border with Unit 25 (Map A6-14).

SECTION 5

Year 5 Vegetation Monitoring – Units 14 and 19

5.1. Units 14 and 19 – Introduction

A prescribed burn was conducted in Units 14 and 19 in October 2009 (Figure 1-2; Figure 5-1). Prior to the burn, baseline sampling of shrubs and HMP annuals in Units 14 and 19 was conducted by Burleson Consulting in spring and early summer 2009 (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.

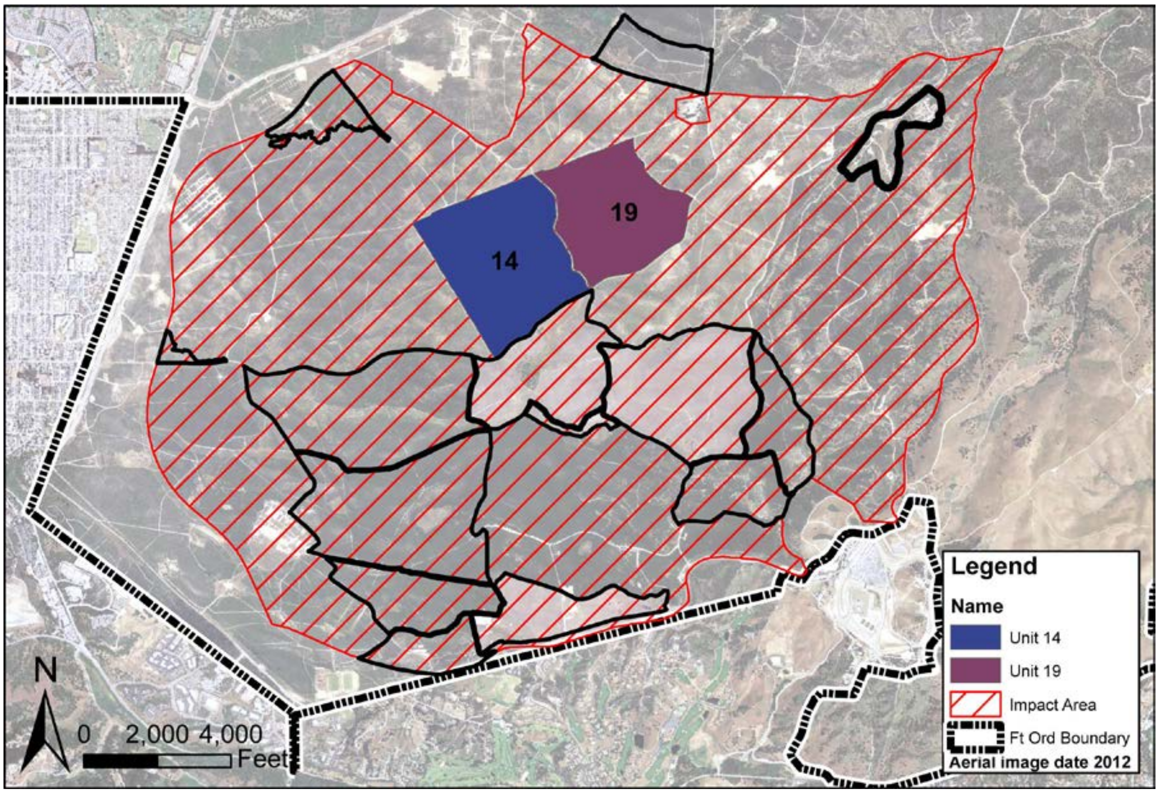

Figure 5-1 Year 5 Units surveyed in 2014.

Year 1 follow-up monitoring of the three HMP annuals and of annual grasses was conducted in 2010 (Tetra Tech and EcoSystems West 2011). Shrub transect monitoring was not conducted in 2010 in accordance with vegetation monitoring protocols. In the spring and early summer of 2012, Year 3 follow-up monitoring of shrub transects, HMP annual species, and annual grasses was conducted in Units 14 and 19 (Tetra Tech and EcoSystems West 2013). Year 5 follow-up monitoring was conducted in spring 2014.

5.2. Units 14 and 19 – Setting

Units 14 and 19 are located north of Watkins Gate Road in the east-central portion of the area of former Fort Ord. Unit 14 encompasses 295 acres and Unit 19 encompasses 227 acres. The terrain is gently rolling to locally steep. Prior to treatment, 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” (extensive 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 (*Stipa 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 USDA (2014) maps the soils throughout Units 14 and 19 as Arnold-Santa Ynez complex. Characteristics of this soil are presented in Table 2-1. As discussed previously for the baseline areas (Section 2.2), it is apparent in the field that two distinct soil types occur in these units, with the HMP annual species almost entirely confined to the variant characterized by coarser, looser sand mostly without pebbles.

5.3. Units 14 and 19 – Methods

The 2014 Year 5 follow-up monitoring in Units 14 and 19 consisted of the following activities:

- Repeat density monitoring for three HMP annual species: Monterey spineflower, sand gilia, and seaside bird’s-beak.
- Repeat line intercept transect sampling of transects previously sampled in 2009 (Burleson 2010), and 2012 (Tetra Tech and EcoSystems West 2013) to sample shrub species composition in the maritime chaparral that is recovering from past disturbance (the 2009 controlled burn and the 2010 munitions and ordnance cleanup).
- Mapping of non-native annual grasses within the primary containment areas.
- Mapping of invasive species, including iceplant, pampas grass, and French broom, where encountered.

5.3.1. HMP Annuals Monitoring

Density monitoring for three HMP annual species, Monterey spineflower, sand gilia, and seaside bird’s-beak, was conducted in Units 14 and 19 between 14 and 24 May 2014. 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, but was readily identifiable by its vegetative characteristics.

In the 2009 baseline monitoring (Burleson 2009b), a total of 258 100×100 foot grids were randomly selected from among the grids deemed to contain suitable habitat for the three HMP annual species based on aerial photo interpretation, without regard for whether or not those grids actually contained individuals of any of the three HMP annuals. In the Year 1 monitoring conducted in these units in 2010 (Tetra Tech and EcoSystems West 2011), sampled grids included a randomly selected 20 percent of the grids sampled in 2009, plus a randomly selected 10 percent of all 100×100 foot grids adjacent to the 2009 sample grids for a total of 198 grids.

In 2012 (Year 3), 185 grids that were sampled in the Year 1 monitoring in 2010 were resampled. Seven grids in Unit 14 and three grids in Unit 19 were not resampled in 2012 because less than 50 percent of the grid was within the area that was treated in 2009 and/or outside permanently maintained fuel break areas. In addition, for a few grids in both units, only a portion of the grid was sampled; these consisted of grids where more than 50 percent of the grid was within the area that was treated in 2009 and/or outside a permanently maintained fuel break area. In 2012, a total of 86 grids in Unit 14 and 99 grids in Unit 19 were sampled. In the 2014 Year 5 monitoring, one grid in Unit 14 that was inadvertently dropped from sampling in Year 3 was resampled for a total 87 grids in Unit 14 and 99 grids in Unit 19 (a total of 186 grids). The corners of the grids were generally but not always staked with lath stakes due to deterioration by weather, or growth of woody vegetation since the stakes were installed in 2010. Where the corners were not staked, we therefore used a resource grade Trimble GeoXH GPS receiver with the grid boundaries loaded as a map layer to determine the boundaries of the grids to be sampled.

Once the grids to be sampled were located, sampling was conducted as described for the baseline monitoring, and the same density classes were used. However, as mentioned above (Section 2.3.2), all grids were censused to calculated density; no 2.5-meter radius circular subplots were used in 2014. When only a portion of the grid was sampled, the density classes were scaled proportional to the percentage of the total grid sampled.

5.3.2. Shrub Transect Monitoring

Burleson Consulting (2009b) conducted baseline shrub transect monitoring in Units 14 and 19 in 2009, and Year 3 follow-up monitoring of these units was conducted in 2012 (Tetra Tech and EcoSystems West 2013). All 22 transects in Unit 14 and 21 transects in Unit 19 that were sampled in 2009 and 2012 were resampled in 2014. Year 5 monitoring of shrub species composition in Units 14 and 19 was conducted between 8 April and 19 May 2014

All transects sampled in Units 14 and 19 in 2014 were 50 meters in length. The surveyors used a resource grade Trimble GeoXH GPS receiver to locate the previously recorded start and end points of each transect monitored. Once the start and end points were located, the transects were sampled using the line intercept method following the same methodology as in the baseline monitoring areas (Section 2.3.3).

5.3.3. Annual Grass Monitoring

Non-native annual grass monitoring was conducted within the primary containment lines surrounding Units 14 and 19 on 24 and 25 June 2014. Annual grass species included in this monitoring were the same species as in the baseline areas annual grass monitoring (Section 2.3.4). Annual grass monitoring was conducted using the same methodology and density classes as those used in the baseline monitoring.

5.3.4. Invasive Species

Invasive species were mapped when encountered incidentally 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. A comprehensive survey for invasive species was not conducted. This information will be used for targeted eradication efforts of invasive species in subsequent years.

5.4. Units 14 and 19 – Results and Discussion

Density monitoring of HMP annuals was conducted in Units 14 and 19 between 14 and 24 May 2014. Maps of survey grids for the sampled Units are provided in Appendix A3.

5.4.1. Sand Gilia

In 2014, sand gilia was present in 88 percent of the 186 grids surveyed in Units 14 and 19 (Figure 5-1; Maps A4-1 and A4-5). Average density class and overall frequency of occurrence of this species in the two Units peaked in 2010 (Year 1) and then declined in 2012 and 2014. The 2014 values are similar to those in baseline conditions (2009).

5.4.2. Seaside Bird's-Beak

Seaside bird's-beak showed differing response to the effects of the prescribed burn in 2009 in Units 14 and 19. Under pre-burn conditions in 2009 the species was present in 3 percent of the 259 plots sampled in Units 14 and 19 (Table 5-2; Maps A4-2 and A4-6). In comparison, 12 percent of the total plots in the two Units were occupied in 2010, 20 percent were occupied in 2012, and 19 percent in 2014. The majority of these responses were seen in Unit 14 as overall density and frequency of occurrence were low in Unit 19 (Table 5-2).

5.4.3. Monterey Spineflower

The Monterey spineflower is the most widespread and frequently occurring of the three HMP species sampled. The Monterey spineflower exhibited a response to the effects of the prescribed burn in 2009. In 2009, the species was present in 78 percent of the 259 sampled plots in both Units 14 and 19 (Table 5-3; Maps A4-3 and A4-7). In 2010, the species occupied 88 percent, in 2012, it was present in 84 percent of the sampled plot, and in 2014 it was present in 80 percent of the sampled plots across both Units.

Table 5-1
Sand Gilia – Number of Grids per Density Class in Units 14 and 19

	Unit 14 Plots				Unit 19 Plots			
Density Class	**2009**	**2010**	**2012**	**2014**	**2009**	**2010**	**2012**	**2014**
0 plants/grid (percent of plots)	76 (61%)	26 (28%)	54 (63%)	43 (49%)	70 (52%)	18 (17%)	35 (35%)	40 (40%)
1–50 plants/grid (percent of plots)	49 (39%)	26 (28%)	23 (27%)	31 (36%)	27 (20%)	20 (19%)	51 (52%)	46 (47%)
51–100 plants/grid (percent of plots)	0 (0%)	6 (7%)	2 (2%)	6 (7%)	12 (9%)	11 (10%)	4 (4%)	2 (2%)
101–500 plants/grid (percent of plots)	0 (0%)	16 (17%)	5 (6%)	4 (5%)	22 (16%)	27 (26%)	7 (7%)	9 (9%)
> 500 plants/grid (percent of plots)	0 (0%)	19 (21%)	2 (2%)	3 (3%)	3 (2%)	29 (28%)	2 (2%)	2 (2%)
Average Density Class	**0.4**	**1.7**	**0.6**	**0.8**	**1.0**	**2.3**	**0.9**	**0.9**
Total Occupied Plots	**49**	**66**	**32**	**44**	**64**	**87**	**64**	**59**
Total Plots Sampled	**125**	**93**	**86**	**87**	**133**	**105**	**99**	**99**

*Each plot is 100- x 100- feet, or 10,000 square feet, or 0.23 acre.

Table 5-2
Seaside Bird's-Beak – Number of Plots per Density Class in Units 14 and 19

Density Class	Unit 14 Plots 2009	Unit 14 Plots 2010	Unit 14 Plots 2012	Unit 14 Plots 2014	Unit 19 Plots 2009	Unit 19 Plots 2010	Unit 19 Plots 2012	Unit 19 Plots 2014
0 plants/grid (percent of plots)	118 (94%)	71 (76%)	55 (64%)	56 (64%)	132 (99%)	102 (97%)	93 (94%)	94 (95%)
1–50 plants/grid (percent of plots)	7 (6%)	10 (11%)	9 (10%)	25 (29%)	1 (1%)	3 (3%)	3 (3%)	4 (4%)
51–100 plants/grid (percent of plots)	0 (0%)	5 (5%)	5 (6%)	2 (2%)	0 (0%)	0 (0%)	2 (2%)	1 (1%)
101–500 plants/grid (percent of plots)	3 (2%)	5 (5%)	13 (15%)	4 (5%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)
>500 plants/grid (percent of plots)	0 (0%)	2 (2%)	4 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Average Density Class	**0.1**	**0.5**	**0.9**	**0.5**	**0.0**	**0.0**	**0.1**	**0.1**
Total Occupied Plots	**7**	**22**	**31**	**31**	**1**	**3**	**6**	**5**
Total Plots Sampled	**125**	**93**	**86**	**87**	**133**	**105**	**99**	**99**

*Each plot is 100- x 100- feet, or 10,000 square feet, or 0.23 acre.

Table 5-3
Monterey Spineflower – Number of Plots per Density Class in Units 14 and 19

Density Class	Unit 14 Plots				Unit 19 Plots			
	2009	2010	2012	2014	2009	2010	2012	2014
0 plants/grid (percent of plots)	31 (25%)	5 (5%)	9 (10%)	7 (8%)	26 (20%)	19 (18%)	20 (20%)	30 (30%)
1–50 plants/grid (percent of plots)	62 (50%)	30 (32%)	13 (15%)	19 (22%)	27 (20%)	38 (36%)	42 (42%)	38 (38%)
51–100 plants/grid (percent of plots)	15 (12%)	9 (10%)	5 (6%)	11 (13%)	14 (11%)	7 (7%)	11 (11%)	5 (5%)
101–500 plants/grid (percent of plots)	13 (10%)	14 (15%)	29 (34%)	20 (23%)	30 (23%)	15 (14%)	18 (18%)	18 (18%)
>500 plants/grid (percent of plots)	4 (3%)	35 (38%)	30 (35%)	30 (35%)	36 (27%)	26 (25%)	8 (8%)	8 (8%)
Average Density Class	**1.2**	**2.5**	**2.7**	**2.5**	**2.2**	**1.9**	**1.5**	**1.4**
Total Occupied Plots	**94**	**88**	**77**	**80**	**107**	**86**	**79**	**69**
Total Plots Sampled	**125**	**93**	**86**	**87**	**133**	**105**	**99**	**99**
*Each plot is 100- x 100- feet, or 10,000 square feet, or 0.23 acre.								

In contrast, the pattern of change in the average density class differs between Units. In Unit 14 the average density class increased in 2010 and has remained relatively constant since then. However, in Unit 19, the average density class decreased in 2010 and has continued to decrease over time (Table 5-3).

5.4.4. Effect of Treatment on HMP Density

To assess whether treatment had an effect on the subsequent density of the HMP annual plants, the average density class for each species, treatment, and Unit was calculated for each of the four monitoring years (Years 0, 1, 3, and 5) (Figure 5-2). Variation in response of the species can be seen in the plot.

In Unit 14, all three species achieved greater densities in response to burning as compared to mastication (Figure 5-2). However, in Unit 19 there is a variable response, and masticated areas generally have higher densities, particularly in the case of Monterey spineflower.

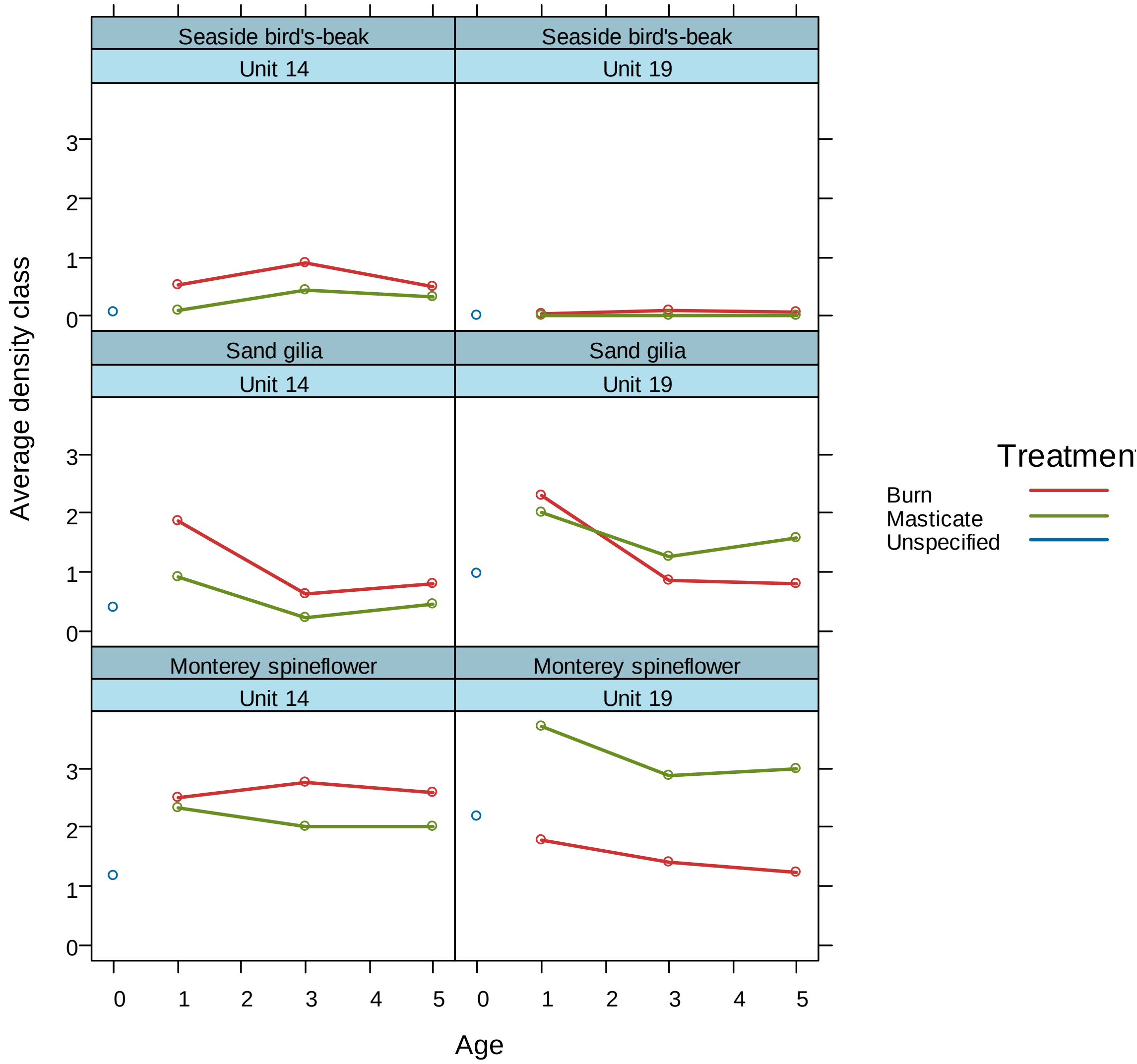

Figure 5-2 Average density class of each HMP annual species plotted by Unit and age.

5.4.5. Shrub Transect Monitoring

A total of 43 transects were sampled in Units 14 and 19 during 2014 (Map A4-4 and Map A4-8). Total shrub cover averaged 63.5 percent and ranged from 31.4 to 104.2 percent (Figure 5-3). Herbaceous vegetation occupied an average of 2.49 percent, and bare ground averaged 43.2 percent (Figure 5-4; Figure 5-5). Raw data for the shrub transects sampled in 2014 are provided in Appendix B.

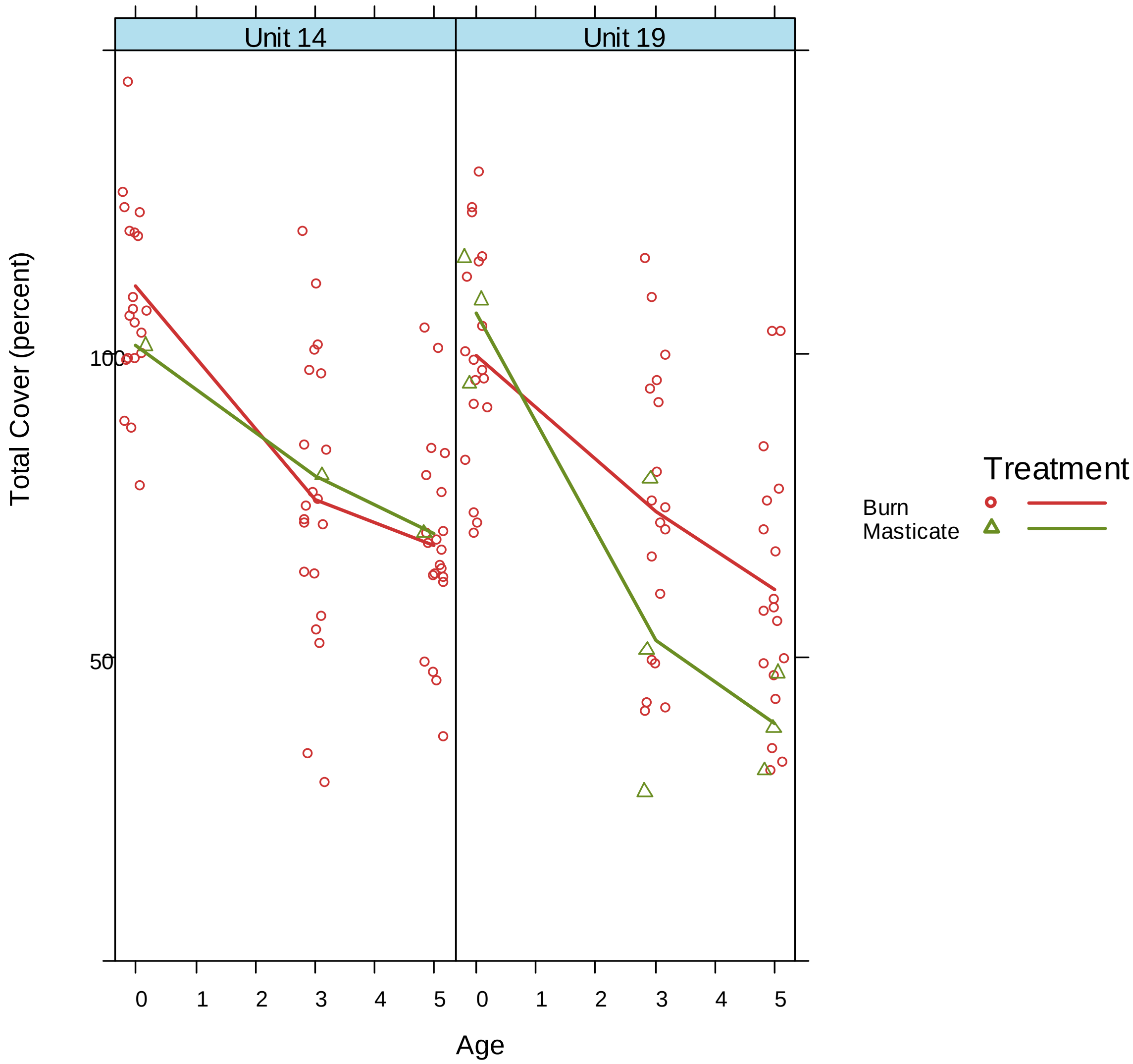

Figure 5-3 **Temporal changes in total shrub cover on Units 14 and 19. Age represents years since treatment.**

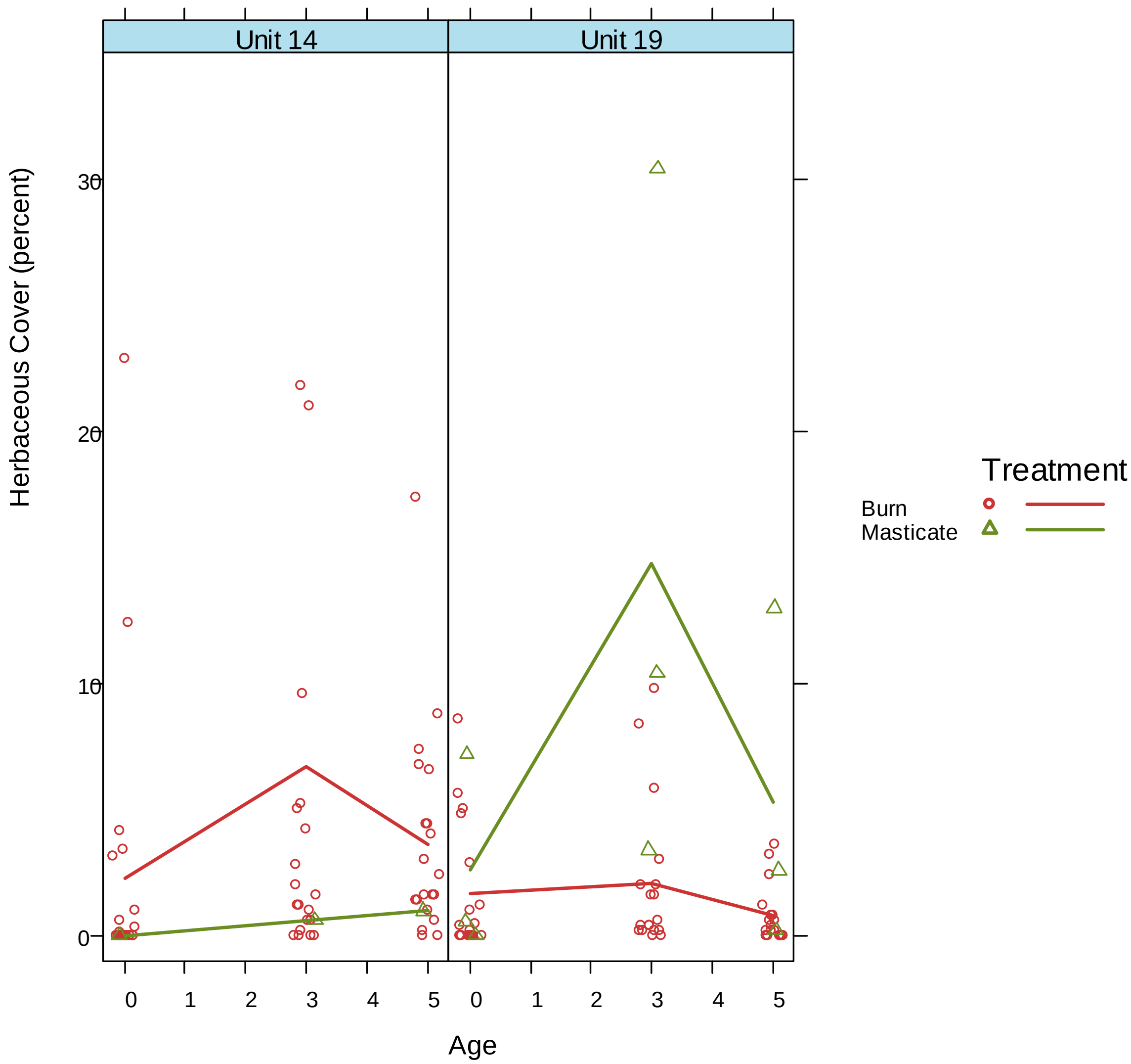

Figure 5-4 Temporal changes in herbaceous plant cover on Units 14 and 19. Age represents years since treatment.

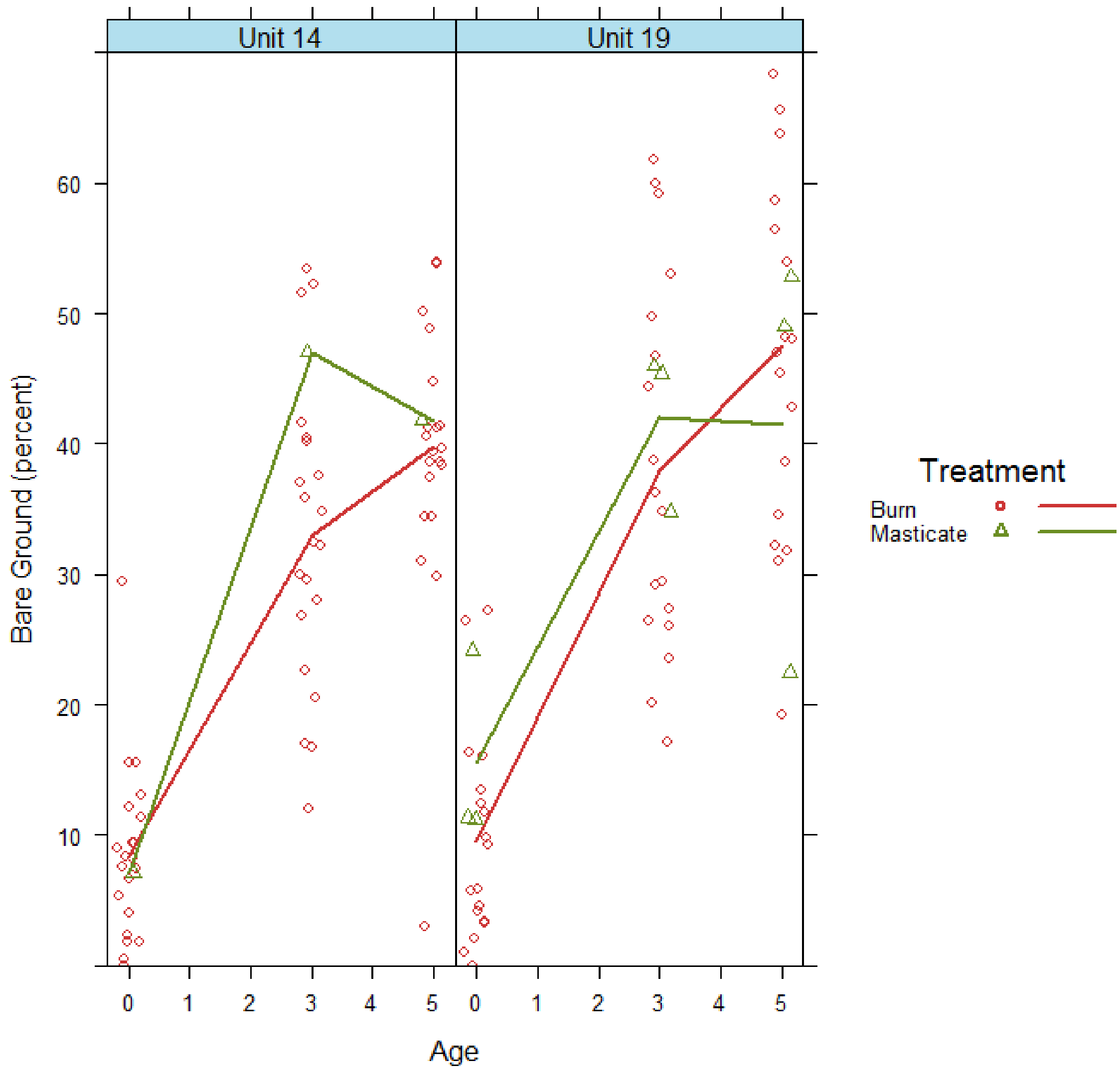

Figure 5-5 Temporal changes in cover of bare ground on Units 14 and 19. Age represents years since treatment.

Units 14 and 19 were cleared of vegetation in 2009. The majority of both Units was burned and portions of the periphery were masticated as a fire break (Figure 1-2). 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 years and between treatments in Units 14 and 19. Temporal trends differ from expected patterns by exhibiting a continual decrease in total shrub cover and increasing bare ground after treatment in 2012 (Figure 5-3 and Figure 5-5). Herbaceous cover showed an increase in cover in 2012 (Year 3) and a subsequent decrease in Year 5 (2014) as would be expected (Figure 5-4). However, this response varied between Units. In Unit 14, herbaceous cover increased slightly after mastication between 20092 and 2012 and then decreased to baseline levels in 2014. Masticated areas in Unit 14 exhibited a slight upward trend in herbaceous cover between 2009 and 2014. However, the situation is reversed in Unit 19. Herbaceous cover in masticated areas increased sharply from 2009 to 2012 and then decreased to baseline levels in 2014. In the burned areas of Unit 19, herbaceous cover was constant between baseline and Year 3 and exhibited a marginal decrease between years 3 and 5. The absence of an increase in shrub cover between Year 3 and Year 5 and a continued increase in bare ground may be representative of drought conditions occurring in California between 2012 and 2014.

ANOVA was used to test for differences between Units, treatments, and age. ANOVA results indicate that only age effects are consistently significant while treatment effects are not significant. Unit has an effect on total cover and species richness, but not on diversity.

Table 5-4
Results of Three-way ANOVAs for Effect of Treatment, Age, and Unit

Parameter	Treatment Effect	Age Effect	Unit Effect
Total cover	$p = 0.07$	$p < 0.0001$	$p = 0.04$
Species richness	$p = 0.32$	$p < 0.0001$	$p = 0.04$
Diversity	$p = 0.53$	$p < 0.0001$	$p = 0.47$

To test for effects on association structure, multivariate statistics (cluster and ordination techniques) were used. These techniques are based on measures of dissimilarity between samples (transects). This analysis was conducted using NMDS as implemented in function “metaMDS” in the “vegan” package in R (Oksanen et al. 2011).

The results of the NMDS ordination show a community level response relative to time. Temporal changes are clearly evident in Figure 5-6, which displays the position of each transect relative to the centroid for each year. The baseline transects are clearly separated from both post-treatment years, and the Year 5 transects are more similar to Year 0 (baseline) transects than are the Year 3 transects, suggesting that community structure has begun to revert towards baseline conditions.

The effect of year and treatment can be clearly seen when the 95 percent confidence ellipsoids are plotted for each Unit (Figure 5-7 and Figure 5-8). The confidence ellipsoids are a two-dimensional representation of the 95 percent confidence interval surrounding the average position (i.e. centroid) of each group. In Unit 14, only one transect was conducted in the masticated area each year and therefore ellipsoids are not produced for that group and the effect of mastication cannot be seen in the plot (Figure 5-7). The temporal effect of burning in Unit 14 is visible as changes in position of the ellipsoids. Some overlap is present in the position of the 2012 and 2014 ellipsoids indicating small differences in vegetation.

In Unit 19, a clear separation can be seen between the burned (red ellipses) and masticated (blue ellipses) transects as well as temporal changes in position (Figure 5-8). It is clear that within any year there are differences in community structure between burned and masticate transects. However, both the burned and masticated transects show a progression towards baseline conditions in Year 3 and Year 5.

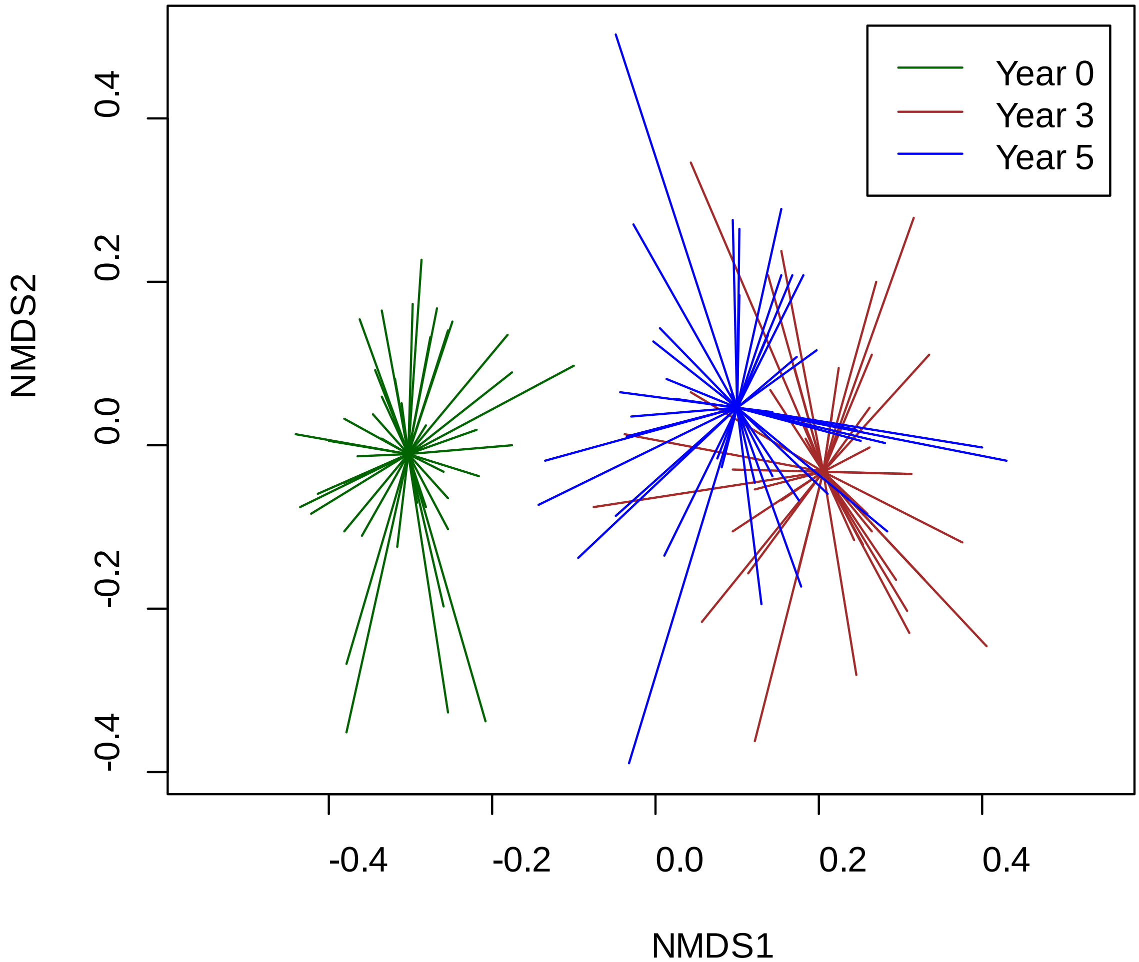

Figure 5-6 NMDS ordination plot of shrub association structure on Units 14 and 19 with respect to time.

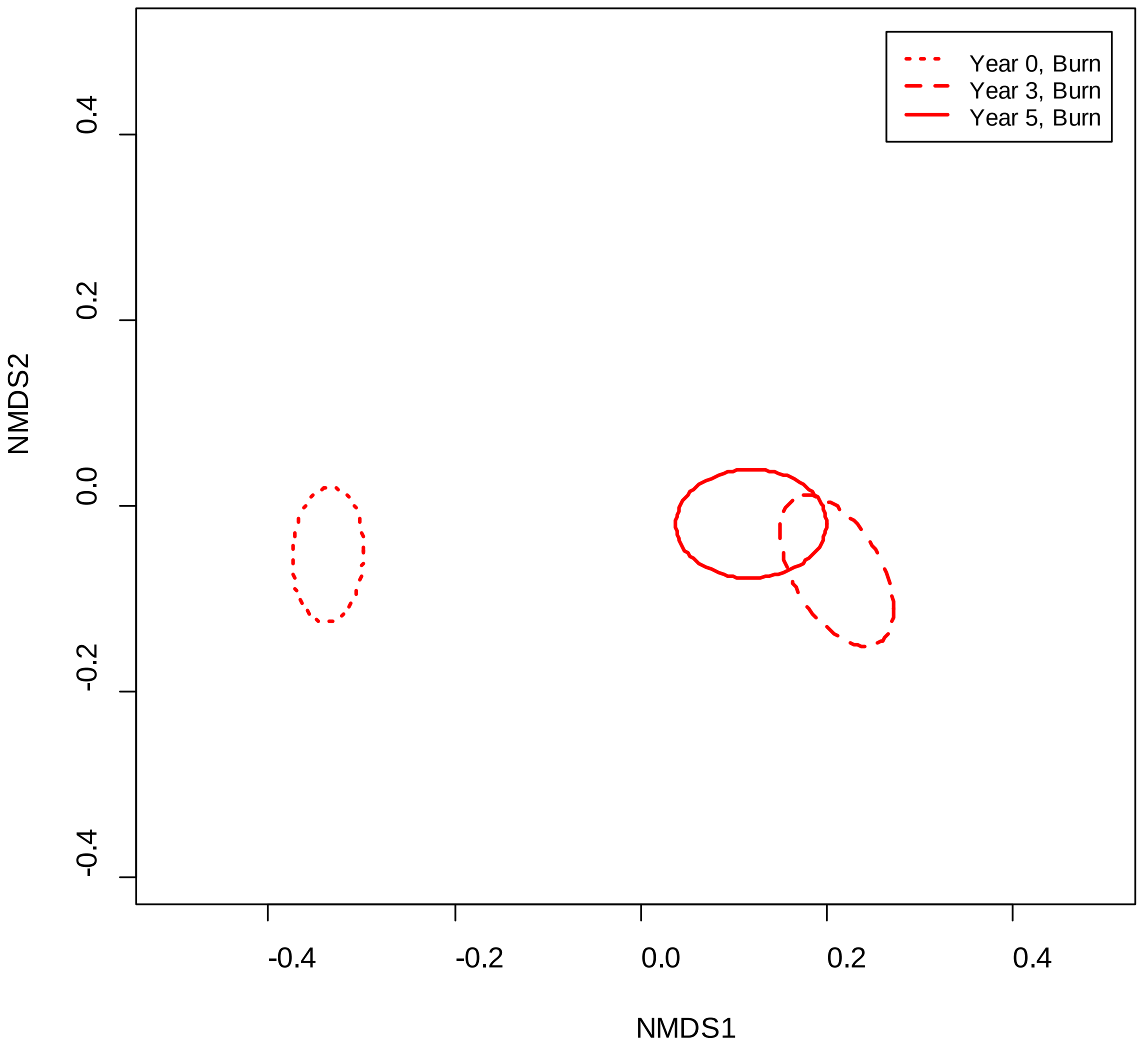

Figure 5-7 **Comparison of 95 percent confidence ellipsoids for temporal and treatment groupings in Unit 14. Only one transect was conducted on masticated areas in each year and therefore ellipsoids are not produced.**

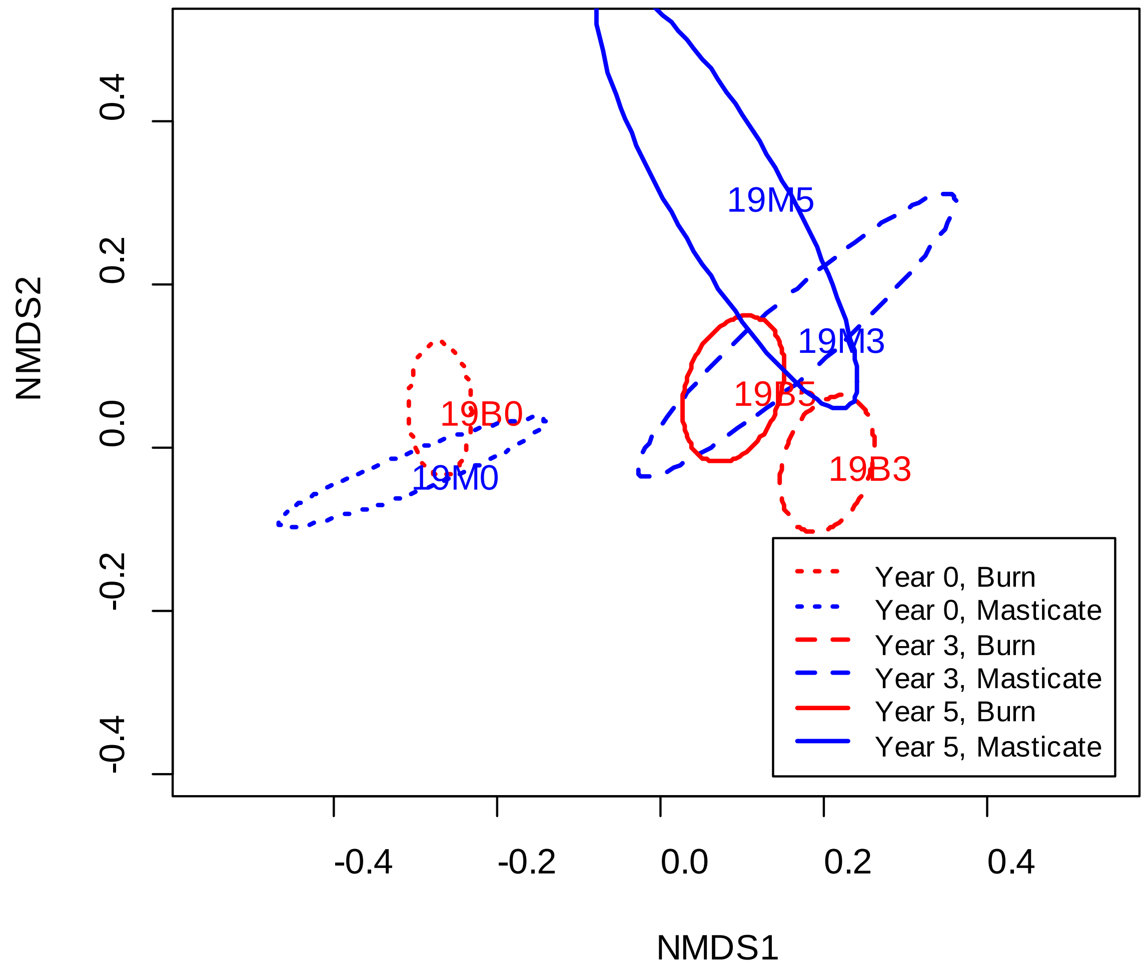

Figure 5-8 Comparison of 95 percent confidence ellipsoids for temporal and treatment groupings in Unit 19.

5.4.6. Annual Grass Monitoring

The areal extent of annual grasses on Units 14 and 19 is provided in Table 5-5. Annual grasses are present within the primary containment areas along the south-east border of these adjacent Units (Map A6-17 and Map A6-18).

5.4.7. Invasive Species Monitoring

No invasive species were observed in Unit 14 or Unit 19.

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

Cover Class	Unit 14	Unit 19
1 (low) = 1–5 percent	5.16	6.37
2 (medium) = 6–25 percent	5.51	4.44
3 (high) = >25 percent	4.05	9.95
Total Acreage	**14.73**	**20.76**

SECTION 6

Year 8 Vegetation Monitoring— MRS 16

6.1. MRS 16 – Introduction

Initial baseline surveying in the MRS 16 area was conducted by Harding Lawson Associates in 1996 and 1998 (Harding Lawson 1996, 1998). In 1996, nine 50-meter shrub transects were established and sampled. Monitoring activities in 1996 and 1998 also included mapping of HMP herbaceous species and estimation of population sizes. Monterey spineflower was the only HMP annual species observed during this monitoring. Data from the Harding Lawson (1996) survey are not present in the project database.

In 2006, Shaw Environmental conducted baseline surveys in a 150 foot wide fuel break area around the perimeter of the MRS-16 area (Shaw 2010). Shrub composition was sampled along seven newly established 50-meter transects located within the fuel break area. Shaw also mapped HMP annual species within the fuel break area. Mapped sand gilia population sizes were estimated, while Monterey spineflower was mapped by estimated percent cover in three cover classes. Seaside bird's-beak was not encountered in the 2006 survey.

MRS-16 was burned in late 2006 after baseline monitoring was completed. In 2007, Shaw Environmental conducted Year 1 follow-up monitoring (Shaw 2008). This monitoring included only mapping of HMP annual species (Monterey spineflower and sand gilia) using the same methodology as that used in the 2006 fuel break baseline survey (Shaw 2010). Data from the Shaw (2008) report are not present in the electronic version of the report.

Burleson Consulting (2009b) conducted Year 3 monitoring in 2009, and EcoSystems West performed Year 5 monitoring in 2011 (Tetra Tech and EcoSystems West 2012). Year 8 follow-up monitoring was performed in spring 2014 following the same methods used for Year 5 monitoring.

6.2. MRS-16 – Setting

The MRS 16 area is located north of Eucalyptus Road, west of Watkins Gate Road, and south of Parker Flats Road, and encompasses an area of 57 acres (Figure 6-1). The terrain is level to gently rolling. In baseline condition, the vegetation of the unit was principally mature maritime chaparral, with substantial areas of coast live oak woodland near the site periphery in the northern and southwestern portions.

Soils in the MRS 16 area are mapped as Arnold-Santa Ynez complex (USDA 2014; Table 2-1). As discussed previously for the baseline areas (Section 2.2), it is apparent in the field that two distinct soil types occur in these units, with the HMP annual species almost entirely confined to the variant characterized by coarser, looser sand mostly without pebbles.

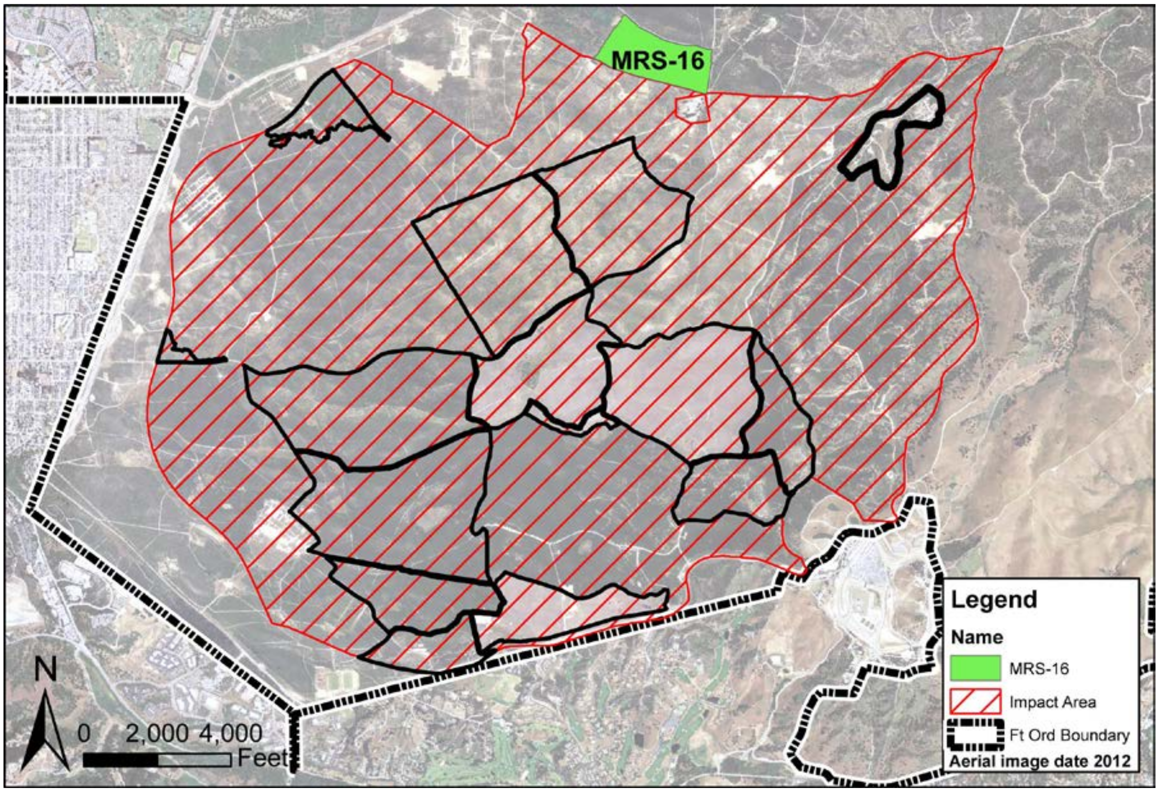

Figure 6-1 Year 8 Units surveyed in 2014.

6.3. MRS-16 – Methods

The 2014 monitoring in the MRS-16 area consisted of the following:

- Density monitoring for three HMP annual species: Monterey spineflower, sand gilia, and seaside bird's-beak.
- Line intercept sampling of transects previously sampled in 1996, 1998, 2006, 2009, and 2011 (Harding Lawson 1996, 1998; Burleson 2009b; Shaw 2010; Tetra Tech and EcoSystems West 2012) to sample shrub species composition in the maritime chaparral that is recovering from past disturbance (the 2006 prescribed burn and the subsequent munitions and ordnance cleanup.
- Mapping of non-native annual grasses within the primary containment areas.
- Mapping of invasive species.

6.3.1. HMP Annuals Monitoring

Density monitoring for the three HMP annual species in the MRS 16 area was conducted on 17 April 2014. 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, but was readily identifiable by its vegetative characteristics. In the 2011 and 2014 monitoring, 35 of the 46 previously occupied grid squares in the unit that were sampled by Burleson Consulting in

2009 (Burleson 2009b) were resampled. The remaining 11 grid squares (more than 50% of the grid) sampled in 2009 were not resampled in 2011 or 2014, because they extended substantially out of the treatment areas.

The methodology for the 2014 density monitoring in the MRS-16 area was similar to that described previously (Section 2.3.2) for the baseline 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 to be sampled. Generally, the corners of the grid squares were marked by wooden lath stakes, although, in most cases, the stakes were missing or lying on the ground. When present, the stakes were used to precisely determine the boundaries of the sample grid. Once the grids to be sampled were located, sampling was conducted as described for the baseline monitoring, and the same density classes were used.

6.3.2. Shrub Transect Monitoring

Monitoring of shrub species composition in the MRS 16 area was conducted between 7 and 9 April 2014. All 16 of the shrub transects initially sampled by Harding Lawson Associates in 1996 (Harding Lawson 1996) or Shaw Environmental in 2006 (Shaw 2010), and resampled by Burleson Consulting in 2009 and EcoSystems West in 2011 (Burleson 2009b; Tetra Tech and EcoSystems West 2012), were resampled in 2014.

The surveyors used a resource grade Trimble GeoXH GPS receiver to locate the previously recorded start and end points of each transect monitored. Once the start and end points were located, transects were sampled using the line intercept method following the same methodology as in the baseline monitoring areas (Section 2.3.3).

6.3.3. Annual Grass Monitoring

Non-native annual grass monitoring was conducted within the primary containment lines surrounding the MRS 16 area on 24 June 2014. Annual grass species included in this monitoring were the same species as in the baseline areas annual grass monitoring. Annual grass monitoring was conducted using the same methodology as that used in the baseline monitoring, and the same density classes were used. 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 (Section 2.3.4).

6.3.4. Invasive Species

Invasive species were mapped when encountered incidentally in MRS 16 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. A comprehensive survey for invasive species was not conducted. This information will be used for targeted eradication efforts of invasive species in subsequent years.

6.4. MRS 16 – Results and Discussion

Surveys conducted on MRS 16 included monitoring for density of HMP annual species, and shrub transect cover. In addition, the extent of annual grasses and the presence of invasive species were noted. Prior to 2009, plots that were sampled for HMP annual species and did not contain the species were not reported in the GIS or database. Therefore, average densities are overestimated.

Maps of locations of survey grids are provided in Appendix A4.

6.4.1. Sand Gilia

In 2014, sand gilia was present in 14 percent of the 35 plots surveyed (Table 6-1), and occurred along the southern border of MRS 16 (Map A5-1). This species was absent in most grids (86 percent) and the remaining grids had low densities.

Table 6-1
Sand Gilia – Number of Plots per Density Class in MRS 16

	MRS 16				
Density	**2006**	**2007**	**2009**	**2011**	**2014**
0 plants/grid (percent of plots)	0 (100%)	0 (100%)	10 (33%)	26 (74%)	30 (86%)
1–50 plants/grid (percent of plots)	1 (0%)	22 (0%)	5 (17%)	7 (20%)	4 (11%)
51–100 plants/grid (percent of plots)	1 (0%)	2 (0%)	0 (0%)	1 (3%)	1 (3%)
101–500 plants/grid (percent of plots)	1 (0%)	1 (0%)	5 (17%)	1 (3%)	0 (0%)
>500 plants/grid (percent of plots)	0 (0%)	2 (0%)	10 (33%)	0 (0%)	0 (0%)
Average Density Class	**2.0**	**1.4**	**2.0**	**0.3**	**0.2**
Total Occupied Plots	**3**	**27**	**20**	**9**	**5**
Total Plots Sampled	**3**	**27**	**30**	**35**	**35**

Temporal changes in average density class for sand gilia and other HMP annual species are shown in Figure 6-2. Sand gilia was present at moderate densities in 2006 to 2009 and a substantially lower densities in 2011 and 2014. In 2009 sand gilia was present in 67 percent of the 30 sampled plots and 33 percent of plots had very high densities (>500 plants per plot). In 2011, sand gilia was present in 26 percent of the sampled grids at low densities. Average density remained similar to 2011 in the 2014 samples, but frequency of occurrence decreased.

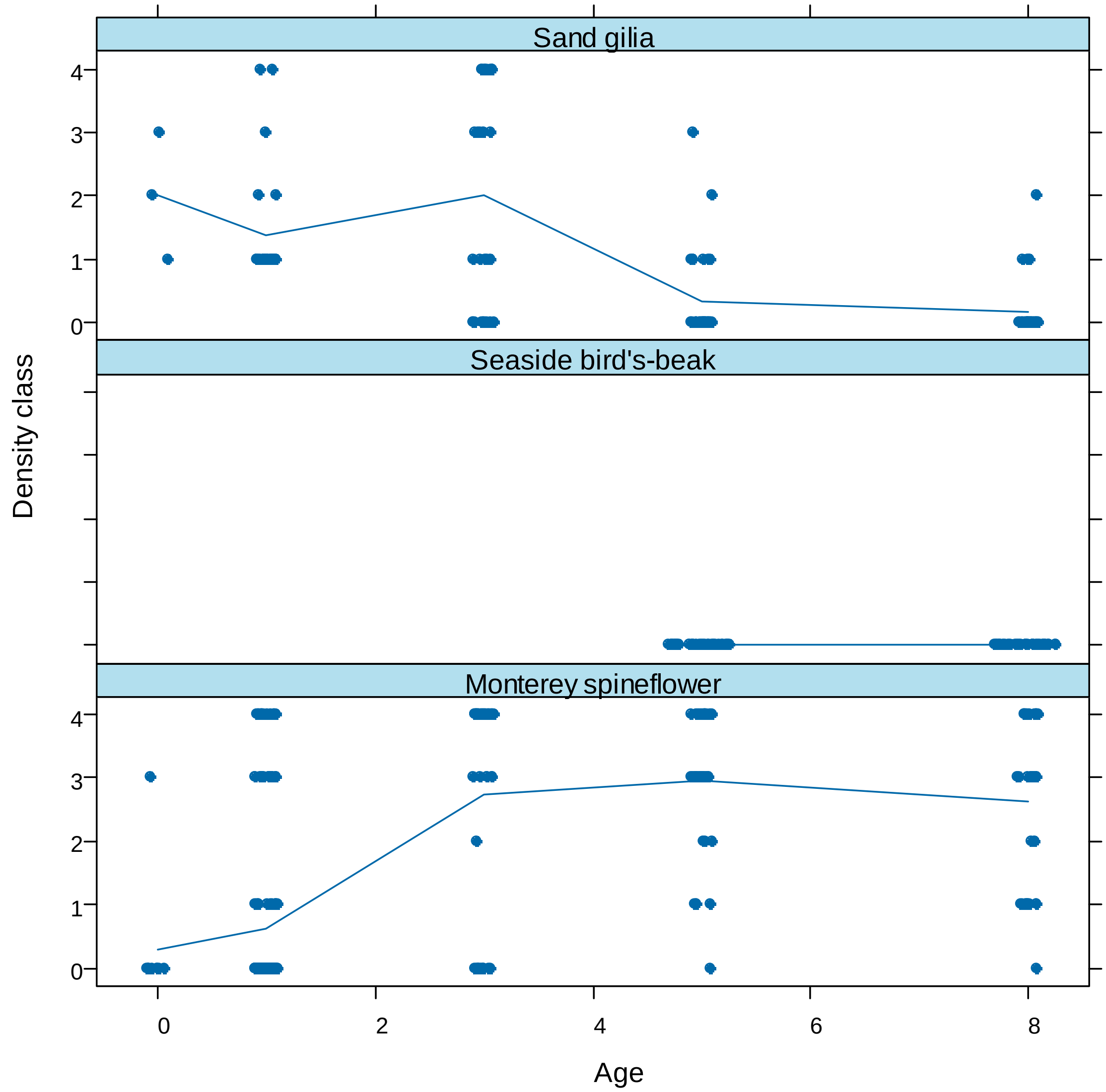

Figure 6-2 Temporal changes in average density class of HMP annual plants on MRS 16.

6.4.2. Seaside Bird's-Beak

Seaside bird's-beak was absent in all plots sampled in 2006 through 2014 (Table 6-2; Map A5-2) in MRS-16.

6.4.3. Monterey Spineflower

In 2014, the Monterey spineflower was present in 97 percent of the 35 plots surveyed with an average density class of 2.6, and occurred along the southern, eastern, and western boundaries of MRS 16 (Table 6-3; Map A5-3). Similar average densities and frequency of occurrence were noted in 2009 and 2011.

Table 6-2
Seaside Bird's-Beak – Number of Plots per Density Class in MRS 16

Density	MRS 16				
	2006	**2007**	**2009**	**2011**	**2014**
0 plants/grid (percent of plots)	0 (0%)	0 (0%)	0 (0%)	35 (100%)	35 (100%)
1–50 plants/grid (percent of plots)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
51–100 plants/grid (percent of plots)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
101–500 plants/grid (percent of plots)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>500 plants/grid (percent of plots)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Average Density Class	**0**	**0**	**0**	**0**	**0**
Total Occupied Plots	**0**	**0**	**0**	**0**	**0**
Total Plots Sampled	**0**	**0**	**0**	**35**	**35**

Table 6-3
Monterey Spineflower – Number of Plots per Density Class in MRS 16

Density	MRS 16				
	2006	2007	2009	2011	2014
0 plants/grid (percent of plots)	9 (90%)	147 (77%)	11 (27%)	1 (3%)	1 (3%)
1–50 plants/grid (percent of plots)	0 (0%)	11 (6%)	0 (0%)	4 (11%)	10 (29%)
51–100 plants/grid (percent of plots)	0 (0%)	0 (0%)	1 (2%)	3 (9%)	2 (7%)
101–500 plants/grid (percent of plots)	1 (10%)	19 (10%)	6 (15%)	15 (43%)	10 (29%)
>500 plants/grid (percent of plots)	0 (0%)	13 (7%)	23 (56%)	12 (34%)	12 (34%)
Average Density Class	**0.3**	**0.6**	**2.7**	**2.9**	**2.6**
Total Occupied Plots	**1**	**43**	**30**	**34**	**34**
Total Plots Sampled	**10**	**190**	**41**	**35**	**35**

6.4.4. Effect of Treatment on HMP Density

To assess whether treatment had an effect on the subsequent density of the HMP annual plants, the average density class for each species, treatment, and Unit was calculated for each of the five monitoring years (Years 0, 1, 3, 5, and 8) (Figure 6-3). Treatments were not determined for grids sampled in baseline (2006) and Years 1 and 3 (2007 and 2009, respectively).

Variation in response of the sand gilia and Monterey spineflower to treatment can be seen in Figure 6-3. Both Monterey spineflower and sand gilia had highest densities in the masticated areas. These areas were similar to or exceeded densities reported for the baseline (2006) year. Burned areas exhibited substantially lower densities than masticated areas for both species. Whereas, Monterey spineflower densities in burned areas exceeded baseline densities, the densities of sand gilia in burned grids were substantially lower than baseline conditions. Therefore, treatment (either burning or mastication) resulted in increased densities of Monterey spineflower. However, treatment resulted in similar (masticated grids) or reduced (burned grids) densities for sand gilia in Years 5 to 8 following treatment.

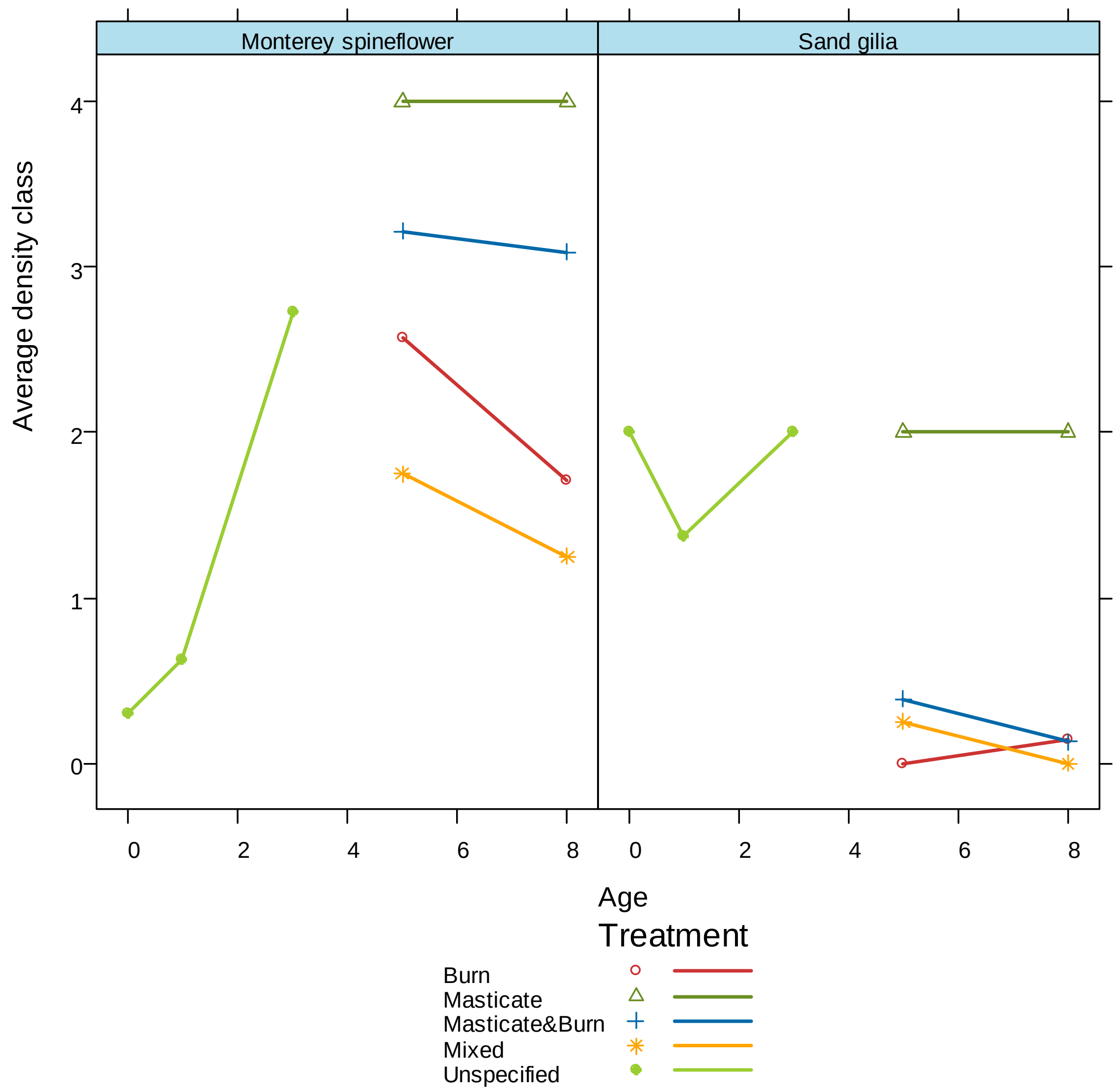

Figure 6-3 Average density class of each HMP annual species plotted by age for MRS 16.

6.4.5. Shrub Transect Monitoring

In 2014, total shrub cover on the 16 shrub transects in MRS-16 averaged 69.5 percent and ranged from 28.0 to 88.4 percent (Figure 6-4; Map A5-3). On average there were 9 species per transect in 2014 (Figure 6-5). Bare ground averaged 34.7 percent cover, and herbaceous vegetation averaged 2.11 percent cover. Raw data for the shrub transects sampled in 2014 are provided in Appendix B.

MRS-16 was cleared of vegetation in 2006. There has been sufficient time for shrub species to recolonize the area, and successional trends are likely to be observed when comparing data collected during successional periods between 2009 (Year 3) and 2014 (Year 8).

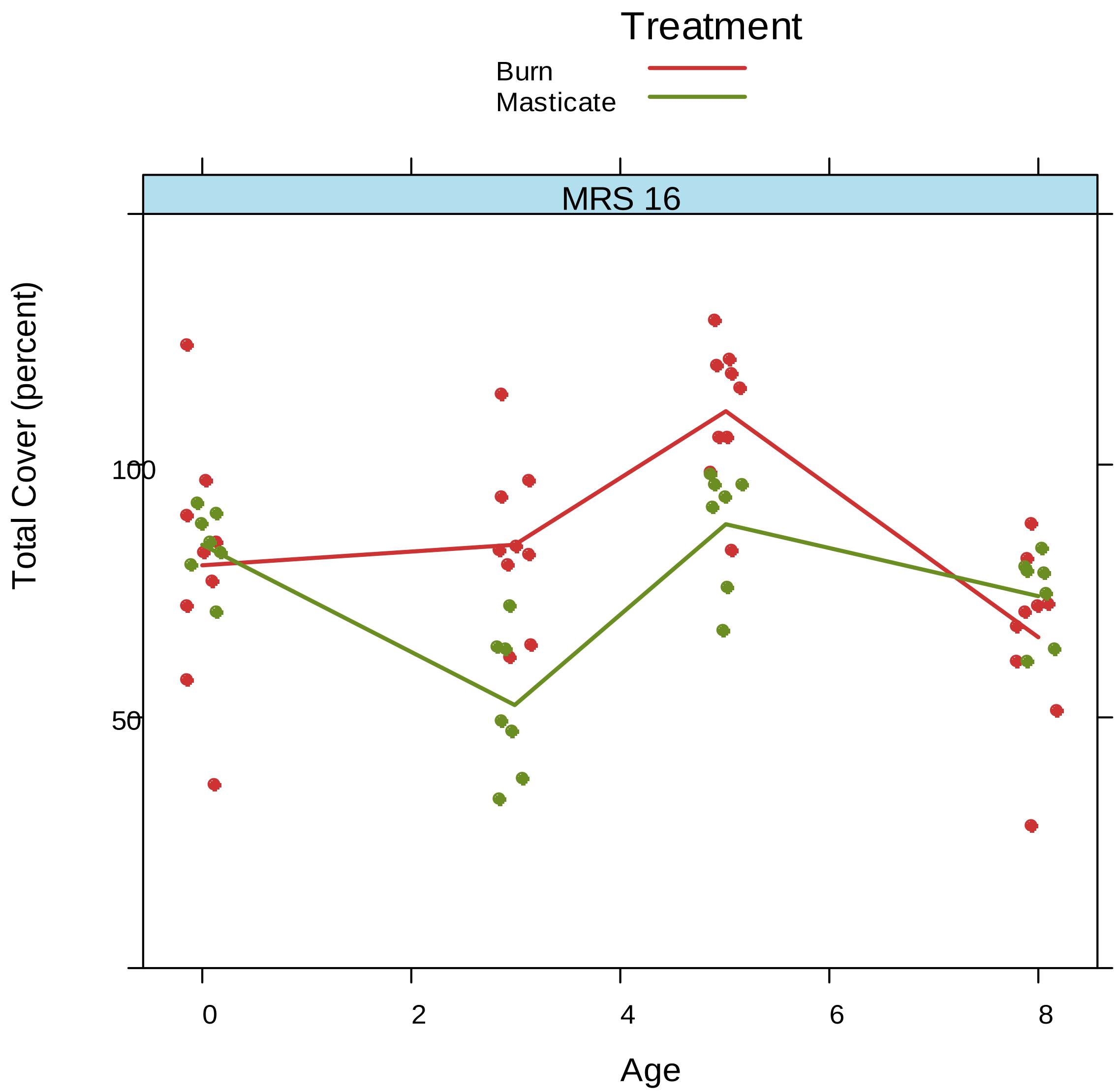

Figure 6-4 **Percent cover of shrubs in MRS 16 transects over time.**

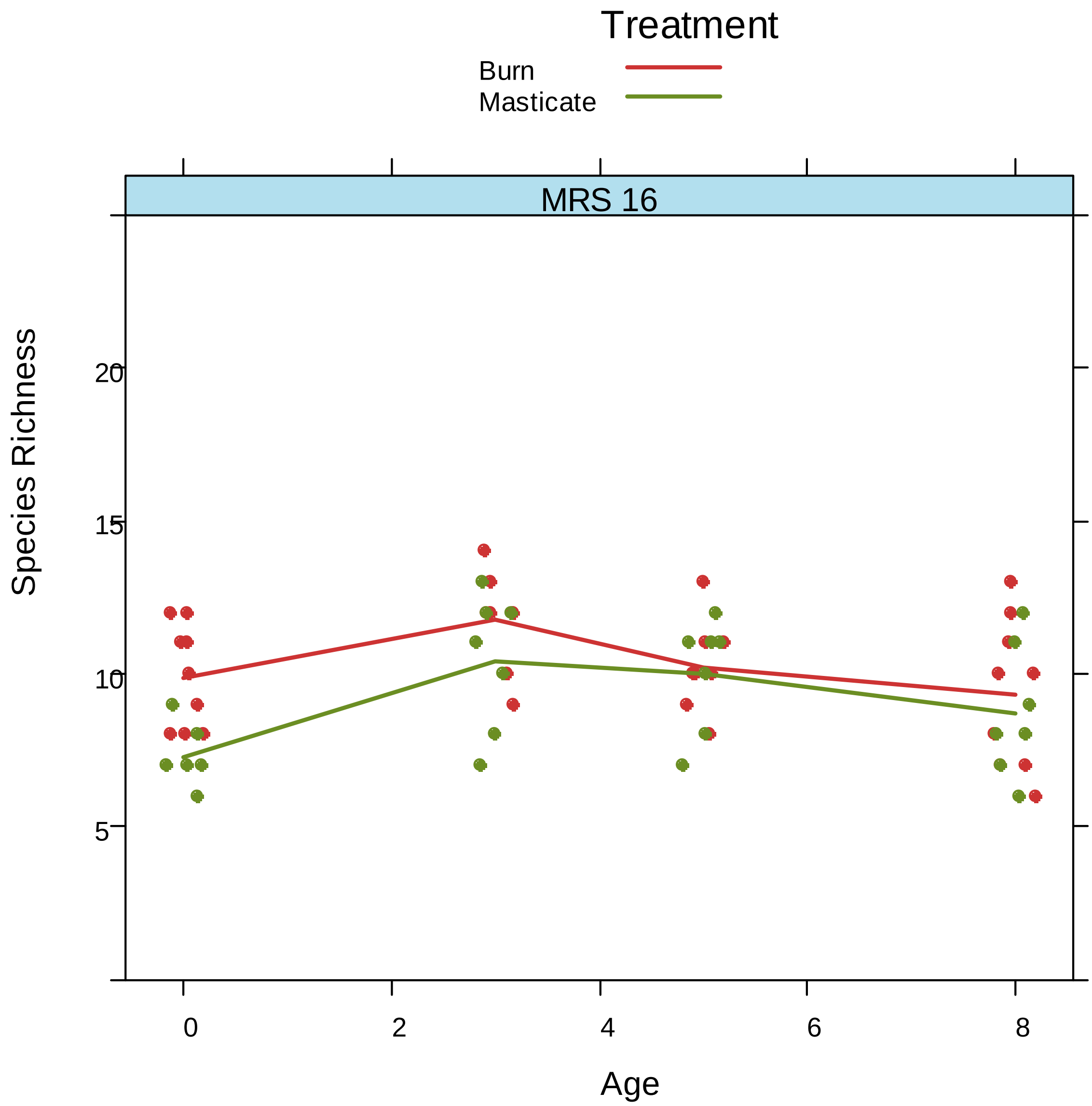

Figure 6-5 Species richness of shrubs in Unit MRS 16 transects over time.

To assess temporal changes in association structure, several standard metrics were examined (total percent cover, species richness, diversity, and evenness). Total percent cover along the shrub transects increased from an average of 70.3 percent in 2009 to 100.8 percent in 2011 (Figure 6-4). Cover subsequently decreased in 2014 to 69.5 percent. The observed decrease in percent cover between 2011 (Year 5) and 2014 (Year 8) is consistent with similar decreases observed in other Units in 2014, and is likely a response to the 2012-2014 drought in California.

Species richness (i.e., the number of species per transect) decreased slightly from 2009 to 2011 and between 2011 and 2014 (Figure 6-5). This pattern is consistent with successional changes, but may also be influenced by the drought conditions.

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 association and their relative abundance (or cover) in the sample. For both burned and masticated transects, diversity decreased slightly between 2009 and 2011 (Figure 6-6). Between 2011 and 2014, diversity in burned transects decreased further while diversity in masticated transects increased slightly. However, the majority of these differences are not statistically significant (Table 6-4). Of the four metrics and two factors tested, only the effect of Treatment on species richness was significant.

The pattern described above is reflected in the changes in species evenness (Figure 6-7). No statistically significant changes were observed in evenness.

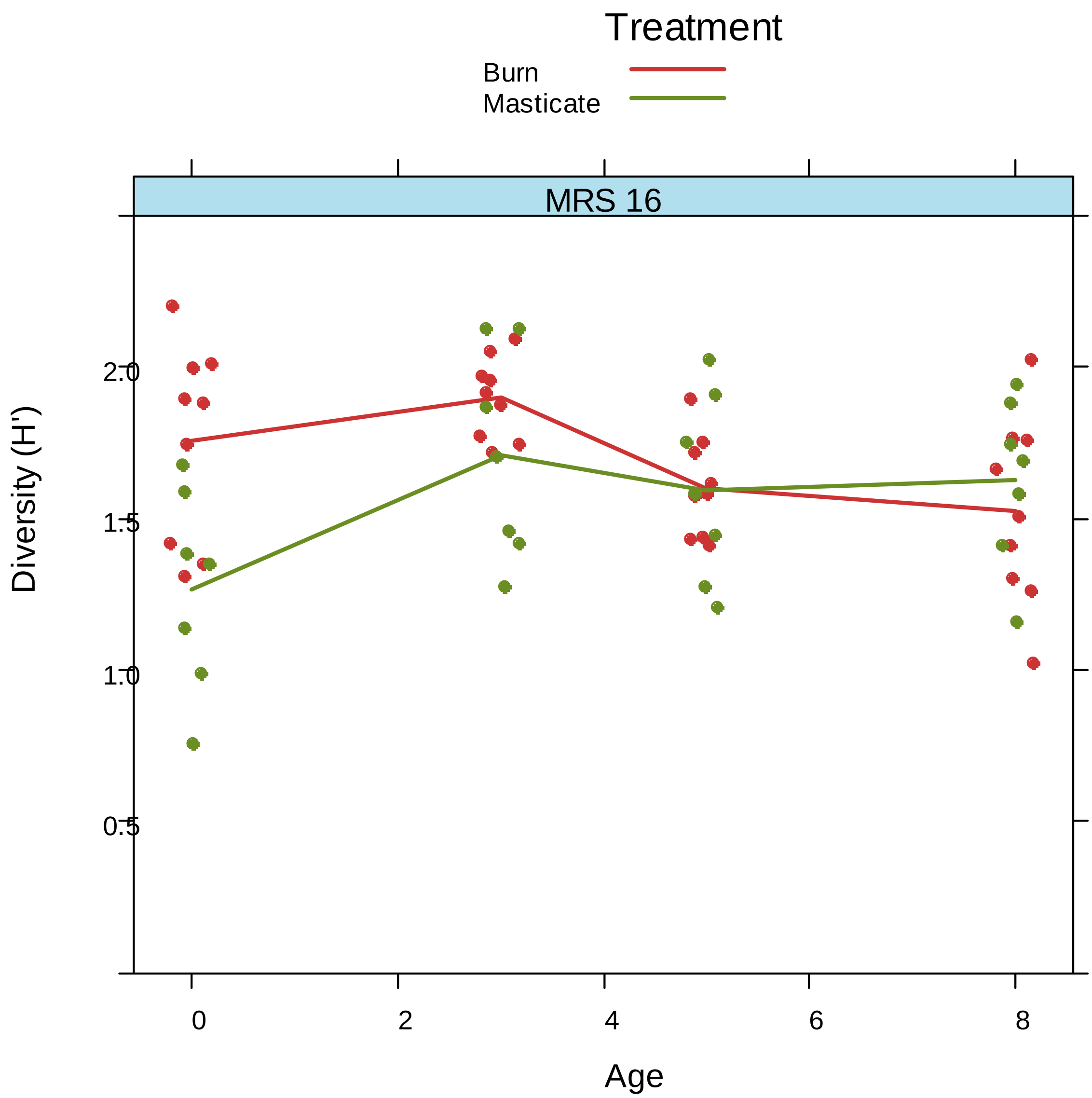

Figure 6-6 Shannon-Weiner diversity of shrubs in Unit MRS 16 transects over time.

Table 6-4
Results of Two-way ANOVAs for Effect of Treatment, Age on Shrub Association Metrics in MRS-16.

Parameter	Treatment Effect	Age Effect
Total cover	p = 0.06	p = 0.55
Species richness	p = 0.02	p = 0.95
Diversity	p = 0.07	p = 0.82
Evenness	p = 0.41	p = 0.91

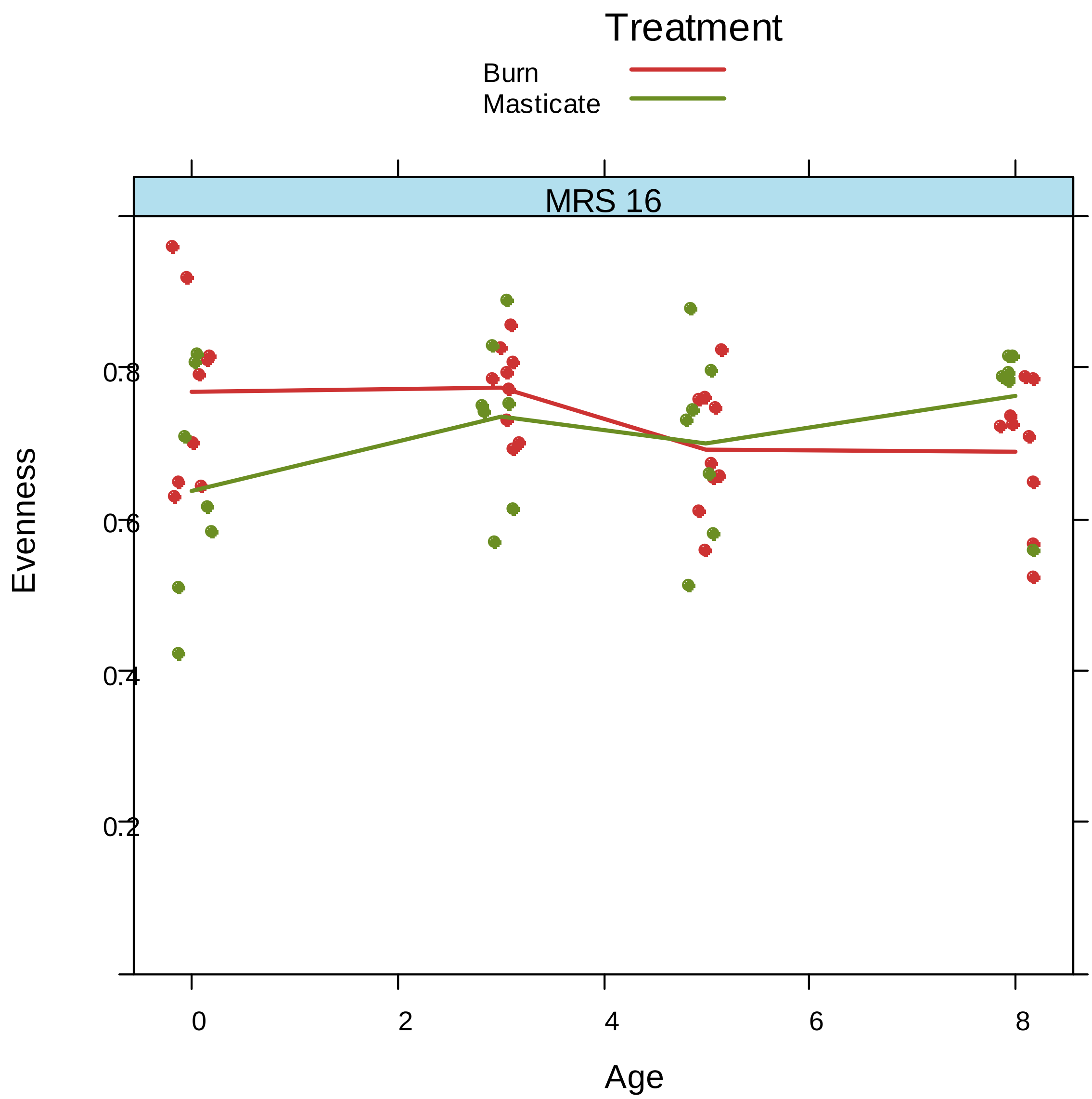

Figure 6-7 Evenness on shrub transects in Unit MRS 16 transects over time.

Multivariate statistics (ordination techniques) were used to assess whether there has been a change in species composition over time (Jongman et al. 1995). The effect of year and treatment can be clearly seen when the 95 percent confidence ellipsoids are plotted for MRS-16 (Figure 6-8). In MRS-16, burned transects in 2009 (Year 3) are significantly different than in 2011 (Year 5) and 2014 (Year 8). This graph suggests that there is no difference between treatments within a year. However, temporal changes in community structure are evident with both masticated and burned transects behaving similarly.

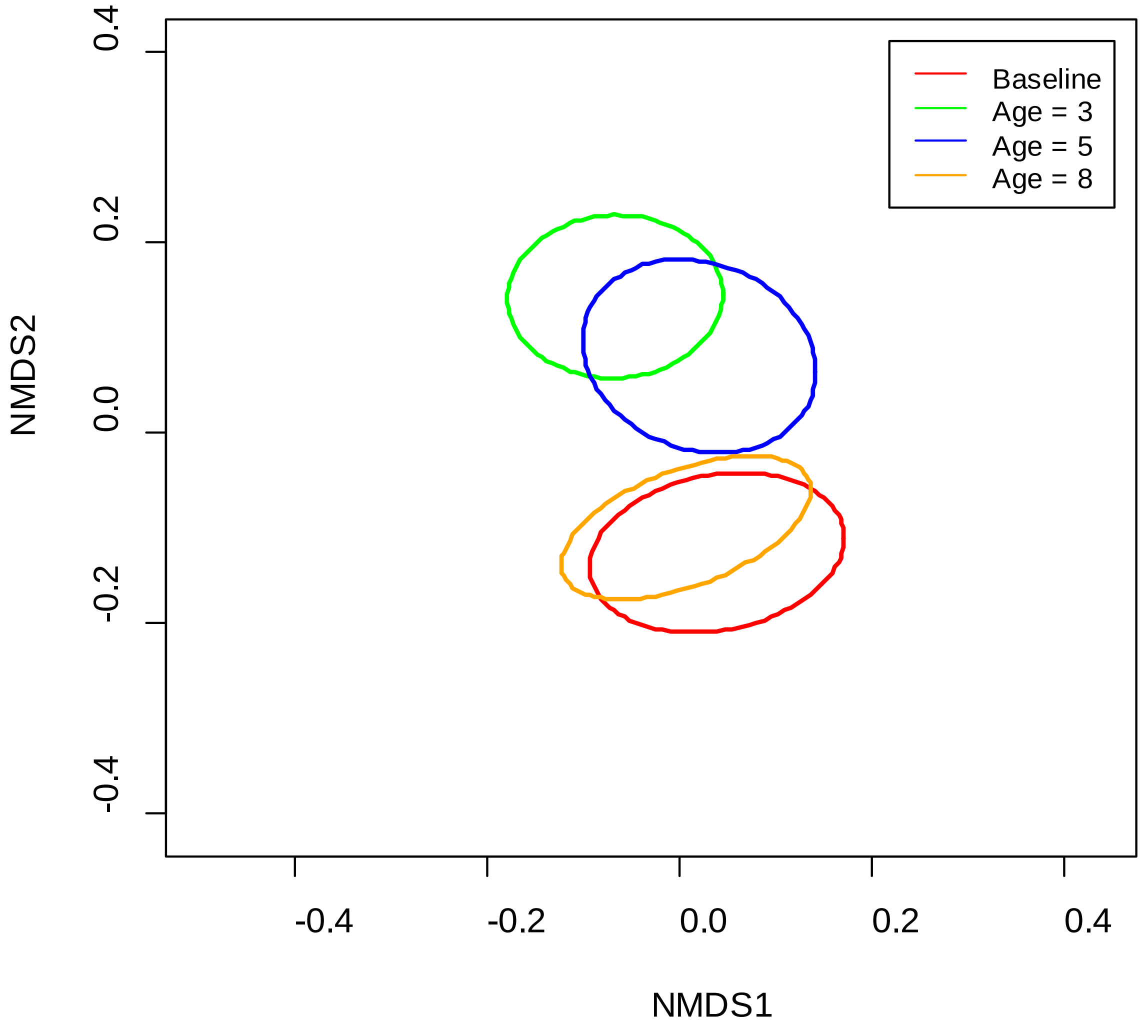

Figure 6-8 Comparison of 95 percent confidence ellipsoids for temporal and treatment groupings in MRS-16.

The results of the association metrics and the ordination suggest that there is a pattern of plant succession on MRS-16. However, the analyses presented above do not provide an indication of which species are important in defining the differences between the groups. To illustrate changes in association structure, a suite of three species (chamise, shaggy-barked manzanita, and dwarf ceanothus) that exhibited dominance, high frequency of occurrence, or uniqueness within different year classes was identified. The changes in percent cover of these species in shown in Figure 6-9.

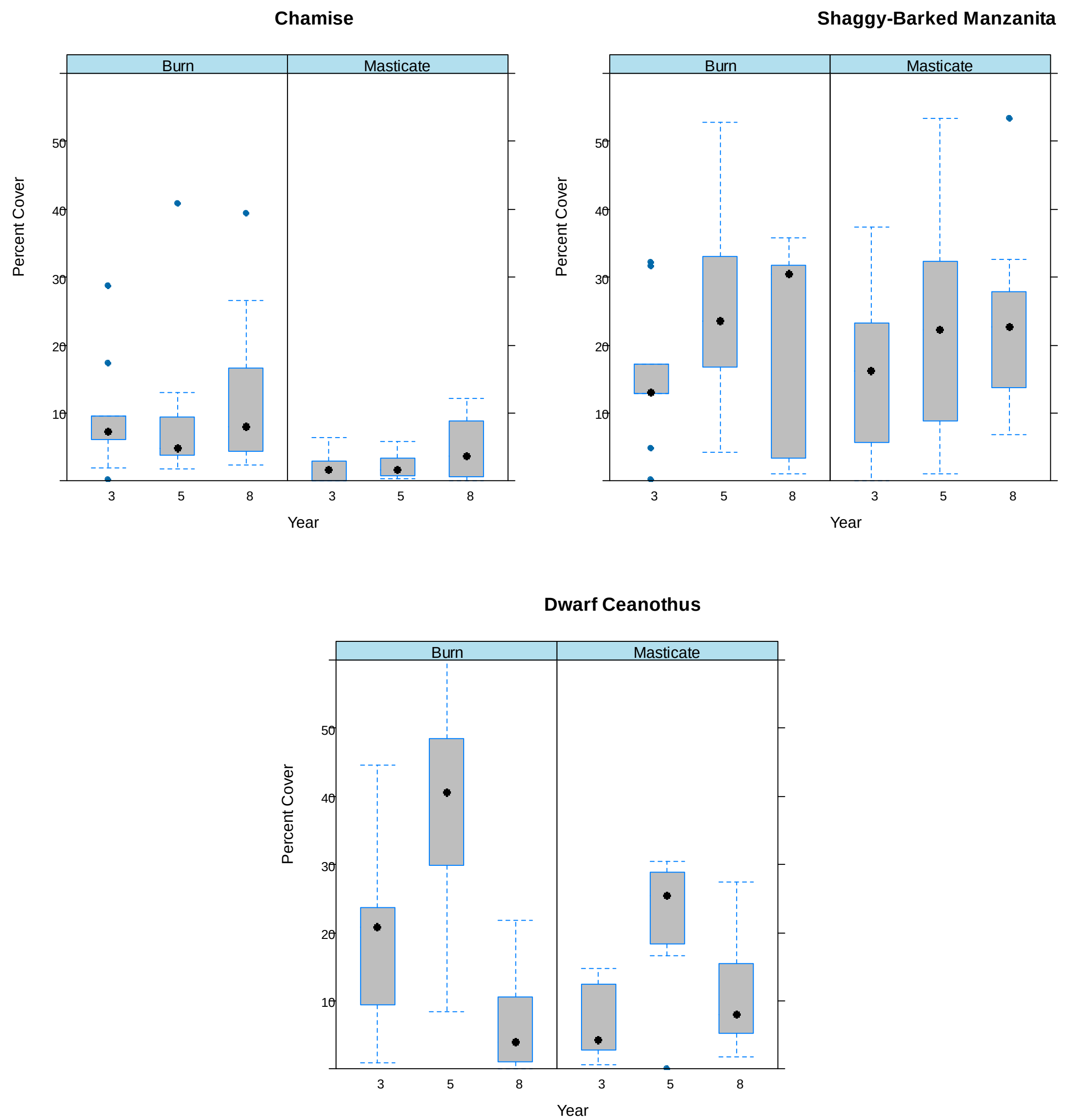

Figure 6-9 Temporal changes in percent cover of key plant species on MRS-16, showing successional patterns of recovery. Black dots represent the median value and the grey boxes represent the 25th to 75th percentiles of the data. The whiskers represent the non-outlier range of the data.

Chamise and shaggy-barked manzanita show similar responses over time, with both species exhibiting increases in percent cover. Chamise shows an initial decline in cover as a result of burn with little response to mastication between 2009 and 2011, but cover increases between 2011 and 2014.

The shaggy-barked manzanita increased in percent cover between 2009 and 2014 but masticated transects are slower to recover. By Year 8, shaggy-barked manzanita had reached approximately 30 percent cover on burned transects and approximately 25 percent cover on masticated transects.

Dwarf ceanothus increased in cover by a factor of 2 in both burned and masticated transects between 2009 and 2011. Between 2011 and 2014, average percent cover decreased to approximately 5 percent in burned transects and approximately 9 percent on masticated transects. Subshrub dwarf ceanothus was likely outcompeted by shrubs like the shaggy-barked manzanita during succession.

These species are considered to represent the major changes in shrub association structure occurring over time. The observed changes in species composition and relative abundance are consistent with the patterns observed in community structure seen in the Year 10 surveys on Ranges 43-48 conducted in 2013 (Tetra Tech and EcoSystems West 2014).

6.4.6. Annual Grass Monitoring

Annual grass are present on approximately 16 acres of the MRS 16 (Table 6-5, Map A6-19). Grasses are present along the northern, eastern, and southern borders of the Unit.

Table 6-5
Estimated Area Occupied (Acres) by Annual Grasses in Year 8 Surveys in MRS 16

Cover Class	MRS 16
1 (low) = 1–5 percent	7.27
2 (medium) = 6–25 percent	4.63
3 (high) = >25 percent	4.52
Total Acreage	**16.42**

6.4.7. Invasive Species Monitoring

No invasive species were encountered on MRS-16.

SECTION 7

California Tiger Salamander and Vernal Pool Survey

A survey of the hydrology of six vernal pools to determine their suitability to support the endangered California tiger salamander was conducted on the former Fort Ord between December 2013 and June 2014. These pools were monitored for hydrology and presence of California tiger salamander (CTS) (*Ambystoma californiense*) and California fairy shrimp (*Linderiella californica*) as a requirement of the U.S. Fish and Wildlife Service's 2005 Biological Opinion (USFWS 2005) and the *Wetland Monitoring and Restoration Plan for Munitions and Contaminated Soil Remedial Activities at Former Fort Ord* (Burleson Consulting, Inc. 2006).

Spring aquatic surveys to monitor known California tiger salamander (CTS) (*Ambystoma californiense*) breeding pools and larval presence were performed from April through June 2014, following on-going munitions and lead remediation activities around the pools. Of the six pools that were sampled, only Pool 10 supported California tiger salamander. It is likely that these larvae successfully metamorphosed into adults based on their large size.

Surveys for the California fairy shrimp failed to yield any individuals.

The results of the survey are provided as Appendix C to this report.

SECTION 8

Conclusions

A significant mitigating factor affecting the response of vegetation at the former Fort Ord is the 2012 to 2014 drought. The Year 3 (Units 4, 11, 12, and 23 N), Year 5 (Units 14 and 19), and Year 8 (MRS-16) Units were last sampled prior to or at the start of the drought. Therefore, comparisons with previous years will include the effects of the drought on recovery. This drought is considered to be the most severe 3-year drought in the past 1200 years, with 2014 having the highest moisture deficit of any previous span of dry years (Griffin and Anchukatis 2014).

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

The results of surveys from HMP annual species on multiple Units and for varying amounts of time have shown that these species continue to persist after vegetation clearance activities. HMP annual species exhibit considerable between-year and between-Unit variability with respect to density in monitored grids. Based on the data presented in this report, there does not appear to be a consistent differential response to burning or mastication treatments. Trajectories of change in density and response to treatment for a given species often differ between adjacent Units. This variation in observed densities may be due to factors other than the applied treatment such as the timing and quantity of precipitation (drought).

Sand gilia and Monterey spineflower vitality rates are both strongly correlated with rainfall (Fox et al. 2006; Fox 2007). Thus, the densities of these species would be expected to fluctuate between years in response to rainfall. In general, both species have increased survival and seed set during years of higher spring rainfall and temperatures. Sand gilia tends to have increased rates of germination in years with higher winter rainfall and temperatures, whereas Monterey spineflower germination is higher during cooler, drier years. Moreover, sand gilia abundance tends to increase with the number of years since the previous El Niño event while Monterey spineflower abundance tends to decline. Sand gilia abundance is independent of the previous years' seed set, while Monterey spineflower density is directly correlated to the previous years' seed set (Fox et al. 2006). Seaside bird's-beak densities are also known to fluctuate dramatically between years based on rainfall and other weather patterns. Further analysis of the data with respect to annual rainfall, soil conditions, and other climatic conditions is recommended.

Whereas the current monitoring approach for the HMP annual species focuses on determining the plant density in fixed plots monitored over time, it does not address changes in areal distribution in post-treatment years. Once the shrub canopy is opened by fire or mastication, annual species may colonize the open areas until such time as the shrub cover closes. Under the current monitoring protocol, the grids selected for monitoring represent a sample of the grids that were identified as supporting one or more HMP annual species during the meandering transects conducted in the baseline (Year 0) surveys. The same grids are monitored in all subsequent years. An alternative approach, using frequency of detection in macroplots, has been proposed and is currently under review by regulatory agencies (Tetra Tech and EcoSystems West 2013b). This approach will allow estimation of changes in both density and distribution of the HMP species.

8.2. Vegetation Transect Survey

Results of the shrub community structure analyses in baseline Units reaffirm the results of the previous surveys and protocol revision study that indicated the presence of at least three sub-associations that differ in the relative percentages of shaggy-barked manzanita and chamise (Tetra Tech and EcoSystems West 2013a,b). Successional patterns may differ between these sub-associations as a result of species composition as well as differential soil or microclimatic conditions.

The 2012-2014 drought may have significantly affected recovery of the shrub community. In the Year 5 transects in Units 14 and 19, total shrub cover continued to decline relative to Year 0 and Year 3 surveys whereas bare ground increased (Figure 5-3 and Figure 5-5). Similarly, the Year 8 surveys on MRS-16 showed a decrease in the number of species and total percent cover between the Year 5 and Year 8 surveys (Figure 6-4 and Figure 6-5).

A focus of the analyses conducted in this survey was the assessment of association-level responses to mastication and burning treatments. Because coastal chaparral is a fire-adapted association and several species are thought to require fire for germination or re-sprouting, it was anticipated that differences in succession may be present between the two treatments. No differences were detected in number of shrub species present, diversity, or evenness between treatments in any of the year classes. However, shrub association structure (species composition and relative abundance) exhibited changes in shrub community structure indicating a progression towards baseline conditions between Years 3, 5 and 8 (Figure 5-6, Figure 5-7, Figure 5-8, and Figure 6-8).

8.3. Annual Grasses

Annual grasses were generally present along the edges of roads, masticated areas, and other disturbed areas, and occasionally extend somewhat into the interior of the study sites. Although there are some localized areas of high annual grass density in cleared fuel break areas, overall it does not appear that colonization by annual grasses is a major problem in these areas. Initial colonization by annual grasses in fuel break areas may be enhanced through the fertilization effect from application of fire suppression chemicals (Parsons 2004).

SECTION 9

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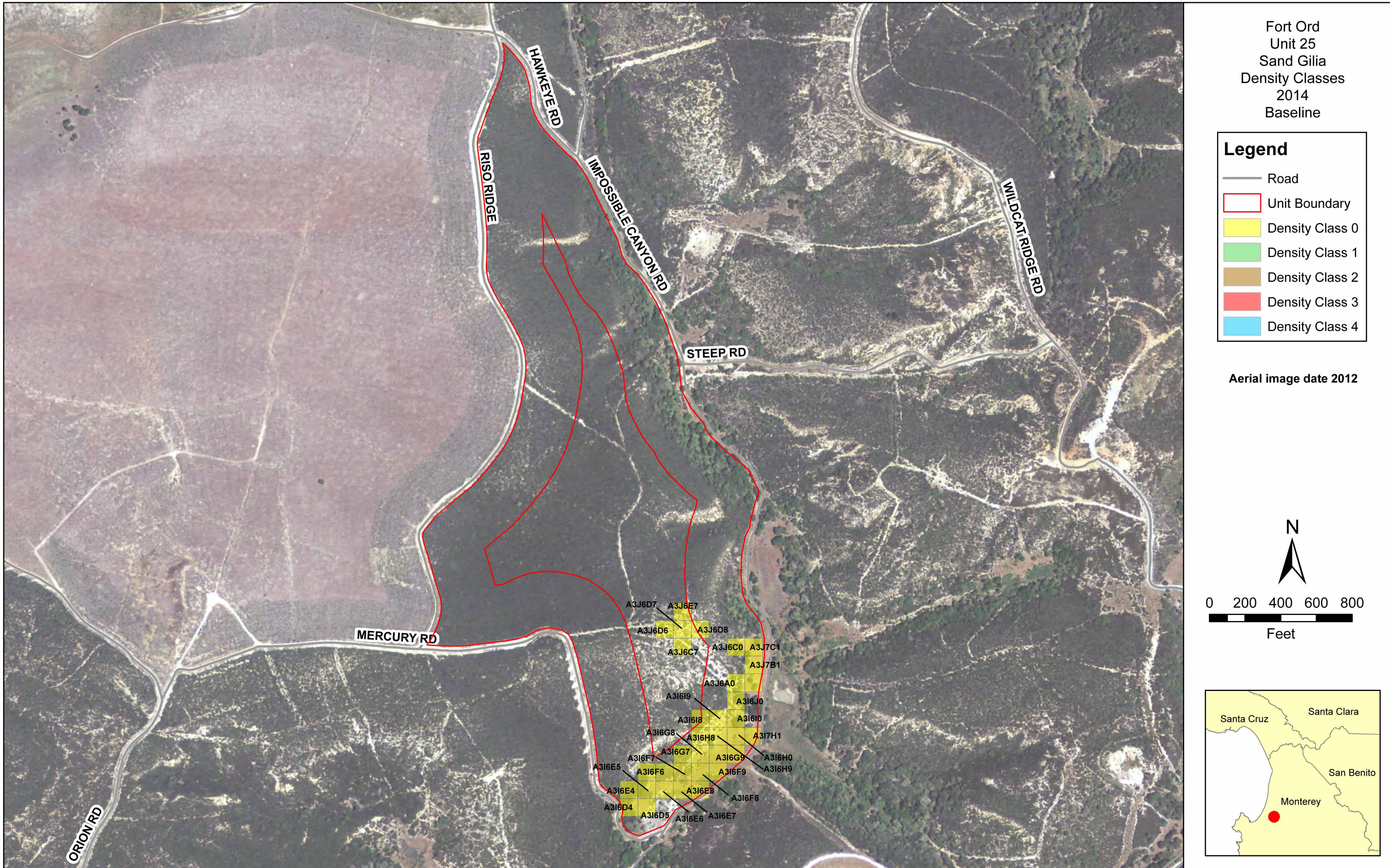
APPENDIX A

Maps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Unit 25
Sand Gilia
Density Classes
2014
Baseline
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
HAWKEYE RD
RISO RIDGE
IMPOSSIBLE CANYON RD
WILDCAT RIDGE RD
STEEP RD
MERCURY RD
ORION RD
A3J6D7
A3J6E7
A3J6D6
A3J6D8
A3J6C7
A3J6C0
A3J7C1
A3J7B1
A3J6A0
A3I6I9
A3I6J0
A3I6I8
A3I6I0
A3I6G8
A3I6H8
A3I7H1
A3I6F7
A3I6G7
A3I6G9
A3I6H0
A3I6H9
A3I6E5
A3I6F6
A3I6F9
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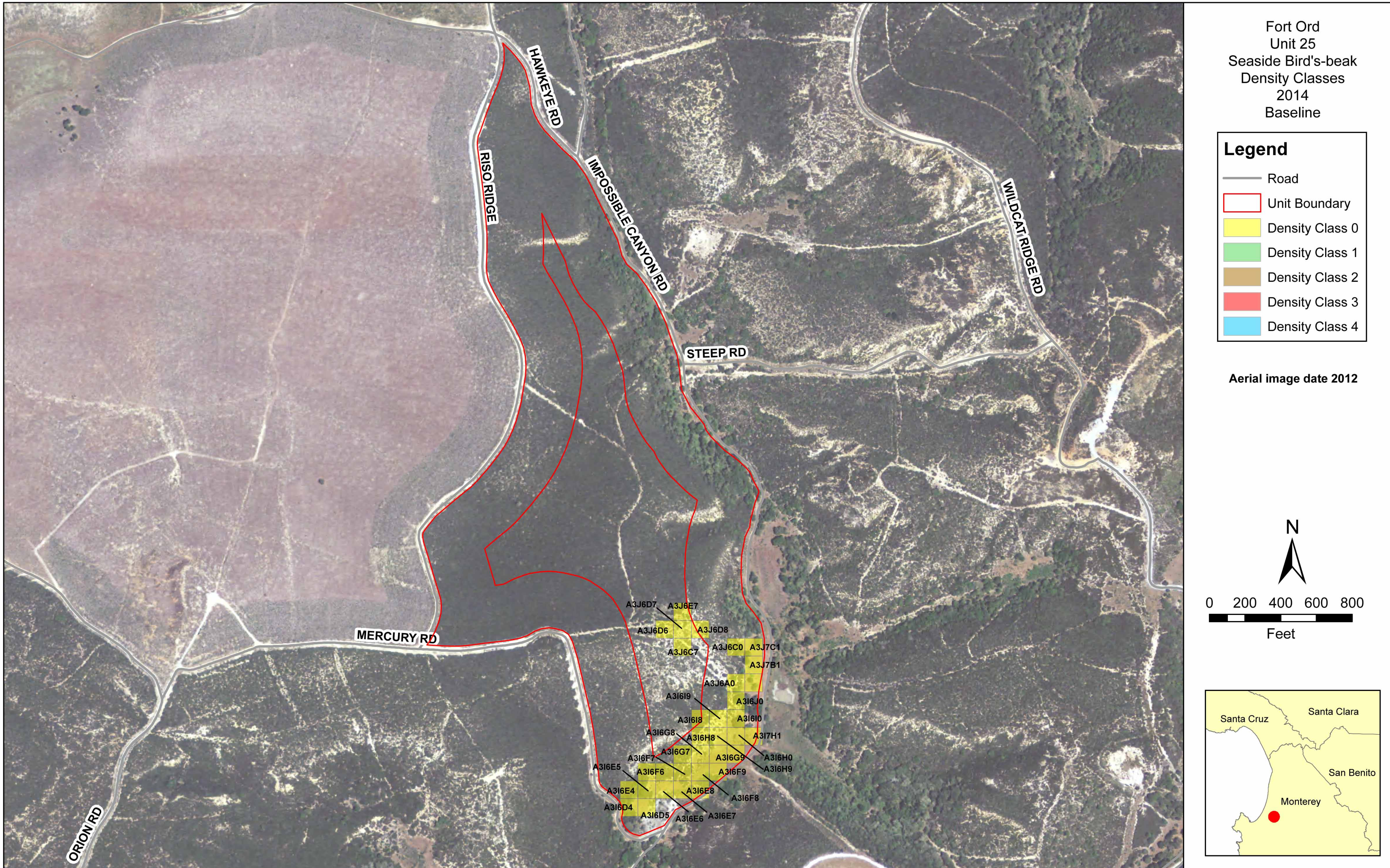
Map A1-1


Fort Ord
Unit 25
Seaside Bird's-beak
Density Classes
2014
Baseline
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
HAWKEYE RD
RISO RIDGE
IMPOSSIBLE CANYON RD
WILDCAT RIDGE RD
STEEP RD
MERCURY RD
ORION RD
A3J6D7
A3J6E7
A3J6D6
A3J6D8
A3J6C7
A3J6C0
A3J7C1
A3J7B1
A3J6A0
A3I6I9
A3I6J0
A3I6I8
A3I6I0
A3I6G8
A3I6H8
A3I7H1
A3I6G7
A3I6F7
A3I6G9
A3I6H0
A3I6H9
A3I6E5
A3I6F6
A3I6F9
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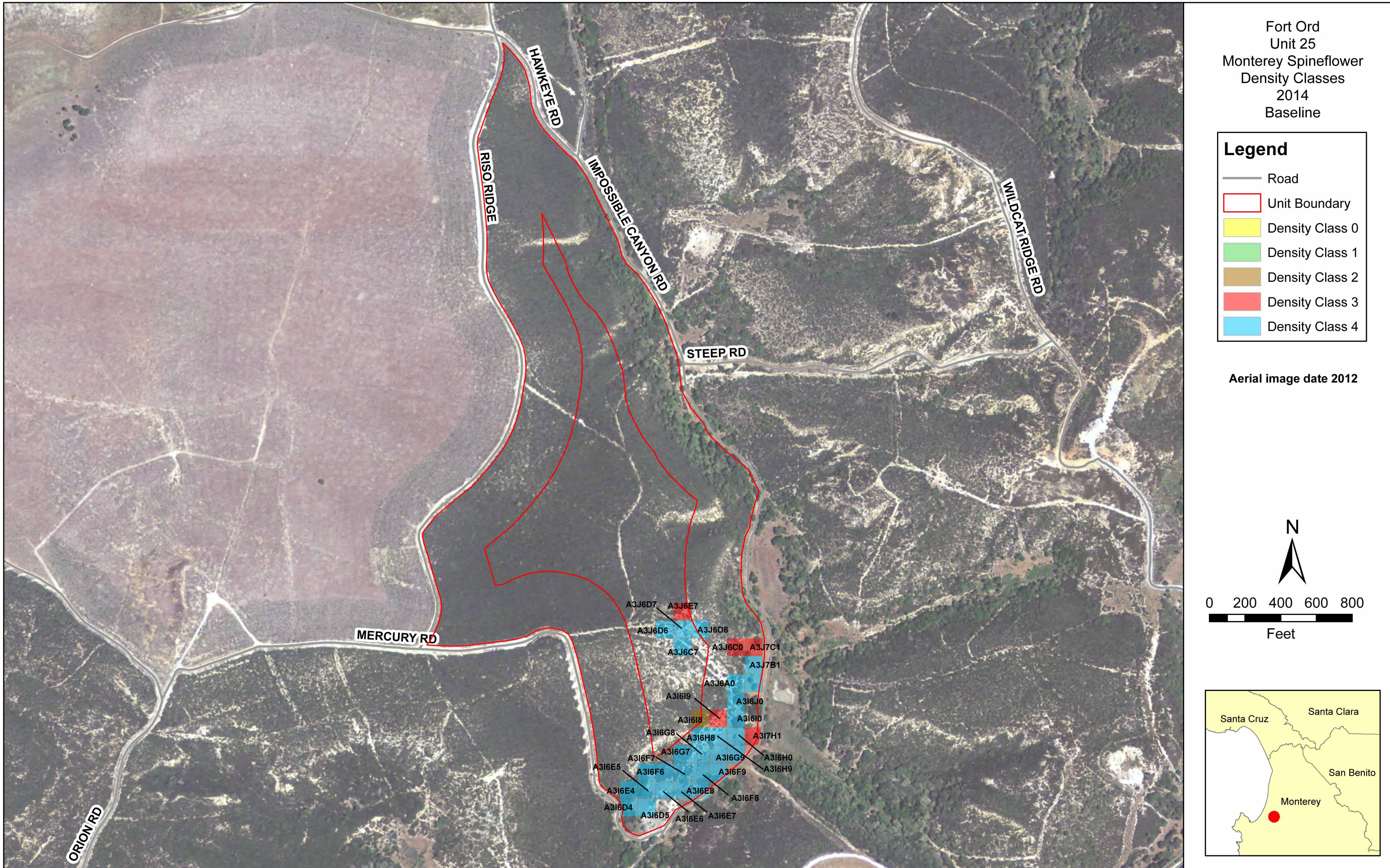
A3I6E6
A3I6E7

Map A1-2



Fort Ord
Unit 25
Monterey Spineflower
Density Classes
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Baseline
Legend
Road
Unit Boundary
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Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
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Feet
Santa Cruz
Santa Clara
San Benito
Monterey
HAWKEYE RD
IMPOSSIBLE CANYON RD
RISO RIDGE
STEEP RD
WILDCAT RIDGE RD
MERCURY RD
ORION RD
A3J6D7
A3J6E7
A3J6D6
A3J6D8
A3J6C7
A3J6C0
A3J7C1
A3J7B1
A3J6A0
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A3I6J0
A3I6I8
A3I6I0
A3I6G8
A3I6H8
A3I7H1
A3I6F7
A3I6G7
A3I6G9
A3I6H0
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A3I6E5
A3I6F6
A3I6F9
A3I6E4
A3I6E8
A3I6F8
A3I6D4
A3I6D5
A3I6E6
A3I6E7

Map A1-3

Fort Ord
Unit 25
Vegetation Transect Locations
2014
Baseline
Legend
Road
Vegetation Transect
Unit Boundary
Aerial image date 2012
N
0 200 400 600 800
Feet
HAWKEYE RD
RISO RIDGE
IMPOSSIBLE CANYON RD
WILDCAT RIDGE RD
STEEP RD
MERCURY RD
ORION RD
25-1
25-2
25-3
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25-9
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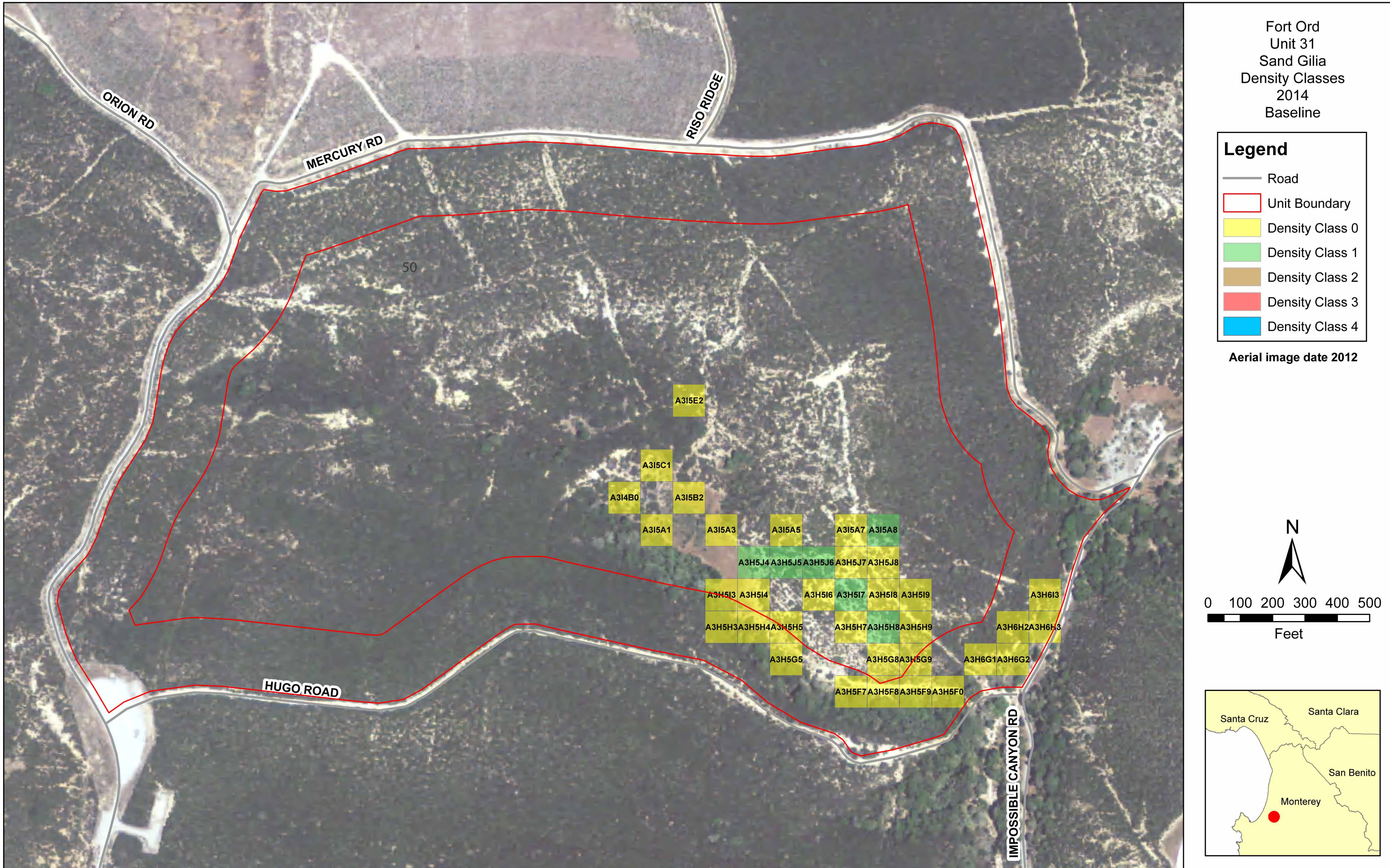
Santa Clara
San Benito
Monterey

Map A1-4



ORION RD
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RISO RIDGE
HUGO ROAD
IMPOSSIBLE CANYON RD
50
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A3I5A1
A3I5A3
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A3H6G2
A3H5F7
A3H5F8
A3H5F9
A3H5F0
Fort Ord
Unit 31
Sand Gilia
Density Classes
2014
Baseline
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
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Feet
Santa Cruz
Santa Clara
San Benito
Monterey

Map A1-5

Fort Ord
Unit 31
Seaside Bird's-beak
Density Classes
2014
Baseline
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
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Feet
Santa Cruz
Santa Clara
San Benito
Monterey
ORION RD
MERCURY RD
RISO RIDGE
HUGO ROAD
IMPOSSIBLE CANYON RD
A3I5E2
A3I5C1
A3I4B0
A3I5B2
A3I5A1
A3I5A3
A3I5A5
A3I5A7
A3I5A8
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A3H5J7
A3H5J8
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A3H6H2
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A3H5F0

Map A1-6

Fort Ord
Unit 31
Monterey Spineflower
Density Classes
2014
Baseline
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
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Feet
Santa Cruz
Santa Clara
San Benito
Monterey
ORION RD
MERCURY RD
RISO RIDGE
HUGO ROAD
IMPOSSIBLE CANYON RD
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A3H6G2
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Map A1-7


Fort Ord
Unit 31
Vegetation Transect Locations
2014
Baseline
Legend
Road
Vegetation Transect
Unit Boundary
Aerial image date 2012
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Feet
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Santa Clara
San Benito
Monterey
ORION RD
MERCURY RD
RISO RIDGE
HUGO ROAD
IMPOSSIBLE CANYON RD
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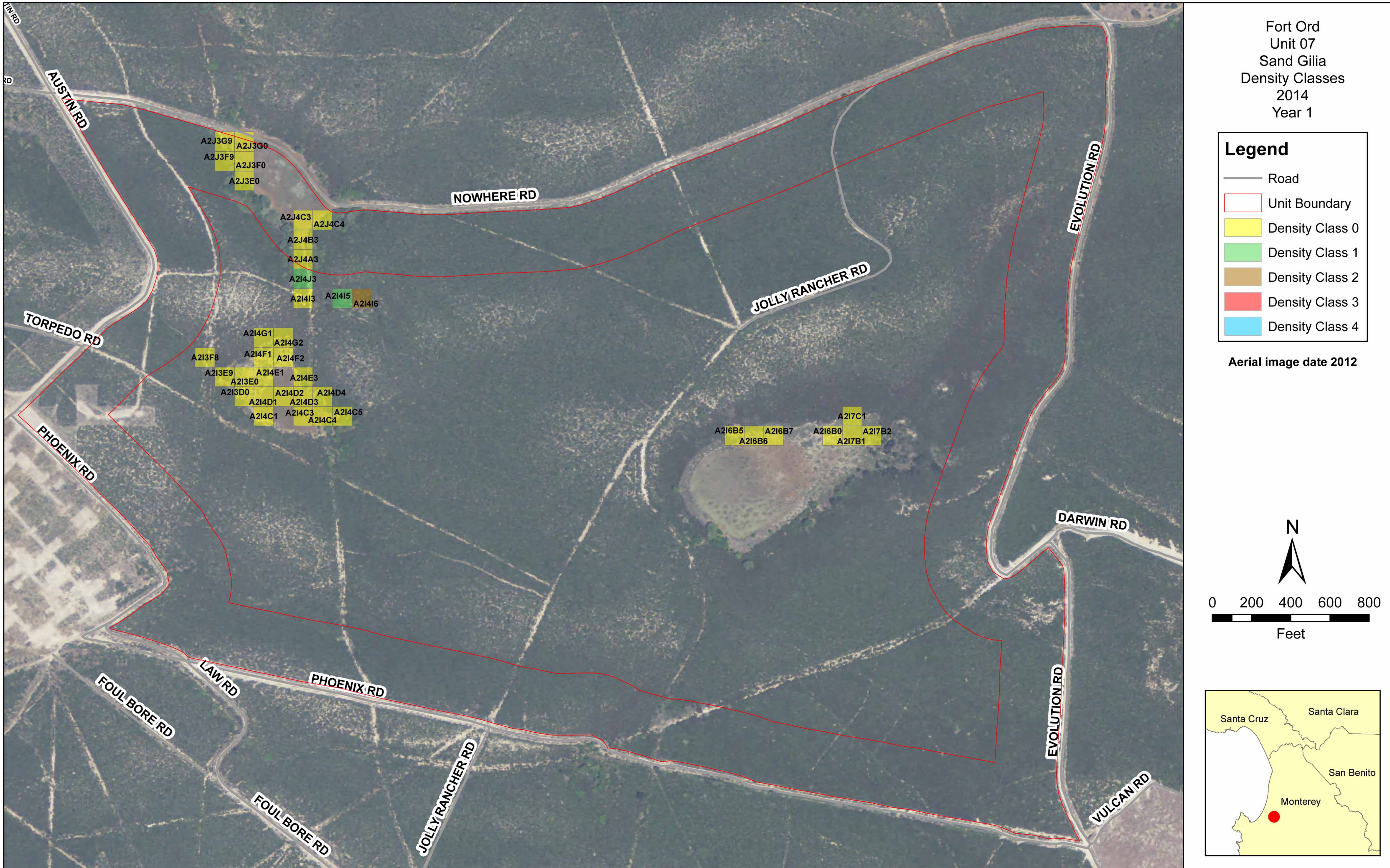
31-8
31-9
31-10

Map A1-8



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Unit 07
Sand Gilia
Density Classes
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Density Class 4
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Santa Clara
San Benito
Monterey
AUSTIN RD
NOWHERE RD
TORPEDO RD
PHOENIX RD
JOLLY RANCHER RD
EVOLUTION RD
DARWIN RD
LAW RD
FOUL BORE RD
VULCAN RD
A2J3G9
A2J3G0
A2J3F9
A2J3F0
A2J3E0
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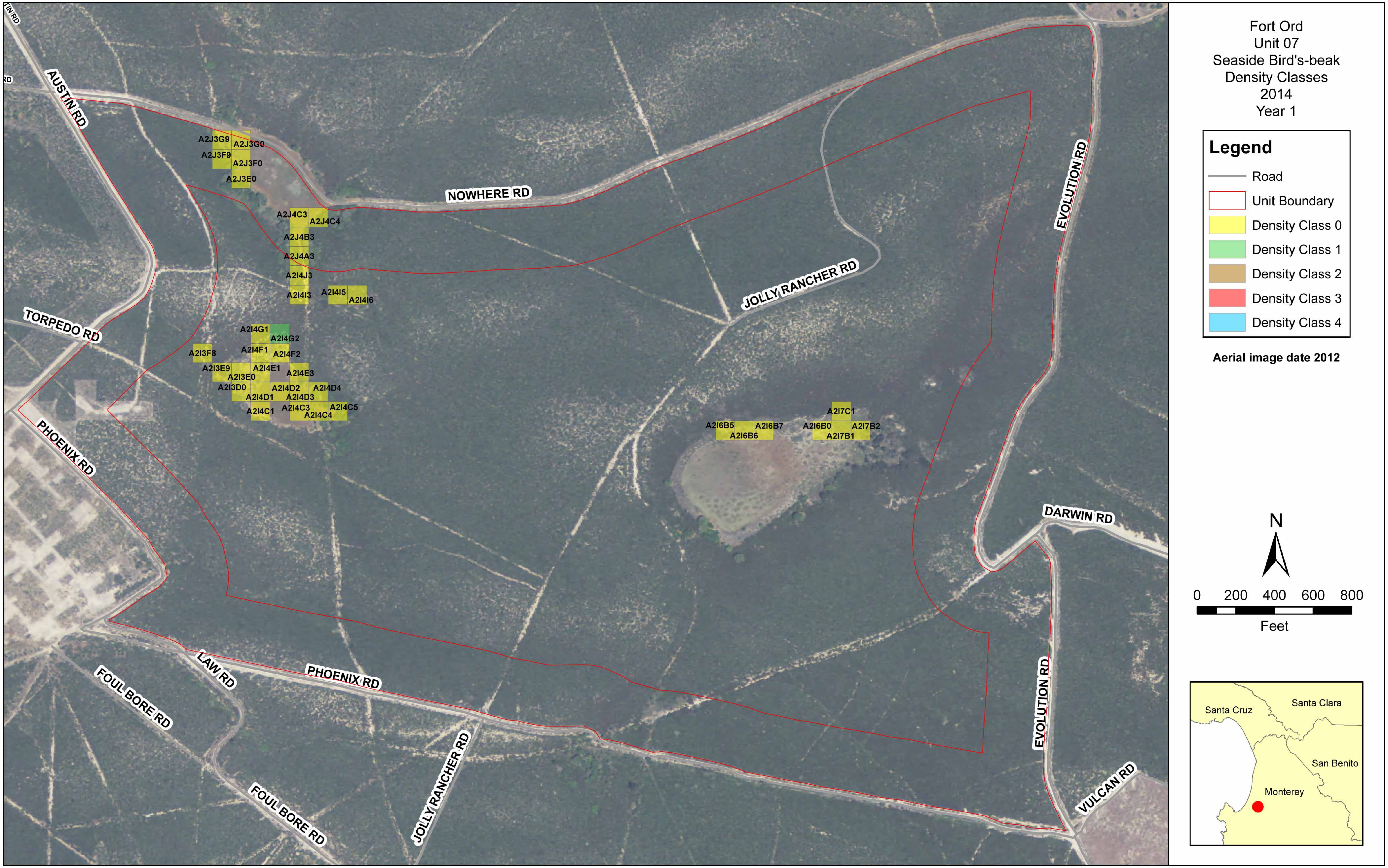
MAP A2-1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Unit 07
Seaside Bird's-beak
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Year 1
Legend
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Density Class 4
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Feet
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Santa Clara
San Benito
Monterey
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NOWHERE RD
TORPEDO RD
PHOENIX RD
JOLLY RANCHER RD
EVOLUTION RD
DARWIN RD
LAW RD
FOUL BORE RD
VULCAN RD
A2J3G9
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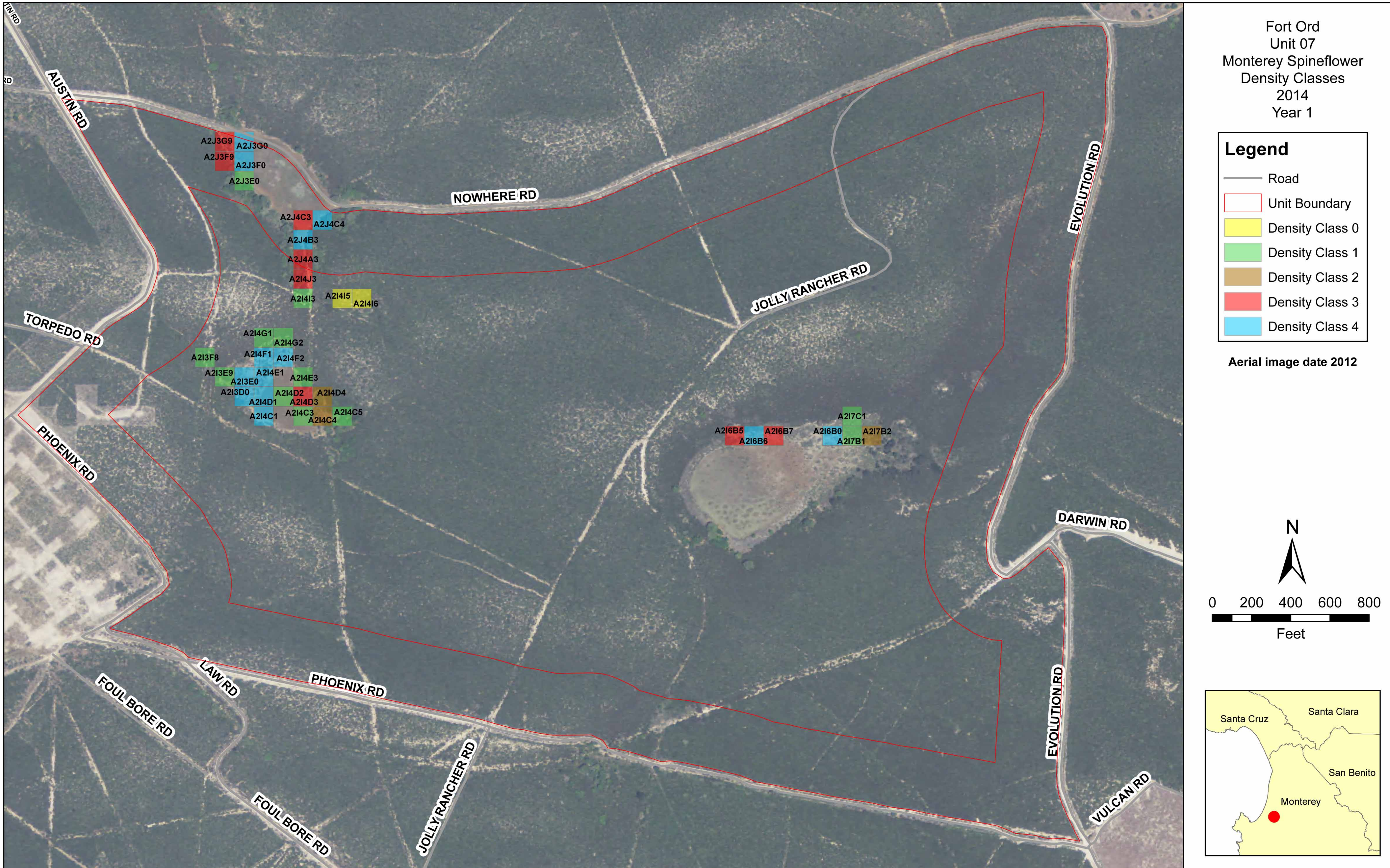
MAP A2-2



AUSTIN RD
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TORPEDO RD
PHOENIX RD
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EVOLUTION RD
DARWIN RD
VULCAN RD
LAW RD
FOUL BORE RD
A2J3G9
A2J3G0
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A2J3E0
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Fort Ord
Unit 07
Monterey Spineflower
Density Classes
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Year 1
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Unit Boundary
Density Class 0
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Density Class 2
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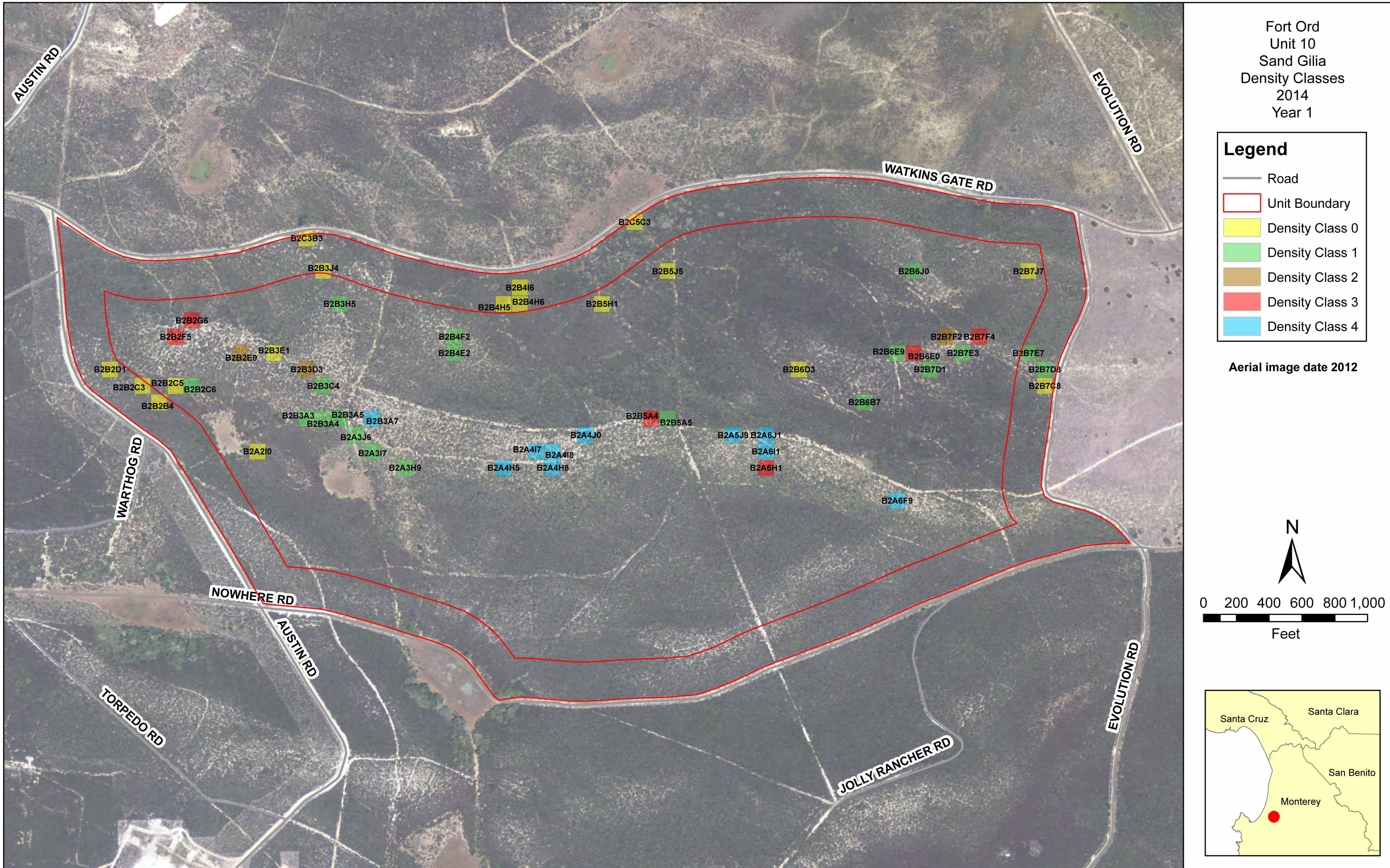
Santa Clara
San Benito
Monterey

MAP A2-3



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Santa Cruz
Santa Clara
San Benito
Monterey
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EVOLUTION RD
WARTHOG RD
NOWHERE RD
TORPEDO RD
JOLLY RANCHER RD
B2C3B3
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B2B3H5
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B2B3A3
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B2A4I7
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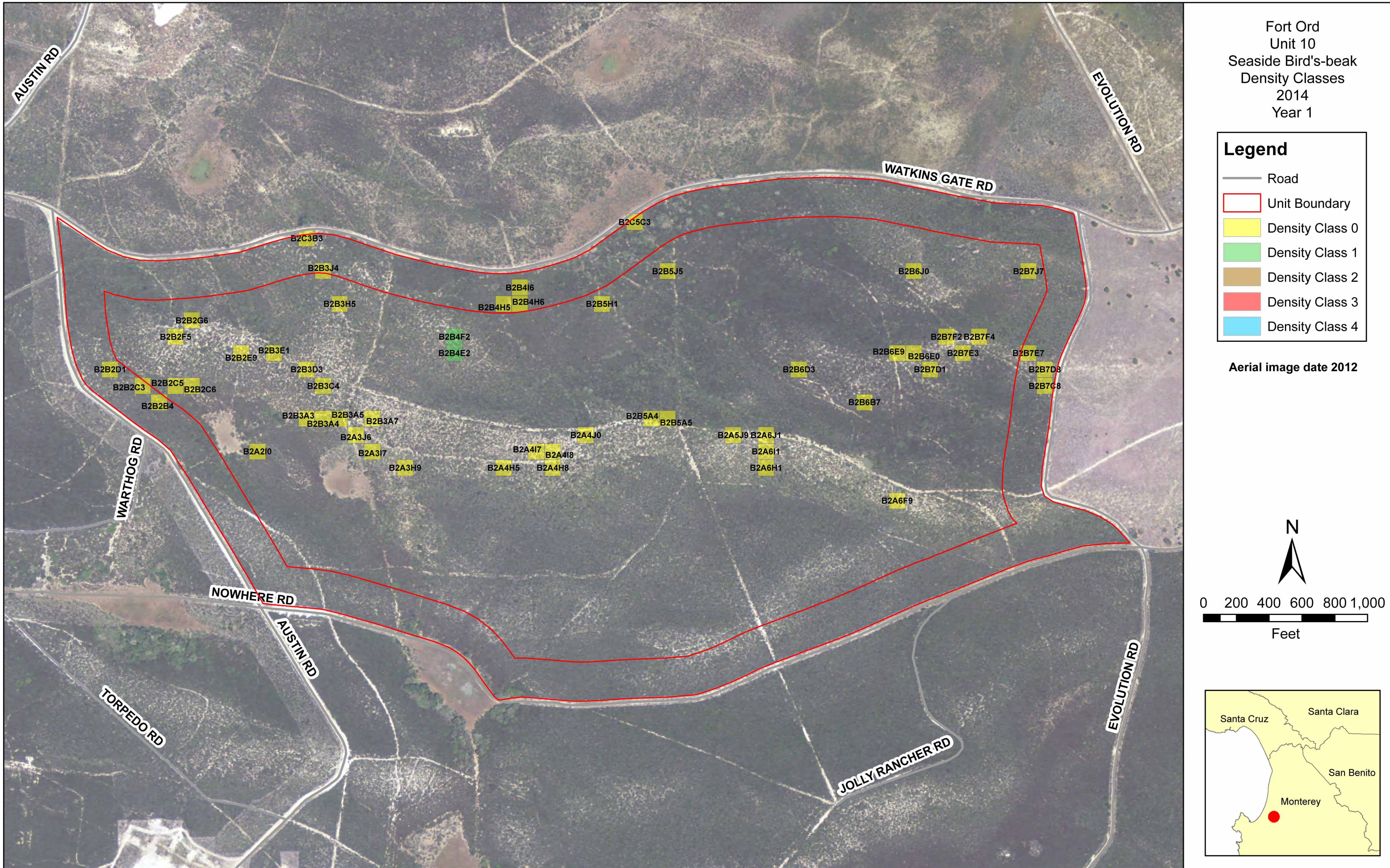
MAP A2-4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Seaside Bird's-beak
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Legend
Road
Unit Boundary
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Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
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Feet
Santa Cruz
Santa Clara
San Benito
Monterey
AUSTIN RD
EVOLUTION RD
WATKINS GATE RD
WARTHOG RD
NOWHERE RD
TORPEDO RD
JOLLY RANCHER RD
B2C5C3
B2C3B3
B2B3J4
B2B5J5
B2B6J0
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B2B4I6
B2B4H5
B2B4H6
B2B5H1
B2B3H5
B2B2G6
B2B2F5
B2B4F2
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B2B6E0
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B2B7C8
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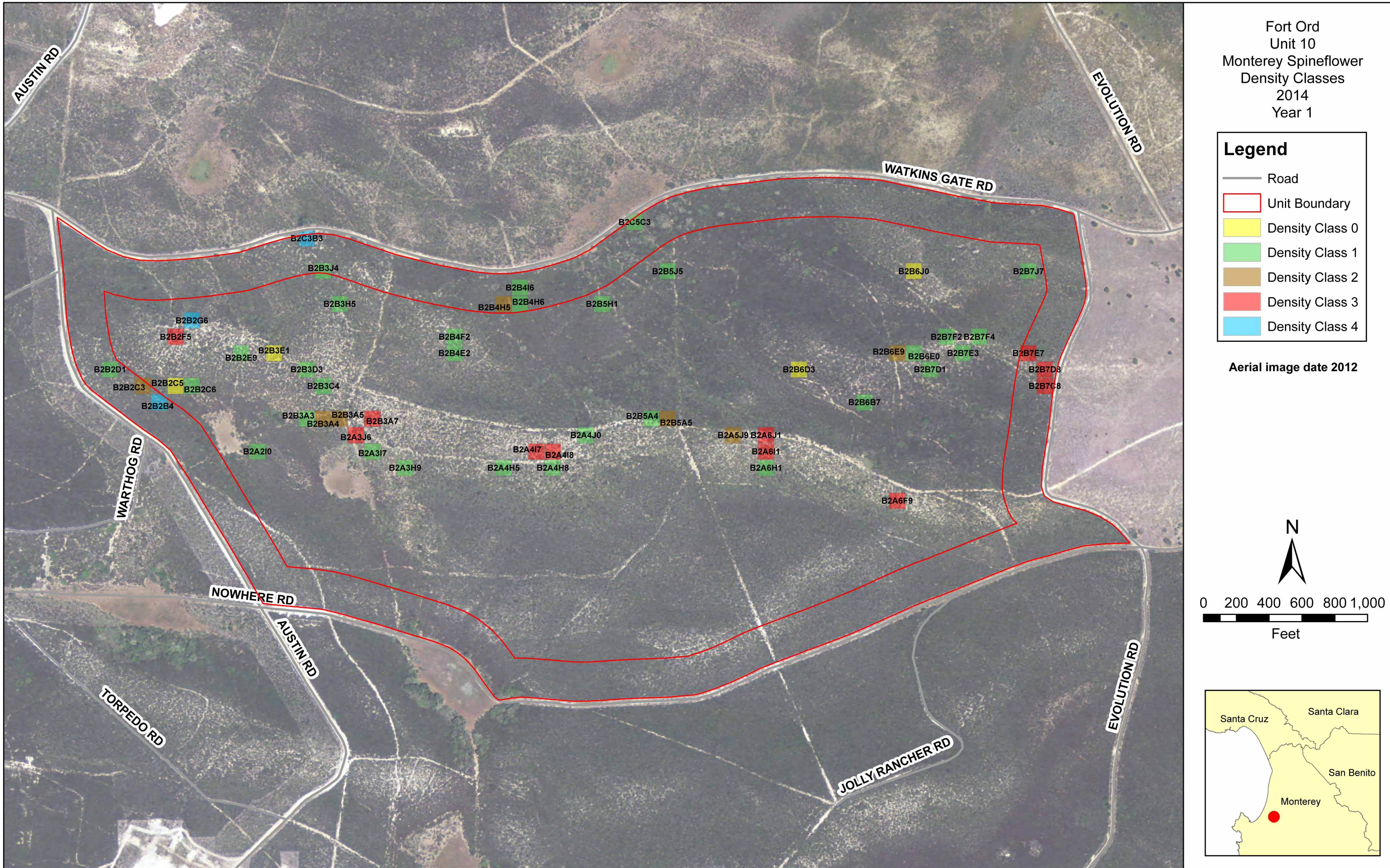
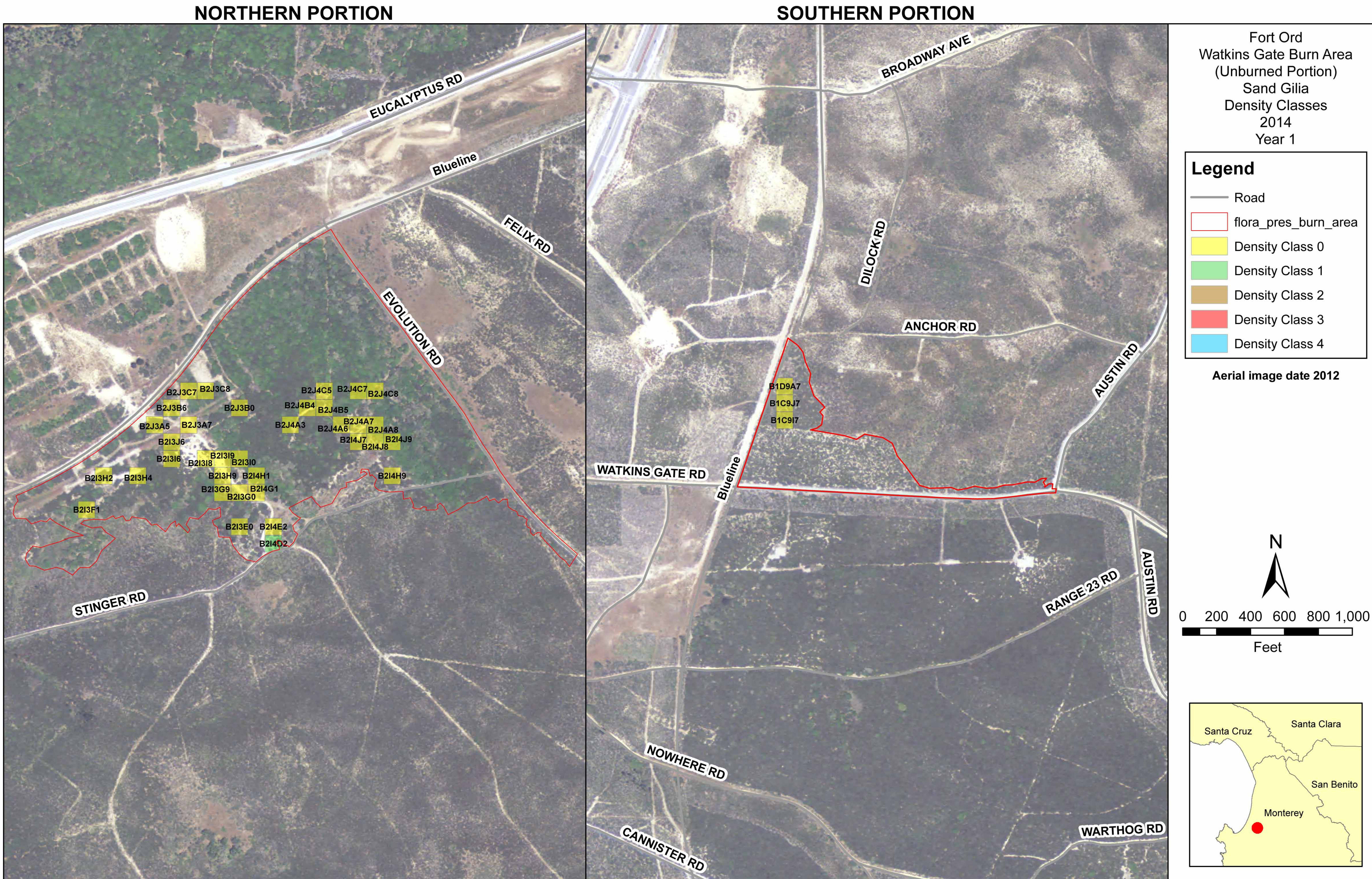
B2A4H5
B2A4H8
B2A6H1
B2A6F9

MAP A2-5


Fort Ord
Unit 10
Monterey Spineflower
Density Classes
2014
Year 1
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
AUSTIN RD
EVOLUTION RD
WATKINS GATE RD
WARTHOG RD
NOWHERE RD
TORPEDO RD
JOLLY RANCHER RD
B2C5C3
B2C3B3
B2B3J4
B2B5J5
B2B6J0
B2B7J7
B2B4I6
B2B4H5
B2B4H6
B2B5H1
B2B3H5
B2B2G6
B2B2F5
B2B4F2
B2B7F2
B2B7F4
B2B3E1
B2B2E9
B2B4E2
B2B6E9
B2B6E0
B2B7E3
B2B7E7
B2B2D1
B2B3D3
B2B6D3
B2B7D1
B2B7D8
B2B2C3
B2B2C5
B2B2C6
B2B3C4
B2B7C8
B2B2B4
B2B6B7
B2B3A3
B2B3A5
B2B3A4
B2B3A7
B2B5A4
B2B5A5
B2A3J6
B2A4J0
B2A5J9
B2A6J1
B2A2I0
B2A3I7
B2A4I7
B2A4I8
B2A6I1
B2A3H9
B2A4H5
B2A4H8
B2A6H1
B2A6F9

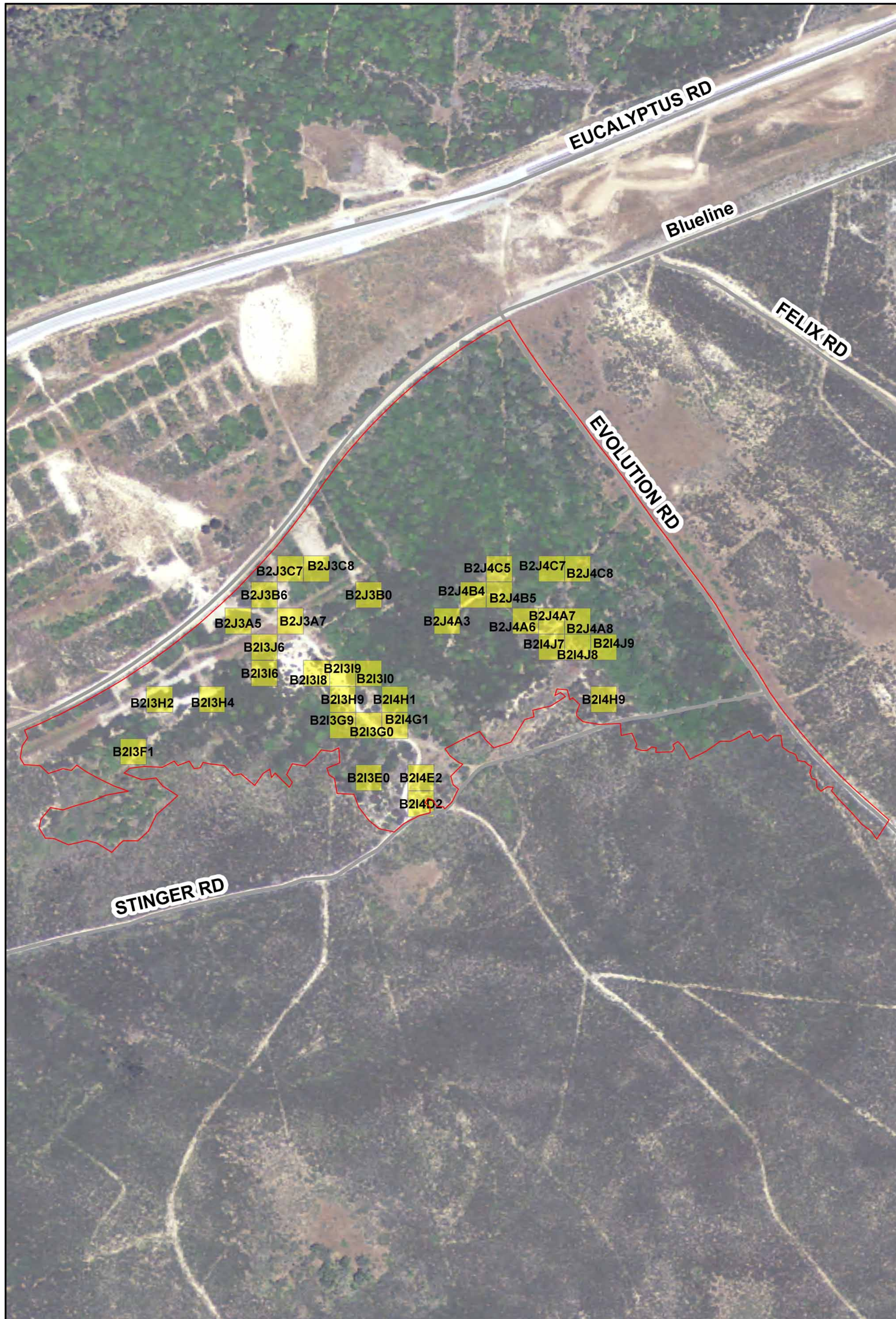
MAP A2-6



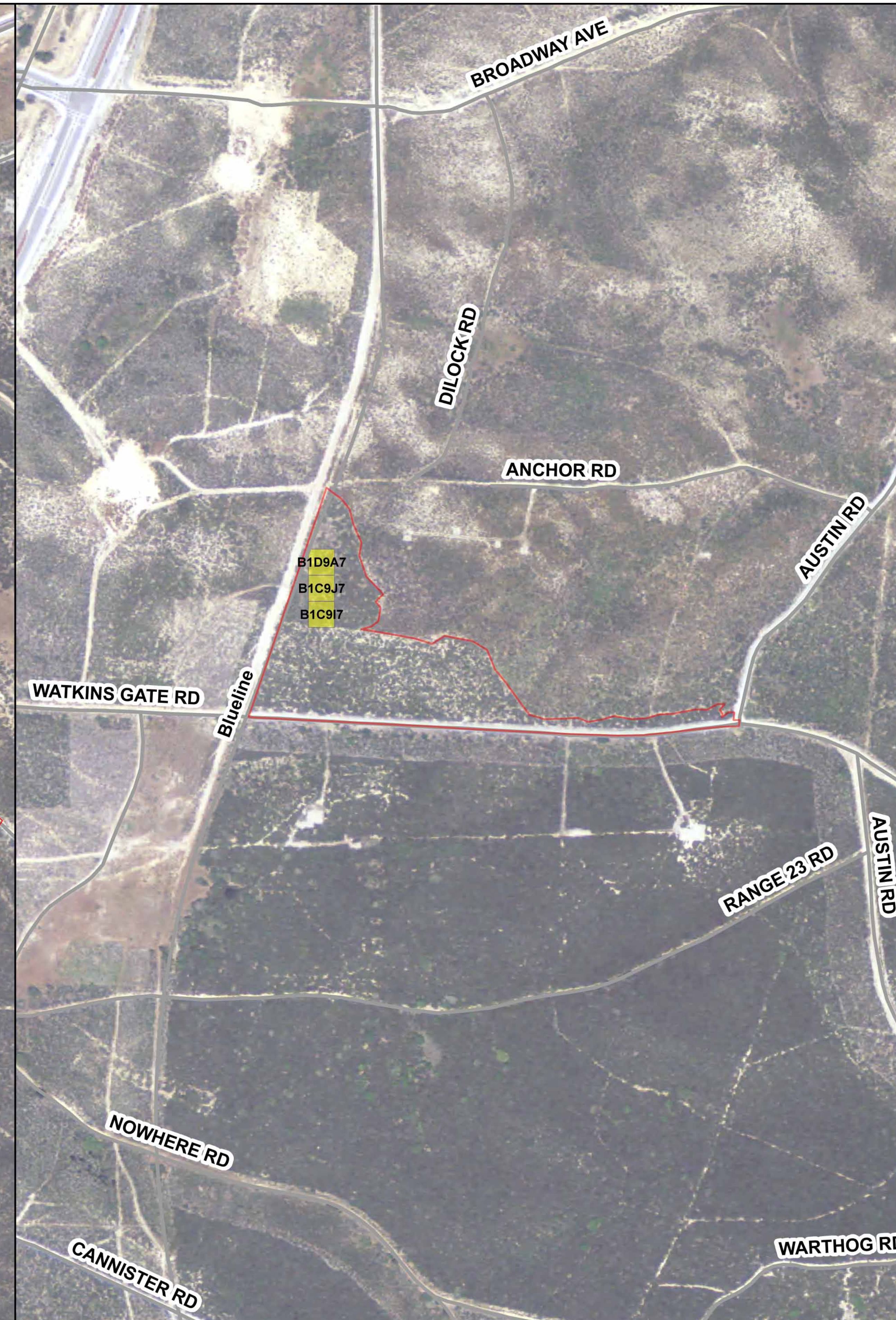
NORTHERN PORTION
SOUTHERN PORTION
EUCALYPTUS RD
Blueline
FELIX RD
EVOLUTION RD
STINGER RD
B2J3C7
B2J3C8
B2J3B6
B2J3B0
B2J3A5
B2J3A7
B2I3J6
B2I3I6
B2I3I8
B2I3I9
B2I3I0
B2I3H2
B2I3H4
B2I3H9
B2I4H1
B2I3G9
B2I4G1
B2I3G0
B2I3F1
B2I3E0
B2I4E2
B2I4D2
B2J4C5
B2J4C7
B2J4C8
B2J4B4
B2J4B5
B2J4A3
B2J4A6
B2J4A7
B2J4A8
B2I4J7
B2I4J8
B2I4J9
B2I4H9
BROADWAY AVE
DILOCK RD
ANCHOR RD
AUSTIN RD
WATKINS GATE RD
B1D9A7
B1C9J7
B1C9I7
RANGE 23 RD
NOWHERE RD
CANNISTER RD
WARTHOG RD
Fort Ord
Watkins Gate Burn Area
(Unburned Portion)
Sand Gilia
Density Classes
2014
Year 1
Legend
Road
flora_pres_burn_area
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

MAP A2-7

NORTHERN PORTION



SOUTHERN PORTION



Fort Ord
Watkins Gate Burn Area
(Unburned Portion)
Seaside Bird's-beak
Density Classes
2014
Year 1

Legend

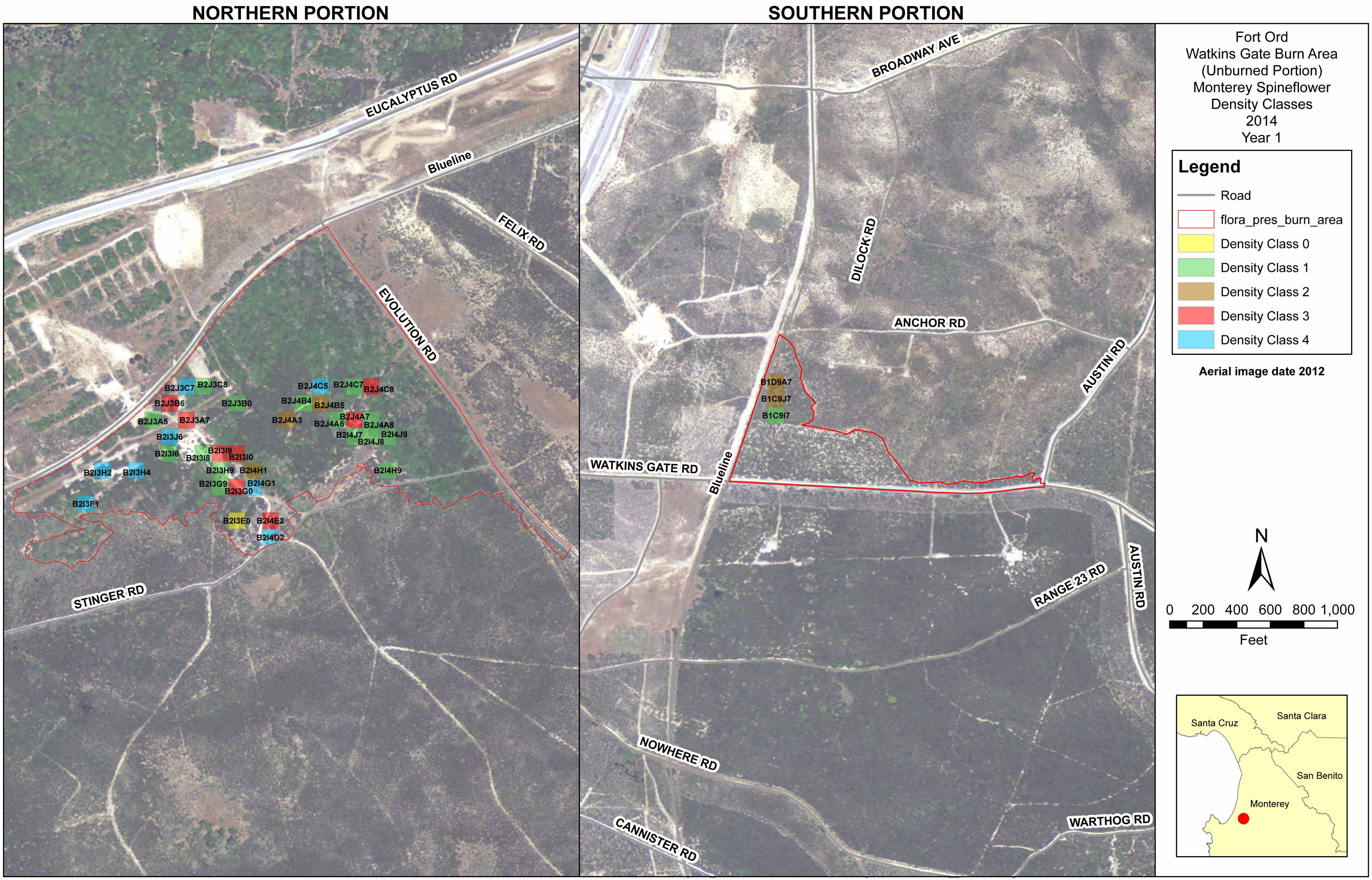
- Road
- flora_pres_burn_area
- Density Class 0
- Density Class 1
- Density Class 2
- Density Class 3
- Density Class 4

Aerial image date 2012

N

0 200 400 600 800 1,000
Feet

MAP A2-8



NORTHERN PORTION
SOUTHERN PORTION
EUCALYPTUS RD
Blueline
FELIX RD
EVOLUTION RD
STINGER RD
B2J3C7
B2J3C8
B2J3B6
B2J3B0
B2J3A5
B2J3A7
B2I3J6
B2I3I6
B2I3I8
B2I3I9
B2I3I0
B2I3H2
B2I3H4
B2I3H9
B2I4H1
B2I3G9
B2I4G1
B2I3G0
B2I3F1
B2I3E0
B2I4E2
B2I4D2
B2J4C5
B2J4C7
B2J4C8
B2J4B4
B2J4B5
B2J4A3
B2J4A6
B2J4A7
B2J4A8
B2I4J7
B2I4J8
B2I4J9
B2I4H9
BROADWAY AVE
DILOCK RD
ANCHOR RD
AUSTIN RD
WATKINS GATE RD
Blueline
B1D9A7
B1C9J7
B1C9I7
RANGE 23 RD
AUSTIN RD
NOWHERE RD
CANNISTER RD
WARTHOG RD
Fort Ord
Watkins Gate Burn Area
(Unburned Portion)
Monterey Spineflower
Density Classes
2014
Year 1
Legend
Road
flora_pres_burn_area
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

MAP A2-9

EUCALYPTUS RD
DALLAS RIDGE
RISO RIDGE
IMPOSSIBLE CANYON RD
B3H9D7
B3H9B8
B3H9A8
B3G8I7
Fort Ord
Military Operations,
Urban Terrrain (MOUT) Facility
Sand Gilia
Density Classes
2014
Year 1
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 100 200 400 600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

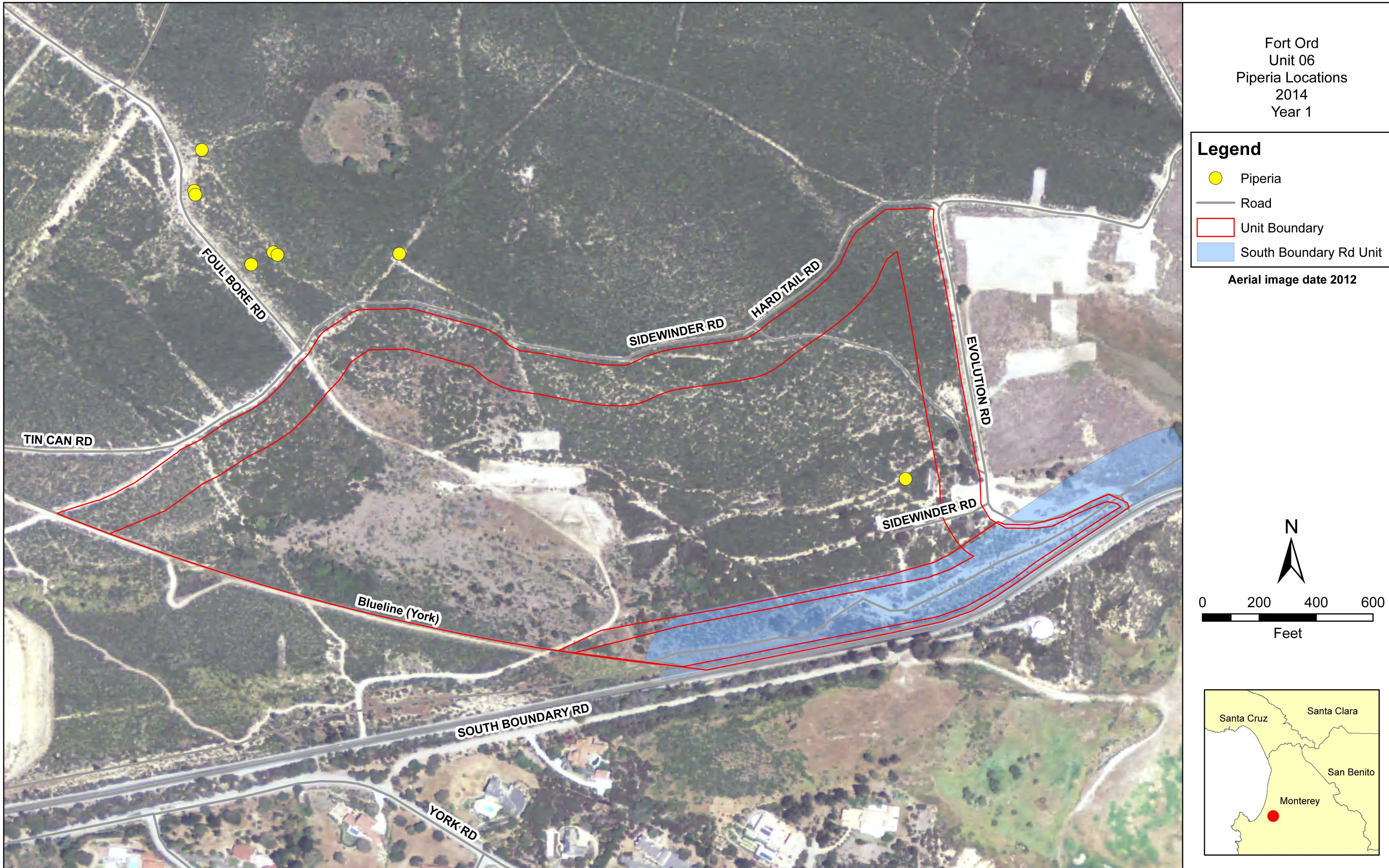
MAP A2-10

EUCALYPTUS RD
DALLAS RIDGE
RISO RIDGE
IMPOSSIBLE CANYON RD
B3H9D7
B3H9B8
B3H9A8
B3G8I7
Fort Ord
Military Operations,
Urban Terrrain (MOUT) Facility
Seaside Bird's-beak
Density Classes
2014
Year 1
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 100 200 400 600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

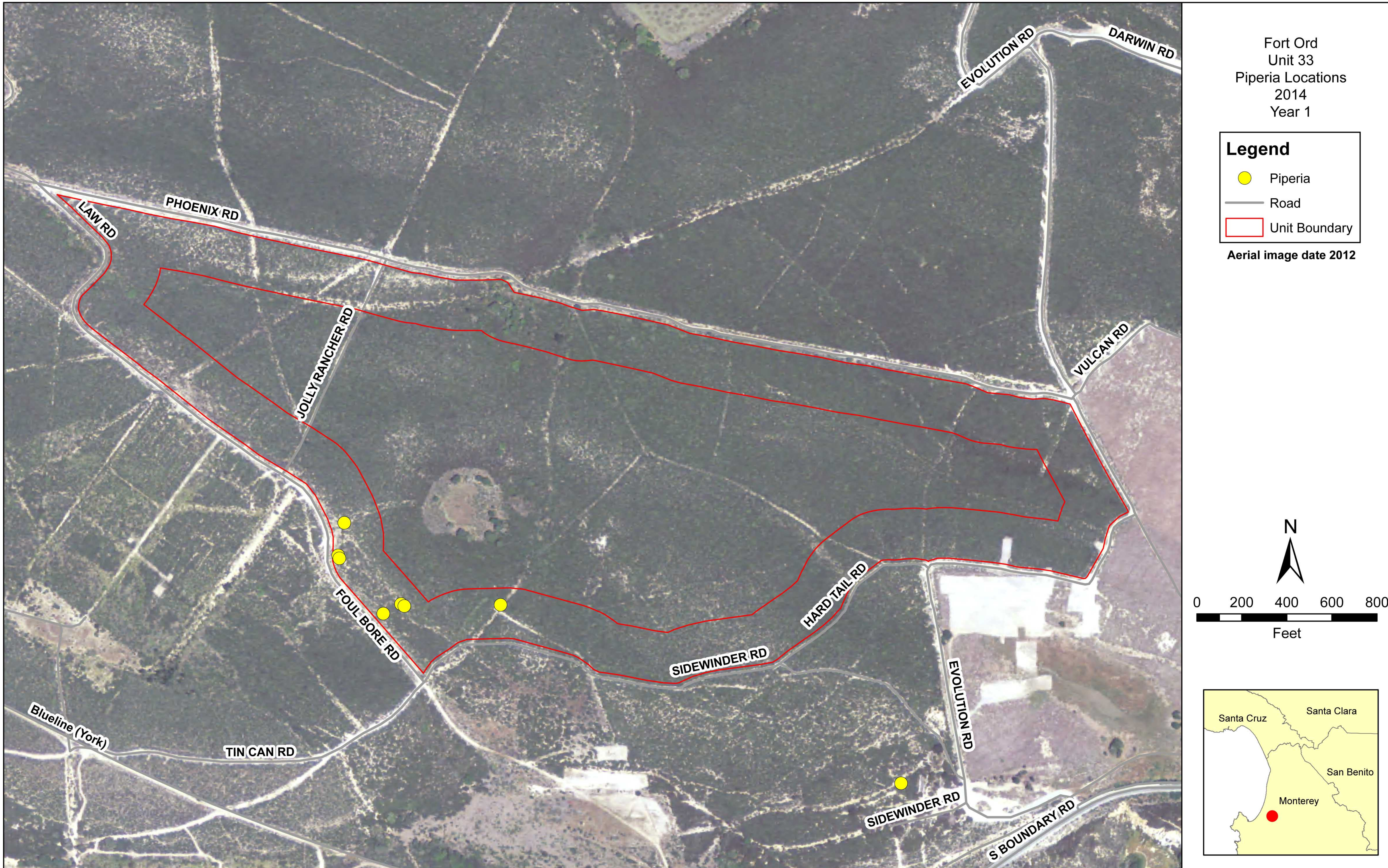
MAP A2-11

Fort Ord
Military Operations,
Urban Terrrain (MOUT) Facility
Monterey Spineflower
Density Classes
2014
Year 1
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 100 200 400 600
Feet
EUCALYPTUS RD
DALLAS RIDGE
RISO RIDGE
IMPOSSIBLE CANYON RD
B3H9D7
B3H9B8
B3H9A8
B3G8I7
Santa Cruz
Santa Clara
San Benito
Monterey

MAP A2-12


Fort Ord
Unit 06
Piperia Locations
2014
Year 1
Legend
Piperia
Road
Unit Boundary
South Boundary Rd Unit
Aerial image date 2012
FOUL BORE RD
SIDEWINDER RD
HARD TAIL RD
EVOLUTION RD
TIN CAN RD
SIDEWINDER RD
Blueline (York)
SOUTH BOUNDARY RD
YORK RD
N
0 200 400 600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

MAP A2-13


Fort Ord
Unit 33
Piperia Locations
2014
Year 1
Legend
Piperia
Road
Unit Boundary
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
PHOENIX RD
LAW RD
JOLLY RANCHER RD
EVOLUTION RD
DARWIN RD
VULCAN RD
FOUL BORE RD
SIDEWINDER RD
HARD TAIL RD
Blueline (York)
TIN CAN RD
S BOUNDARY RD

MAP A2-14


Fort Ord
Unit 04
Sand Gilia
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
EVOLUTION RD
PHOENIX RD
FORRESTAL RD
VULCAN RD
DARWIN RD
NASON ROAD
ORION RD
SOFTTAIL RD
A2F8A2
A2F8A3
SIDEWINDER RD
S BOUNDARY RD (INTERIOR)
S BOUNDARY RD
BELAVIDA RD
SOUTH BOUNDARY RD
CIRCULO DE CASITAS
ESTRELLA AVE
VIA DEL MILAGRO
TESORO RD
ALLEY
PASADERA

Map A3-1


Fort Ord
Unit 04
Seaside Bird's-beak
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0
200
400
600
800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
A2F8A2
A2F8A3
EVOLUTION RD
PHOENIX RD
FORRESTAL RD
DARWIN RD
ORION RD
NASON ROAD
VULCAN RD
SOFTTAIL RD
S BOUNDARY RD (INTERIOR)
S BOUNDARY RD
BELAVIDA RD
SOUTH BOUNDARY RD
SIDEWINDER RD
CIRCULO DE CASITAS
ESTRELLA AVE
VIA DEL MILAGRO
TESORO RD
ALLEY
PASADERA

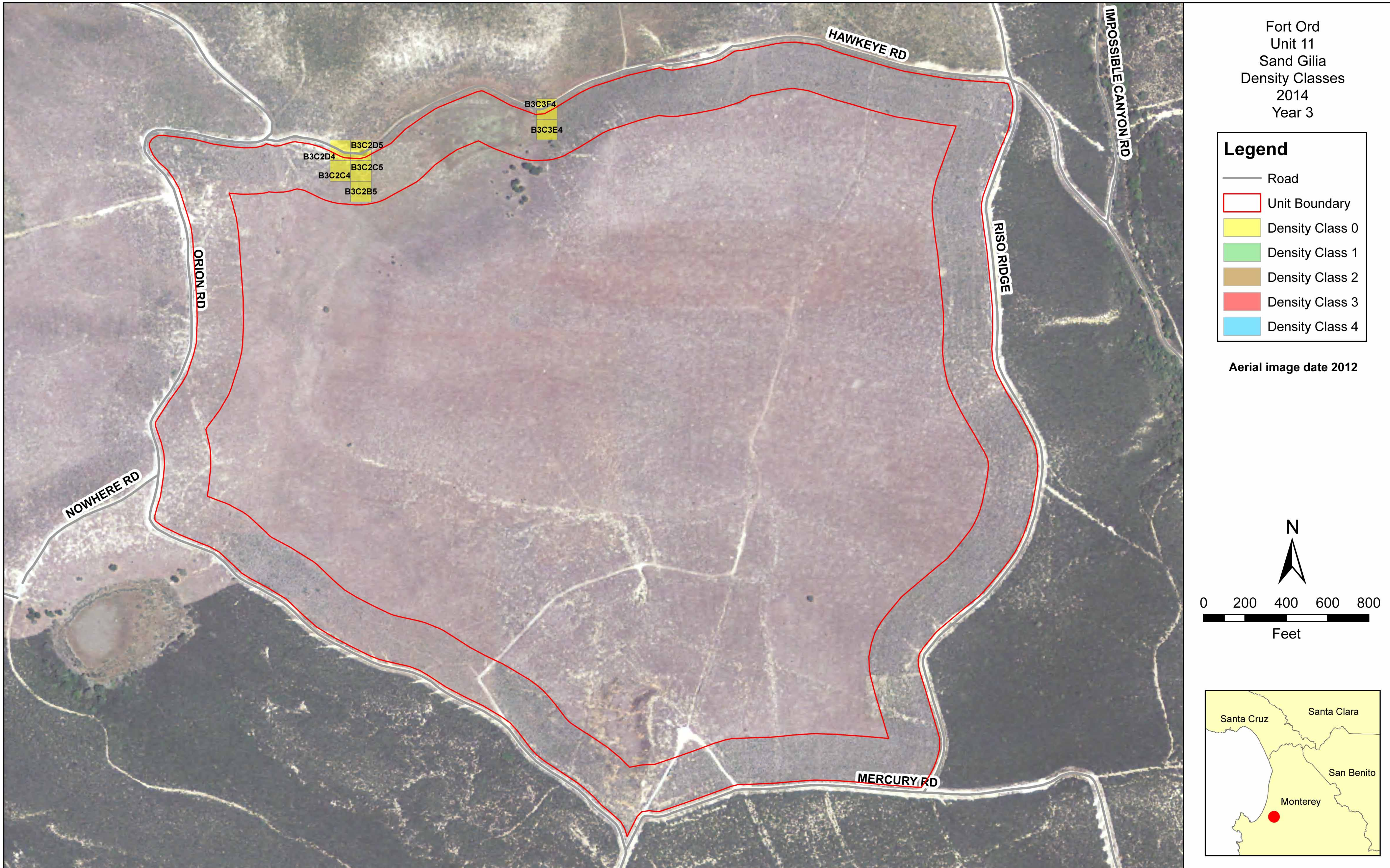
Map A3-2

Fort Ord
Unit 04
Monterey Spineflower
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
EVOLUTION RD
PHOENIX RD
FORRESTAL RD
DARWIN RD
ORION RD
NASON ROAD
VULCAN RD
SOFTTAIL RD
A2F8A2
A2F8A3
SIDEWINDER RD
S BOUNDARY RD (INTERIOR)
S BOUNDARY RD
BELAVIDA RD
SOUTH BOUNDARY RD
CIRCULO DE CASITAS
ESTRELLA AVE
VIA DEL MILAGRO
TESORO RD
ALLEY
PASADERA

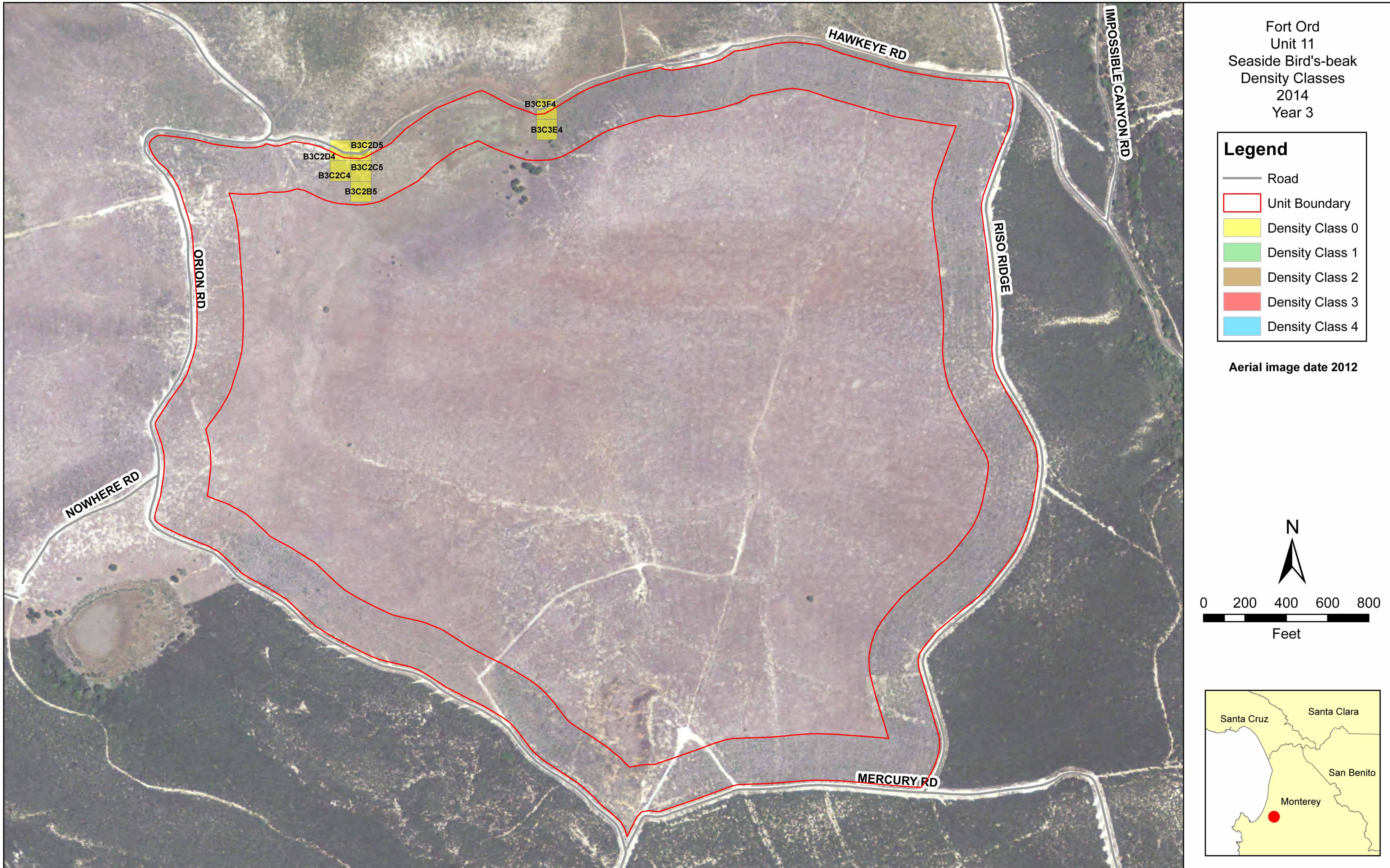
Map A3-3


Fort Ord
Unit 04
Vegetation Transect Locations
2014
Year 3
Legend
Road
Vegetation Transect
Unit Boundary
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
DARWIN RD
ORION RD
EVOLUTION RD
FORRESTAL RD
NASON ROAD
PHOENIX RD
VULCAN RD
SOFTTAIL RD
S BOUNDARY RD (INTERIOR)
S BOUNDARY RD
BELAVIDA RD
SOUTH BOUNDARY RD
SIDEWINDER RD
CIRCULO DE CASITAS
ESTRELLA AVE
VIA DEL MILAGRO
TESORO RD
ALLEY
PASADERA
4-1
4-5
4-6
4-7
4-8
4-9
4-10
4-11
T8
T2

Map A3-4

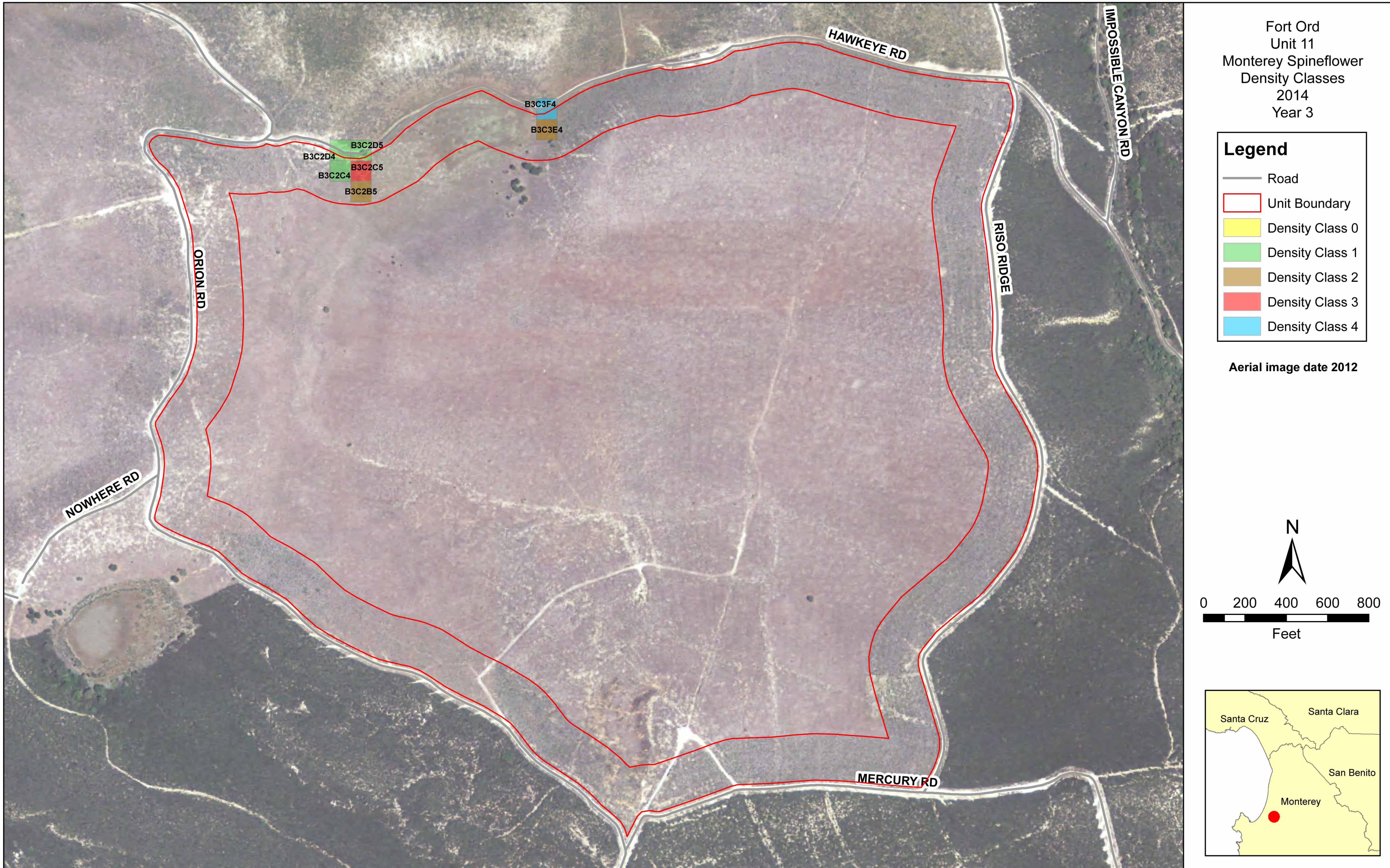

HAWKEYE RD
IMPOSSIBLE CANYON RD
RISO RIDGE
ORION RD
NOWHERE RD
MERCURY RD
B3C3F4
B3C3E4
B3C2D5
B3C2D4
B3C2C5
B3C2C4
B3C2B5
Fort Ord
Unit 11
Sand Gilia
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

Map A3-5



Fort Ord
Unit 11
Seaside Bird's-beak
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0
200
400
600
800
Feet
HAWKEYE RD
IMPOSSIBLE CANYON RD
ORION RD
RISO RIDGE
NOWHERE RD
MERCURY RD
B3C3F4
B3C3E4
B3C2D5
B3C2D4
B3C2C5
B3C2C4
B3C2B5
Santa Cruz
Santa Clara
San Benito
Monterey

Map A3-6


Fort Ord
Unit 11
Monterey Spineflower
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
HAWKEYE RD
IMPOSSIBLE CANYON RD
RISO RIDGE
ORION RD
NOWHERE RD
MERCURY RD
B3C3F4
B3C3E4
B3C2D5
B3C2D4
B3C2C5
B3C2C4
B3C2B5

Map A3-7


Fort Ord
Unit 11
Piperia Locations
2014
Year 3
Legend
Piperia
Unit Boundary
Road
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
HAWKEYE RD
IMPOSSIBLE CANYON RD
RISO RIDGE
ORION RD
NOWHERE RD
MERCURY RD

Map A3-8

Fort Ord
Unit 11
Vegetation Transect Locations
2014
Year 3

Legend

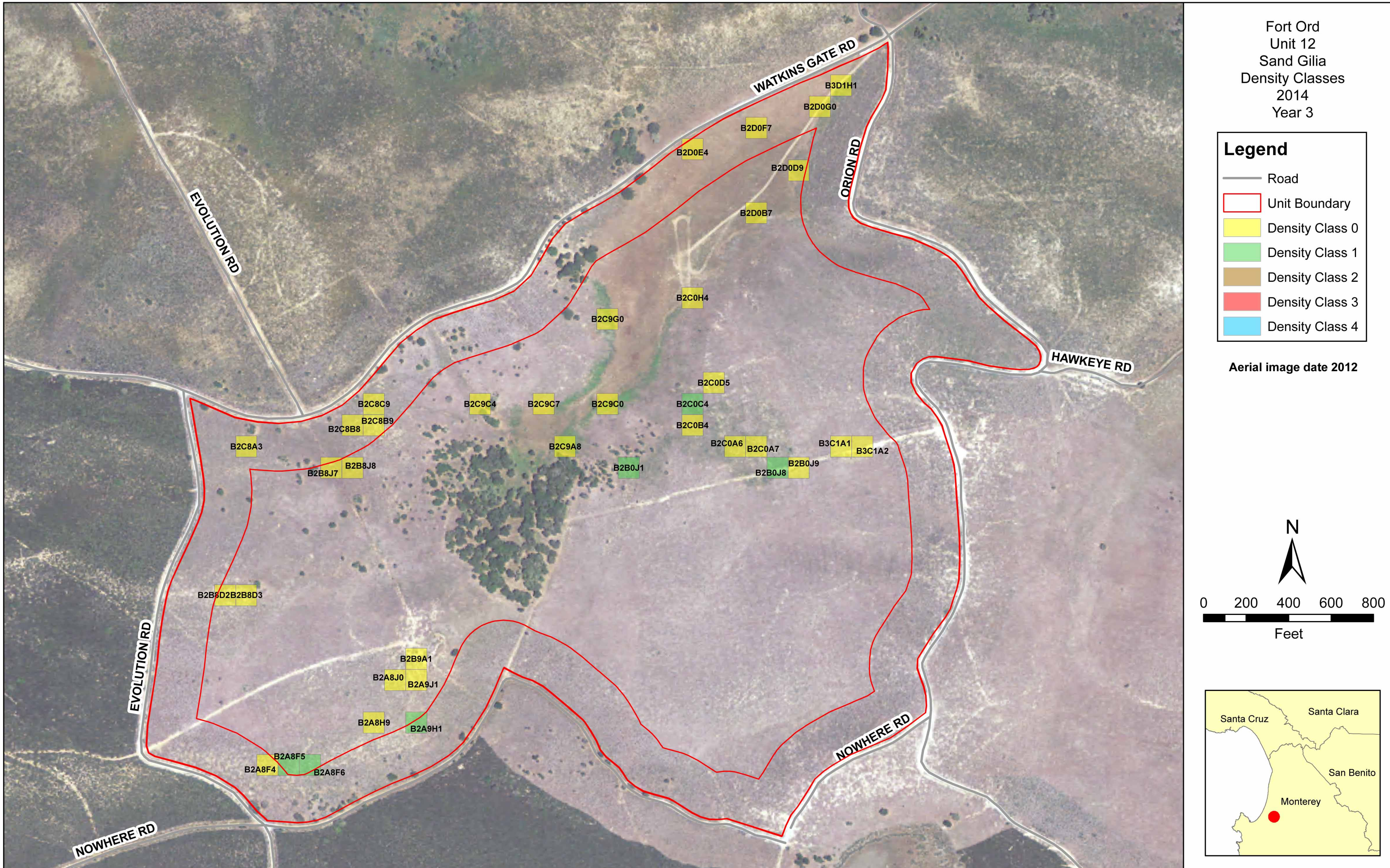
Road
Vegetation Transect
Unit Boundary

Aerial image date 2012

N

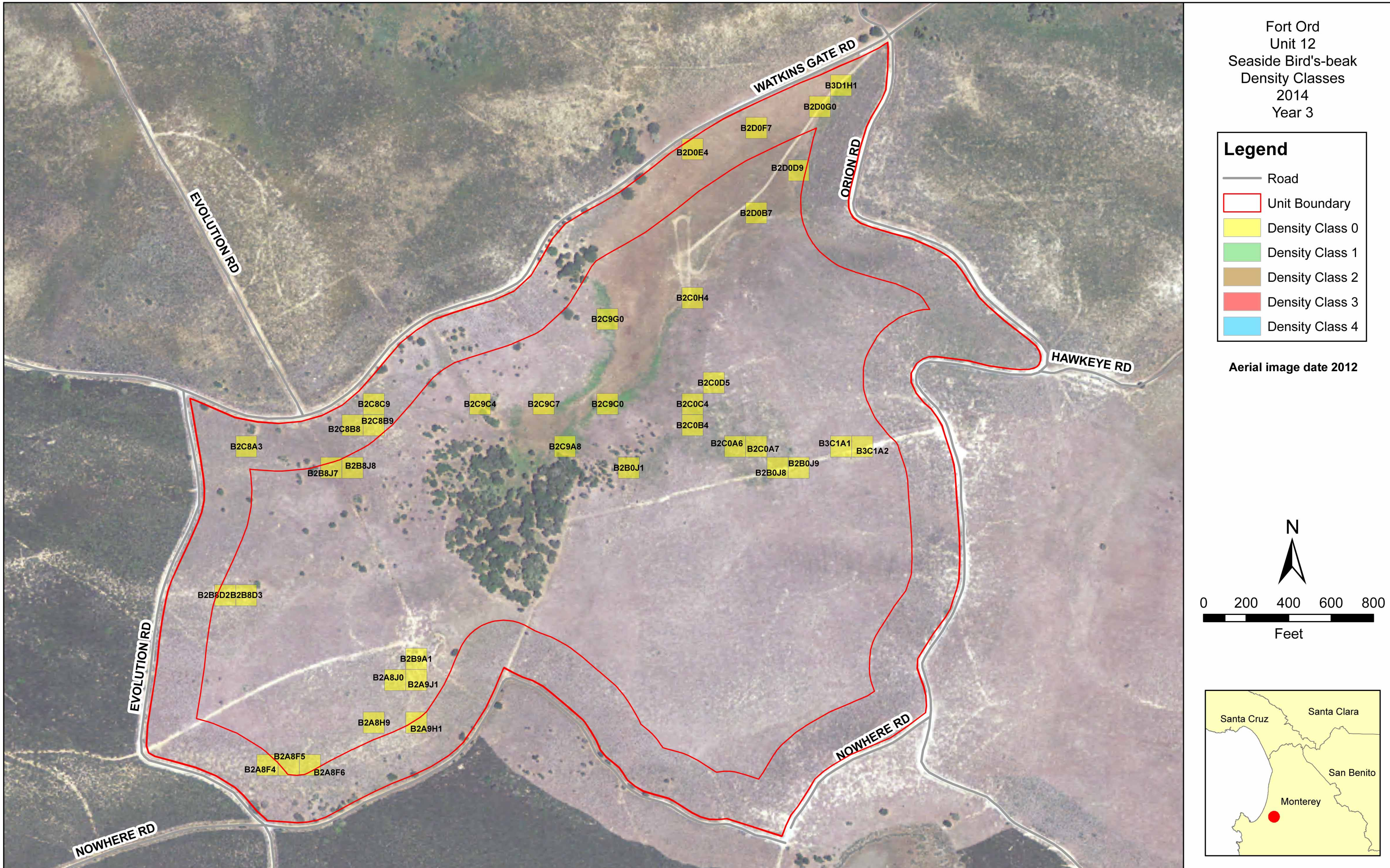
0 200 400 600 800
Feet

Map A3-9

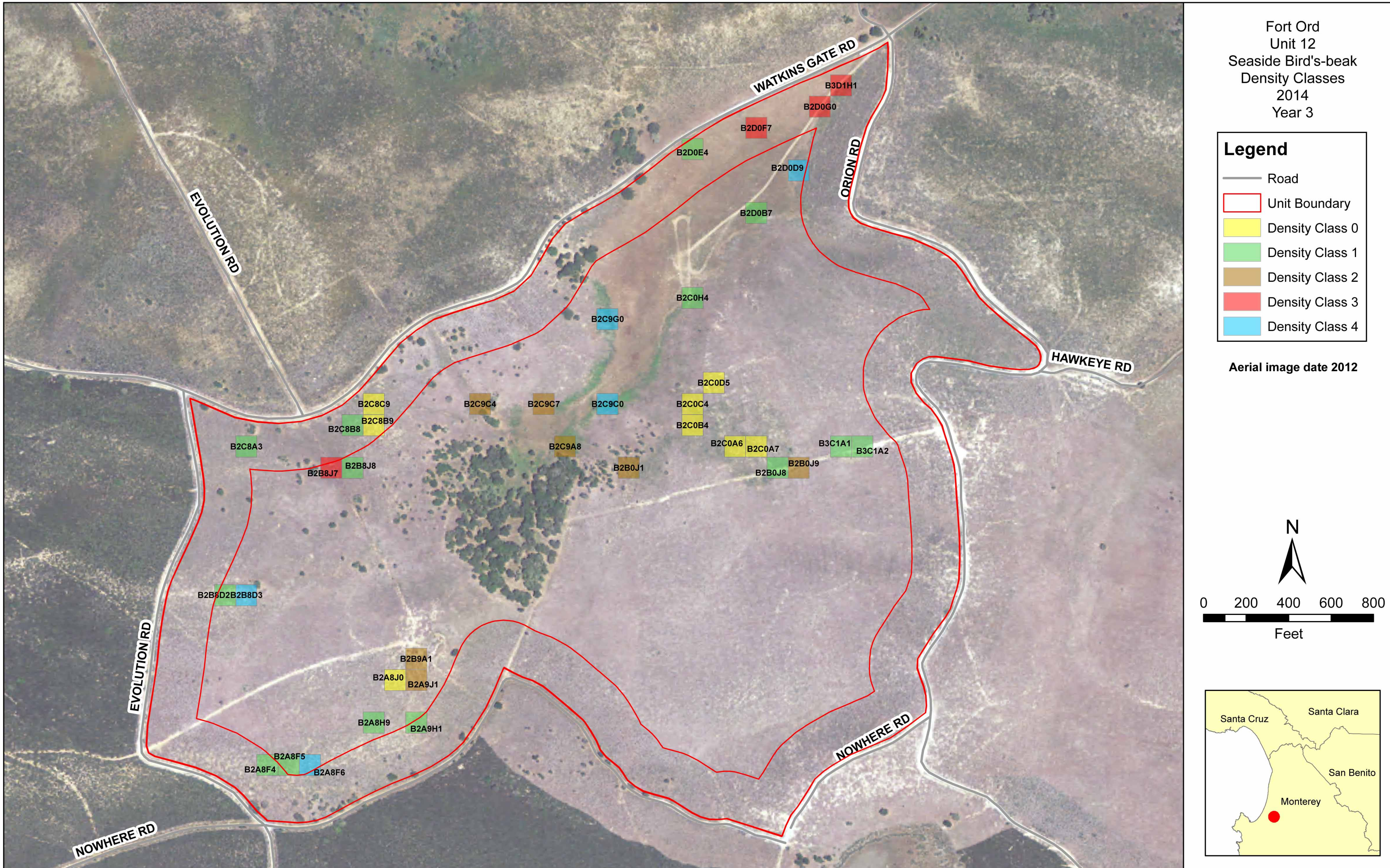


Fort Ord
Unit 12
Sand Gilia
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
WATKINS GATE RD
ORION RD
HAWKEYE RD
EVOLUTION RD
NOWHERE RD
B3D1H1
B2D0G0
B2D0F7
B2D0E4
B2D0D9
B2D0B7
B2C0H4
B2C9G0
B2C0D5
B2C8C9
B2C9C4
B2C9C7
B2C9C0
B2C0C4
B2C8B8
B2C8B9
B2C0B4
B2C8A3
B2C9A8
B2C0A6
B2C0A7
B3C1A1
B3C1A2
B2B8J7
B2B8J8
B2B0J1
B2B0J9
B2B0J8
B2B8D2
B2B8D3
B2B9A1
B2A8J0
B2A9J1
B2A8H9
B2A9H1
B2A8F5
B2A8F4
B2A8F6

Map A3-10


Fort Ord
Unit 12
Seaside Bird's-beak
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
WATKINS GATE RD
ORION RD
HAWKEYE RD
EVOLUTION RD
NOWHERE RD
B3D1H1
B2D0G0
B2D0F7
B2D0E4
B2D0D9
B2D0B7
B2C0H4
B2C9G0
B2C0D5
B2C8C9
B2C9C4
B2C9C7
B2C9C0
B2C0C4
B2C8B9
B2C8B8
B2C0B4
B2C8A3
B2C9A8
B2C0A6
B2C0A7
B3C1A1
B3C1A2
B2B8J8
B2B8J7
B2B0J1
B2B0J9
B2B0J8
B2B8D2
B2B8D3
B2B9A1
B2A8J0
B2A9J1
B2A8H9
B2A9H1
B2A8F5
B2A8F4
B2A8F6

Map A3-11



Fort Ord
Unit 12
Seaside Bird's-beak
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
WATKINS GATE RD
EVOLUTION RD
ORION RD
HAWKEYE RD
NOWHERE RD
B3D1H1
B2D0G0
B2D0F7
B2D0E4
B2D0D9
B2D0B7
B2C0H4
B2C9G0
B2C0D5
B2C8C9
B2C9C4
B2C9C7
B2C9C0
B2C0C4
B2C8B8
B2C8B9
B2C0B4
B2C8A3
B2C9A8
B2C0A6
B2C0A7
B3C1A1
B3C1A2
B2B8J7
B2B8J8
B2B0J1
B2B0J9
B2B0J8
B2B8D2
B2B8D3
B2B9A1
B2A8J0
B2A9J1
B2A8H9
B2A9H1
B2A8F5
B2A8F4
B2A8F6

Map A3-12


Fort Ord
Unit 12
Vegetation Transect Locations
2014
Year 3
Legend
Road
Vegetation Transect
Unit Boundary
Aerial image date 2012
N
0
200
400
600
800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
WATKINS GATE RD
ORION RD
HAWKEYE RD
EVOLUTION RD
NOWHERE RD
12-1
12-2
12-3
12-4
12-5
12-6
12-7
12-8
12-9
12-10
12-11
12-12
12-14
12-15
12-16
12-17
12-18

Map A3-13


Fort Ord
Unit 23N
Sand Gilia
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 50 100 200 300 400
Feet
NOWHERE RD
NOWHERE RD
ORION RD
B3A1C2
B3A1C3
B3A1C4
Santa Cruz
Santa Clara
San Benito
Monterey

Map A3-14


Fort Ord
Unit 23N
Seaside Bird's-beak
Density Classes
2014
Year 3
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 50 100 200 300 400
Feet
NOWHERE RD
NOWHERE RD
ORION RD
B3A1C2
B3A1C3
B3A1C4
Santa Cruz
Santa Clara
San Benito
Monterey

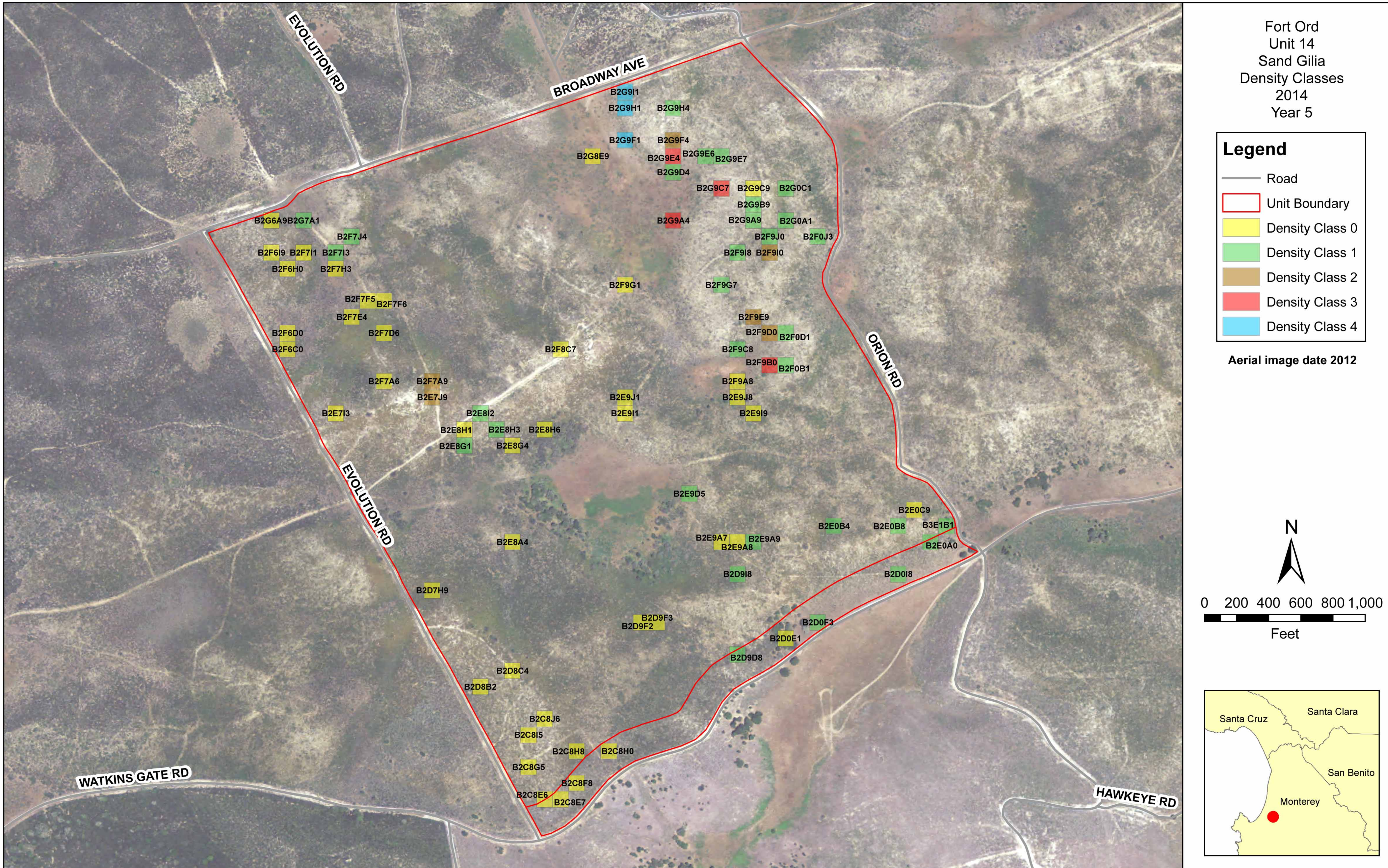
Map A3-15

Fort Ord
Unit 23N
Seaside Bird's-beak
Density Classes
2014
Year 3

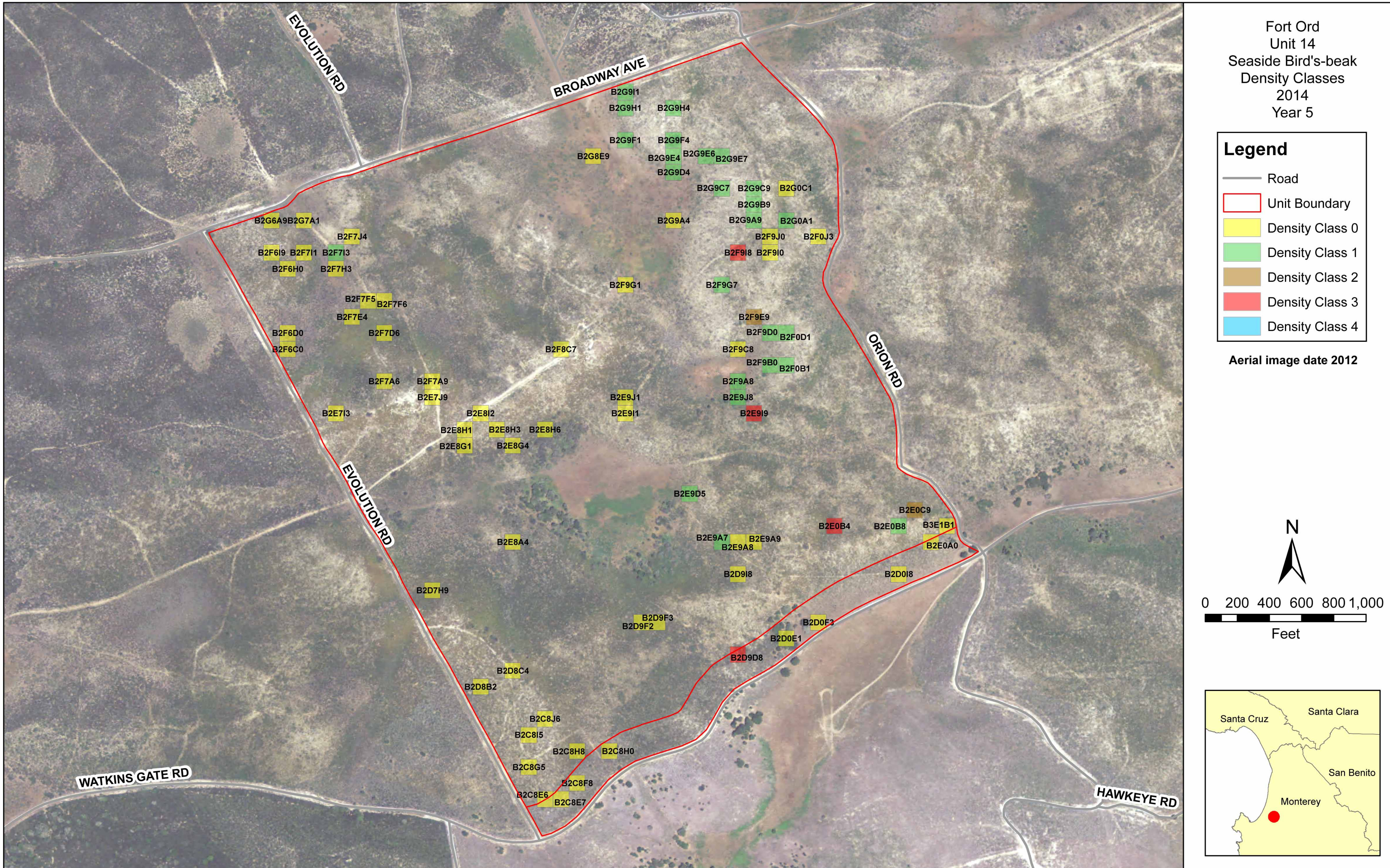
Map A3-16


Fort Ord
Unit 23N
Vegetation Transect Locations
2014
Year 3
Legend
Road
Unit Boundary
Vegetation Transect
Aerial image date 2012
N
0 50 100 200 300 400
Feet
NOWHERE RD
NOWHERE RD
ORION RD
T11
T6
Santa Cruz
Santa Clara
San Benito
Monterey

Map A3-17

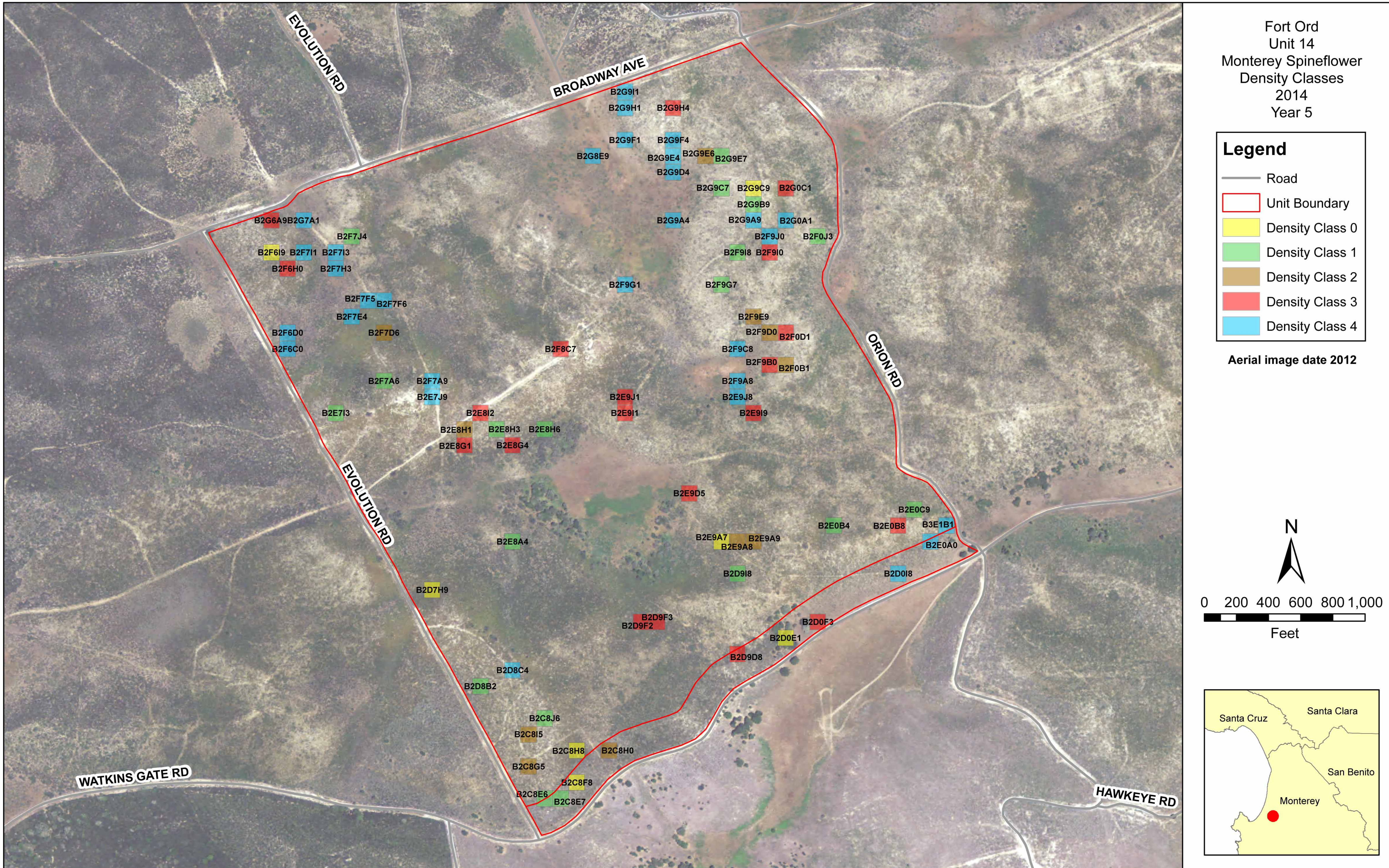

Fort Ord
Unit 14
Sand Gilia
Density Classes
2014
Year 5
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
BROADWAY AVE
EVOLUTION RD
EVOLUTION RD
ORION RD
WATKINS GATE RD
HAWKEYE RD
B2G9I1
B2G9H1
B2G9H4
B2G9F1
B2G9F4
B2G8E9
B2G9E4
B2G9E6
B2G9E7
B2G9D4
B2G9C7
B2G9C9
B2G0C1
B2G9B9
B2G6A9
B2G7A1
B2G9A4
B2G9A9
B2G0A1
B2F7J4
B2F9J0
B2F0J3
B2F6I9
B2F7I1
B2F7I3
B2F9I8
B2F9I0
B2F6H0
B2F7H3
B2F9G1
B2F9G7
B2F7F5
B2F7F6
B2F7E4
B2F9E9
B2F6D0
B2F7D6
B2F9D0
B2F0D1
B2F6C0
B2F8C7
B2F9C8
B2F9B0
B2F0B1
B2F7A6
B2F7A9
B2F9A8
B2E7J9
B2E9J1
B2E9J8
B2E7I3
B2E8I2
B2E9I1
B2E9I9
B2E8H1
B2E8H3
B2E8H6
B2E8G1
B2E8G4
B2E9D5
B2E0C9
B2E0B4
B2E0B8
B3E1B1
B2E9A7
B2E9A9
B2E9A8
B2E8A4
B2E0A0
B2D9I8
B2D0I8
B2D7H9
B2D9F3
B2D9F2
B2D0F3
B2D0E1
B2D9D8
B2D8C4
B2D8B2
B2C8J6
B2C8I5
B2C8H8
B2C8H0
B2C8G5
B2C8F8
B2C8E6
B2C8E7

Map A4-1



Fort Ord
Unit 14
Seaside Bird's-beak
Density Classes
2014
Year 5
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
EVOLUTION RD
BROADWAY AVE
ORION RD
EVOLUTION RD
WATKINS GATE RD
HAWKEYE RD
B2G9I1
B2G9H1
B2G9H4
B2G9F1
B2G9F4
B2G8E9
B2G9E4
B2G9E6
B2G9E7
B2G9D4
B2G9C7
B2G9C9
B2G0C1
B2G9B9
B2G6A9
B2G7A1
B2G9A4
B2G9A9
B2G0A1
B2F7J4
B2F9J0
B2F0J3
B2F6I9
B2F7I1
B2F7I3
B2F9I8
B2F9I0
B2F6H0
B2F7H3
B2F9G1
B2F9G7
B2F7F5
B2F7F6
B2F7E4
B2F9E9
B2F6D0
B2F7D6
B2F9D0
B2F0D1
B2F6C0
B2F8C7
B2F9C8
B2F9B0
B2F0B1
B2F7A6
B2F7A9
B2F9A8
B2E7J9
B2E9J1
B2E9J8
B2E7I3
B2E8I2
B2E9I1
B2E9I9
B2E8H1
B2E8H3
B2E8H6
B2E8G1
B2E8G4
B2E9D5
B2E0C9
B2E0B4
B2E0B8
B3E1B1
B2E9A7
B2E9A9
B2E9A8
B2E0A0
B2E8A4
B2D9I8
B2D0I8
B2D7H9
B2D9F3
B2D9F2
B2D0F3
B2D0E1
B2D9D8
B2D8C4
B2D8B2
B2C8J6
B2C8I5
B2C8H8
B2C8H0
B2C8G5
B2C8F8
B2C8E6
B2C8E7

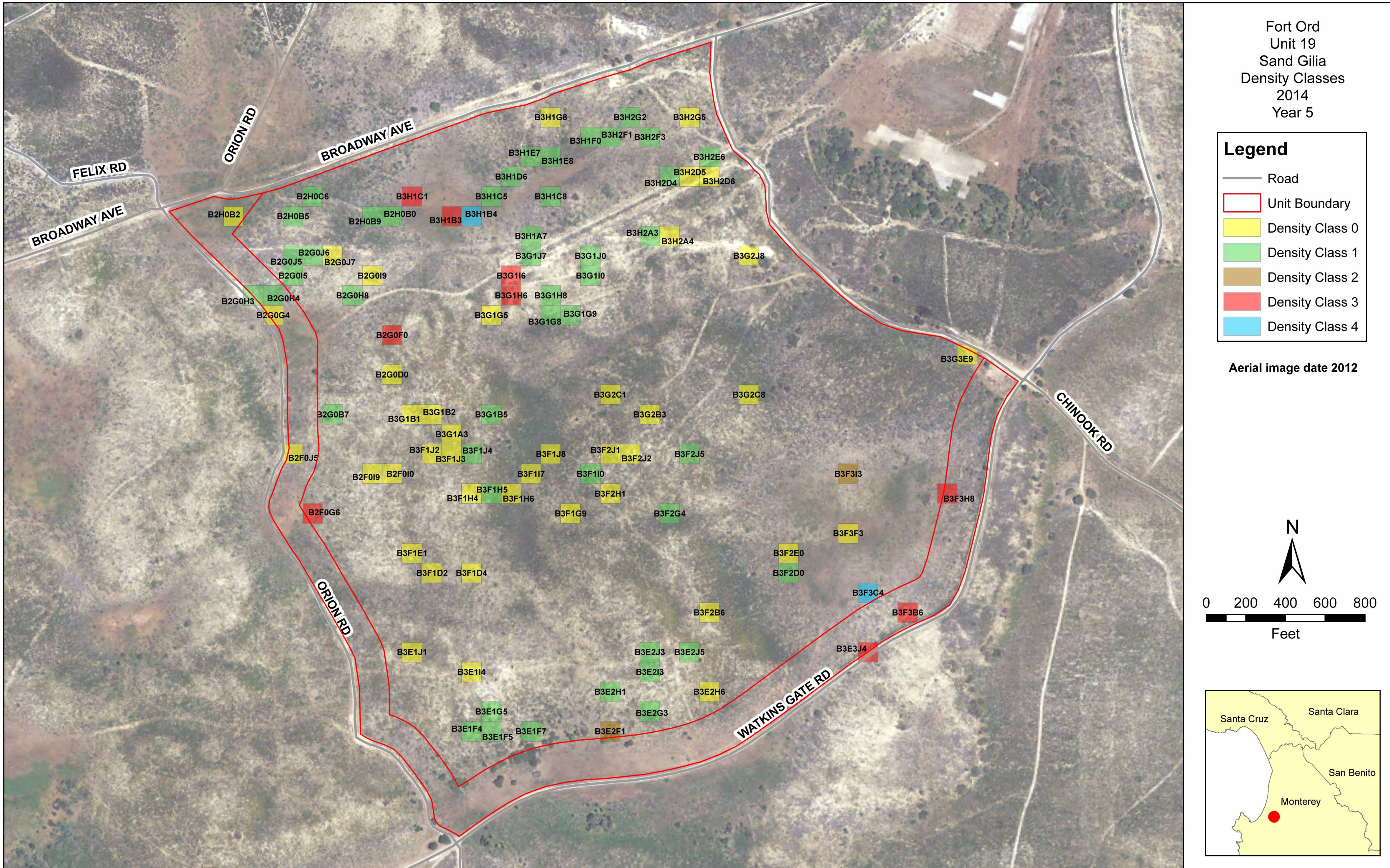
Map A4-2


Fort Ord
Unit 14
Monterey Spineflower
Density Classes
2014
Year 5
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
EVOLUTION RD
BROADWAY AVE
ORION RD
EVOLUTION RD
WATKINS GATE RD
HAWKEYE RD
B2G9I1
B2G9H1
B2G9H4
B2G9F1
B2G9F4
B2G8E9
B2G9E4
B2G9E6
B2G9E7
B2G9D4
B2G9C7
B2G9C9
B2G0C1
B2G9B9
B2G6A9
B2G7A1
B2G9A4
B2G9A9
B2G0A1
B2F7J4
B2F9J0
B2F0J3
B2F6I9
B2F7I1
B2F7I3
B2F9I8
B2F9I0
B2F6H0
B2F7H3
B2F9G1
B2F9G7
B2F7F5
B2F7F6
B2F7E4
B2F9E9
B2F6D0
B2F7D6
B2F9D0
B2F0D1
B2F6C0
B2F8C7
B2F9C8
B2F9B0
B2F0B1
B2F7A6
B2F7A9
B2F9A8
B2E7J9
B2E9J1
B2E9J8
B2E7I3
B2E8I2
B2E9I1
B2E9I9
B2E8H1
B2E8H3
B2E8H6
B2E8G1
B2E8G4
B2E9D5
B2E0C9
B2E0B4
B2E0B8
B3E1B1
B2E9A7
B2E9A9
B2E9A8
B2E8A4
B2E0A0
B2D9I8
B2D0I8
B2D7H9
B2D9F3
B2D9F2
B2D0F3
B2D0E1
B2D9D8
B2D8C4
B2D8B2
B2C8J6
B2C8I5
B2C8H8
B2C8H0
B2C8G5
B2C8F8
B2C8E6
B2C8E7

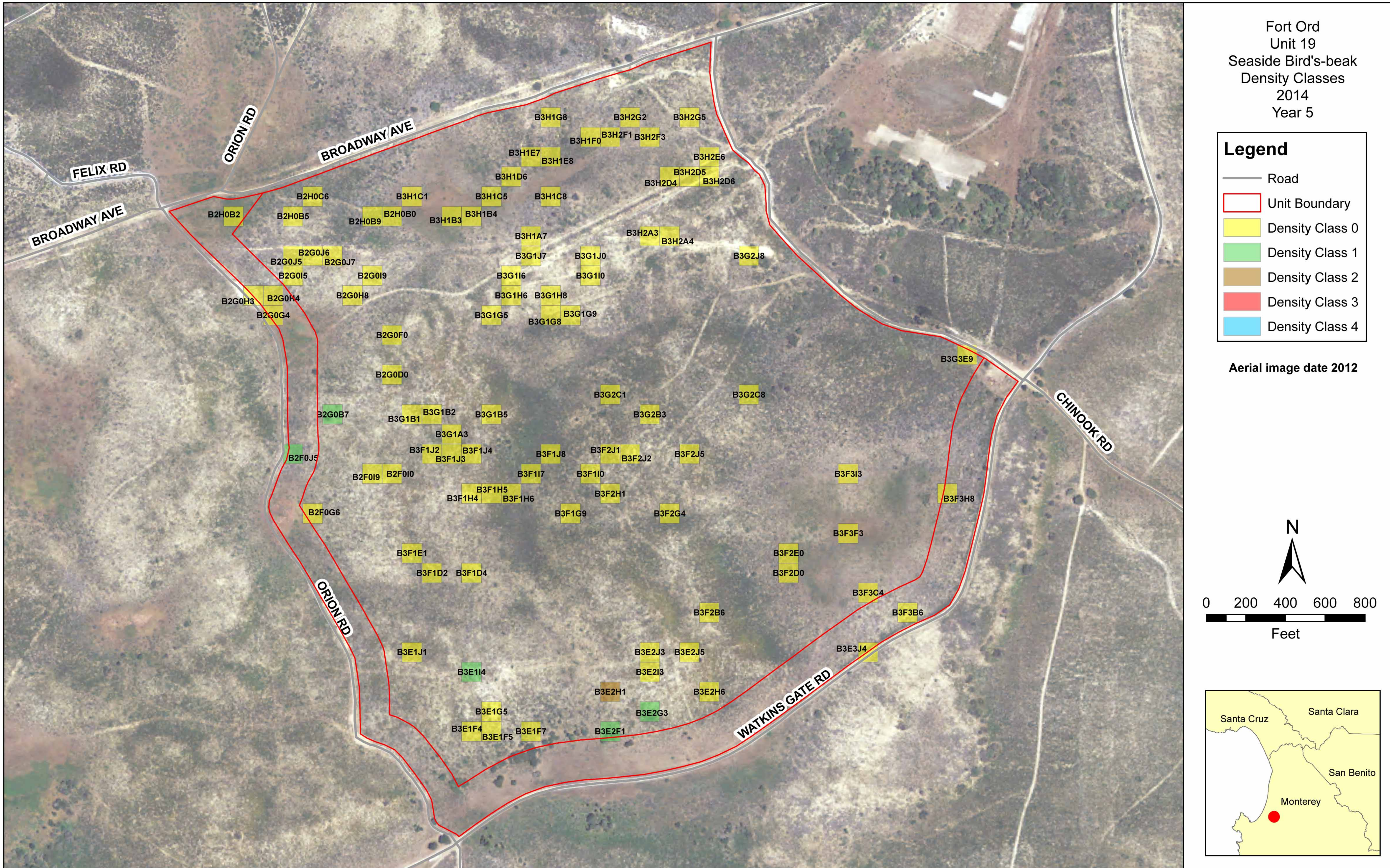
Map A4-3


Fort Ord
Unit 14
Vegetation Transect Locations
2014
Year 5
Legend
Road
Vegetation Transect
Unit Boundary
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
EVOLUTION RD
BROADWAY BYPASS
BROADWAY AVE
ORION RD
WATKINS GATE RD
HAWKEYE RD
14-1
14-2
14-3
14-4
14-5
14-6
14-7
14-8
14-9
14-10
14-11
14-12
14-13
14-14
14-15
14-16
14-17
14-18
14-19
14-20
14-21
14-22

Map A4-4

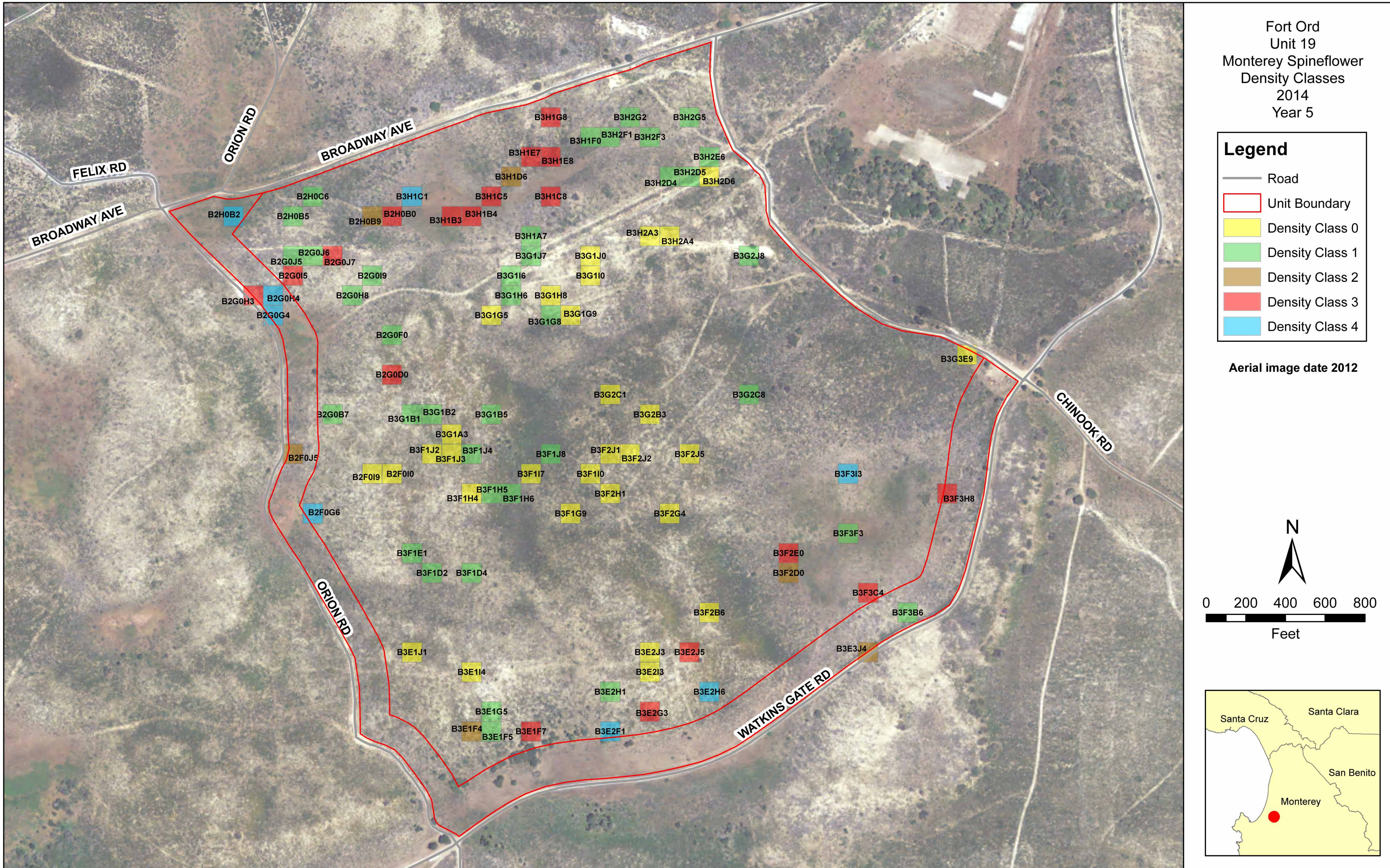

Fort Ord
Unit 19
Sand Gilia
Density Classes
2014
Year 5
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
BROADWAY AVE
ORION RD
FELIX RD
CHINOOK RD
WATKINS GATE RD
B3H1G8
B3H2G2
B3H2G5
B3H1F0
B3H2F1
B3H2F3
B3H1E7
B3H1E8
B3H2E6
B3H1D6
B3H2D5
B3H2D4
B3H2D6
B2H0C6
B3H1C1
B3H1C5
B3H1C8
B2H0B2
B2H0B5
B2H0B9
B2H0B0
B3H1B3
B3H1B4
B3H1A7
B3H2A3
B3H2A4
B2G0J6
B2G0J5
B2G0J7
B3G1J7
B3G1J0
B3G2J8
B2G0I5
B2G0I9
B3G1I6
B3G1I0
B2G0H3
B2G0H4
B2G0H8
B3G1H6
B3G1H8
B2G0G4
B3G1G5
B3G1G8
B3G1G9
B2G0F0
B3G3E9
B2G0D0
B3G2C1
B3G2C8
B2G0B7
B3G1B1
B3G1B2
B3G1B5
B3G2B3
B3G1A3
B3F1J2
B3F1J3
B3F1J4
B3F1J8
B3F2J1
B3F2J2
B3F2J5
B2F0J5
B2F0I9
B2F0I0
B3F1I7
B3F1I0
B3F3I3
B3F1H5
B3F1H4
B3F1H6
B3F2H1
B3F3H8
B2F0G6
B3F1G9
B3F2G4
B3F3F3
B3F1E1
B3F2E0
B3F1D2
B3F1D4
B3F2D0
B3F3C4
B3F2B6
B3F3B6
B3E1J1
B3E2J3
B3E2J5
B3E3J4
B3E1I4
B3E2I3
B3E2H1
B3E2H6
B3E1G5
B3E2G3
B3E1F4
B3E1F5
B3E1F7
B3E2F1

Map A4-5



Fort Ord
Unit 19
Seaside Bird's-beak
Density Classes
2014
Year 5
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
BROADWAY AVE
FELIX RD
ORION RD
CHINOOK RD
WATKINS GATE RD

Map A4-6


Fort Ord
Unit 19
Monterey Spineflower
Density Classes
2014
Year 5
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 200 400 600 800
Feet
BROADWAY AVE
ORION RD
FELIX RD
CHINOOK RD
WATKINS GATE RD
Santa Cruz
Santa Clara
San Benito
Monterey

Map A4-7

Fort Ord
Unit 19
Vegetation Transect Locations
2014
Year 5
Legend
Road
Vegetation Transect
Unit Boundary
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
BANJO RD
ORION RD
BROADWAY AVE
FELIX RD
WATKINS GATE RD
CHINOOK RD
19-1
19-2
19-3
19-4
19-5
19-6
19-7
19-8
19-9
19-10
19-11
19-12
19-13
19-14
19-15
19-16
19-17
19-19
19-20
19-23
19-25

Map A4-8

Fort Ord
MRS-16
Sand Gilia
Density Classes
2014
Year 8
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 100 200 400 600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
PARKER FLATS RD
TRAIL 70 SPUR 1
TRAIL 70
WATKINS GATE RD
ORION RD
EUCALYPTUS RD
C3A2J2
C3A1E9
C3A1D8
C3A1D0
C3A1C9
C3A2C1
C3A1C0
C3A1B9
C3A1B0
B3J2J5
B3J2I6
B3J2I7
B3J2H9
B3J2H8
B3J2H0
B3J3H7
B3J3G5
B3J3G2
B3J3G4
B3J3G6
B3J3F4
B3J3F6
B3J3E0
B3J4E2
B3J4E1
B3J4E5
B3J4E6
B3J4D1
B3J4D3
B3J4D5
B3J4D2
B3J4D4
B3J4D6
B3J4C4
B3J4C5

Map A5-1


Fort Ord
MRS-16
Seaside Bird's-beak
Density Classes
2014
Year 8
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 100 200 400 600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
PARKER FLATS RD
TRAIL 70 SPUR 1
TRAIL 70
WATKINS GATE RD
ORION RD
EUCALYPTUS RD
C3A2J2
C3A1E9
C3A1D8
C3A1D0
C3A1C9
C3A2C1
C3A1C0
C3A1B9
C3A1B0
B3J2J5
B3J2I6
B3J2I7
B3J2H9
B3J2H8
B3J2H0
B3J3H7
B3J3G5
B3J3G2
B3J3G4
B3J3G6
B3J3F4
B3J3F6
B3J3E0
B3J4E2
B3J4E1
B3J4E5
B3J4E6
B3J4D1
B3J4D3
B3J4D5
B3J4D2
B3J4D4
B3J4D6
B3J4C4
B3J4C5

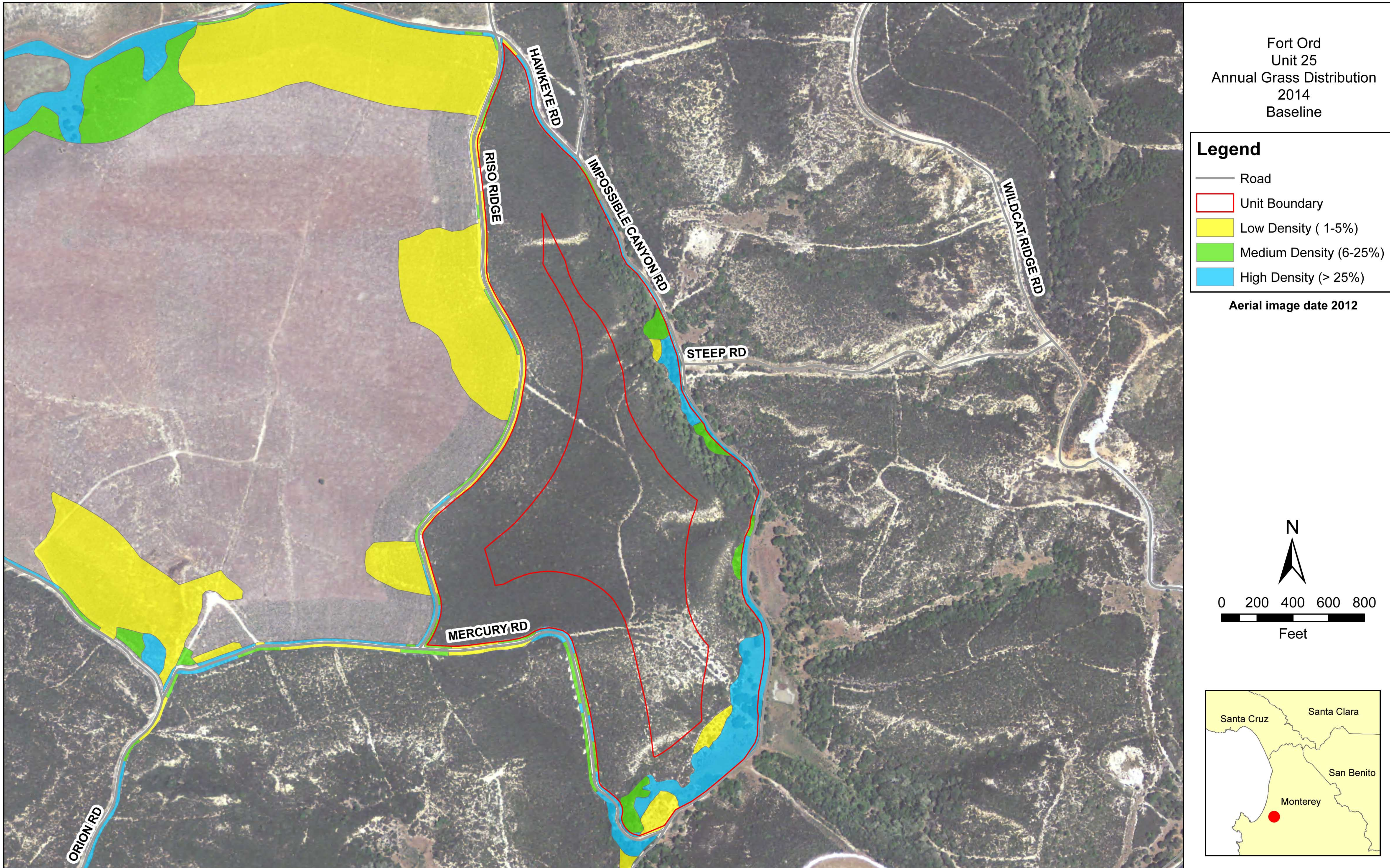
Map A5-2

Fort Ord
MRS-16
Monterey Spineflower
Density Classes
2014
Year 8
Legend
Road
Unit Boundary
Density Class 0
Density Class 1
Density Class 2
Density Class 3
Density Class 4
Aerial image date 2012
N
0 100 200 400 600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
PARKER FLATS RD
TRAIL 70 SPUR 1
TRAIL 70
WATKINS GATE RD
ORION RD
EUCALYPTUS RD
EUCALYPTUS RD
WATKINS GATE RD
C3A2J2
C3A1E9
C3A1D8
C3A1D0
C3A1C9
C3A2C1
C3A1C0
C3A1B9
C3A1B0
B3J2J5
B3J2I6
B3J2I7
B3J2H9
B3J2H8
B3J2H0
B3J3G2
B3J3G5
B3J3G4
B3J3G6
B3J3H7
B3J3F4
B3J3F6
B3J3E0
B3J4E2
B3J4E1
B3J4D1
B3J4D3
B3J4D2
B3J4D4
B3J4E5
B3J4E6
B3J4D5
B3J4D6
B3J4C4
B3J4C5

Map A5-3

Fort Ord
MRS-16
Vegetation Transect Locations
2014
Year 8
Legend
Road
Vegetation Transect
Unit Boundary
Aerial image date 2012
N
0 100 200 400 600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
PARKER FLATS RD
TRAIL 70 SPUR 1
TRAIL 70
WATKINS GATE RD
ORION RD
EUCALYPTUS RD
16-1
16-2
16-3
16-4
16-5
16-6
16-7
16-8
16-9
16-10
16-11
16-12
16-13
16-14
16-15
16-16

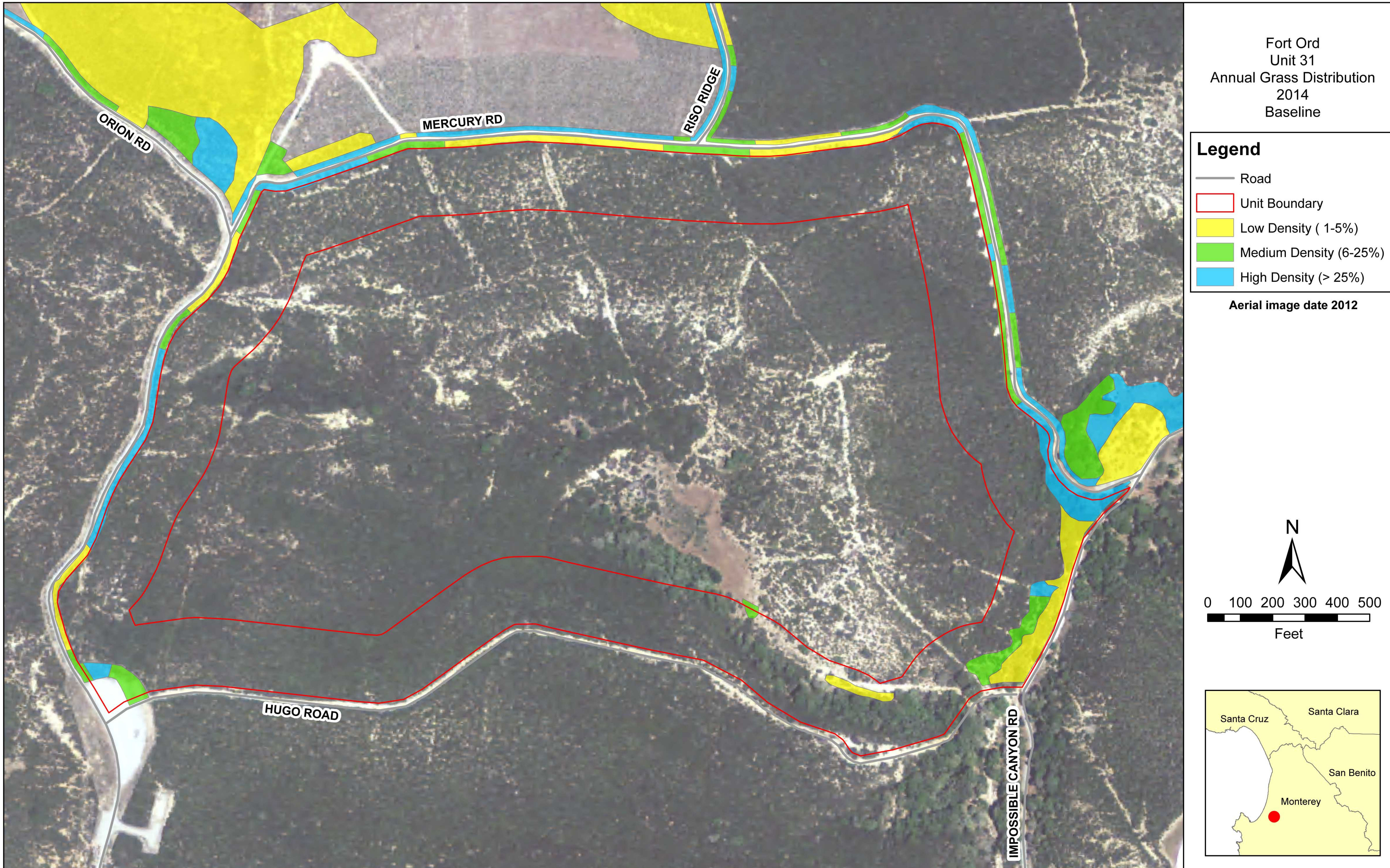
Map A5-4


Fort Ord
Unit 25
Annual Grass Distribution
2014
Baseline
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
HAWKEYE RD
RISO RIDGE
IMPOSSIBLE CANYON RD
WILDCAT RIDGE RD
STEEP RD
MERCURY RD
ORION RD

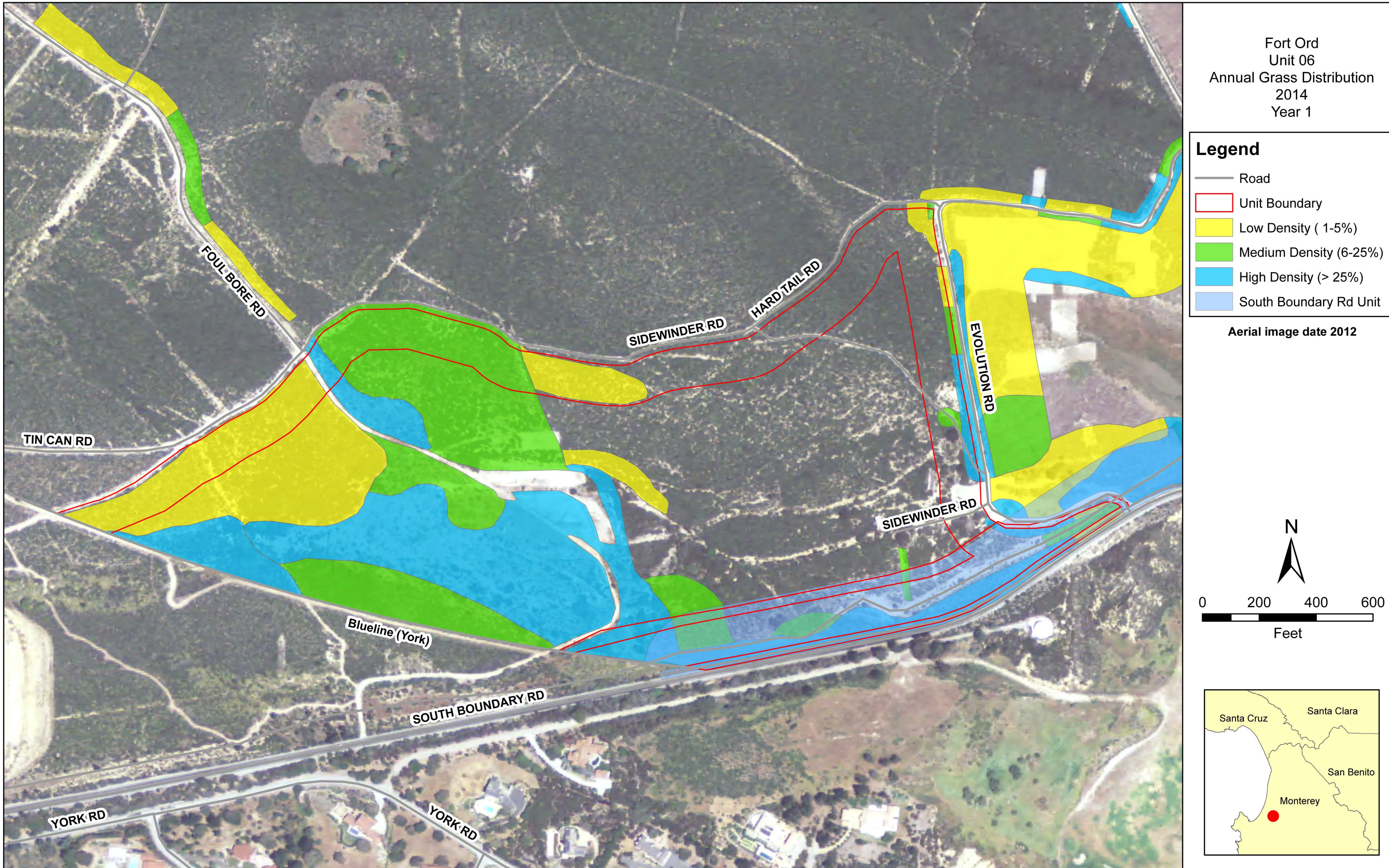
Map A6-1

Fort Ord
Unit 25
Invasive Weeds
2014
Baseline
Legend
Road
Unit Boundary
Pampas Grass
Iceplant
French Broom
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
HAWKEYE RD
RISO RIDGE
IMPOSSIBLE CANYON RD
WILDCAT RIDGE RD
STEEP RD
MERCURY RD
ORION RD

Map A6-2


Fort Ord
Unit 31
Annual Grass Distribution
2014
Baseline
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 100 200 300 400 500
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
ORION RD
MERCURY RD
RISO RIDGE
HUGO ROAD
IMPOSSIBLE CANYON RD

Map A6-3



Fort Ord
Unit 06
Annual Grass Distribution
2014
Year 1
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
South Boundary Rd Unit
Aerial image date 2012
N
0
200
400
600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
FOUL BORE RD
SIDEWINDER RD
HARD TAIL RD
EVOLUTION RD
TIN CAN RD
SIDEWINDER RD
Blueline (York)
SOUTH BOUNDARY RD
YORK RD
YORK RD

Map A6-4


Fort Ord
Unit 06
Invasive Weeds
2014
Year 1
Legend
Road
Unit Boundary
Pampas Grass
Iceplant
French Broom
South Boundary Rd Unit
Aerial image date 2012
N
0
200
400
600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
FOUL BORE RD
HARD TAIL RD
SIDEWINDER RD
EVOLUTION RD
TIN CAN RD
SIDEWINDER RD
Blueline (York)
SOUTH BOUNDARY RD
YORK RD

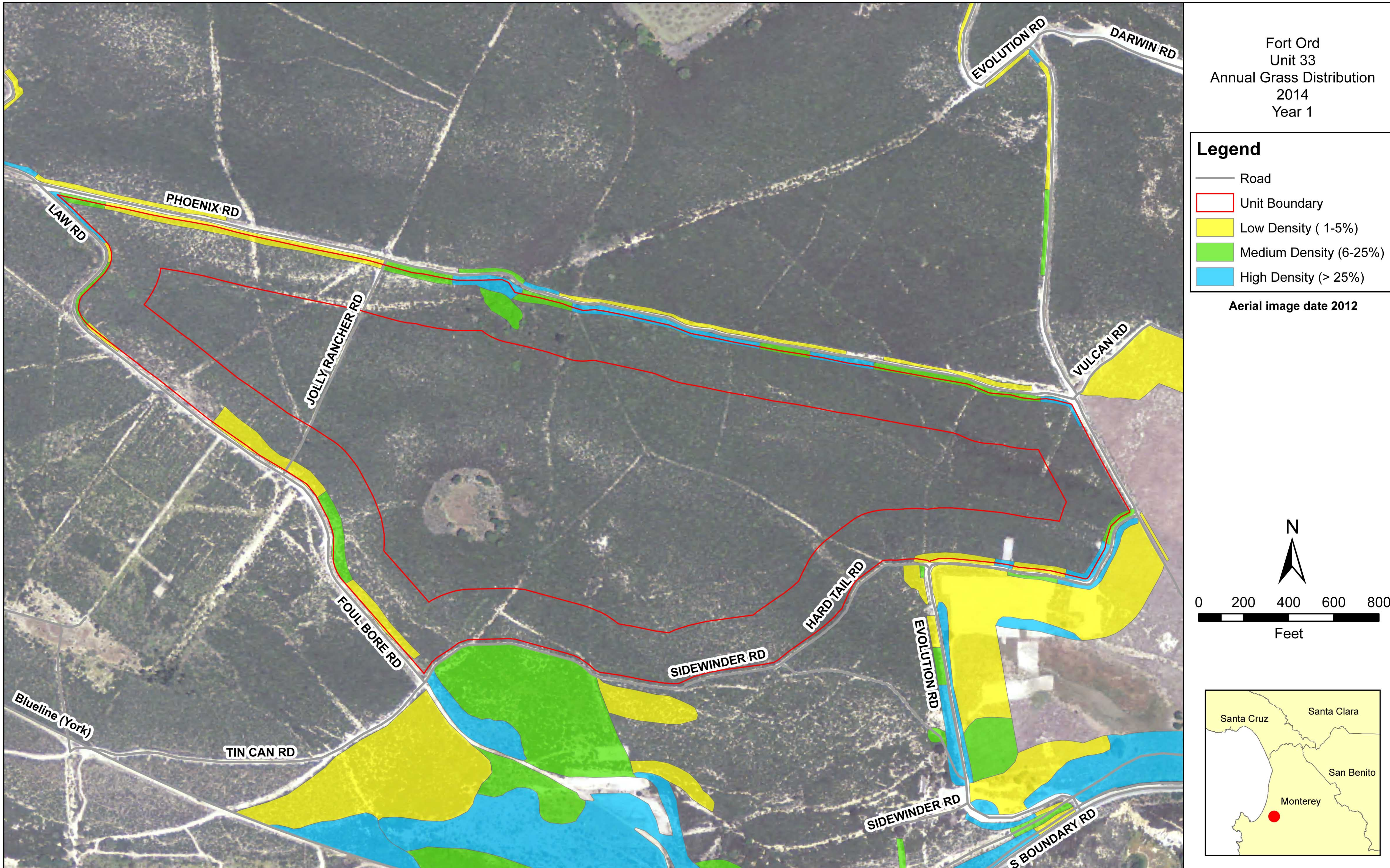
Map A6-5


Fort Ord
Unit 07
Annual Grass Distribution
2014
Year 1
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
NOWHERE RD
AUSTIN RD
JOLLY RANCHER RD
EVOLUTION RD
PHOENIX RD
DARWIN RD
LAW RD
FOUL BORE RD
VULCAN RD

Map A6-6


Fort Ord
Unit 10
Annual Grass Distribution
2014
Year 1
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
AUSTIN RD
EVOLUTION RD
WATKINS GATE RD
WARTHOG RD
NOWHERE RD
TORPEDO RD
JOLLY RANCHER RD

Map A6-7



Fort Ord
Unit 33
Annual Grass Distribution
2014
Year 1
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0
200
400
600
800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
PHOENIX RD
LAW RD
JOLLY RANCHER RD
EVOLUTION RD
DARWIN RD
VULCAN RD
FOUL BORE RD
SIDEWINDER RD
HARD TAIL RD
Blueline (York)
TIN CAN RD
S BOUNDARY RD

Map A6-8

Fort Ord
Unit 33
Invasive Weeds
2014
Year 1
Legend
Road
Unit Boundary
Pampas Grass
Iceplant
French Broom
Aerial image date 2012
N
0
200
400
600
800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
PHOENIX RD
LAW RD
JOLLY RANCHER RD
EVOLUTION RD
DARWIN RD
VULCAN RD
FOUL BORE RD
SIDEWINDER RD
HARD TAIL RD
Blueline (York)
TIN CAN RD
S BOUNDARY RD

Map A6-9


NORTHERN PORTION
SOUTHERN PORTION
EUCALYPTUS RD
Blueline
FELIX RD
EVOLUTION RD
STINGER RD
BROADWAY AVE
DILOCK RD
ANCHOR RD
AUSTIN RD
WATKINS GATE RD
Blueline
RANGE 23 RD
AUSTIN RD
NOWHERE RD
CANNISTER RD
WARTHOG RD
Fort Ord
Watkins Gate Burn Area
(Unburned Portion)
Annual Grass Distribution
2014
Year 1
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

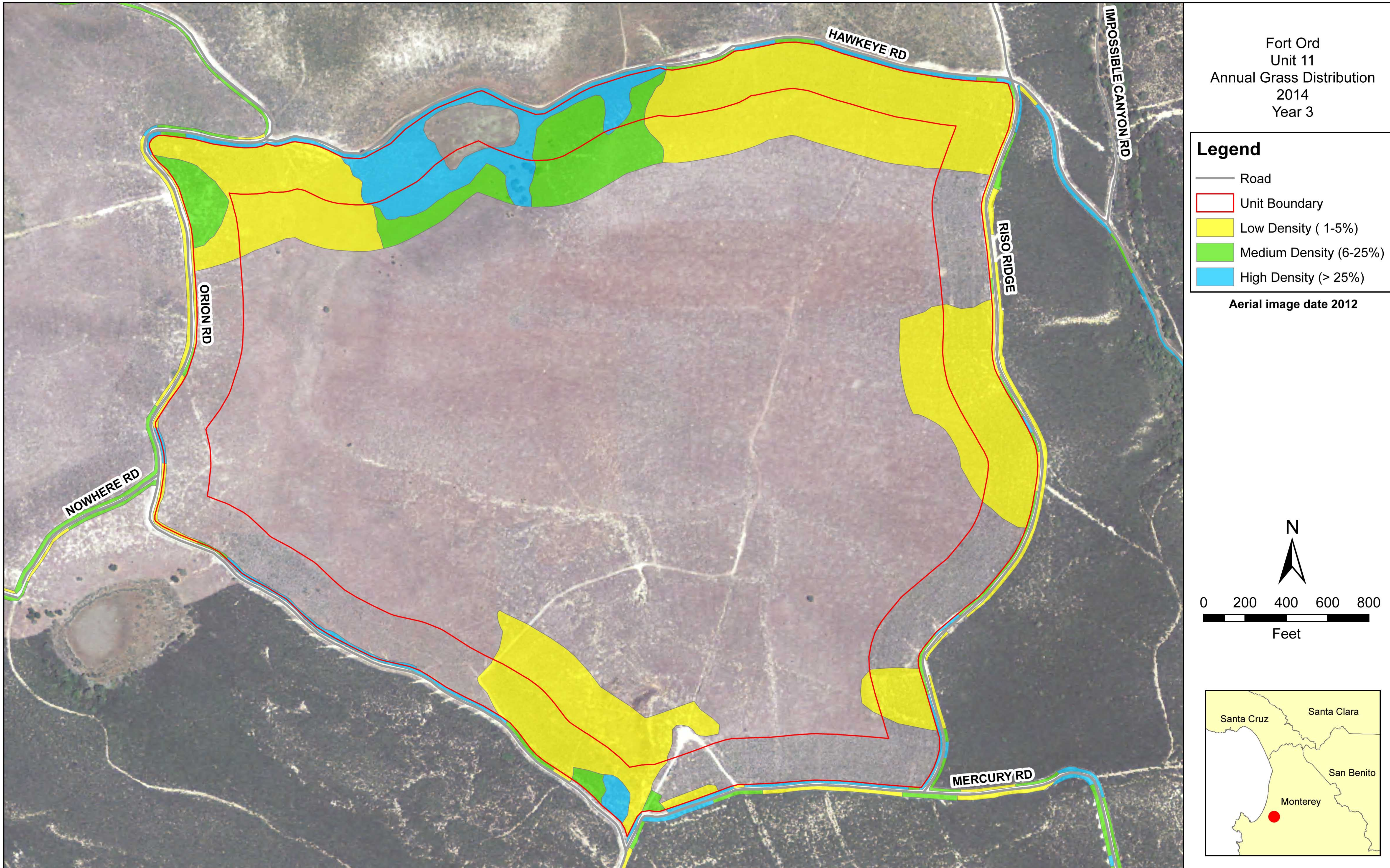
Map A6-10


EUCALYPTUS RD
DALLAS RIDGE
RISO RIDGE
IMPOSSIBLE CANYON RD
Fort Ord
Military Operations,
Urban Terrrain (MOUT) Facility
Annual Grass Distribution
2014
Year 1
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 100 200 400 600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

Map A6-11

Fort Ord
Unit 04
Annual Grass Distribution
2014
Year 3
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 200 400 600 800
Feet
EVOLUTION RD
PHOENIX RD
FORRESTAL RD
VULCAN RD
DARWIN RD
ORION RD
NASON ROAD
SOFTTAIL RD
BELAVIDA RD
SOUTH BOUNDARY RD
Santa Cruz
Santa Clara
San Benito
Monterey

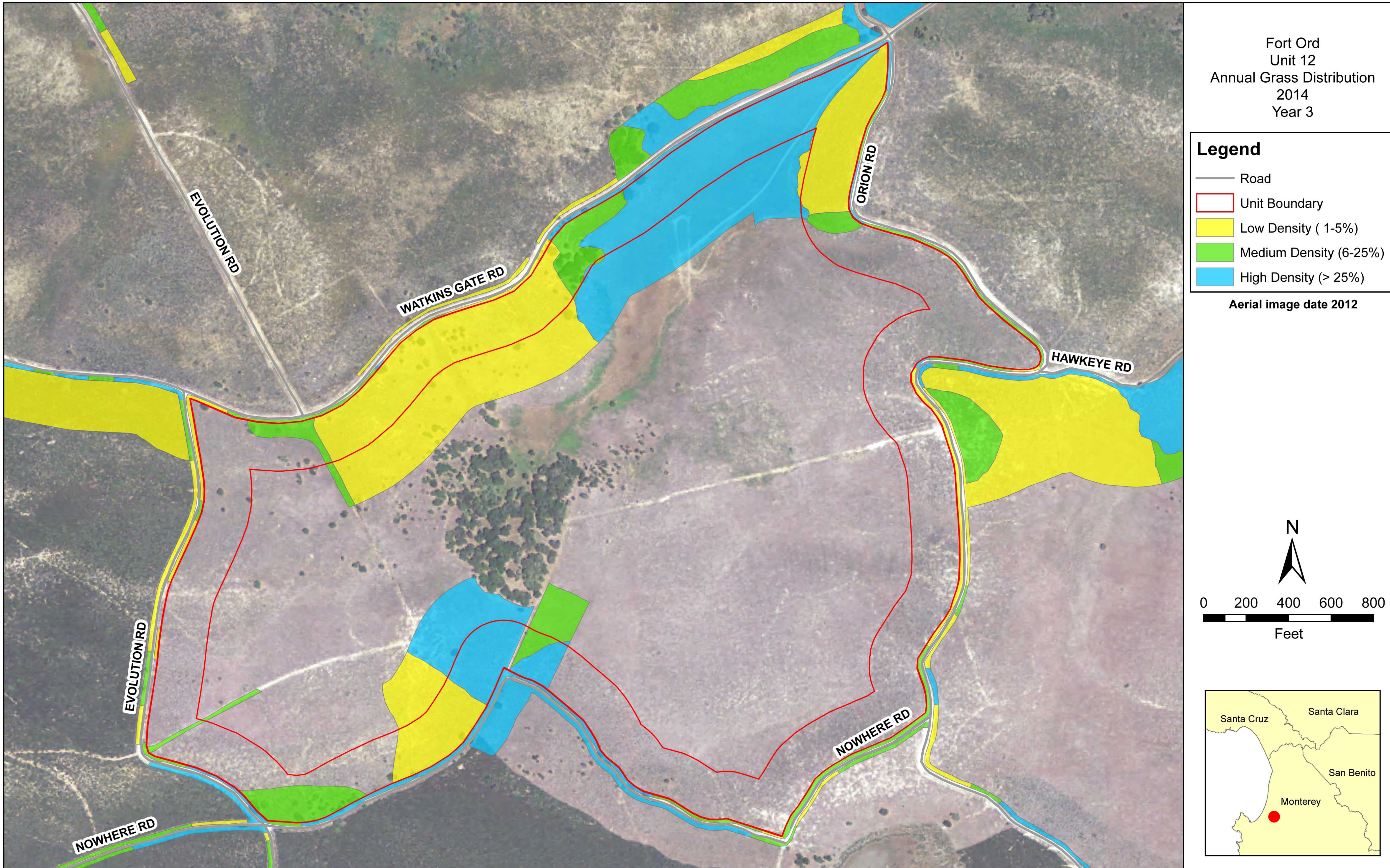
Map A6-12


Fort Ord
Unit 11
Annual Grass Distribution
2014
Year 3
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
HAWKEYE RD
IMPOSSIBLE CANYON RD
RISO RIDGE
ORION RD
NOWHERE RD
MERCURY RD
N
0
200
400
600
800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

Map A6-13


HAWKEYE RD
IMPOSSIBLE CANYON RD
ORION RD
RISO RIDGE
NOWHERE RD
MERCURY RD
Fort Ord
Unit 11
Invasive Weeds
2014
Year 3
Legend
Road
Unit Boundary
Pampas Grass
Iceplant
French Broom
Aerial image date 2012
N
0
200
400
600
800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

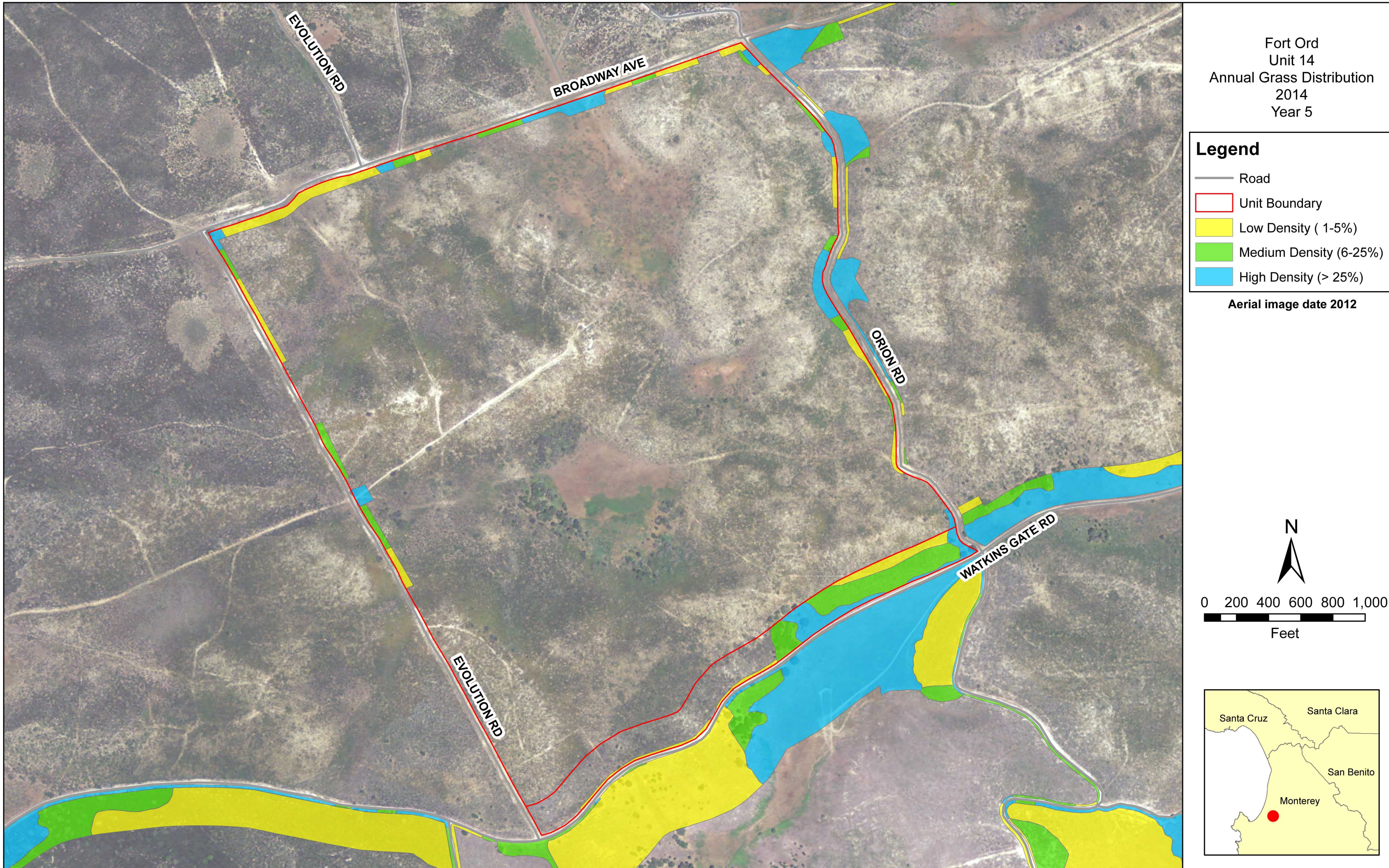
Map A6-14


Fort Ord
Unit 12
Annual Grass Distribution
2014
Year 3
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 200 400 600 800
Feet
Santa Cruz
Santa Clara
San Benito
Monterey
EVOLUTION RD
WATKINS GATE RD
ORION RD
HAWKEYE RD
EVOLUTION RD
NOWHERE RD
NOWHERE RD

Map A6-15

Fort Ord
Unit 23N
Annual Grass Distribution
2014
Year 3
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
NOWHERE RD
ORION RD
N
0 50 100 200 300 400
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

Map A6-16



Fort Ord
Unit 14
Annual Grass Distribution
2014
Year 5
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 200 400 600 800 1,000
Feet
EVOLUTION RD
BROADWAY AVE
ORION RD
WATKINS GATE RD
EVOLUTION RD
Santa Cruz
Santa Clara
San Benito
Monterey

Map A6-17


Fort Ord
Unit 19
Annual Grass Distribution
2014
Year 5
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 200 400 600 800
Feet
BROADWAY AVE
ORION RD
FELIX RD
BROADWAY AVE
ORION RD
CHINOOK RD
WATKINS GATE RD
Santa Cruz
Santa Clara
San Benito
Monterey

Map A6-18

PARKER FLATS RD
TRAIL 70
TRAIL 70 SPUR 1
WATKINS GATE RD
ORION RD
EUCALYPTUS RD
EUCALYPTUS RD
Fort Ord
MRS-16
Annual Grass Distribution
2014
Year 8
Legend
Road
Unit Boundary
Low Density (1-5%)
Medium Density (6-25%)
High Density (> 25%)
Aerial image date 2012
N
0 100 200 400 600
Feet
Santa Cruz
Santa Clara
San Benito
Monterey

Map A6-19

APPENDIX B

Shrub Transect Data

Appendix B1

Baseline Transects, Units 25 and 31

Code	Species	25-1	25-2	25-3	25-4	25-5	25-6	25-7	25-8
ADFA	*Adenostoma fasciculatum*	21.2	22.2	18.8	47	14.2	45	44.6	24.2
ARPU	*Arctostaphylos pumila*	0	0	0	0	2.2	0	0	0
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	76.6	71.8	92.4	53.4	72	59.6	27.8	81.6
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	0	0	0	6.4	0	0	0
ARMO	*Arctostaphylos montereyensis*	0	0	0	0	11.2	0	0	0
BAPI	*Baccharis pilularis*	0	0	0	0	0	0	0	1
CEDE	*Ceanothus dentatus*	0	0	0	0	0	0	0	0
CERI	*Ceanothus rigidus*	0.6	5.4	3.8	1.2	3	8.4	0	1
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0	0	0
GAEL	*Garrya elliptica*	0	5.2	0	0	4	0	0	2.6
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0	0	0	0
HESC	*Helianthemum scoparium*	0	0	0	0	0	0	0	0
LECA	*Lepechinia calycina*	0	0	0	0	0	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	0	0	0	0	0	0	0.4	0
MIAU	*Mimulus aurantiacus*	0	0	0	0	0	0	0	0
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	2.4	3	0	3.6	0	10.6	5.6	0
SYMO	*Symphoricarpos mollis*	0	0	0	0	0	0	0	0
TODI	*Toxicodendron diversilobium*	0	5.6	0	9.6	0	0	0	0
BG	Bare ground	9	10.2	6.4	9	0	4.2	28	9.2
HERB	Herbaceous vegetation	0	0	0	0	0	0	1.6	0

Appendix B1

Baseline Transects, Units 25 and 31

Code	Species	25-9	31-1	31-10	31-2	31-3	31-4	31-5	31-6
ADFA	*Adenostoma fasciculatum*	15.6	33.4	42.6	20	24	38	21.6	25.8
ARPU	*Arctostaphylos pumila*	0	0	0	0	2.4	0	0	5.8
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	89.6	48.2	46.6	70	60.2	60.4	57.8	71.4
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	10.8	0	3.4	0	0	0	0
ARMO	*Arctostaphylos montereyensis*	7.4	0	0	0	0	0	0	0
BAPI	*Baccharis pilularis*	0	0	0	0	0	1	0	0
CEDE	*Ceanothus dentatus*	0	0	0	0	0.2	0.4	1.2	0
CERI	*Ceanothus rigidus*	0.4	1.8	2.8	5	10.6	13.4	1	15.4
ERFA	*Ericameria fasciculata*	0	0	0	2	0	0	1.2	0
GAEL	*Garrya elliptica*	0	0	0	0	0	0	0	0
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0	0	0	0
HESC	*Helianthemum scoparium*	0	0	0	0	0	0	0.2	0
LECA	*Lepechinia calycina*	0	1.6	0	0	0	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	0	0	0	0	0	0	0	0
MIAU	*Mimulus aurantiacus*	0	8	0	0	0	0	0	0
QUAG	*Quercus agrifolia*	0	0	0	0	0	2	0	0
SAME	*Salvia mellifera*	0	0	14.2	8.8	5.8	0	10.2	5.2
SYMO	*Symphoricarpos mollis*	0	0	0	0	0	0.6	0	0
TODI	*Toxicodendron diversilobium*	0	0.6	0	0	0	1	0	0
BG	Bare ground	0	10.8	13.4	8.8	12.2	6.6	19	4
HERB	Herbaceous vegetation	0	0.4	0	0	0	0	0	0

Appendix B1

Baseline Transects, Units 25 and 31

Code	Species	31-7	31-8	31-9
ADFA	*Adenostoma fasciculatum*	49.2	33.2	44
ARPU	*Arctostaphylos pumila*	0	0	0
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	67.8	58.2	44.6
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	10.2	1.8
ARMO	*Arctostaphylos montereyensis*	0	0	0
BAPI	*Baccharis pilularis*	0	0.6	8
CEDE	*Ceanothus dentatus*	0	0	0
CERI	*Ceanothus rigidus*	11.4	4.4	13.2
ERFA	*Ericameria fasciculata*	0	0	0
GAEL	*Garrya elliptica*	0	3.6	0
HEAR	*Heteromeles arbutifolia*	0	2	1.6
HESC	*Helianthemum scoparium*	0	0	0
LECA	*Lepechinia calycina*	0	5.2	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	0	0	0
MIAU	*Mimulus aurantiacus*	0	0.2	0
QUAG	*Quercus agrifolia*	0	0	0
SAME	*Salvia mellifera*	2	0	1.8
SYMO	*Symphoricarpos mollis*	0	0	0
TODI	*Toxicodendron diversilobium*	0.6	2	0
BG	Bare ground	1.6	4.2	0
HERB	Herbaceous vegetation	0	0	0

Appendix B2

Year 3 Transects, Units 4, 11, 12, and 23N

		Unit 4							
Code	Species	4-1	4-5	4-6	4-7	4-8	4-9	4-10	4-11
ADFA	*Adenostoma fasciculatum*	5	3.2	2.6	16.2	4.6	8.4	5.4	7.4
ARPU	*Arctostaphylos pumila*	1.2	0	3	1.2	0.6	6.6	5.6	1.2
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	41	34.6	32.4	46.6	33.6	13.2	4.8	23.6
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	0	0	0	0	0	0	0
BAPI	*Baccharis pilularis*	0.6	0	0	0	0	0	0	1
CAED	*Carpobrotus edulis*	0	0	0	0	0	0	0	2
CEDE	*Ceanothus dentatus*	0	0	0.6	0	0	0	0.2	0.4
CERI	*Ceanothus rigidus*	0	0	0	0	0	0	0	0
ERCO	*Eriophyllum confertiflorum*	0	0	0	0.8	1.4	4.6	0	0.8
ERER	*Ericameria ericoides*	0	0	0	0	0	0	0	0
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0.4	1.8	0
GAEL	*Garrya elliptica*	1.4	0	0	0	0	0	0	0
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0	0	0.4	0
HESC	*Helianthemum scoparium*	0	0	0	2.2	1	0.4	0.6	1.4
LECA	*Lepechinia calycina*	0	0	0	0	0	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	1	1.8	9	4	1.8	5.4	22.2	14.6
MIAU	*Mimulus aurantiacus*	0	0	1.4	0	0	0.2	0	0.4
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
RISA	*Ribes sanguineum*	0	0	0	0	0	0	0	0
ROCA	*Rosa californica*	0	0	0	0	0	0	0	0
RUUR	*Rubus ursinus*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	6	0	0.4	2.8	3	1	10.2	8.8
SYMO	*Symphoricarpos mollis*	0	0	0	0	0	2.4	0	0
TODI	*Toxicodendron diversilobium*	0	2.8	0	0	0	2.2	0	0
BG	Bare ground	47.8	58	53.2	26.6	55	54.6	54.4	41.6
HERB	Herbaceous vegetation	0	0	1.8	2.4	1	4.8	3.6	0.6

Appendix B2

Year 3 Transects, Units 4, 11, 12, and 23N

		Unit 4		Unit 11					
Code	Species	SB-T2	SB-T8	11-1	11-2	11-3	11-4	11-5	11-6
ADFA	*Adenostoma fasciculatum*	7.6	22	4.8	13.8	47.6	11.8	6	8.6
ARPU	*Arctostaphylos pumila*	0	0	0	0	0	0	3.4	0
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	9.1	24.8	42	25.2	8.2	20.8	25.8	48.2
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	0	0	0	0	0	0	0
BAPI	*Baccharis pilularis*	14.3	0.2	0	7.4	0	0	0	3
CAED	*Carpobrotus edulis*	0	0	0	0	0	0	0	0
CEDE	*Ceanothus dentatus*	0	0	1.4	0	0	0	0	0.8
CERI	*Ceanothus rigidus*	0	0	0.6	0	0	0.2	0.2	0
ERCO	*Eriophyllum confertiflorum*	0	1.2	0	0.4	0	1.8	0.8	0
ERER	*Ericameria ericoides*	0	0	0	1.6	0	0	0	0
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0	0	0
GAEL	*Garrya elliptica*	0	0	0	0	1	2	0	0
HEAR	*Heteromeles arbutifolia*	0	0	5.4	1.8	0	0	0	0
HESC	*Helianthemum scoparium*	0	2	0.6	0	0	0.4	0.2	0
LECA	*Lepechinia calycina*	0	0	2.6	1.4	0.2	0	0	8.2
LOSC	*Acimispon glaber (= Lotus scoparius)*	0	0.4	2.4	8.6	0	0	2.8	0
MIAU	*Mimulus aurantiacus*	1.4	0	0	2	0.6	0	0	0.6
QUAG	*Quercus agrifolia*	7.9	0	0	0	0	0	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	6.8	0	0
RISA	*Ribes sanguineum*	0	0	0	0	0	0	0	0
ROCA	*Rosa californica*	0	0	0	0	0	0	0	1.4
RUUR	*Rubus ursinus*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	0	0	7.4	1.6	3.4	0.4	0	0
SYMO	*Symphoricarpos mollis*	0	0	0	2.4	0	0	0	0
TODI	*Toxicodendron diversilobium*	0.5	0.6	6.2	0.2	0.2	0	10.8	0.2
BG	Bare ground	37.1	49.4	37.4	29.2	42.6	51.4	48.6	0
HERB	Herbaceous vegetation	9.8	1.6	0.8	21.8	1.2	9.8	5.6	2.6

Appendix B2

Year 3 Transects, Units 4, 11, 12, and 23N

		Unit 11							
Code	Species	11-7	11-8	11-9	11-10	11-11	11-12	11-13	11-14
ADFA	*Adenostoma fasciculatum*	19	15.6	5.6	6.8	9.8	40.2	26.2	16.4
ARPU	*Arctostaphylos pumila*	0	0	0	0	0	0	0	0
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	20	30.2	45.6	38.2	24.2	11.6	10.8	21.2
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	0	0	0	0	0	4	0.6
BAPI	*Baccharis pilularis*	0.4	0	0	2.4	0	0.6	2	10.6
CAED	*Carpobrotus edulis*	0	0	0	0	0	0	0	0
CEDE	*Ceanothus dentatus*	0.4	0.4	0	0.2	1	0	0.2	0.4
CERI	*Ceanothus rigidus*	0	0	0	0	0.6	0	0	0
ERCO	*Eriophyllum confertiflorum*	0	0	0	3	9.6	0	0.4	4.2
ERER	*Ericameria ericoides*	0	0	0	0	0	0	0	0
ERFA	*Ericameria fasciculata*	0	0	0	2	0	0	0	0
GAEL	*Garrya elliptica*	0	1.2	2.6	0	0	0	1.6	0.6
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0	0	1.8	0
HESC	*Helianthemum scoparium*	1.4	0	0	0.4	0.4	0	0	0.2
LECA	*Lepechinia calycina*	0	0.6	2	0	1.6	1.2	1	0.4
LOSC	*Acimispon glaber (= Lotus scoparius)*	0	0	1	0	1.2	0	2.4	0.4
MIAU	*Mimulus aurantiacus*	0	2.8	0	0	0	0	0.2	0.4
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
RISA	*Ribes sanguineum*	0	0	0	0	0	0	0	0
ROCA	*Rosa californica*	0	0	0	0	0	0	0	0
RUUR	*Rubus ursinus*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	1.8	1.8	0.8	0.2	4.4	8.6	3.2	0
SYMO	*Symphoricarpos mollis*	0	0	0.8	0	0	0	4.6	1.6
TODI	*Toxicodendron diversilobium*	0	1	3	0	3	17.8	14.2	4.8
BG	Bare ground	58.6	48.2	41.6	46	46.6	34.2	40	51.2
HERB	Herbaceous vegetation	1.8	0.2	3.4	3.6	2.8	0	7.8	3.2

Appendix B2

Year 3 Transects, Units 4, 11, 12, and 23N

		Unit 11							
Code	Species	11-15	11-16	11-17	11-18	11-19	11-20	11-21	11-22
ADFA	*Adenostoma fasciculatum*	19.8	16.2	15.4	28	5.4	12.2	30.8	3.8
ARPU	*Arctostaphylos pumila*	0	0	0	0	0	0	0	0
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	18.8	47.2	29.8	38	38.4	44.6	22.4	43.4
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0.8	0	0	0	0	0	0	0
BAPI	*Baccharis pilularis*	20.8	0	0	1.4	8	5.2	0	0.6
CAED	*Carpobrotus edulis*	0.4	0	0	0	0	0	0	0
CEDE	*Ceanothus dentatus*	0	1	0	0	0	0	0.4	0
CERI	*Ceanothus rigidus*	0	0.2	0	1	0	0	0	0
ERCO	*Eriophyllum confertiflorum*	0.8	1.2	0.4	0	1	1.2	1.4	0.6
ERER	*Ericameria ericoides*	0	0	0	0	0	0	0	0
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0	0	0
GAEL	*Garrya elliptica*	0	0	1.2	0	4.4	1.2	0	0
HEAR	*Heteromeles arbutifolia*	2.4	0.2	0	0	0	0	0	3
HESC	*Helianthemum scoparium*	0	0	0.4	0.2	0	0	0	0
LECA	*Lepechinia calycina*	0	2.2	0.8	0	1.6	0.2	1.4	3.2
LOSC	*Acimispon glaber (= Lotus scoparius)*	1.2	0	0	0	0	0	0	0
MIAU	*Mimulus aurantiacus*	9.6	0.2	0	0	0	0	0	0.6
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
RISA	*Ribes sanguineum*	2.4	0	0	0	0	0	0	0
ROCA	*Rosa californica*	0	0	0	0	0	0	0	0
RUUR	*Rubus ursinus*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	0	5.2	0.4	1.4	0	0	0	6
SYMO	*Symphoricarpos mollis*	15	0	0	0	3.4	0.6	0.6	2.6
TODI	*Toxicodendron diversilobium*	18.8	2	0	6.8	1.2	0	25.2	0
BG	Bare ground	19.2	30.2	54.2	33.2	38.2	41.2	37.2	42.6
HERB	Herbaceous vegetation	1.2	2.2	2.4	0	5.6	0.2	1.6	0.2

Appendix B2

Year 3 Transects, Units 4, 11, 12, and 23N

		Unit 11		Unit 12					
Code	Species	11-23	11-24	12-1	12-2	12-3	12-4	12-5	12-6
ADFA	*Adenostoma fasciculatum*	9.6	25.8	3	23.8	13.8	16.4	20.6	11
ARPU	*Arctostaphylos pumila*	0	0	0	0	0	21.2	7.6	0.2
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	43.6	29.2	42	27	25.6	14.2	12.8	37.2
ARHO	*Arctostaphylos hookeri ssp. hookeri*	43.6	0	0	0	0	0	0	0
BAPI	*Baccharis pilularis*	0	12	0	0	4.8	0	0	0
CAED	*Carpobrotus edulis*	0	0	0	0	0	0	0	0
CEDE	*Ceanothus dentatus*	0	0	0	0	0	0	0	0
CERI	*Ceanothus rigidus*	0	0	0.2	0.2	1.2	0	0	0
ERCO	*Eriophyllum confertiflorum*	0.4	0	0	0.8	1.4	0	0	0.4
ERER	*Ericameria ericoides*	0	0	0	0	0	0	0	0
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0	0	0
GAEL	*Garrya elliptica*	0	1.2	0	0	0	0	0	0
HEAR	*Heteromeles arbutifolia*	0	0.6	0	0	0.2	0	1.4	0
HESC	*Helianthemum scoparium*	0	0	0.4	0.4	0	0	1.4	0.6
LECA	*Lepechinia calycina*	1.6	6.4	2.8	0	3.6	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	0	0	0	0.6	8	3.6	1.6	1.4
MIAU	*Mimulus aurantiacus*	1.6	0	0	0	2.8	0.6	2.4	0
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	0.6	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
RISA	*Ribes sanguineum*	0	0	0	0	0	0	0	0
ROCA	*Rosa californica*	0	0	0	0	0	0	0	0
RUUR	*Rubus ursinus*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	0	0	0	9.6	0.2	18.8	9.2	1.2
SYMO	*Symphoricarpos mollis*	9.2	0.2	0	0	7.2	0	0	0
TODI	*Toxicodendron diversilobium*	0.4	1.2	0	0	20.2	0	0	0
BG	Bare ground	39.8	37	50.8	42.4	33.2	39	45.6	49.6
HERB	Herbaceous vegetation	4.6	0	2	0	0.6	1.2	0.4	0

Appendix B2

Year 3 Transects, Units 4, 11, 12, and 23N

		Unit 12							
Code	Species	12-7	12-8	12-9	12-10	12-11	12-12	12-14	12-15
ADFA	*Adenostoma fasciculatum*	22.8	21.2	21	14	30.6	25.8	15.2	21.8
ARPU	*Arctostaphylos pumila*	0	0	0	0	0	0	0	0
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	27.8	24.2	34	17.4	34.2	41.2	39.8	30
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	0	0	0	0	0	0	0
BAPI	*Baccharis pilularis*	0	0.6	0	0	0	0	0	0
CAED	*Carpobrotus edulis*	0	0	0	0	0	0	0	3.2
CEDE	*Ceanothus dentatus*	0	0	1.2	0.4	0	0	0.2	0
CERI	*Ceanothus rigidus*	0.6	2.6	0	0	0.6	0	0	0.4
ERCO	*Eriophyllum confertiflorum*	0	1.2	0	0.4	0	0	0	0
ERER	*Ericameria ericoides*	0	0	0	0	0	0	0	0
ERFA	*Ericameria fasciculata*	0	0	0	0.8	0	0	0	0
GAEL	*Garrya elliptica*	0	0	0	1	3.2	0	0.6	0
HEAR	*Heteromeles arbutifolia*	0.6	0.6	7.4	0	0	0	0	7.6
HESC	*Helianthemum scoparium*	0	0.6	0.2	1	0	0	0.2	0
LECA	*Lepechinia calycina*	0.8	1	6.2	0	1.2	0	9	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	0	0	0	0	0	0	0	0
MIAU	*Mimulus aurantiacus*	0	0	0	0	0	0	0	0
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	0	7.2
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
RISA	*Ribes sanguineum*	0	0	0	0	0	0	0	0
ROCA	*Rosa californica*	0	0	0	0	0	0	0	0
RUUR	*Rubus ursinus*	0	0	0	1	0	0	0	0
SAME	*Salvia mellifera*	12.6	6.6	2.2	2.4	0	0	5.4	1
SYMO	*Symphoricarpos mollis*	0	5.8	0	0	3.6	0	0	0
TODI	*Toxicodendron diversilobium*	0	3	8.4	0.2	2.2	0	1.4	8.8
BG	Bare ground	42.4	44.8	32	61	31.4	37.8	35	33.8
HERB	Herbaceous vegetation	0	0	0	1.8	0.4	0	0	1.8

Appendix B2

Year 3 Transects, Units 4, 11, 12, and 23N

		Unit 12			Unit 23N	
Code	Species	12-16	12-17	12-18	T11	T6
ADFA	*Adenostoma fasciculatum*	10	18.2	11.8	8.6	24
ARPU	*Arctostaphylos pumila*	0	0	0	0	0
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	36	26	9.4	17	21.8
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	0	0	0	0
BAPI	*Baccharis pilularis*	0	0	0	0	0
CAED	*Carpobrotus edulis*	0	0	3.2	0	0
CEDE	*Ceanothus dentatus*	0	1.8	0	0	0
CERI	*Ceanothus rigidus*	0.4	0.2	0	0	0.6
ERCO	*Eriophyllum confertiflorum*	0.6	1.4	1.2	0.6	0.2
ERER	*Ericameria ericoides*	0	0	0	0	0
ERFA	*Ericameria fasciculata*	0	0	0	0	0
GAEL	*Garrya elliptica*	0	0	0	0	0
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0
HESC	*Helianthemum scoparium*	1.2	1	1.6	2.8	1.8
LECA	*Lepechinia calycina*	0	2.4	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	0	0	11.4	4.8	4
MIAU	*Mimulus aurantiacus*	0	0	1.6	0	0
QUAG	*Quercus agrifolia*	0	0.8	0	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0
RISA	*Ribes sanguineum*	0	0	0	0	0
ROCA	*Rosa californica*	0	0	0	0	0
RUUR	*Rubus ursinus*	0	0	0	0	0
SAME	*Salvia mellifera*	6.6	7	9	9.2	1.6
SYMO	*Symphoricarpos mollis*	0	0	0	0	0
TODI	*Toxicodendron diversilobium*	0	0	0	0	0
BG	Bare ground	49.6	44.8	55.2	61.4	48.2
HERB	Herbaceous vegetation	0	1.8	3.6	1.8	0.2

Appendix B3
Year 5 Transects, Units 14 and 19

		Unit 14							
Code	Species	14-1	14-10	14-11	14-12	14-13	14-14	14-15	14-16
ADFA	*Adenostoma fasciculatum*	2.2	6.6	14.4	16.8	7	0.6	7.8	12.8
ARPU	*Arctostaphylos pumila*	3.4	0	1.4	2.4	0.2	0.6	3.4	1.8
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	15.2	1.4	6.4	11.4	12.8	22.2	23	5.8
BAPI	*Baccharis pilularis*	0	0	0	0	0	0	0.2	0
CAED	*Carpobrotus edulis*	0	0	0	0	0	0.4	0	0.4
CEDE	*Ceanothus dentatus*	2.4	2.4	12	0	3.6	3.6	7.6	5.8
CERI	*Ceanothus rigidus*	15	0.8	12.4	0	10	6.8	25.4	0.8
ERCO	*Eriophyllum confertiflorum*	1.4	11.4	5.4	3.8	4.2	0.4	0.8	4.8
ERER	*Ericameria ericoides*	22	0	0	0	0	0	3.4	0.2
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0	0	0
GAEL	*Garrya elliptica*	0	0	0	3	0	0	0	0
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0	0	5.6	0
HESC	*Helianthemum scoparium*	4.4	30	15	16.2	20	22.4	0.2	9.4
LECA	*Lepechinia calycina*	0	0	0	0	0	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	1.4	8.8	1.4	8.2	6.6	5.8	0	3.4
LUAL	*Lupinus albifrons*	0	0	0	0	1.2	0.6	0.2	2.2
MIAU	*Mimulus aurantiacus*	0	0	0	1	0	0	0.6	0
QUAG	*Quercus agrifolia*	0	0	0	0	5	0	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	0	0.8	0.8	8.4	0	0	0.4	0.2
SOUM	*Solanum umbelliferum*	0	0	0	0	0	0	0	0
SYMO	*Symphoricarpos mollis*	0	0	0	0	0	0	1.2	0
TODI	*Toxicodendron diversilobium*	0.2	0	0	13.2	0.2	0	0	0
BG	Bare ground	41.4	37.4	38.4	34.4	39.6	38.6	29.8	50.2
HERB	Herbaceous vegetation	6.8	1.6	1.6	0.6	0	3	8.8	7.4

Appendix B3
Year 5 Transects, Units 14 and 19

Code	Species	Unit 14							
		14-17	14-18	14-19	14-2	14-20	14-21	14-22	14-3
ADFA	*Adenostoma fasciculatum*	9.4	13	9.6	13.2	6.6	17.6	17.2	11
ARPU	*Arctostaphylos pumila*	0	0	4.4	6.2	1	2.6	0.6	0
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	11.8	19.2	30.6	4.2	9	9.8	11.4	15.2
BAPI	*Baccharis pilularis*	0	0	0	0	0	0.6	0	0
CAED	*Carpobrotus edulis*	0	0	0	0	1.2	2.4	0	0
CEDE	*Ceanothus dentatus*	7.6	28.4	0	1	24	0	2.8	4.8
CERI	*Ceanothus rigidus*	6.8	8.8	11	6	1.4	13	8	1
ERCO	*Eriophyllum confertiflorum*	4.4	0.2	2.2	2	4	0.4	1.4	5.6
ERER	*Ericameria ericoides*	0	0	0	0	0	0	0	0.2
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0	0.8	0.2
GAEL	*Garrya elliptica*	1	0	0	0	0	0	0	0
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0	0	0	0
HESC	*Helianthemum scoparium*	9.6	2	10.6	0	32.8	9.4	3.2	16
LECA	*Lepechinia calycina*	0	0	0	0	0	0	4.4	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	9.2	0.2	1.6	0	1.4	1.6	2.2	3.6
LUAL	*Lupinus albifrons*	0	0	0	0	0	0	0.8	0
MIAU	*Mimulus aurantiacus*	0	3.6	1.8	0	0.4	0.8	0	0
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	4.5	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	3.4	1.4	11.8	0	1.8	6.2	1.6	6.2
SOUM	*Solanum umbelliferum*	0	0.2	0	0	0	0	0	0
SYMO	*Symphoricarpos mollis*	0	0.2	0	0	0	0	0.4	0
TODI	*Toxicodendron diversilobium*	0	0	17.2	4.2	0	0.2	11.2	0
BG	Bare ground	39.4	38.6	53.8	48.8	34.4	44.8	41.8	40.6
HERB	Herbaceous vegetation	2.4	4.4	0.2	17.4	1.6	0	1	4.4

Appendix B3

Year 5 Transects, Units 14 and 19

Code	Species	Unit 14						Unit 19	
		14-4	14-5	14-6	14-7	14-8	14-9	19-1	19-10
ADFA	*Adenostoma fasciculatum*	12.8	12.4	23.8	1.2	5.2	3.6	0	16.4
ARPU	*Arctostaphylos pumila*	0	0.2	0	0.2	1	1.8	7.6	0.4
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	8.4	5.8	6.8	17	6.2	21	20.6	4.6
BAPI	*Baccharis pilularis*	0	35.4	0	0	0.2	0	0	0
CAED	*Carpobrotus edulis*	0	0	0	0	0	0	0	0
CEDE	*Ceanothus dentatus*	4.2	3.2	0.8	14.6	2.8	13.8	12.2	1
CERI	*Ceanothus rigidus*	2	0	6.8	9.2	5.8	11.8	1.4	9
ERCO	*Eriophyllum confertiflorum*	10.4	8.4	0.8	1.2	0.8	0.8	20.4	5.4
ERER	*Ericameria ericoides*	0	0	0	0	0	0	0	0
ERFA	*Ericameria fasciculata*	1.2	0.2	1.4	0	0	0	0	0
GAEL	*Garrya elliptica*	0	2.8	0	0	0	0	0	3.6
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0	0	0	0
HESC	*Helianthemum scoparium*	9.4	25.4	8.2	19.8	23.8	8.4	2.2	4.4
LECA	*Lepechinia calycina*	0	0	0	0	0	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	0.6	9.6	12.2	7.2	0.2	0.6	6.2	2
LUAL	*Lupinus albifrons*	0	0	0	0	0	0	0	0
MIAU	*Mimulus aurantiacus*	0	0	0	0	0	0	0	0
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	6.6	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	0	0.8	4.2	0	0	0	0	0.2
SOUM	*Solanum umbelliferum*	0	0	0	0	0	0.2	0	0
SYMO	*Symphoricarpos mollis*	0	0	0	0	0	3	6.6	0
TODI	*Toxicodendron diversilobium*	0.2	0	3.6	0	0	0	19.8	0
BG	Bare ground	54	3	31	41.2	54	41.2	31.8	56.4
HERB	Herbaceous vegetation	1.4	4	6.6	1.6	1	1.4	0.2	0

Appendix B3

Year 5 Transects, Units 14 and 19

Code	Species	Unit 19							
		19-11	19-12	19-13	19-14	19-15	19-16	19-17	19-19
ADFA	*Adenostoma fasciculatum*	14	10.6	18.6	28.2	12.4	21.6	15.4	12.6
ARPU	*Arctostaphylos pumila*	0.6	0.8	4	2.8	0.2	0.4	0.2	0.8
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	15	13.4	19	9.8	7.6	9.6	8	9.8
BAPI	*Baccharis pilularis*	0	0	0	0	0	0	0	0
CAED	*Carpobrotus edulis*	0	0	0	0	0.2	1	0	0
CEDE	*Ceanothus dentatus*	5.6	0	0	0	0.4	8.2	0.4	3.2
CERI	*Ceanothus rigidus*	18	21.6	2.6	1.2	3	3.8	0.4	7.8
ERCO	*Eriophyllum confertiflorum*	3.4	2.2	4.4	2	7.6	5.8	8	6.4
ERER	*Ericameria ericoides*	0	0	0	0	0	0	0	0
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0	0.2	0
GAEL	*Garrya elliptica*	0	0	0	0	0	0	1.8	0
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0	0	0	0
HESC	*Helianthemum scoparium*	15.4	9	3	5.2	25.8	38.2	3.8	14.8
LECA	*Lepechinia calycina*	0	0	0	0	0	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	5.2	0	1.8	2.4	10	14.8	6.4	2.8
LUAL	*Lupinus albifrons*	0	0	4.8	2	0	0	0	0
MIAU	*Mimulus aurantiacus*	0	0	0	0	1.8	0	0	0
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	0.6	0	1	0	2	0.4	2.8	0
SOUM	*Solanum umbelliferum*	0	0	0	0	0	0	0	0
SYMO	*Symphoricarpos mollis*	0	0	0	0	0	0	0	0
TODI	*Toxicodendron diversilobium*	0	0	0.2	2.4	0	0	0	0
BG	Bare ground	32.2	47	48.2	48	34.6	19.2	52.8	45.4
HERB	Herbaceous vegetation	0.6	0	0.2	0.8	2.4	0.2	2.6	0

Appendix B3

Year 5 Transects, Units 14 and 19

Code	Species	Unit 19							
		19-2	19-20	19-23	19-25	19-3	19-4	19-5	19-6
ADFA	*Adenostoma fasciculatum*	13.6	18.8	15.4	12.6	13.6	12.8	21	16.6
ARPU	*Arctostaphylos pumila*	0.4	0.2	2	6	0.2	1	0	0.2
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	11	0.8	32.8	0	3	4.4	0	4.6
BAPI	*Baccharis pilularis*	0	0	0	0	0	0	0	0
CAED	*Carpobrotus edulis*	0	0	0	0	0	0	0	0
CEDE	*Ceanothus dentatus*	0	0.6	0	0	0.6	0	0	1.8
CERI	*Ceanothus rigidus*	6.4	8.4	19.4	0	5	4.4	12	0
ERCO	*Eriophyllum confertiflorum*	0	0.8	3.2	0	2.4	5.4	10.4	3.6
ERER	*Ericameria ericoides*	1.2	0	0.8	16.4	0	1.8	0	0
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0	0	0
GAEL	*Garrya elliptica*	0	0	0	0	0	0	0	0
HEAR	*Heteromeles arbutifolia*	0	0	0	0	0	0	0	0
HESC	*Helianthemum scoparium*	15.4	11.6	1.6	0	7	0.6	3.8	14
LECA	*Lepechinia calycina*	0	0	0	0	0	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	0	1.8	0.4	2.2	1.6	0.6	2.6	19.4
LUAL	*Lupinus albifrons*	0	0	0	1.2	1.4	0	0	0.8
MIAU	*Mimulus aurantiacus*	0	0	0	0	0	0	0	2
QUAG	*Quercus agrifolia*	0	0	0	0	0	0	0	1.4
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	0	0	0	0	0	0.4	0	0
SOUM	*Solanum umbelliferum*	0	0	0.2	0	0	0	0	0
SYMO	*Symphoricarpos mollis*	0	0	0	0	0	0	0	0
TODI	*Toxicodendron diversilobium*	1	0	0	0	0	0	0	2.8
BG	Bare ground	63.8	58.6	31	49	68.4	70.4	54	42.8
HERB	Herbaceous vegetation	0	0.4	0	13	1.2	0.8	0	3.6

Appendix B3

Year 5 Transects, Units 14 and 19

Code	Species	Unit 19		
		19-7	19-8	19-9
ADFA	*Adenostoma fasciculatum*	7	10.9	23.4
ARPU	*Arctostaphylos pumila*	4	0.2	1
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	3.6	5.1	14.2
BAPI	*Baccharis pilularis*	0	0	0
CAED	*Carpobrotus edulis*	0	0	0
CEDE	*Ceanothus dentatus*	0	0.8	1.8
CERI	*Ceanothus rigidus*	4	0.2	16.8
ERCO	*Eriophyllum confertiflorum*	2.8	3.5	1.8
ERER	*Ericameria ericoides*	0	0	0
ERFA	*Ericameria fasciculata*	0	0	0
GAEL	*Garrya elliptica*	0	0	1.4
HEAR	*Heteromeles arbutifolia*	0.6	0	0
HESC	*Helianthemum scoparium*	5.8	3.8	5
LECA	*Lepechinia calycina*	0	0	0
LOSC	*Acimispon glaber (= Lotus scoparius)*	3.4	0.3	3.6
LUAL	*Lupinus albifrons*	0	0	0
MIAU	*Mimulus aurantiacus*	0	0	0
QUAG	*Quercus agrifolia*	0	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0.1	0
SAME	*Salvia mellifera*	1.4	0.1	0
SOUM	*Solanum umbelliferum*	0	0	0.2
SYMO	*Symphoricarpos mollis*	0	0	4.4
TODI	*Toxicodendron diversilobium*	0	6.4	11.2
BG	Bare ground	65.6	22.5	38.6
HERB	Herbaceous vegetation	3.2	0.2	0.6

Appendix B4

Year 8 Transects, MRS-16

Code	Species	16-1	16-10	16-11	16-12	16-13	16-14	16-15	16-16
ADFA	*Adenostoma fasciculatum*	2.4	0	12.2	0.4	0.8	7.6	3.6	10.2
ARPU	*Arctostaphylos pumila*	0	18	13.6	15.6	11.2	10.4	6.2	4.6
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	31	6.8	8.8	22.6	18.8	32.6	53.4	23
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	0	0	0	0	0	1.4	0
BAPI	*Baccharis pilularis*	1	0.2	0	0	0	4	0.6	2.4
CEDE	*Ceanothus dentatus*	0	20.6	5.6	27.4	10.4	8	5	1.8
CERI	*Ceanothus rigidus*	0.8	18	11.8	11.6	16.2	11.8	8.2	10.8
CETH	*Ceanothus thyrsiflorus*	8.2	0	0	0	0	0	0	0
ERCO	*Eriophyllum confertiflorum*	0	0	0.2	0	0	0	0	0.8
ERFA	*Ericameria fasciculata*	0	0	0	0	0	0	0	0
GAEL	*Garrya elliptica*	0	0	0	0	0	0.6	0	0
HESC	*Helianthemum scoparium*	0	0	25.6	0	0	0	0	2
LECA	*Lepechinia calycina*	2.4	0	0	0	0	0.6	0	4
MIAU	*Mimulus aurantiacus*	0	1.6	0.2	0	0	0	0	0
QUAG	*Quercus agrifolia*	0	6.6	3.8	0	0	4	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	2.8	0	0	0.8
RISP	*Ribes speciosum*	0	0	0	0	0	0	0.6	0
SAME	*Salvia mellifera*	5.2	2.6	1.2	0	0.8	0	0	1.6
SOUM	*Solanum umbelliferum*	0	0	0	0	0	0	0	0
SYMO	*Symphoricarpos mollis*	0	0	0	1	0	0	0	0
TODI	*Toxicodendron diversilobium*	0	0	0.2	0	0	0	0	1.2
BG	Bare ground	51	31.4	28	23.6	45.4	31	23.4	37.2
HERB	Herbaceous vegetation	0	2.6	0.4	3.2	0.6	0.2	0	7.8

Appendix B4

Year 8 Transects, MRS-16

Code	Species	16-2	16-3	16-4	16-5	16-6	16-7	16-8	16-9
ADFA	*Adenostoma fasciculatum*	4.4	8	8.8	6.2	16.6	4	39.4	26.6
ARPU	*Arctostaphylos pumila*	0	0	0	0.2	6.2	0	0.8	0
ARTO	*Arctostaphylos tormentosa ssp. tormentosa*	31.8	30.4	3.4	35.8	1	32.2	2.6	12.8
ARHO	*Arctostaphylos hookeri ssp. hookeri*	0	0	0	0	1.2	0	1.4	0.8
BAPI	*Baccharis pilularis*	2	0	0	0.6	11.8	0	0	2.8
CEDE	*Ceanothus dentatus*	9.4	10.6	4	21	21.8	1.4	1	0.4
CERI	*Ceanothus rigidus*	2.6	6.6	10.8	7	12.4	8.6	25.2	25
CETH	*Ceanothus thyrsiflorus*	8.6	0.8	0.6	0	0	0	0	6.4
ERCO	*Eriophyllum confertiflorum*	0	0	0	0.2	0	0	0	0
ERFA	*Ericameria fasciculata*	0	1.2	0	0	0	0	0	0
GAEL	*Garrya elliptica*	2.8	2.6	0	0	0	4.2	0	1
HESC	*Helianthemum scoparium*	0	0.2	0	0.4	0	0.4	0	0
LECA	*Lepechinia calycina*	1.8	1.2	0.4	0.4	0.4	4.2	0.2	4.8
MIAU	*Mimulus aurantiacus*	1.2	0.4	0	0	0	0	0	0
QUAG	*Quercus agrifolia*	0	0	0	0	12.2	0	0	0
RHCA	*Frangula (Rhamnus) californica*	0	0	0	0	0.6	0	0	0
RISP	*Ribes speciosum*	0	0	0	0	0	0	0	0
SAME	*Salvia mellifera*	0.6	9.6	0	0.4	0.6	6	0	0
SOUM	*Solanum umbelliferum*	0	0	0	0	0	0	0	0.6
SYMO	*Symphoricarpos mollis*	2.6	0	0	0	2.4	0	0	0
TODI	*Toxicodendron diversilobium*	0	0.4	0	0	1.2	0	0	0
BG	Bare ground	40.6	36.4	30	34.6	31.8	41.6	37.2	32.2
HERB	Herbaceous vegetation	3.8	0.8	2.8	0.2	3	0.8	6.4	1.2

APPENDIX C

2014 California Tiger Salamander and California Fairy Shrimp, Aquatic Sampling

2014 California Tiger Salamander and California Fairy Shrimp Aquatic Sampling 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 2015

2014 California Tiger Salamander and California Fairy Shrimp Aquatic Sampling Former Fort Ord

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SECTION 1

Introduction

This report presents the results of monthly surveys of six vernal pools on the former Fort Ord between December 2013 and June 2014. These pools were monitored for hydrology and presence of California tiger salamander (CTS) (*Ambystoma californiense*) and California fairy shrimp (*Linderiella californica*). Monitoring of CTS breeding sites, as well as monitoring for the occurrence of California fairy shrimp following remediation actions at the former Fort Ord is a requirement of the U.S. Fish and Wildlife Service's 2005 Biological Opinion (USFWS 2005) and the *Wetland Monitoring and Restoration Plan for Munitions and Contaminated Soil Remedial Activities at Former Fort Ord* (Burleson Consulting, Inc. 2006).

Spring aquatic surveys for California tiger salamander (CTS) (*Ambystoma californiense*) larvae were performed from April through June 2014, to monitor known CTS breeding pools, following on-going munitions and lead remediation activities performed by the U.S. Army Corps of Engineers (COE) in and around the pools. Monthly hydrology monitoring visits to assess the size, depth, and water quality of the pools were conducted following the first significant rainfall in December 2013 through completion of CTS/fairy shrimp monitoring from April to June 2014. This marks the second consecutive year of monitoring these same pools by Bryan Mori and EcoSystems West. Before 2013, surveys for CTS larvae were performed in 2007, 2009 and 2010 prior to remediation activities by Denise Duffy & Associates (DD&A, 2007, 2009, 2010). These surveys included three control pools, where no remediation activities were planned (DD&A 2007, 2009 and 2010). The Army also conducted wetland surveys in 1992, 1994, 1995, and 1996 (Jones and Stokes Wetland Restoration Plan for Unexploded Ordnance Removal Activities at Former Fort Ord, 1997). Additionally, surveys for CTS were conducted on BLM lands in 2003 by students and faculty of UC Davis (Biological Evaluation of Army Actions that May Affect California Tiger Salamander and Contra Costa Goldfields Critical Habitat, Former Fort Ord, Monterey County). All of the control pools and two of the remediation pools (Pools 8 and 10) are known to have supported CTS prior to remediation (B. Kowalski, pers. comm).

The ability of the pools to support successful CTS reproduction was very limited due to the third consecutive year of drought in California. Precipitation in the project vicinity during the 2013-2014 rain year was significantly below normal, despite relatively normal rainfall totals in February and March (125% and 75% of normal respectively)(Department of Meteorology, Naval Postgraduate School (NPS) website: http://met.nps.edu/~ldm/renard_wx/). Monthly rainfall totals were significantly below normal from November 2013 through January 2014, at just 11 – 25% of normal precipitation for weather stations in the vicinity of Fort Ord. Overall, precipitation in the project region through April of the 2013-14 rain year was only 45 – 55% of normal. Relevant weather stations at Fort Ord NPS (just north of Marina Municipal Airport), Marina (southeast end of Marina) and the National Weather Service Climate Office at the Monterey Airport recorded 8.99, 8.79, and 8.46 and inches for the rain year, respectively. At the Marina station, the rainfall totals were estimated at 53 percent of normal (Department of Meteorology, Naval Postgraduate School 2014).

SECTION 2

Methods

The CTS spring larval survey methods followed the US Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW) protocol, *Interim Guidance on Site Assessment for Determining the Presence or a Negative Finding of the California Tiger Salamander, October 2003* (USFWS and CDFW 2003), and the methods employed in the DD&A baseline surveys. Bryan Mori, the lead biologist, presently holds a US Fish and Wildlife Service (USFWS) Recovery Permit (TE-78668-8) and California Department of Fish and Wildlife (CDFW) Scientific Collection Permit/MOU (No. 001912) for CTS. Justin Davilla (Biologist, Ecosystems West Consulting Group) and Bart Kowalski (Biologist, Chenega Global Services) assisted with aquatic sampling, under the direct supervision of Mr. Mori. The USFWS and CDFW were notified prior to start of the study of the intended sampling.

The purpose of monthly hydrology monitoring was to determine whether vernal pools at remediation and control sites were ponded at a depth and duration necessary to support breeding CTS and California fairy shrimp. In general, successful CTS breeding requires a minimum pool depth of 20 cm for at least four to five months (Shaffer and Trenham 2005), whereas California fairy shrimp require a minimum pool depth of 10 cm for at least 18 consecutive days. The hydrology monitoring also served to determine whether remediation activities had altered the functional capabilities of pools to support these and other aquatic species, and to assess water quality of the pools using a calibrated multi-parameter water quality meter.

Where aquatic habitat was present, inundated surface area and maximum ponded depth were measured during each of the six monthly surveys. Hydrology monitoring was not conducted in January 2014 due to a near total lack of rain (0.04 inches in January) following observation of entirely dry pools during the initial December 2013 site visit. Pool depths were measured visually at one meter staff gauges positioned in the deepest portion of the pools. Surface area of pool inundation was mapped using a hand-held, resource grade GPS unit with sub-foot accuracy, and acreage was calculated using the Xtools extension for ArcGIS software. Only one of the six original pool sites (Pool 10) was sampled for water quality during this study due to the lack of water in the remaining pools. Pools 10B and 30B/30C were recently formed adjacent to existing remediation pools by remediation activities and were also sampled for water quality. Pool 56, a control site, had a small amount of standing water in two parallel tire tracks bisecting the pool but the ponded depth was too shallow to properly use of the water quality meter. Water quality (temperature, pH, turbidity, and dissolved oxygen) was assessed on 7 April 2014, using a calibrated multi-parameter digital water quality meter.

Sampling for CTS was conducted on three separate occasions (7 April, 6 May, and 3 June 2014) to assess habitat variability throughout the sampling period, and examine larval growth and reproductive success (i.e., metamorphosis to terrestrial form). The start of sampling was delayed until the first week of April to avoid injuring small larvae, due to the late formation of the pools. Pools sampled in 2014 included 10, 10B, 30B, 30C. Of these, only remediation Pool 10 was a primary monitoring site, whereas the remaining pools were secondary sites formed by the ponding of newly formed depressions adjacent to the primary monitoring sites. All pools were surveyed using dipnets in order to minimize the disturbances to aquatic habitats and to provide comparable results between sampling years. However, a significant change in the dip net method was employed in 2014, due to munitions clearance matters. Unlike in previous years, dip-netting was restricted to the immediate shoreline of Pools 10 and 10B, significantly reducing the surface area available to sample. This requirement was implemented as a safety measure as remediation site pools have not been surface-cleared of munitions, and submerged objects are difficult to detect due to the high turbidity of standing water in the pools. The dipnets were of standard length (5 ft) with a mesh size of 1/8 inch. Depending on the extent of aquatic habitat present, one to three biologists sampled each site. Small pools, such as 30B and 30C, were sampled in their entirety, while a minimum of 30% of the surface area was sampled for Pool 10, which was greater than one acre in size during the sampling period. Sampling at Pool 10 was performed for 2-person hours each visit. All CTS larvae captured were measured for total length and photographed.

The presence/absence of California fairy shrimp also was assessed concurrently with CTS sampling, following recommendations in the monitoring and restoration plan (Burleson Consulting, Inc. 2006). The timing of the fairy shrimp surveys were based on those used for the 2009 and 2010 DD&A baseline studies, which sampled fairy shrimp concurrent to CTS sampling, rather than earlier in winter, as in the DD&A 2007 study. Sampling for fairy shrimp in this manner was selected for efficiency and to avoid indirect and direct disturbances to CTS eggs, which are more likely to be present earlier in winter. In addition to the dipnets described, above, one dipnet with fine mesh (1 mm) for invertebrate sampling was utilized during CTS larval sampling and, unlike the DD&A (2009, 2010) method of 5-10 sweeps per pool, all sweeps were inspected for invertebrates.

As part of the CTS and fairy shrimp sampling, all captured amphibians and, where practical, aquatic invertebrates were identified and recorded on data sheets.

SECTION 3

Results

3.1. Site Hydrology

The 2013-14 rain year represented the third consecutive year of drought in California. Unlike in the previous rain year, which began with a series of heavy storms prior to January followed by months of little to no rainfall, the 2013-14 rainy season was characterized by below normal rainfall for all months except for February (http://met.nps.edu/~ldm/renard_wx/). Consequently, the hydrology at the pools was limited as early season rainfall is typically required for long-term saturation and ponding (Table 3-1). Early season rainfall occurs during periods of cooler air temperatures and shorter days, thereby decreasing the rate of evaporation and transpiration by aquatic plants (=evapotranspiration). Moreover, early rain will decompose thatch (dead plant material from the previous year) causing pools to be deeper and more suitable for CTS and fairy shrimp reproduction.

Water quality measurements from the April survey is provided in Table 3-2. Only four pools retained enough water in February and March to allow water quality sampling during sampling for CTS and California fairy shrimp.

None of the three control site pools supported aquatic habitat suitable for CTS and fairy shrimp sampling. Pool 10 was the only original remediation site pool to provide aquatic habitat suitable for sampling for CTS and fairy shrimp. This was expected because this large vernal pool is recognized as one of the most significant CTS breeding sites in the region. Pools 10B, 30B, and 30C, formed recently as a result of munitions and lead remediation activities, also supported small pools of standing water that remained inundated into the CTS and fairy shrimp sampling period.

Table 3-1
Depth and Surface Area of Monitored Vernal Pools at Former Fort Ord

Pool	12/11/2014		2/18/2014*		3/17/2014		4/7/2014		5/6/2014		6/3/2014	
	Depth (cm)	Area (acres)	Depth (cm)	Area (acres)	Depth (cm)	Area (acres)	Depth (cm)	Area (acres)	Depth (cm)	Area (acres)	Depth (cm)	Area (acres)
5	0	0	0	0	Damp	0	Damp	0	0	0	0	0
56	0	0	0	0	0	0	10	~20 ft^2	0	0	0	0
101E	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	Damp	0	0	0	0	0
10	0	0	4	0.05	47	1.77	53	2.03	41	1.60	29	1.33
10B	0	0	25	0.04	6	0.03	25	0.04	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
30B	0	0	0	0	1	~4 ft^2	3	0.01	0	0	0	0
30C	0	0	0	0	3	0.01	7	0.02	0	0	0	0

*no hydrology monitoring visit occurred in January because pools were dry and measurable rainfall greater than 0.01 inches in a 24 hour period did not materialize over this time period.

Table 3-2
Vernal Pool Water Quality Measurements for Vernal Pools Sampled for CTS and California Fairy Shrimp at Former Fort Ord

	Temperature (Fahrenheit)	**pH**	**Turbidity (NTU)**	**Dissolved Oxygen (mg/L)**
Pool*	**4/7/2014**	**4/7/2014**	**4/7/2014**	**4/7/2014**
10	72.0	6.6	378	9.3
10B	66.7	6.4	295	9.9
30B	76.0	7.0	476	8.8
30C	79.7	6.3	345	9.5

* Pool 56 was too shallow to properly use the water quality meter. The 10cm measured depth was only a small depression directly beneath the staff gauge. The remaining ponded area was less than 5 cm and too shallow for accurate water quality measurements.

3.1.1. Control Pools: Pools 5, 56 and 101E

The control sites consisted of vernal pools located within a mosaic of oak woodland, coyote brush scrub, annual grassland, and maritime chaparral with varying mixes of these habitats surrounding each site (Figure 3-1; Appendix A). Spikerush (*Eleocharis macrostachya*) and salt grass (*Distichlis spicata*) were dominant in and along the margin of Pools 5 and 56, whereas curly dock (*Rumex crispus*), alkali mallow (*Malvella leprosa*), and a variety of non-native annual grasses were the dominant plant species at Pool 101E. Pool 56 was the only control site that supported standing water after late February-early March rainfall during the study and hydrology was limited to existing tire tracks near the center of the feature. Physiognomic conditions of the control site pools are described below. However, due to insufficient hydrology, none of these pools were sampled for CTS larvae and fairy shrimp during the 2013-14 monitoring period.

Pool 5. This pool did not support standing water during the 2013-14 monitoring period. Several areas were damp, but not saturated, near the staff gauge during the March and April site visits but were completely dry during the remainder of the monitoring period. Vegetation within this large, relatively flat feature was dominated by spikerush, with patchy areas of salt grass and curly dock. However, due to very low early winter precipitation totals, decomposition of thatch, germination of annual plants, and plant productivity (biomass), was limited due throughout the 2013-14 monitoring period.

Pool 56. Surface water was present on 7 April but covered an area of approximately 20 ft² with a maximum depth of 10 cm centered on the staff gauge (Table 3-1). Standing water was limited to remnant tire tracks and was too shallow to properly use the water quality meter. Aquatic habitat for CTS and fairy shrimp was limited to the small pooled area within the remnant tire tracks. Surface water was absent by the 7 May sampling date. Vegetation within the pool was dominated by salt grass, spikerush, and alkali mallow (*Malvella leprosa*), with widely scattered rabbitfoot grass (*Polypogon monspeliensis*), clustered dock (*Rumex conglomeratus*), and hedge nettle (*Stachys* sp.). Similar to other control site pools, annual plant germination and biomass was reduced due to drought stress.

Pool 101E. Surface water was not present during any of the 2013-2014 hydrology monitoring site visits. As a result, this pool was not sampled for presence of CTS or fairy shrimp. For the most part, this pool was entirely dry without any evidence of soil saturation near the surface, and germination of hydrophytic (wetland) plants was greatly reduced. The vegetation that was present within the pool was dominated by curly dock and alkali mallow, with rabbitfoot grass and spikerush also present to some extent, but at lower densities than 2013.

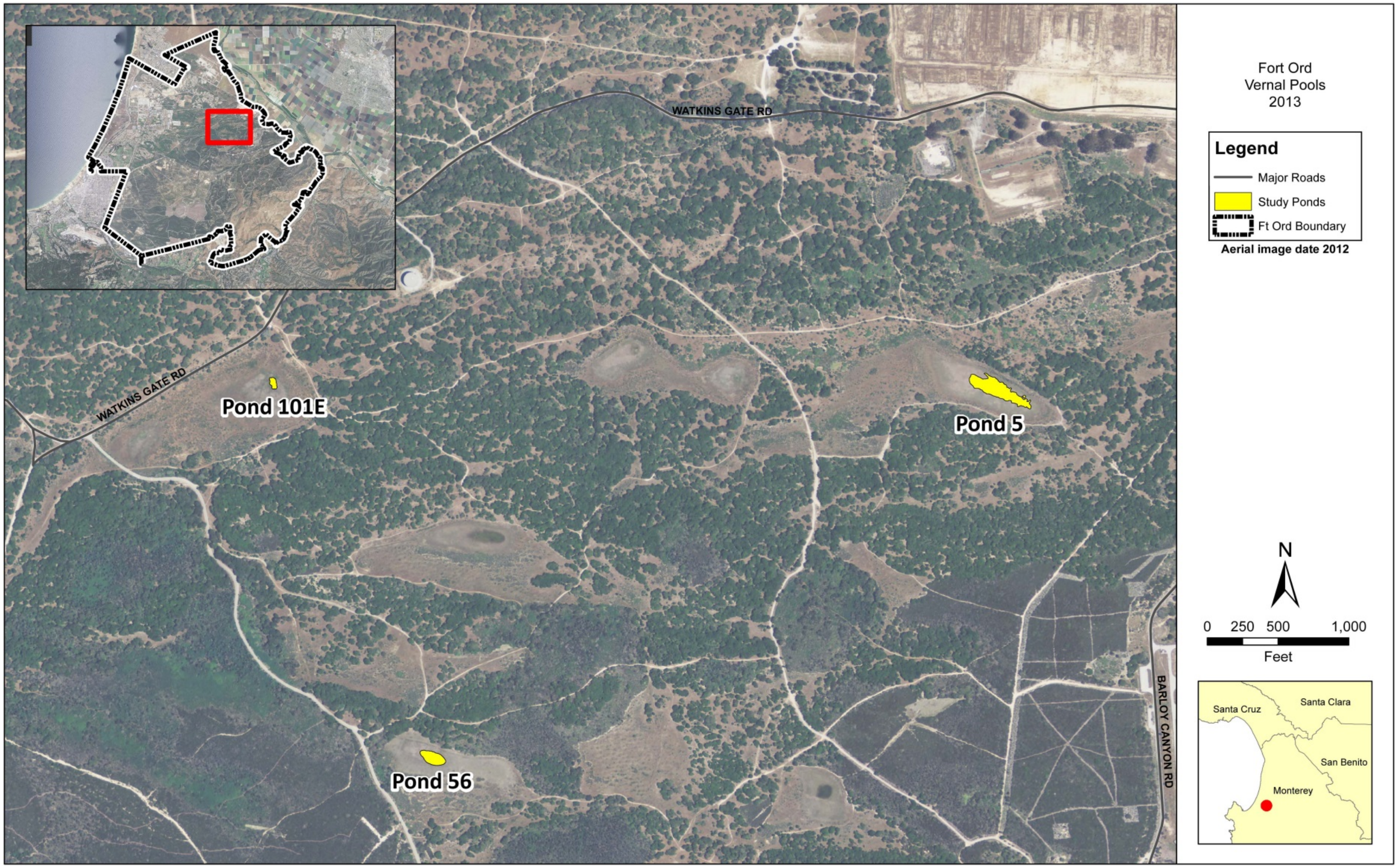

Figure 3-1 Control vernal pool sampling sites (2014), Fort Ord, California.

3.1.2. Remediation Pools: Pools 8, 10, 10B, 30, and 30B/30C

The remediation sampling sites, like the control sites, are all vernal pools (Figure 3-2; Appendix A). Whereas oak woodland was a prominent feature in the surrounding landscape of the control pools, the habitat mosaic surrounding the post-remediation pools was dominated by coyote brush scrub and maritime chaparral, with oak woodland being a minor component. Spikerush was dominant at Pools 10 and 30; however, geranium, filarees, and annual grasses were the main species at Pool 8. Pool 10 was the only primary remediation site that supported standing water during this study.

In addition to Pool 10, three secondary sites also supported standing water during CTS/fairy shrimp sampling – Pools 30B and 30C, excavated depressions adjacent to remediation Pool 30 previously sampled in 2013, and Pool 10B, a newly formed depression in the staging area immediately west of Pool 10.

Physiognomic conditions for all remediation and secondary sites, including specific aquatic sampling conditions of Pools 10, 10B, 30, 30B and 30C, are described below. Details of monthly hydrology monitoring visits are presented Table 3-1.

Pool 8. This feature consists of a relatively flat grassy meadow that did not support standing water during the monitoring period and a small pit depression that was damp, but never inundated during the monitoring 2013-2014 monitoring period (Table 3-1). Due to dry conditions, Pool 8, including the pit depression, was not sampled for CTS or fairy shrimp. Similar to observations from the previous 2012-2013 monitoring period, the meadow portion is arguably no longer a functioning wetland as evidenced by a preponderance of upland grasses and forbs including soft chess (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), sheep sorrel (*Rumex acetosella*), filarees (*Erodium* spp.), and cutleaf geranium (*Geranium dissectum*). Vegetation within the pit was sparse and comprised primarily of alkali mallow, rabbitfoot grass, and spikerush. As with other pools observed this year, the lack of early season rain caused as significant build up of thatch, and germination and productivity of annual plants was greatly reduced.

Pool 10. This large vernal pool has been altered by previous earth-moving activities when Fort Ord was an active military installation. An artificial berm surrounds the west and northwest margins of the pool and the head of the pool appears to have been scraped, increasing its depth. This end contains the main area of standing water. Surface water was present throughout the sampling period from 7 April through 3 June (Table 3-1). During this period, surface water covered an area of 2.03 acres on 7 April, all of which was limited to the deeper, less vegetated western portion (head) of the pool; maximum water depth was 53 cm. By 6 May, the surface water remained entirely within the head of the pool, and was reduced to 1.6 acres, with a maximum depth of 41 cm. By 3 June the pool had receded to 1.33 acres, with a maximum depth of 33 cm. The water was highly turbid throughout the sampling period. The vegetation within and immediately adjacent to the pool is dependent on depth and duration of inundation. The shallower east portion is dominated by spikerush with cattails and bulrush present in several deeper trenched areas. The deeper west portion is mostly unvegetated with a small patch of water smartweed (*Persicaria* sp.) near the north bank and spikerush, curly dock, rabbitfoot grass, and alkali mallow common along the pool margins, particularly along the north, south and west banks.

Pool 10B Pool 10B consists of a remnant depression created from recent munitions remediation activities sometime in late 2013. This pool was located within a large staging area used for munitions and waste disposal, adjacent to and west of remediation Pool 10. This feature was largely unvegetated since little time had elapsed since its formation to allow for the development of a viable seed bank.

Pool 30. Similar to Pool 8, this feature consists of a relatively flat meadow that did not support standing water during the 2013–2014 rain year. The pool is intact despite close proximity to lead remediation activities. The pool was dominated by a mix of upland and wetland vegetation including spikerush, curly dock, soft chess, filaree, groundsel (*Scenecio sylvaticus*), bull thistle (*Cirsium vulgare*), and hood canarygrass (*Phalaris paradoxa*).

Pool 30B and 30C. Pools 30B and 30C are within remnant depressions from munitions remediation activities adjacent to and west of vernal Pool 30. Based on aerial photo interpretations, the area previously supported a mix of moderately-dense maritime chaparral and non-native grassland. The area is presently mostly barren, except for regenerating and pioneering plants.

Pool 30B only ponded water through the first sampling date on 7 April 2014. At that time, surface water covered approximately 400 ft^2 (0.01 acre) and was only 3 cm deep. The water was highly turbid. Vegetation cover was very sparse due to recent remediation activities and was comprised of widely scattered spikerush and rabbitfoot grass.

Pool 30C also supported surface water through the 7 April 2014 sampling date. Surface water covered 0.02 acres and the maximum depth was 7 cm. By 6 May, the pool was reduced to a mudflat without standing water. Similar to Pool 30B, the vegetation was sparse due to recent scraping and was comprised of spikerush and rabbitfoot grass.

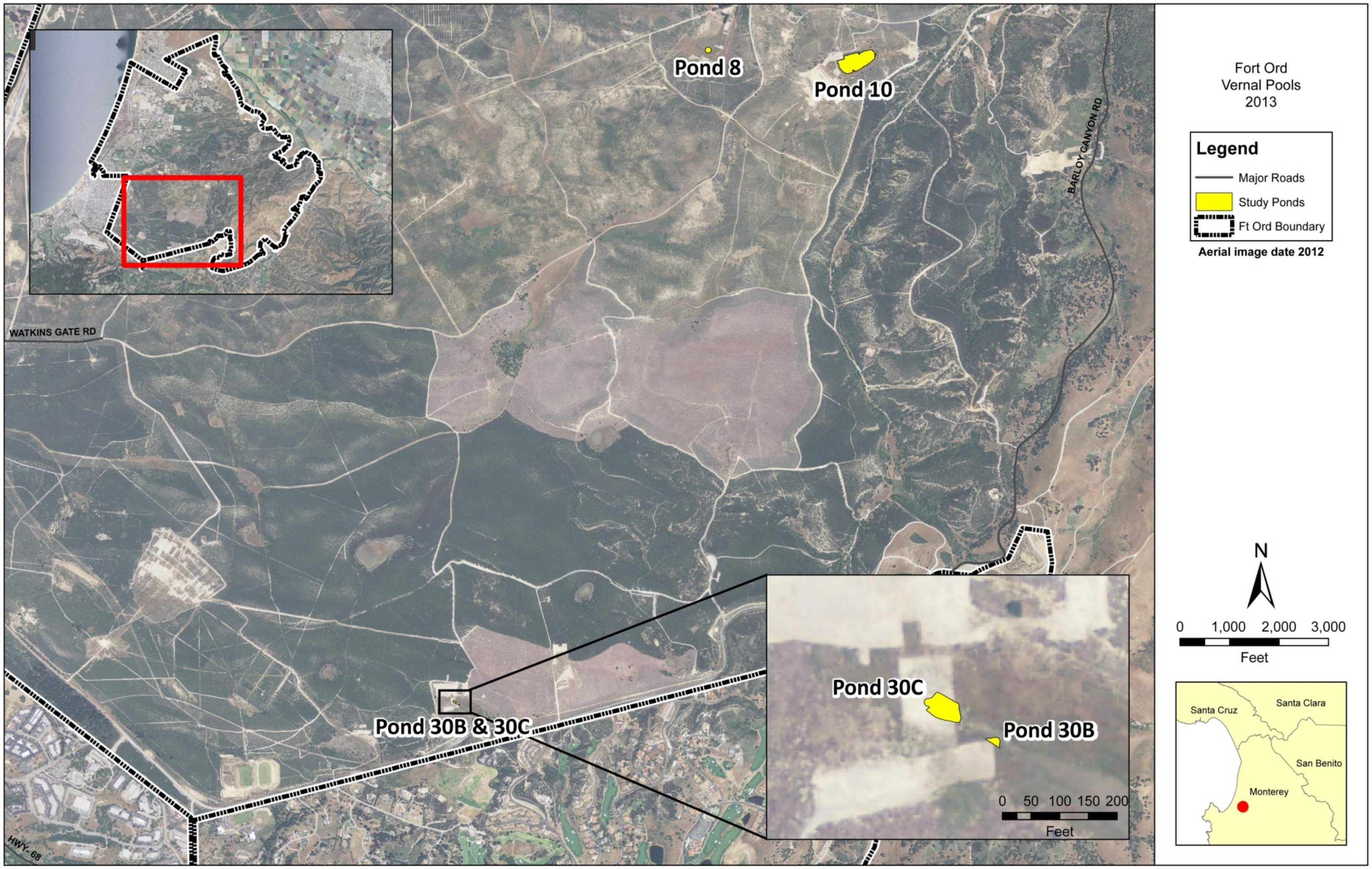

Figure 3-2 Remediation vernal pool sampling sites (2014), Fort Ord, California.

3.2. California Tiger Salamander

CTS was present only at remediation Pool 10. No CTS were observed at secondary site Pools 10B, 30B or 30C, despite their presence at the latter site in 2013 (Table 4-1). Formal sampling was not conducted at remediation Pool 56, as surface water was limited to shallow pools in remnant tire tracks. However, through visual observation on 7 April, no CTS larvae or eggs were observed at Pool 56.

At Pool 10, the number of larvae captured ranged from a high of just four (4) on 7 April to a low of two (2) on 3 June (Figure 3-3). Mean total length in April was 25 mm and increased to 120.0 mm by June (Figure 3-4). Other amphibians observed included Pacific chorus-frog (*Pseudacris regilla*) tadpoles, which seemed more numerous than in 2013, and western toad (*Bufo boreas*), which was not recorded in 2013. Although present in 2013, Coast Range newt (*Taricha torosa*) was not observed in 2014. Pacific chorus-frog and western toad were also was recorded at secondary Pools 10B, 30B and 30C.

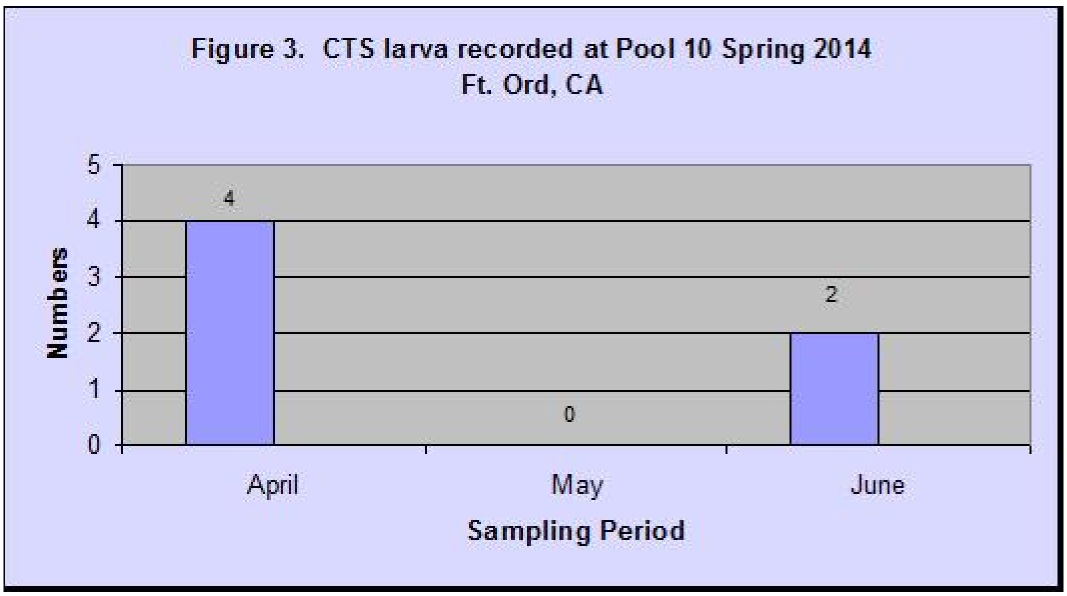

Figure 3-3 **Number of California tiger salamander larvae recorded in Pool 10 during the spring 2014 surveys, Ft. Ord, California.**

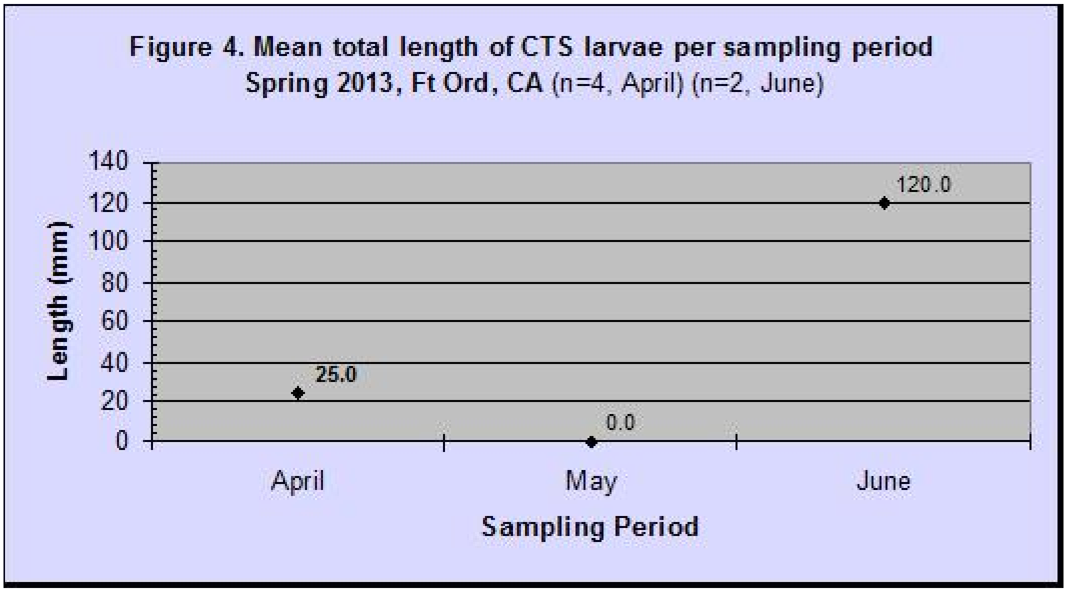

Figure 3-4 **Mean total length of California tiger salamander larvae in Pool 10 during spring 2014 surveys, Ft. Ord, CA. Bars represent the range of sizes measured.**

Table 3-3
Summary of CTS Aquatic Sampling Results, Spring 2014, Fort Ord, California

Pool	Aquatic Habitat	Method/Effort	CTS	Notes
5	Dry	None	N	Control site. Not sampled. Habitat did not support standing water during the study.
56	Present	Visual	N	Control site. Surface water was present only as a small pooled area within remnant tire tracks on 7 April. This site was not sampled with a dipnet due to the limited aquatic habitat. No CTS were observed during a visual inspection of the tire tracks.
101E	Dry	None	N	Control site. Not sampled. Habitat did not support standing water during the study.
8	Dry	None	N	Remediation site. Not sampled. Habitat did not support standing water during the study.
10	Pool	Dipnet (2-person hrs)	Y	Remediation site. Sampled from April through June. Three biologists sampled for 2-person hours along the immediate shoreline only, due to safety restrictions. CTS larvae were captured in April and June, but not in May. A high of only four were captured on 7 April. Pacific chorus frog and western toad tadpoles were common.
10B	Pool	Dipnet (50%)	N	Secondary site. Pool formed in a depression resulting from remediation activities near Pool 10. The site was sampled only in April, when it supported a broad, shallow, turbid pool approximately 25 cm deep. Sampling was conducted only from the shoreline due to safety restrictions. Recently hatched tree frog tadpoles were present. The site was dry on 6 May.
30	Dry	None	N	Remediation site. Not sampled. Habitat did not support standing water during the study.
30B	Pool	Dipnet (100%)	N	Secondary site. Pool formed in an excavated depression resulting from remediation activities near site 30. The site was sampled only on 7 April, when it supported a shallow, turbid puddle under 8 cm deep. Recently hatched western toad tadpoles were present only during a pre-survey assessment in March; none were observed during the April survey. The site was dry on 6 May.
30C	Pool	Dipnet (100%)	N	Secondary site. Pool formed in an excavated depression resulting from remediation activities near site 30. The pool was sampled only on 7 April, when it supported a shallow, turbid pool under 18 cm deep. Recently hatched western toad tadpoles were present only during a pre-survey assessment in March; none were observed during the April survey. The site was dry on 6 May.

3.3. California Fairy Shrimp

California fairy shrimp were not observed in any of the pools sampled during the spring 2014 surveys. A variety of aquatic invertebrates were observed at remediation Pool 10 and secondary site Pool 10B and included snails, daphnia, seed shrimp, clam shrimp, damselfly nymphs, diving beetles, water boatmen and mosquitoes (Table 3-4). No invertebrates were observed at secondary sites 30B and 30C. Formal sampling was not conducted at control Pool 56, as surface water was limited to shallow pools in tire tracks. Regardless, through visual observation on 7 April, no fairy shrimp were observed at Pool 56 despite being present in 2013.

Table 3-4
Aquatic Invertebrates Observed at Vernal Pool Sampling Sites

Species	Site 10	Site 10B	Site 30B	Site 30C
California Fairy Shrimp (*Linderiella californica*)				
Nematodes	X			
Clam Shrimp (Order Conchostraca)	X			
Water fleas (Daphnia sp.)				
Seed Shrimp (Order Ostracoda)	X	X		
Copepods (Order Eucopepoda)				
Scuds (Order Amphipoda)				
Mayfly (Order Ephemeroptera)	X			
Dragonfly (Order Anisoptera)				
Damselfly (Order Zygoptera)	X			
Waterboatmen (Family Corixidae)	X	X		
Backswimmer (Family Corixidae)	X	X		
Predaceous diving beetle (Family Dytiscidae)	X			
Water scavenger beetle (Family Hydrophilidae)	X	X		
Mosquito (Family Culicidae)	X			
Dipteran larvae				
Snails (Planorbidae)	X			

SECTION 4

Discussion

The wetland monitoring and restoration plan (Burleson 2006) considers wetland function at sites following remediation activities to be acceptable, if the monitoring results show that the wetlands, which supported CTS and California fairy shrimp prior to remediation, continued to support these species. The success standard used in the monitoring plan is based on species presence/absence.

Table 4-1 and Table 4-2 present the results from this study and the 2007, 2009 and 2010 DD&A baseline aquatic surveys, and 2013 follow-up surveys. Beyond the presence/absence standard, direct comparisons are difficult to make between the results from this study and the baseline studies, due to differences in methods and, presumably, changes in upland habitat conditions.

As was the case in 2013, wetlands function with respect to CTS and California fairy shrimp presence was evaluated for remediation Pool 10 only, due to drought conditions and the lack of aquatic habitats elsewhere in 2014. The low rainfall totals during the 2013-14 rainy season precluded the formation of pools suitable for sampling at control Pools 5, 56 and 101E and remediation Pools 8 and 30, although, minor inundation at secondary site pools associated with remediation Pools 10 and 30 allowed limited supplemental sampling. It remains unclear based on the 2013-14 hydrology monitoring visits whether the portions of Pool 8 or Pool 30 that were not inundated with standing water would have supported aquatic habitat during a normal rain year. Remediation activities do not appear to have significantly altered the non-inundated (i.e. meadow) portions of the pools.

In general, water quality measurements indicate that CTS can tolerate wide variations in water temperature and high levels of turbidity (Table 3-2). The sampled pools had consistently neutral pH readings and similar levels of dissolved oxygen as well. However, due to the overall lack of ponding in 2013-2014, and the new safety procedures prohibiting sampling beyond the shoreline of sampled pools, water quality measurements were only taken once and near shore during the monitoring period. The results of the water quality readings are similar to results from the previous year’s (2013) monitoring although turbidity is notably lower than in 2013 (Bryan Mori et al 2013).

Table 4-1
Comparison of CTS Abundances from Baseline Surveys and the 2013 and 2014 Post-remediation Monitoring

Pool	2007 Baseline	2009 Baseline	2010 Baseline	2013 Monitoring	2014 Monitoring
5	0	-	11-100 (2)	Dry	Dry
56	0	-	-	0	0
101E	0	-	11-100 (2)	Dry	Dry
8	Dry	-	0	Dry	Dry
10	101+ (1)	-	-	421 (3)	4
30C	Dry	-	0	21 (4)	0
Key: (1) = “abundant” category (DD&A 2007); (2) = “common” category (DD&A 2010); (3) = 421 represents the high count during post-remediation monitoring; (4) = captured at site 30C					

Table 4-2
Comparison of California Fairy Shrimp Abundances from Baseline Surveys and the 2013 and 2014 Post-remediation Monitoring

Pool	2007 Baseline	2009 Baseline	2010 Baseline	2013	2014
5	0	-	0	Dry	Dry
56	11-100 (1)	-	-	Present (2)	0
101E	0	-	0	Dry	Dry
8	dry	-	1-10 (3)	Dry	Dry
10	0	-	-	0	0
30	Dry	-	0	Dry	0(4)
Key: (1) = “moderate” category (DD&A 2007); (2) = observed only during a pre-survey reconnaissance; (3) = “low” category (DD&A 2010); (4) = including sites 30B and 30C					

4.1. California Tiger Salamander

4.1.1. Control Pools: Pools 5, 56 and 101E

Pool 5: No CTS larvae were present as this pool did not contain standing water during the study.

Pool 56: This pool did not pond and a depth and duration necessary to support CTS breeding populations during the study. The shallow pools that formed in remnant tire tracks did not fill until late March and did not persist throughout the remainder of the monitoring period.

Pool 101E: No CTS larvae were present as this pool did not contain standing water during the study.

4.1.2. Remediation Pools: Pools 8, 10, 30, and Secondary Pools 10B, 30B and 30C

Pool 8: No CTS larvae were present as this pool did not contain standing water during the study.

Pool 10: Compared with the DD&A baseline aquatic surveys (DD&A 2007, 2009, 2010), the 2014 monitoring results show that in terms of presence, the success standard for remediation Pool 10 was met for the second consecutive year, as CTS larvae were present, albeit, at substantially lower numbers than in 2013. With over one acre of surface water still present on 3 June, CTS reproduction at Pool 10 was likely successful, given the large size of the larvae. The presence of CTS breeding habitat at this pool over the past two years of drought highlights its importance as one of the most reliable CTS breeding sites on Fort Ord.

Regarding the drastic reduction in the numbers of CTS larvae captured in 2014 relative to 2013, two main factors could be responsible: 1) change in dip netting methods employed in 2014, and 2) the severe drought and timing of rainfall during the 2013-14 rainy season. The change in dip-netting method in 2014 severely limited the extent of habitat sampled at Pool 10. Unlike in 2013, when the entire pond was accessible (i.e., shallow and deep water habitats), sampling was restricted to only the immediate shoreline, which was only a few inches deep, due to safety concerns about remnant munitions. The lack of sampling in deeper waters undoubtedly contributed to the lower number of CTS larvae captured this year. How the drought and rainfall pattern in 2013-14 may have contributed to the low numbers of CTS larvae is uncertain. Given that suitable CTS breeding habitat was not present at Pool 10 until early March, when, under normal circumstances, the breeding season would be coming to an end and the adults moving back towards the uplands, the expectation is that fewer adults, if any, would have been present to attempt breeding. In general, data on CTS reproductive success given these unusual environmental circumstances are lacking. Preliminary results from other CTS sampling efforts in 2014 documented a lack of reproduction at known CTS breeding sites (M. Allaback and B. Shaffer, pers. comm.), suggesting abandonment of reproductive activities, despite the presence of water.

Pool 10B: This newly formed pool was the first area to pond significantly during the 2013-2014 rain year. Due to its close proximity to Pool 10, and observations of opportunistic breeding in a similar secondary site (Pool 30C) in 2013, potential existed for CTS to this feature for breeding, especially since it was the only area with available habitat during the normal breeding season for CTS. However, despite complete sampling of this pool, CTS larvae were not observed. Moreover, this pool was completely dry by the 6 May 2014 sampling visit.

Pools 30, 30B: These pools did not contain sufficient amounts of standing water during the study and therefore did not support CTS larvae.

Pool 30C: CTS were not present in the excavated depression at secondary site Pool 30C, adjacent to remediation Pool 30, despite the presence of larvae in 2013 (Bryan Mori Biological Consulting *et al* 2013). This secondary site pool was ultimately unsuitable as successful breeding habitat in 2013, as all of the larvae perished prior to metamorphosis (J. Davilla, pers. obs.). Habitat suitability at this site was even less suitable in 2014, following the second consecutive year of drought. Thus, the absence of CTS in 2014 was not surprising. Also, given that the absolute number of CTS larvae (21) was determined through complete sampling of this site in 2013, and that they all measured in the same size class indicates that the larvae were likely the product of a single, opportunistic female. Newly colonized ponds with small adult breeding populations are expected to show high variability in annual occupancy. The long-term reproductive value of this pool is uncertain, though, given that sampling at this site has not taken place during a normal rainfall year.

4.2. California Fairy Shrimp

4.2.1. Control Pools: Pools 5, 56 and 101E

California fairy shrimp were not observed at any of the control pools in 2014, despite observation of their presence in Pool 56 in 2013, although only during a pre-survey reconnaissance, not during actual aquatic surveys. The lack of fairy shrimp observations at Pool 56 during the 2014 aquatic surveys may have been the result of differences in the timing of sampling between the DD&A baseline studies and the 2013 surveys and/or due to annual variations in fairy shrimp occurrence in response to rainfall patterns. Most likely, the lack of fairy shrimp observed in 2014 was attributable to drought, and the short duration of ponding was insufficient for fairy shrimp to complete their lifecycle.

Pools 5 and 101E were dry during the sampling period and therefore did not support fairy shrimp.

4.2.2. Remediation Pools: Pools 8, 10, 30, and Secondary Sites 10B, 30B and 30C

The wetland function success standard (i.e., presence of fairy shrimp) was impossible to assess at Pools 8 and 30 relative to the California fairy shrimp, due to the current drought conditions and the lack of suitable aquatic habitat in 2014. Both remediation Pools 8 and 30 were dry during the sampling period. No fairy shrimp were observed at Pool 10 in 2014, despite suitable aquatic conditions throughout the sampling period (Table 4-2). However, no fairy shrimp were observed in 2013 follow-up monitoring, during the 2007 DD&A survey, or in 1992 baseline surveys of Pool 10. Although no baseline data exists for the newly formed secondary site pools, no fairy shrimp were observed in Pools 10B, 30B and 30C in 2014.

4.3. Monitoring Conclusions

One objective of the wetlands restoration and monitoring plan is to ensure that vernal pools that supported CTS and California fairy shrimp, prior to remediation activities, continue to support these species following such activities (i.e., exhibit similar wetlands functions). Where this standard is met, a remediation site would be considered successful. This determination would be made following the evaluation of baseline and post-remediation trends.

There is insufficient information to identify trends, due to small sample sizes and lack of consistent sampling. For instance, control Pool 56 and remediation Pools 8, 10 and 30 were only sampled once during the baseline 2007, 2009 and 2010 surveys (DD&A 2007, 2009, 2010). In addition, one or both of the CTS or California fairy shrimp were not recorded in these pools during the earlier baseline one-year sampling efforts. Hence it is not possible to determine whether these pools ever supported CTS or California fairy shrimp. Under these circumstances, a determination of wetland function success at these remediation sites cannot be made when comparing monitoring results only with the baseline studies. Furthermore, follow-up monitoring in 2013 and 2014 occurred in two consecutive years of drought with yearly rainfall totals just 61.4 and 53 percent of normal, respectively. It is very difficult to determine whether the lack of CTS and fairy shrimp reproduction in these ponds is representative of current normal conditions and potentially attributable to remediation activities, or whether this was a direct result of the lack of suitable hydrologic conditions in the pools. Lastly, new safety protocol which limits sampling to the edge of pools may potentially lead to “false negative” results where target species are missed due to sampling methodology and rather than unsuccessful breeding. This is particularly notable for Pool 10, where despite higher early season rainfall totals in 2013 than in 2014, CTS larvae totaled 421, 125, and 59 individuals during the three 2013 sampling visits respectively; whereas, in 2014 CTS larvae totaled just 4, 0, and 2 individuals respectively. This decline is significant and may be attributable to low breeding success due to drought, sampling techniques which do not include deeper areas of the pond that may offer refugia from predators, or some combination of the two.

SECTION 5

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APPENDIX A

Photos of Sampling Sites

Photo 1 **Control Pool 5 on 7 April 2014. Note lack of surface water and the abundance of thatch remaining into the spring.**

Photo 2 **Control Pool 56 on 7 April 2014. Surface water limited to tire tracks but no CTS larvae or fairy shrimp observed.**

Photo 3 **Control Pool 101E on 7 April 2014. Note lack of surface water and dead curly dock (*Rumex crispus*) thatch from previous year.**

Photo 4 **Remediation Pool 8 on 7 April 2013. Note lack of surface water, presence of thatch, and low germination rates of annual plants.**

Photo 5 **Remediation Pool 10 on 7 April 2014. Surface water present. CTS larvae present; no fairy shrimp observed**

Photo 6 **Remediation secondary site Pool 10B on 7 April 2014. Surface water present in newly formed depression west of Pool 10 but no CTS larvae or fairy shrimp observed.**

Photo 7. Remediation Pool 30 on 25 February 2013. Note lack of surface water.

Photo 8 Remediation secondary site Pool 30B on 7 April 2014. Surface water present but no CTS larvae or fairy shrimp observed.

Photo 9 **Remediation Pool 30C on 7 April 2014. Surface water present but no CTS or larvae or fairy shrimp observed.**