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2018 ANNUAL REPORT
BIOLOGICAL MONITORING

for Units 13, 17, and 20; BLM Area B-3 West, and BLM Area B Subareas A and B Containment Lines; Units 5A, 9, 23, and 28; Units 1 East, 6, 7, 10, Watkins Gate Unburned Area, and MOUT Buffer; Units 15, 21, 32, and 34.
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CONTENTS

Section **Page**

FIGURES

TABLES

APPENDICES

ACRONYMS AND ABBREVIATIONS

AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
Burleson	Burleson Consulting, Inc.
EcoSystems West	EcoSystems West Consulting Group, Inc.
ER	Evidence Ratio
ft	feet
GPS	Global Positioning System
HMP	Habitat Management Plan
HMP annuals	Annuals Species of Concern
HMP shrub	Shrub Species of Concern
LER	Log_{10} Evidence Ratio
MEC	Munitions and Explosives of Concern
m	meter(s)
MRA	Munitions Remediation Area
NOAA NCDC	National Oceanic and Atmospheric Administration National Climatic Data Center
NPS	Naval Postgraduate School
NMDS	Non-metric Multidimensional Scaling
PERMANOVA	Permutation-Based Multivariate Analysis of Variance
PBO	Programmatic Biological Opinion
Protocol	Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at Former Fort Ord
RAC	Rank Abundance Curve
Revised Protocol	Revisions of Protocol for Conducting Vegetation Monitoring for Compliance with the Installation-Wide Multispecies Habitat Management Plan, Former Fort Ord
Tetra Tech	Tetra Tech Inc.
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WGBA	Watkins Gate Burned Area

1 INTRODUCTION

The United States Army Corps of Engineers (USACE) contracted Burleson Consulting, Inc. (Burleson) to conduct biological monitoring at former Fort Ord, Monterey County, California (see Figures 1-1 and 1-2). Burleson subcontracted EcoSystems West Consulting Group (EcoSystems West) to support field monitoring and data review. Monitoring is centered on biological impacts associated with environmental cleanup activities for munitions and explosives of concern (MEC). Biological monitoring includes rare annual plant species density, annual grass density, invasive and rare species locations, and shrub transects.

This report presents results of biological monitoring conducted in Units 13, 17, and 20 (Baseline); BLM Area B-3 West, and BLM Area B Subareas A and B Containment Lines (Year 1 monitoring); Units 5A, 9, 23, and 28 (Year 3 monitoring); Units 1 East, 6, 7, 10, Watkins Gate Burned Area (WGBA), and Military Operations Urban Terrain (MOUT) Buffer (Year 5 monitoring); and Units 15, 21, 32, and 34 (Year 8 monitoring). Monitoring was conducted during spring and summer of 2018 to satisfy requirements of the *Installation-wide Multispecies Habitat Management Plan for Former Fort Ord* (HMP) and the reinitiated *Programmatic Biological Opinion for Cleanup and Property Transfer Actions Conducted at the Former Fort Ord* (PBO) issued by the United States Fish and Wildlife Service (USFWS) (USACE, 1997; USFWS, 2017). This annual monitoring report presents results of monitoring for HMP annuals, shrubs, grasses, and invasive plants. Baseline monitoring is conducted prior to cleanup activities (such as vegetation clearance, MEC removal, and other related operations) to establish presence, location, and abundance of protected species. Vegetation clearance is achieved by burning and/or masticating standing vegetation to allow access to the soil surface. Appendices included present species acronyms (Appendix A), HMP annuals grid monitoring maps (Appendix B), HMP shrub transect maps (Appendix C), annual grass density maps (Appendix D), invasive and rare species location maps (Appendix E), HMP shrub transect cover data (Appendix F), non-native species tables (Appendix G), and macroplots presence/absence maps (Appendix H).

After completion of cleanup activities, follow-up monitoring of protected species and habitat is conducted to determine whether the species and habitat recovery are meeting success criteria as established in the *Revisions of Protocol for Conducting Vegetation Monitoring for Compliance with the Installation-Wide Multispecies Habitat Management Plan, Former Fort Ord* (Revised Protocol) and the *Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at Former Fort Ord* (Protocol) (Tetra Tech Inc. (Tetra Tech) and EcoSystems West, 2015b; Burleson, 2009a). As part of the development of the Revised Protocol, a series of three major shrub associations were identified based on the dominant species present in the Baseline surveys and their successional patterns described. These associations included: Association A – shaggy-barked manzanita (*Arctostaphylos tomentosa*) dominated with chamise (*Adenostoma fasciculatum*) sub-dominant; Association B – chamise dominated with shaggy-barked manzanita and sandmat manzanita (*Arctostaphylos pumila*) subdominant; Association C/D – sandmat manzanita dominated.

Densities of annual HMP plants have been monitored at 1, 3, 5, and 8 years after completion of vegetation clearance. Shrub communities have been monitored at 3, 5, 8, and 13 years after completion of vegetation clearance. With the issuance of the 2015 PBO, USFWS concurred with the Army's recommendation to reduce the duration of monitoring to a maximum of 5 years for HMP annuals and 8 years for shrub communities (USFWS, 2015). This change was based on an analysis of vegetation data collected from over 5,000 acres over a period of up to 10 years that indicated that recovery could be documented based on a reduced time period (Tetra Tech and EcoSystems West, 2015b).

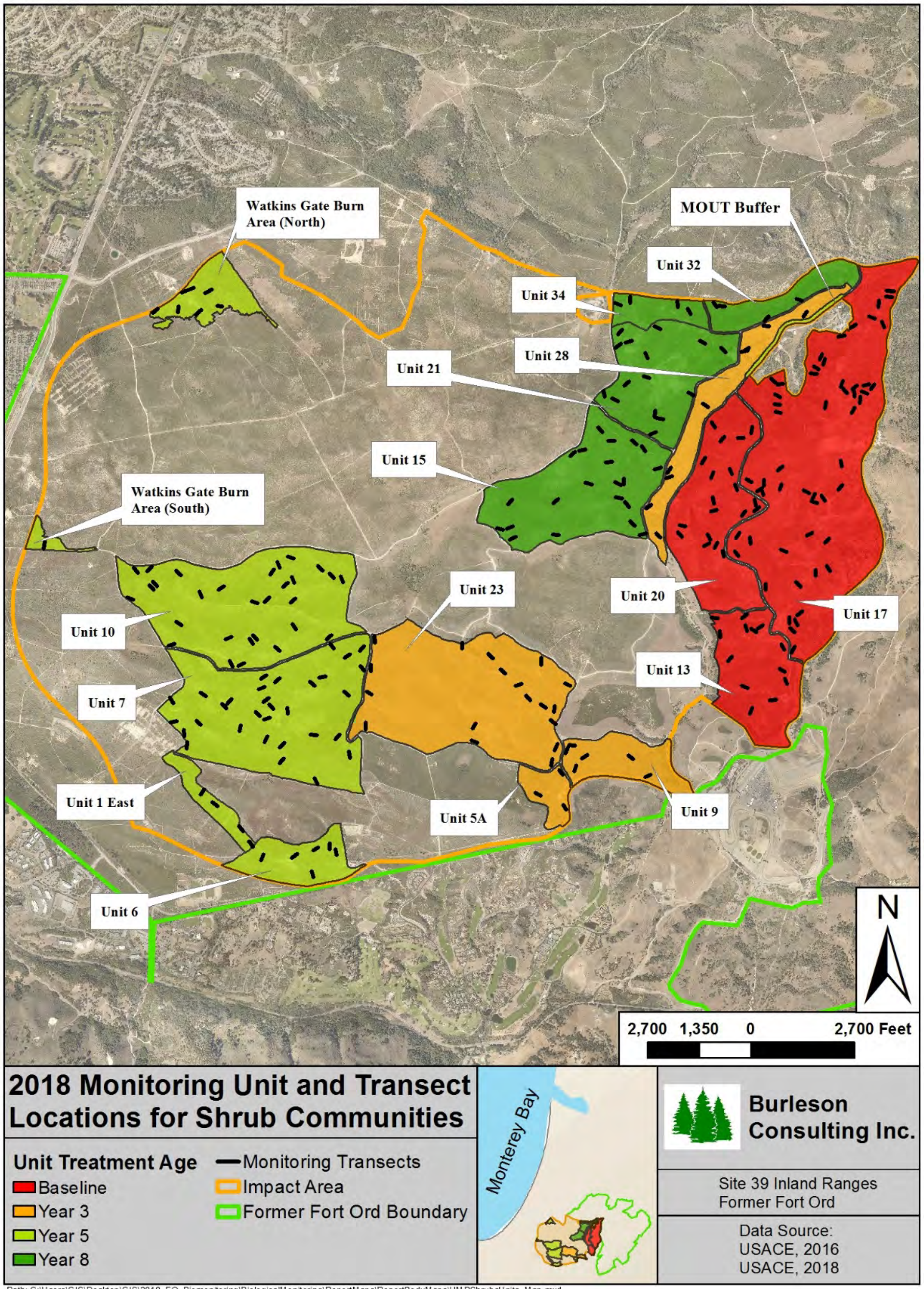

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Figure 1-1. Map of Former Fort Ord, Monterey, CA, Showing Locations of Units and Transects Sampled for Shrub Community in 2018.

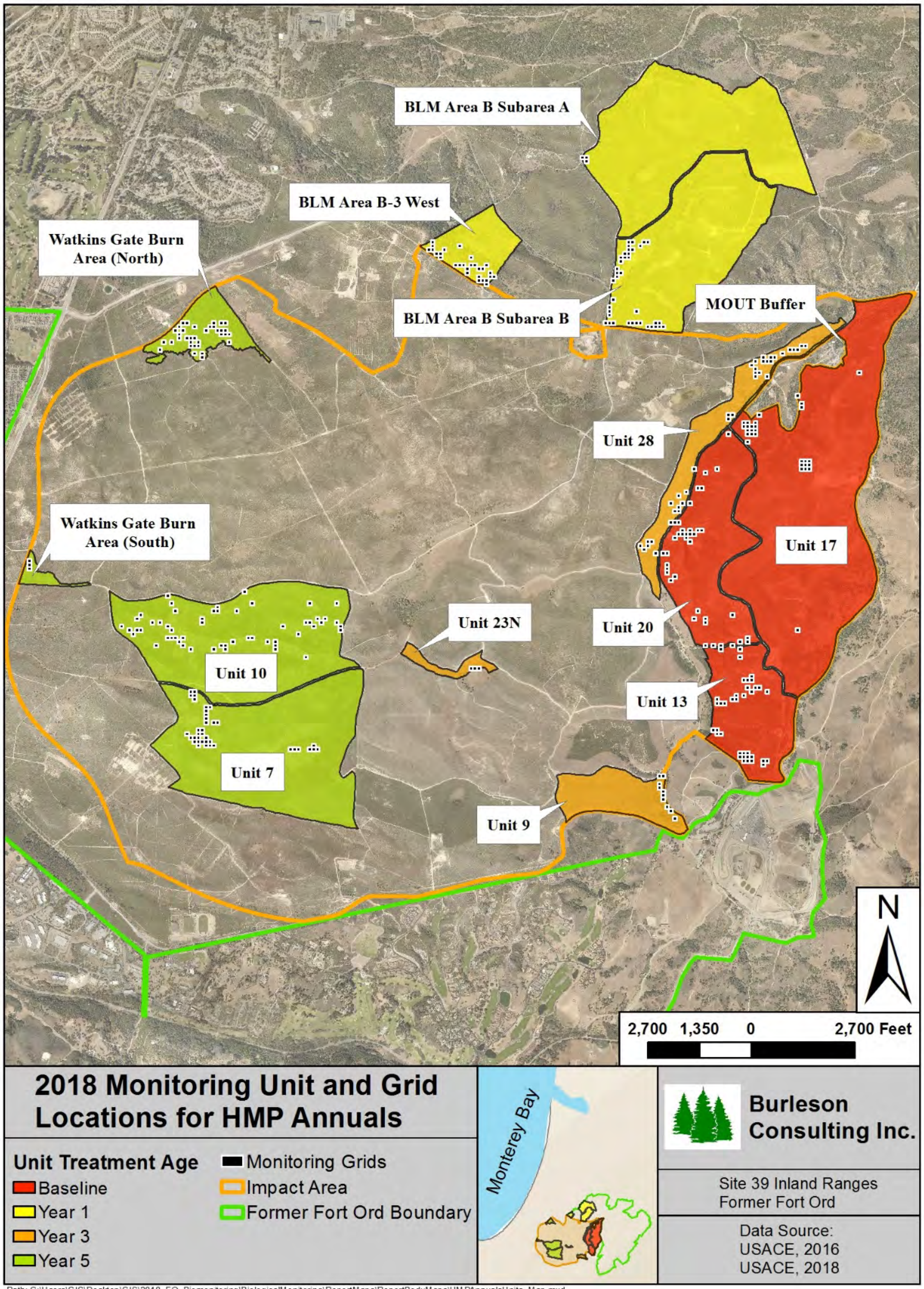

Figure 1-2. Map of Former Fort Ord, Monterey, CA, Showing Locations of Units and Grids Sampled for HMP Annuals in 2018.

Terrain over most of the Units 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 adapted to periodic fires that remove the dominant shrub species and create open space that can be colonized by annual plants. Van Dyke *et al.* (2001) suggested that prescribed burning, or mechanical disturbance with smoke treatment, may be necessary in central maritime chaparral management. This regime may support the establishment of a more diverse chaparral community by creating more open space.

A significant mitigating factor affecting the response of vegetation at former Fort Ord in recent years was the drought that spanned water-years 2012 to 2016. During the drought, precipitation was below normal for the 2011-2012 through 2014-2015 water years (Naval Postgraduate School (NPS), 2018). Though the drought was not without precedent, the Central Coast Region experienced some of the most severe conditions during the California drought (He *et al.*, 2017). The previous two water-years (2015-2016 and 2016-2017) ended the drought with higher than normal precipitation levels (Figure 1-3) (NPS, 2018; National Oceanic and Atmospheric Administration National Climatic Data Center (NOAA NCDC), 2016). The 2017-2018 water-year was below normal.

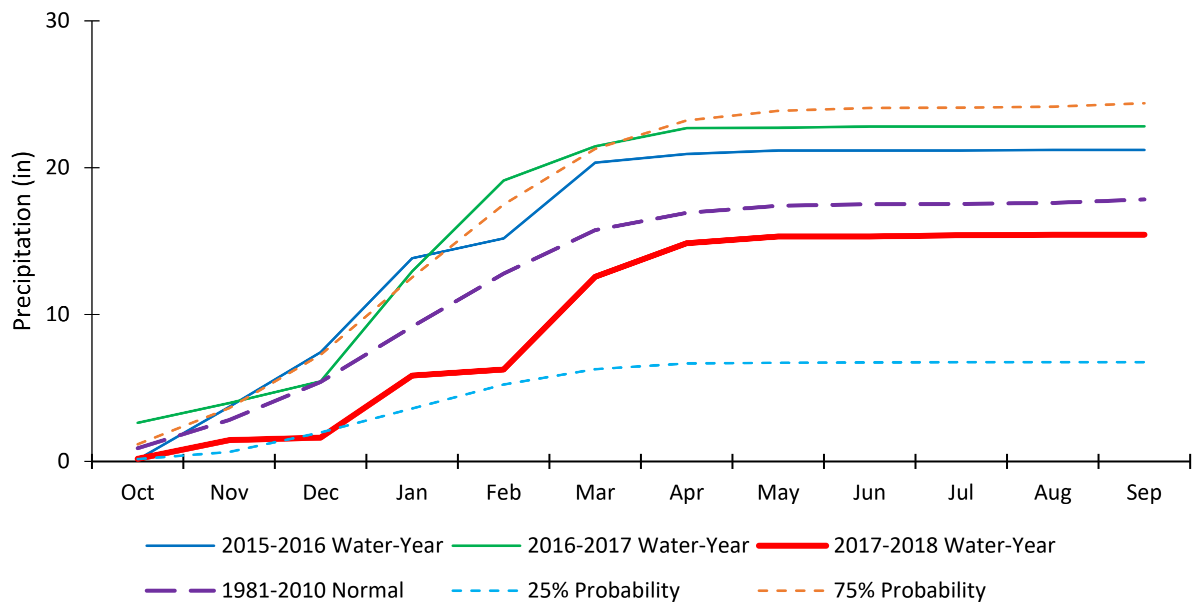

Figure 1-3. Cumulative Monthly Precipitation for the 2017-2018 Water Year Compared to the 30-Year Normal (mean 1981-2010), the previous two water-years, and the 25% and 75% Probabilities (NPS, 2018; NOAA NCDC, 2016). These Data Were Collected at the Monterey NWSFO Station Located at the Monterey Regional Airport.

1.1 Species Included in 2018 Habitat and Rare Species Monitoring

Plant species within central maritime chaparral habitat include a variety of shrub and herbaceous plants (see Appendix A). These include five shrub species and three annual herbaceous species that are special-status species and, as such, designated by the HMP as species of concern (USACE, 1997). The shrub species of concern (HMP shrubs) include:

- California Native Plant Society (CNPS) 1B.2 listed sandmat manzanita,
- CNPS 1B.2 listed Toro manzanita (*Arctostaphylos montereyensis*),
- CNPS 1B.2 listed Hooker's manzanita (*Arctostaphylos hookeri* ssp. *hookeri*),
- CNPS 4.2 listed Monterey ceanothus (*Ceanothus rigidus*),
- and CNPS 1B.1 listed Eastwood's goldenbush (*Ericameria fasciculata*).

The annual species of concern (HMP annuals) include:

- state threatened and federally endangered sand gilia (*Gilia tenuiflora* ssp. *arenaria*),
- federally threatened Monterey spineflower (*Chorizanthe pungens* var. *pungens*),
- state endangered and CNPS 1B.1 listed seaside bird's-beak (*Cordylanthus rigidus* ssp. *littoralis*).

Survey teams also report the locations of federally endangered Yadons's piperia (*Piperia yadonii*) when encountered during monitoring efforts.

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 to remain consistent with historical data.

1.2 Previous Surveys Conducted on the Sites

Previous surveys conducted at specific former Fort Ord Units monitored in 2018 are referenced in Table 1-1. Data from previous surveys for HMP annuals and shrub line transects were obtained from GIS shapefiles and associated metadata provided by the USACE, and from results of previous surveys (HLA, 1997; Shaw, 2008; Burleson, 2009b; Tetra Tech and EcoSystems West, 2011 – 2015a; Burleson, 2016 – 2017a).

When appropriate and available, shrub transect data were transcribed from the electronic versions of previous monitoring reports. In addition to incorporating past line transect data into the database, adjustments were made to the "density" class field in the HMP vegetation monitoring data table to correspond to the density classes defined by Burleson (2009a) while maintaining the original data. If only count data were provided in previous reports or the database, then an entry was provided in the "density" class field. If the database contained only qualitative estimates of HMP densities (e.g., high, medium, low), then an appropriate density class was determined.

Four treatment classes were identified based on treatments applied:

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

Table 1-1. Previous Monitoring Surveys at 2018 Study Units on Fort Ord.

Survey Year	Survey
1997	Harding Lawson Associates (1997) performed Baseline surveys in Units 1 East (formerly called the Multirange Area).
2003	MACTEC (2004) performed Baseline surveys in Unit 23 (formerly Range 30A).
2007	Shaw (2008) performed Baseline surveys in Unit 1 East.
2010	Tetra Tech and Ecosystems West (2011) performed Baseline surveys in Units 15, 21, 32, and 34.
2011	Tetra Tech and EcoSystems West (2012) performed Baseline surveys in Units 5A, 9, 23, 23N, 28, WGBA and MOUT Buffer; and Year 1 surveys in Units 15, 21, 32, and 34.
2012	Tetra Tech and EcoSystems West (2013) performed Baseline surveys in Units 6 and 10.
2013	Tetra Tech and EcoSystems West (2014) performed Baseline surveys in Unit 7; and Year 3 surveys in Units 15, 21, 32, and 34.
2014	Tetra Tech and EcoSystems West (2015a) performed Year 1 surveys in Units 6, 7, 10, WGBA, and MOUT Buffer.
2015	Burleson (2016) performed Baseline surveys in BLM Area B-3 West and the Containment Lines of BLM Area B Subareas A and B; and Year 5 shrub transect monitoring in Units 15, 21, 32, and 34.
2016	Burleson (2017a) performed Year 1 surveys in Units 9, 23N, and 28; and Year 3 surveys in Units 1 East, 6, 7, 10, WGBA, and MOUT Buffer.

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 USACE (USACE, 2018).

2 METHODS

This section describes the standard monitoring methods used during the 2018 vegetation monitoring program. Monitoring was completed based on methodology presented in the HMP, Protocol, and Revised Protocol (USACE, 1997; Burleson, 2009a; Tetra Tech and EcoSystems West, 2015b). Unit specific modifications to methods are identified in the introduction to each age class results.

2.1 Soils

The U.S. Department of Agriculture (USDA) maps seven soil types as occurring in Units monitored in 2018, shown in Table 2-1 (USDA, 2018). Antioch very fine sandy loam, 2 to 9 percent slopes occur in the BLM Area B Subarea A and Subarea B Containment Lines. Aquic Xerofluvents occurs only in a small portion of Unit 17 and MOUT Buffer. Arnold loamy sand, 9-15 percent slopes, occurs in Units 17, 20, and 32. Arnold loamy sand, 15-50 percent slopes, occurs only in Unit 17 and MOUT Buffer. Arnold-Santa Ynez complex comprises a large portion of the munitions remediation area (MRA) and occurs in 1 East, 5A, 6, 7, 9, 10, 13, 15, 17, 20, 21, 23, 32, 34, BLM Area B-3 West, BLM Area B Subarea A Containment Line, BLM Area B Subarea B Containment Line, MOUT Buffer, and WGBA. Baywood sand, 2-15 percent slopes, occurs in Units 10, 17, and WGBA. Oceano loamy sand, 2 to 15 percent slopes occurs in BLM Area B-3 West and BLM Area B Subarea A Containment Line. Santa-Ynez fine sandy loam, 15-30 percent slopes, occurs in Units 13 and 17. Xerorthents, dissected, occurs in Units 9, 13, 17, 20, 23, and MOUT Buffer.

Burleson identified at least two distinct types of soil during previous monitoring in areas where the soil is mapped as Arnold-Santa Ynez complex. One type of this 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. It is possible that the soils mapped as Arnold-Santa Ynez complex in the MRA are incorrectly mapped or reflect co-occurring soil types.

Table 2-1. Distribution of Soil Types in Former Fort Ord Biological Monitoring Areas of 2018 (USDA, 2018).

Soil Type	Description	Units Where Found
AeC, Antioch very fine sandy loam, 2 to 9 percent slopes	Very fine loam and sand; moderately well to somewhat poorly drained; derived on level to sloped alluvial fans and terraces	BLM Area B Subarea A Containment Line, BLM Area B Subarea B Containment Line
Af, Aquic Xerofluvents	Texture variable; somewhat poorly drained; derived from alluvium derived from sedimentary rock	17, MOUT Buffer
AkD, Arnold loamy sand, 9 to 15 percent slopes, MLRA 15	**Arnold**: Loamy fine sand; somewhat excessively drained; derived from residuum weathered from sandstone	17, 20, 28, 32
AkF, Arnold loamy sand, 15 to 50 percent slopes, MLRA 15	Loamy fine sand; somewhat excessively drained; derived from residuum weathered from sandstone.	17, MOUT Buffer
Ar, 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	1 East, 5A, 6, 7, 9, 10, 13, 15, 17, 20, 21, 23, 28, 32, 34, BLM Area B-3 West, BLM Area B Subarea A Containment Line, BLM Area B Subarea B Containment Line, MOUT Buffer, WGBA
BbC, Baywood sand, 2 to 15 percent slopes	Sand; somewhat excessively drained; derived from stabilized sandy aeolian sands	10, 17, WGBA
OaD, Oceano loamy sand, 2 to 15 percent slopes	Loamy sand, sand; deep, excessively drained soils that formed in material weathered from sandy aeolian deposits	BLM Area B-3 West, BLM Area B Subarea A Containment Line
ShE, Santa Ynez fine sandy loam, 15 to 30 percent slopes	**Santa Ynez**: Fine sandy loam; moderately well drained; derived from residuum weathered from sandstone	13, 17
Xd, Xerorthents, dissected	Loam, clay loam; well drained; derived from mixed unconsolidated alluvium	9, 13, 17, 20, 23, 28, MOUT Buffer

2.2 HMP Annuals Grids Methods

2.2.1 Field Methods

Burleson conducted density monitoring for three HMP annual species (Monterey spineflower, sand gilia, and seaside bird's-beak) during the 2018 monitoring season. These surveys occurred in Units 13, 17, and 20; BLM Area B-3 West and BLM Area B, Subareas A and B Containment Lines; Units 9, 23, and 28; and Units 7, 10, WGBA and MOUT Buffer. Yadon's piperia was not monitored for density as individual plants are often widely scattered and difficult to locate. Instead, individuals were mapped using a Garmin 62s handheld Global Positioning System (GPS) receiver and occurrences were noted for comparison with future monitoring efforts.

The predefined basewide 100×100-ft grids were used as sample grids for density monitoring. In the Baseline Units, a stratified random sample of 100×100-ft grids were selected for sampling, consisting of grids identified during meandering transect surveying as occupied by one or more herbaceous HMP species. The monitoring protocol indicates that 20 percent (%) of occupied grids or 38 total grids, whichever is greater, be selected for HMP annual density monitoring (Burleson, 2009a). Sampling was stratified by species to ensure adequate representation of Monterey spineflower, sand gilia, and seaside bird's-beak, and by containment area versus interior. The baseline grids were not marked in any way in the field. A resource grade Trimble® GeoXH GPS receiver with the grid boundaries loaded as a map layer was used to determine the boundaries of the sampled grids. 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.

Methods specified in the monitoring protocols were followed for all Units monitored in 2018 (Burleson, 2009a; Tetra Tech and EcoSystems West, 2015b). Follow-up monitoring for HMP annual species density is conducted at Baseline, 1, 3, and 5-year intervals following treatment and MEC clearance. For all 2018 HMP annuals density surveys, the surveyors conducted an initial reconnaissance of each 100×100-ft sample grid to determine which HMP annual species were present and how they were distributed within the grid. Entire grids were censused by counting all individuals of a given HMP annual species within the grid using a hand counter. The only exception to this is that when more than 500 individuals of any species were recorded, surveyors stopped recording since this is the maximum density class.

For each HMP annual species in a 100×100-ft sample grid, surveyors estimated the percent suitable habitat within the grid. In practice, "suitable habitat" was essentially treated as equivalent to "occupied habitat." Percent suitable habitat was historically used to calculate the estimated number of individuals present within a 100×100-ft sample grid when a circular subsample plot was used. The 2018 monitoring effort was based on the more recent protocols which eliminated the need for circular plots (Tetra Tech and EcoSystems West, 2015b).

For each HMP annual species, each 100×100-ft sample grid was assigned to one of five density classes based on the number of individuals counted or subsampled to be present. The density classes are as follows when the entire 100×100-ft 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 (i.e., more than 500 plants), the survey team assigned the grid to this density class without attempting to count or estimate numbers of plants. 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-ft sample grid. The general steps taken by field surveyors when monitoring HMP annual grids were:

- Located grid using Trimble® GeoXH GPS receiver.
- Marked the staked corners with flagging tape, or re-staked if necessary.

- Monitored each grid with two surveyors, started at opposite corners of the grid and walked parallel lanes approximately 2-3 ft wide towards the center of the grid.
- Used hand counters, one for each HMP species, to count the number of individuals.
- Marked areas which had been counted to reduce double counting.
- Stopped counting a species once the entire grid was surveyed, or after 501 individuals were counted.
- Estimated percent occupied habitat.
- Recorded counts of individuals in each grid for Monterey spineflower, seaside bird's-beak, and sand gilia and the percent occupied on the field data sheet.

2.2.2 Statistical Methods

HMP annual grid density classes were calculated for Monterey spineflower, seaside bird's-beak, and sand gilia based on individual plant counts and grid area using ArcGIS (Esri, 2017). Partial grid areas were established using a combination of hand digitization and physically walking the partial grid using a Trimble® GeoXH GPS receiver.

Density classes were also assessed by Unit by plotting counts of each density class for each HMP annual species. These are visually displayed using bar plots, and trends between Baseline, intervening survey years, and the current monitoring year are evaluated.

When possible, the effects due to treatment type (burned, masticated, or mixed) were evaluated. Treatment types were allocated by examining shapefiles of the HMP annual monitoring grids against the FODIS shapefiles "flora_pres_burn_area" and "flora_fire_area" using ArcGIS (ESRI, 2017; USACE, 2018). Treatment types were allocated based on the following rules:

- Masticated – Greater than 90% of the grid was only masticated.
- Burned – Greater than 90% of the grid was only burned.
- Mixed – A portion of the grid was masticated and burned, and a portion was only burned. Neither treatment comprised greater than 90%, but the sum was greater than 90%.
- Masticated and Burned – Greater than 90% of the grid was masticated and then subsequently burned.

Effects due to treatment were evaluated using histograms of grid counts by density class and permutation-based multivariate analysis of variance (PERMANOVA) with Jaccard distances (Anderson, 2001; McArdle and Anderson, 2001). The histograms were grouped by *treatment* and *age*. The matrices analyzed through PERMANOVA take the shape of *grid* x *density class* and are grouped by the factors *treatment* and *age*. Significance was defined by *p*-values less than 0.05. Jaccard distances are often used for binary data in ecological datasets (Choi *et al.*, 2010; McCune *et al*., 2002). Burleson employed PERMANOVA using the *adonis* function from the *vegan* package in R Statistical Software (R Core Team, 2017).

2.3 HMP Shrub Transects Methods

2.3.1 Field Methods

Burleson conducted shrub transect monitoring in maritime chaparral in Units 1 East, 5A, 6, 7, 9, 10, 13, 15, 17, 20, 21, 23, 28, 32, 34, MOUT Buffer and WGBA during the 2018 monitoring season. For previously sampled transects, including follow-up monitoring at 3, 5, and 8 years post-treatment, the surveyors used a resource grade Trimble® Juno T41/5B Series GPS unit with an external Trimble® R1 GNSS receiver to locate the previously recorded start points of each transect sampled. One transect was allocated for approximately each 11 acres. Transects were allocated separately within the masticated primary Containment Lines than within the interior of the Units. This is done to evaluate effects due to treatment type when different treatments are employed between the Containment Lines and the interiors.

Locations for all newly established transects were randomly selected using 100×100-ft grids within the areas of maritime chaparral vegetation in each Baseline Unit. The number of grids derived for transects was approximately four times the number needed, to allow field crews to eliminate grids which were unsuitable (difficult terrain, crossing roads, etc.) once the field crew was on-site. These grids were randomly ranked. Transect placement within each selected grid was based on field suitability, as determined by the discretion of the field biologist, based on ability to physically sample the transect line. When a grid was deemed unsuitable, the subsequent ranked grid was used. The start point of each transect was located on or near one of the boundaries of the 100×100-ft grid. Exact transect placement was such that the vegetation along the transect was representative of the surrounding area, and such that most of the transect crossed the selected grid.

Shrub transect sampling was conducted using the line intercept method along transects 50 m in length (Tetra Tech and EcoSystems West, 2015; Burleson, 2009b). The general line intercept methodology included:

- Navigated to the transect start point using Trimble® GeoXH GPS receiver and following line shapefiles of transects from the FODIS database.
- Laid out a 50-m transect along the line, repeating direction from previous year.
- Recorded plants greater than or equal to 0.1 m.
- Identified shrubs to species and recorded start/end points on the transect. Bare ground was also recorded.
- Recorded herbaceous cover collectively when its cover was less than 20% of the transect line, and all species present recorded without cover quantification for each.
    - Herbaceous cover only included individuals that appeared to be from this growing season. Herbaceous cover that appeared dead from the previous growing season was considered thatch and not quantified along the transect line.
    - When herbaceous cover was greater than 20%, quadrat sampling was conducted to describe the species composition and abundance (cover) of herbaceous vegetation at that location. These quadrats alternated from right to left on either side of the transect, placed every 10 m (6 quadrats total).
- Recorded transect direction, clarified species codes for uncommon species, and noted areas of mastication or fuel breaks that may have reduced the effective length of a transect.
- When transects were less than 50 m, calculated cover values with the new transect length. The shortened transects were then analyzed as if they were actually 50 m. This was deemed appropriate since the differences in length occurred on few transects and comprised a small portion of the total transect length.

2.3.2 Statistical Methods

Burleson initially separated treatment Units by the age of treatment at the point when 2018 transect monitoring was conducted (e.g. 5-year-old vs 3-year-old). Within these groups, we conducted either one-way, two-way, or three-way PERMANOVA testing to detect differences in community composition between Unit, Age, or Treatment (Anderson, 2001; McArdle and Anderson, 2001). Community composition is defined by the structural patterns of the community (e.g. abundance, richness, evenness and diversity; Smith and Smith, 2001). Treatment age, Unit, and treatment type are grouping factors which will be referred to as *age*, *unit*, and *treatment*. Burleson conducted these tests using the *adonis* function in the vegan package in R Statistical Software (Oksanen, 2017; R Core Team, 2017). We used Bray-Curtis dissimilarity matrices to measure community composition, and partitioned between factors. The function *adonis* uses permutation testing to detect significance of those partitions. If the factor *unit* was determined as significant ($p \leq 0.05$), we deemed the community compositions between units as different enough to warrant analyzing them separately.

If PERMANOVA results suggested the *unit* was not significant, we conducted combined analyses for Units of the same age. If PERMANOVA results suggested the *unit* was significant, we conducted PERMANOVA on each Unit individually and sought to detect differences in *treatment* or *age*. PERMANOVA testing is a robust alternative to other analyses (e.g. Kruskal-Wallis or analysis of variance (ANOVA)). While the test has the potential to increase the Type II error (false positive) rate compared to other tests, PERMANOVA reduces the need to conduct separate tests for each community structure parameter and eliminates the normality assumption required from ANOVA (some community structure data do not meet normality assumption).

Following Legendre and Legendre (1998), we conducted nonmetric multidimensional scaling (NMDS) ordinations. These allowed qualitative visualizations of the differences detected in PERMANOVA testing. NMDS is a reduced-space ordination method which begins with full dimensional space and attempts to represent groups in as few dimensions as possible while retaining the distance relationships between groups. Burleson grouped vegetation transect data by *treatment* or *age*. The matrices analyzed were *transect* by *species*, and are sometimes longer in the *species* dimension than in the *transect* dimension. Differences between these grouping factors are illustrated by differing locations of ellipsoids that surround grouped transect points in ordination space. These analyses were conducted utilizing the *metaMDS* function in the vegan package, using Bray-Curtis dissimilarity distances (Oksanen, 2017).

Burleson calculated four community metrics and grouped them by *treatment* or *age* within Units to assess community structure. Community metrics calculated were total cover (%), Shannon-Wiener diversity index, species richness (# species), and species evenness index. Cover (%) is identified as:

c = vegetative cover

Species 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 both increasing number of species and 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 ith species = $\frac{n_i}{N}$

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. Evenness is calculated as:

$$J' = \frac{H'}{\ln(S)}$$

where,

S = species richness

These statistics were conducted using the functions *rowSums*, *diversity*,and *specnumber* in the *vegan* package (Oksanen, 2017). One-way, two-way, or mixed-design analysis of variance (ANOVA) were conducted to detect differences of community metrics between *units* within age classes, and *treatment* groups within Units when more than one treatment was applied to any unit. Bare ground cover and herbaceous cover were evaluated using the same methods as for community metrics. These methods were also utilized to evaluate HMP species cover differences between *treatment* types in the Year 8 Units.

When conducting ANOVA tests, the *F*-statistic and *p*-value were used to assess significance. The *F*-statistic is defined as:

$$F = \frac{variation\ between\ sample\ means}{variation\ among\ individuals\ within\ the\ same\ sample}$$

The *F*-statistic can only be zero or positive in value, and is only zero when all sample means are identical (Moore *et al.*, 2013). The *F*-statistic gets larger as the sample means move further apart. Large values provide evidence against the null hypothesis that the means are the same.

The *p*-value is a means to assess the strength of evidence against a claim (the null hypothesis) (Moore *et al.*, 2013). It follows the reasoning that an outcome which would rarely happen if a claim were true is good evidence against that claim. The *p*-value represents the probability of how infrequently an outcome like this would happen if the null hypothesis were true. Small *p*-values are evidence against the null hypothesis because they show that the observed result would be unlikely if the null were true.

For this study, values below 0.05 were considered significant. When results showed a *p*-value less than 0.05 and an *F*-statistic considerably higher than one, these results were termed significant.

When two- or three-way ANOVAs were conducted, *F*-statistic and *p*-value were reported for interaction terms. Significant interactions suggest that unique responses to particular treatment combinations (e.g. *Burned* transects at the *Age* level of Year 8 only) exist (Gotelli and Ellison, 2004).

When appropriate, Mauchly's test was utilized to test that the sphericity assumption was met. This tests for equal variance of the differences between all possible combinations of groups. When community metrics did not meet parametric assumptions of one-way ANOVA testing, either Greenhouse-Geisler sphericity corrections or nonparametric Kruskall-Wallis tests were used. In cases where community metrics did not meet parametric assumptions of two-way ANOVA testing, we made inference using the PERMANOVA results, as there is no nonparametric version of a two-way ANOVA. Descriptive statistics were used to examine differences in communities over time and between treatments.

Rank-abundance curves (RACs) were generated to illustrate the important community relationships and show species-level responses to differences in *treatment* or *age* (Molles, 2010). We plotted RACs with species rank on the x-axis and the log-10 proportional abundance on the y-axis, with species identified using their species code (see Appendix A for complete Fort Ord species code list). The distribution of the species in these Units can characterize the species composition further than the community metrics such as the Shannon-Wiener diversity index or the species evenness index (Calow, 1999). We created rank abundance curves using the *rankabundance* function in the BiodiversityR package (Kindt, 2017).

2.4 Non-native Annual Grasses Methods

2.4.1 Field Methods

Non-native annual grasses were mapped within primary Containment Lines and in roadside fuel breaks adjacent to each Unit monitored in 2018. Areas directly adjacent to the roads were mapped from the vehicle. Areas further than 25-50 ft from the vehicle, or where direct line-of-sight was impeded, were mapped on foot. All mapping occurred using hard copies of ArcGIS derived aerial maps, and hand-drawing the annual grass polygons. Polygons were later digitized and the area occupied was calculated using ArcGIS software. Density classes for each polygon were visually estimated and recorded.

2.4.2 Reporting Methods

Non-native annual grasses are presented on maps derived in ArcGIS (Esri, 2017). Additionally, the estimated area occupied by annual grasses was quantified for all areas where surveys occurred, and reported by density class. The density classes are as follows:

1 (low)	= 1-5%
2 (medium)	= 6-25%
3 (high)	= >25%

2.5 Invasive Species Methods

2.5.1 Field Methods

Invasive species were monitored along shrub transects and where encountered incidentally during meandering transects, HMP annuals density monitoring, and annual grass monitoring. Emphasis was placed on iceplant (*Carpobrotus edulis*), pampas grass (*Cortaderia jubata*), and French broom (*Genista monspessulana*). Iceplant locations were only recorded when the occurrence was larger than about 100 ft^2 or in areas clustered with smaller individuals that collectively indicated a recent and/or potentially problematic infestation. Locations were recorded using either a Garmin 62s GPS receiver or a Trimble® Juno® T41/5B Series GPS unit with an external Trimble® R1 GNSS receiver.

2.5.2 Reporting Methods

Invasive species are presented on maps developed in ArcGIS (Esri, 2017). These surveys were not intended to be comprehensive. The intent is to document occurrences to support invasive species management through the Service Agreement with Bureau of Land Management.

3 BASELINE SURVEYS: UNITS 13, 17 AND 20

3.1 Introduction

Baseline Units in 2018 included Units 13, 17, and 20 (Figure 3-1). These Units are scheduled for future prescribed burning and/or mastication as part of environmental cleanup operations involving MEC removal. No mastication or prescribed burn was scheduled for these Units during 2018.

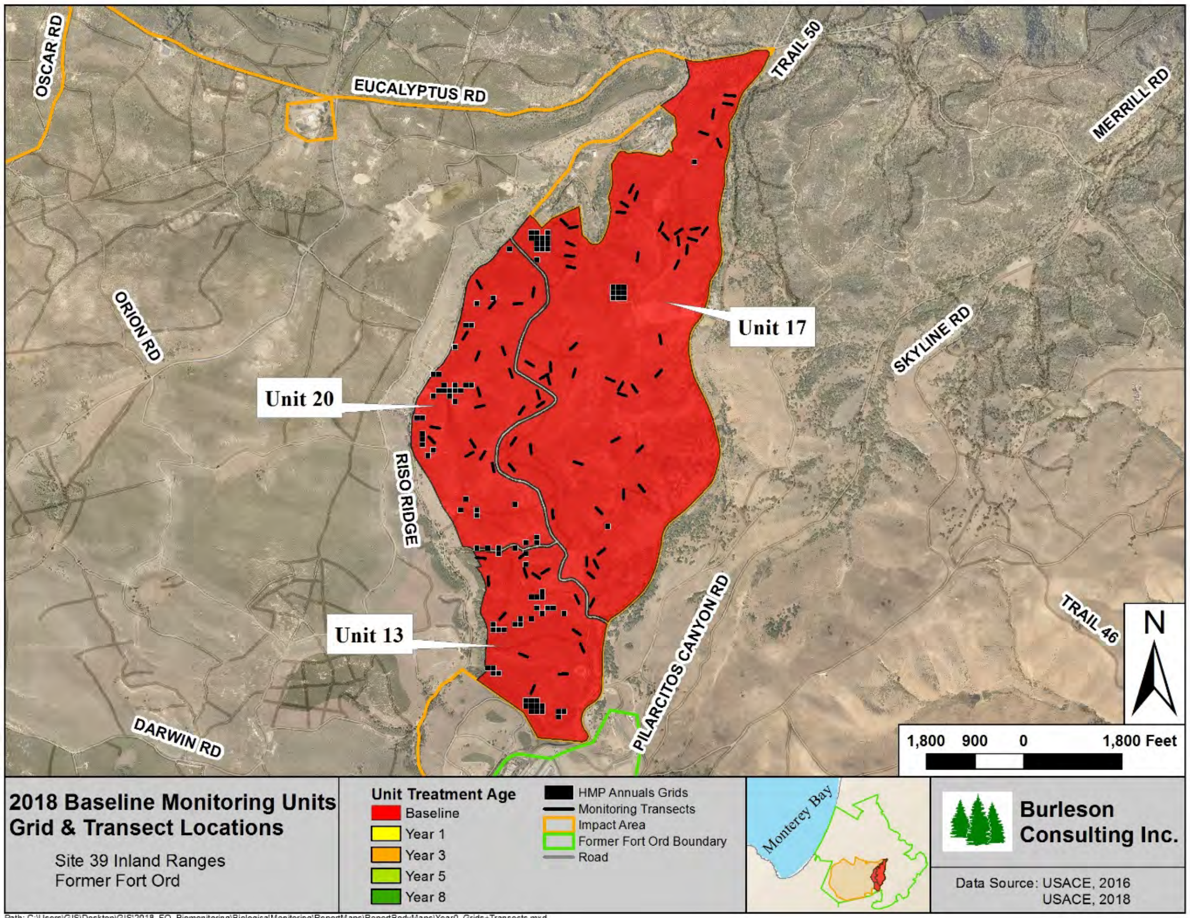

Figure 3-1. Baseline Unit HMP Annuals Grids and Shrub Transects Surveyed in 2018.

3.2 Units 13, 17, and 20: Setting

Unit 13 is dominated by mature maritime chaparral to the north and coast live oak woodland and disturbed non-native grassland on the southern edge. The Unit is 141 acres in size. The Unit is situated along the southern half of a steep west-facing slope forming Impossible Canyon. Unit 13 is bordered to the south by Laguna Seca Raceway, to the east by Barloy Canyon Road and Wildcat Ridge, to the north by Unit 20, and to the west by Impossible Canyon Road and Unit 25. This Unit is vegetated predominantly by chamise and shaggy-barked manzanita.

Unit 17 encompasses an area of 576 acres in the northeast portion of the former Fort Ord Impact Area and north of Unit 13 and the Laguna Seca Raceway, of which, 526 acres were surveyed in 2018. The remaining 50 acres were monitored in 2017. The Unit is bordered on the east by Barloy Canyon Road. The terrain is more varied than the rest of the Impact Area with a prominent north-south trending ridge running through the center, and occasional steep slopes. This Unit is vegetated primarily with mature maritime chaparral largely dominated by chamise and shaggy-barked manzanita. Other dominants can include Hooker's manzanita, Toro manzanita, black sage, Monterey ceanothus, and coast silk tassel.

Historic Area (HA) 34 is located in the middle of the eastern half of Unit 17, just west of Barloy Canyon Road (Burleson, 2017b). HA 34 was used by the Army as a multi-use range that included closed combat course, machine gun assault course, and mortar range. Passive and active restoration activities are ongoing for HA 34 including broadcast seed, plant installation, and annual weed management.

Unit 20 comprises 207 acres and is contiguous with Unit 13 to the south. Ten acres of Unit 20 were masticated in 2016, surveyed in 2015 and 2017, and are excluded from the 2018 Baseline surveys (Burleson, 2016; Burleson, 2018). The 2018 Baseline surveys comprised 197 acres of the Unit. Unit 20 is more heavily dominated by maritime chaparral than Unit 13. There are scattered areas of oak woodland on the western edge of the Unit. There is a large area in the south-central portion of the Unit where past disturbance occurred and non-native fill material is present. Several deteriorated north-south- and west-east-trending roads exist within the Unit providing some degree of unobstructed access to the interior portions of the Unit.

Seven soil types are mapped in the Baseline Units as described in Table 2-1 (USDA, 2018). Xerorthents, dissected soil is the most frequently occurring soil, mapped through most of Units 13 and 20 and in Unit 17 through the middle and the western edge along Wildcat Ridge Road. Aquic Xerofluvents is mapped only in the northwestern corner of Unit 17. Arnold loamy sand, 9 to 15 percent slopes is mapped in the center of Unit 17 and the northernmost portion of Unit 20. Arnold loamy sand, 15 to 50 percent slopes are found only in the northern portion of Unit 17. Arnold-Santa Ynez complex is mapped in the western half of Unit 17, the northeastern portion of Unit 20 and the southernmost tip of Unit 13. Santa Ynez fine sandy loam, 15 to 30 percent slopes is mapped as occurring on the southeastern edges of Units 13 and 17. Baywood sand, 2 to 15 percent slopes was mapped in Unit 17, in the eastern-central portion of the Unit. Characteristics of these soil types are presented in Table 2-1.

3.3 Units 13, 17, and 20: Methods

Following methods outlined in the Revised Protocol (Tetra Tech and EcoSystems West, 2015b) and Section 2 of this report, the 2018 Baseline surveys in Units 13, 17, and 20 consisted of the following components:

- Density monitoring for three HMP annual species: sand gilia, seaside bird's-beak, and Monterey spineflower. This survey effort was conducted to assess Baseline densities of HMP annual species.
- Baseline surveys of shrub community transects. This survey effort was conducted to assess Baseline shrub species composition of the sensitive maritime chaparral community.
- Mapping of invasive species including iceplant, pampas grass, and French broom, where encountered. This survey effort was conducted to assess increase or decrease of invasive populations over time after disturbance.

3.4 Unit 13, 17, and 20: Results and Discussion

Baseline surveys at Units 13, 17, and 20 included 101 HMP monitoring grids and 83 shrub transects. Maps of HMP survey grids and shrub transects for the sampled Units are provided in Appendix B and C (Figures B-1 through B-9 and C-1 through C-3).

3.4.1 Sand Gilia

Sand gilia was observed in four grids in Unit 13, 18 grids in Unit 17, and 11 grids in Unit 20 (Figures 3-2 through 3-4, B-3, B-6, and B-9). During the Baseline year, the frequency of occurrence in monitored plots in Unit 13 was 11% (4 of 38 grids), in Unit 17 was 72% (18 of 25 grids), and in Unit 20 was 29% (11 of 38 grids).

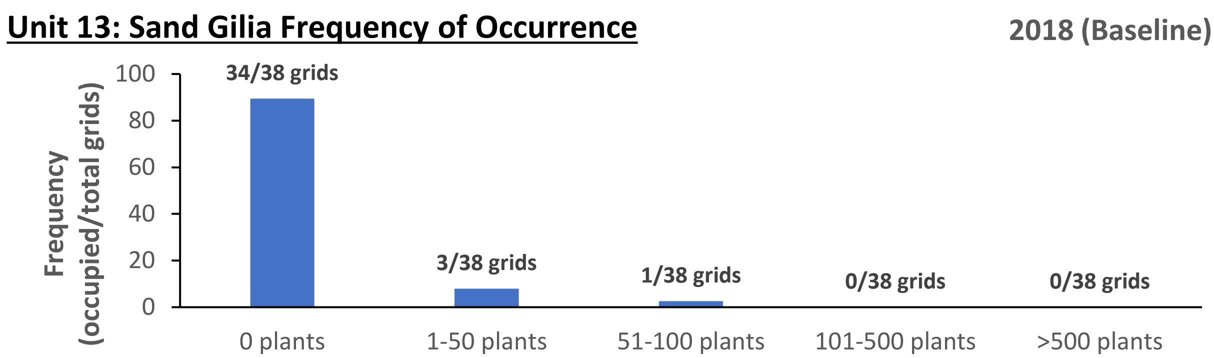

Figure 3-2. Unit 13 Sand Gilia Occurrence in Surveyed Grids (*n*=38) for Baseline (2018).

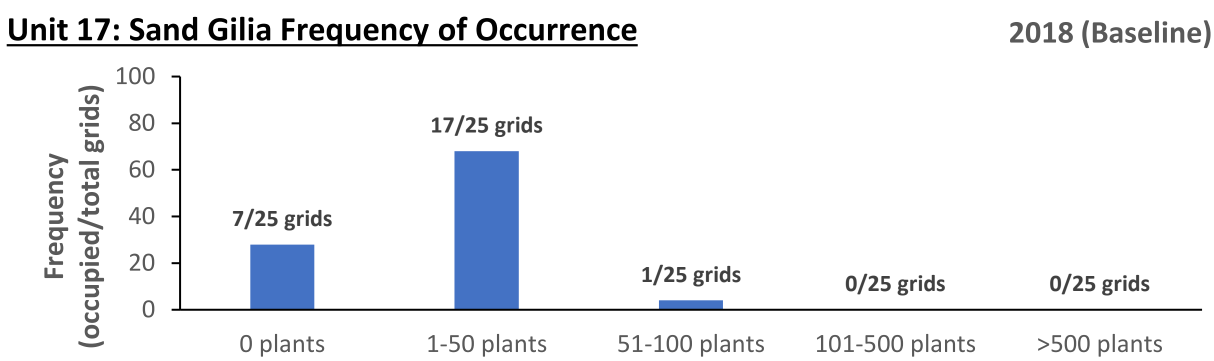

Figure 3-3. Unit 17 Sand Gilia Occurrence in Surveyed Grids (*n*=25) for Baseline (2018).

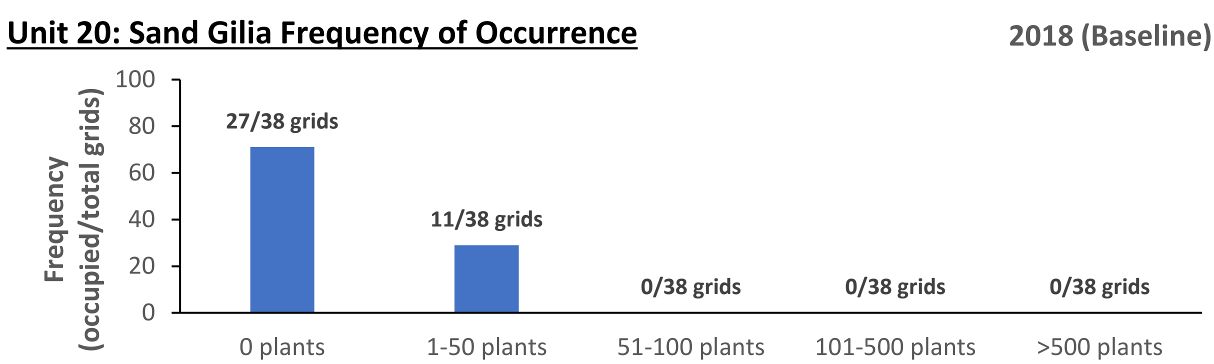

Figure 3-4. Unit 20 Sand Gilia Occurrence in Surveyed Grids (*n*=38) for Baseline (2018).

3.4.2 Seaside Bird's-Beak

Seaside bird's-beak was not observed in any of the Baseline HMP monitoring grids during 2018 surveys (Figures B-2, B-5, and B-8).

3.4.3 Monterey Spineflower

Monterey spineflower was observed in all 38 grids in Unit 13, 21 grids in Unit 17, and 37 grids in Unit 20 during the 2018 surveys (Figures 3-5 through 3-7, B-1, B-4, and B-7). During the baseline year, the frequency of occurrence in monitored plots in Unit 13 was 100% (38 of 38 grids), in Unit 17 was 84% (21 or 25 grids), and in Unit 20 was 97% (37 of 38 grids).

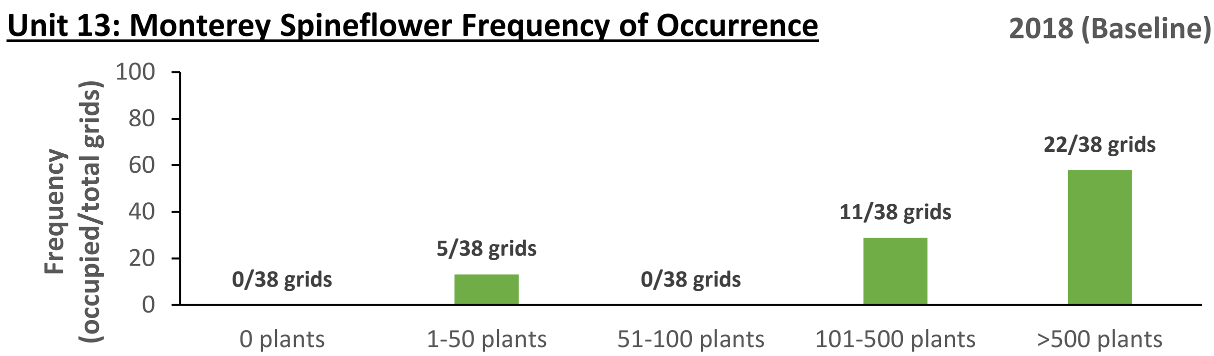

Figure 3-5. Unit 13 Monterey Spineflower Occurrence in Surveyed Grids (*n*=38) for Baseline (2018).

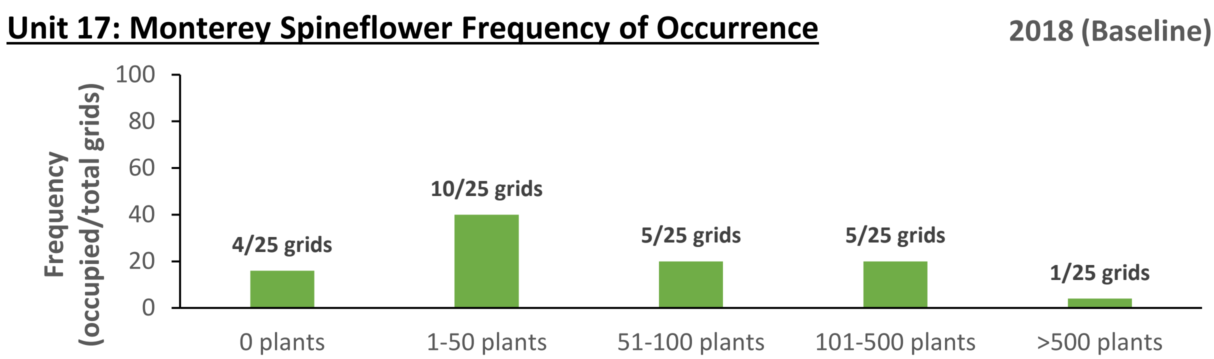

Figure 3-6. Unit 17 Monterey Spineflower Occurrence in Surveyed Grids (*n*=25) for Baseline (2018).

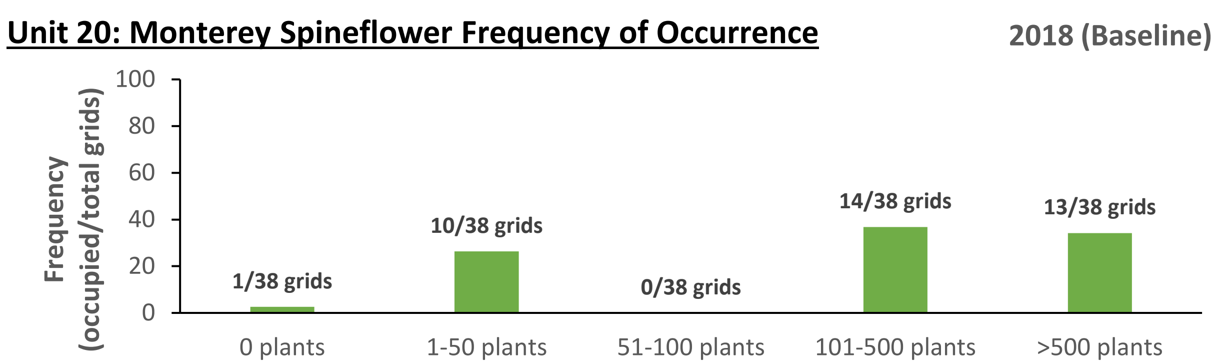

Figure 3-7. Unit 20 Monterey Spineflower Occurrence in Surveyed Grids (*n*=38) for Baseline (2018).

3.4.4 Yadon's Piperia

Yadon's piperia was observed in Unit 13, but not Units 17 or 20, during the 2018 monitoring season. The occurrence in Unit 13 consisted of one individual in the northwest corner of the Unit (Figure E-1).

3.4.5 Shrub Transect Monitoring

Eighty-three shrub transects ($n_{Unit\ 13}$=13 transects, $n_{Unit\ 17}$=51 transects, $n_{Unit\ 20}$=19 transects) were monitored in the Baseline units during the 2018 monitoring season (Figure 3-1). Total shrub cover exceeded 100% for some transects because of overlapping cover between adjacent shrubs. To assess differences between Baseline units, Burleson conducted one-way PERMANOVA testing. These results suggested that community composition was not significantly different between Baseline units (Table 3-1).

Table 3-1. One-way PERMANOVA results for Units 13, 17, and 20 community compositions, based on Bray-Curtis distance matrices. Significance is denoted using an asterisk (*) and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Unit	1.10	0.326

To assess Baseline conditions in association structure, several standard metrics were examined: vegetation strata, total percent cover, species richness, diversity, and evenness (Figures 3-8 and 3-9). Mean total shrub cover was 112%, mean richness was 6.4 species, mean diversity was 1.17, mean evenness was 0.64, mean bare ground cover was 9.32%, and mean herbaceous cover was 0.28%. Raw data for the shrub transects sampled in 2018 are provided in Appendix F.

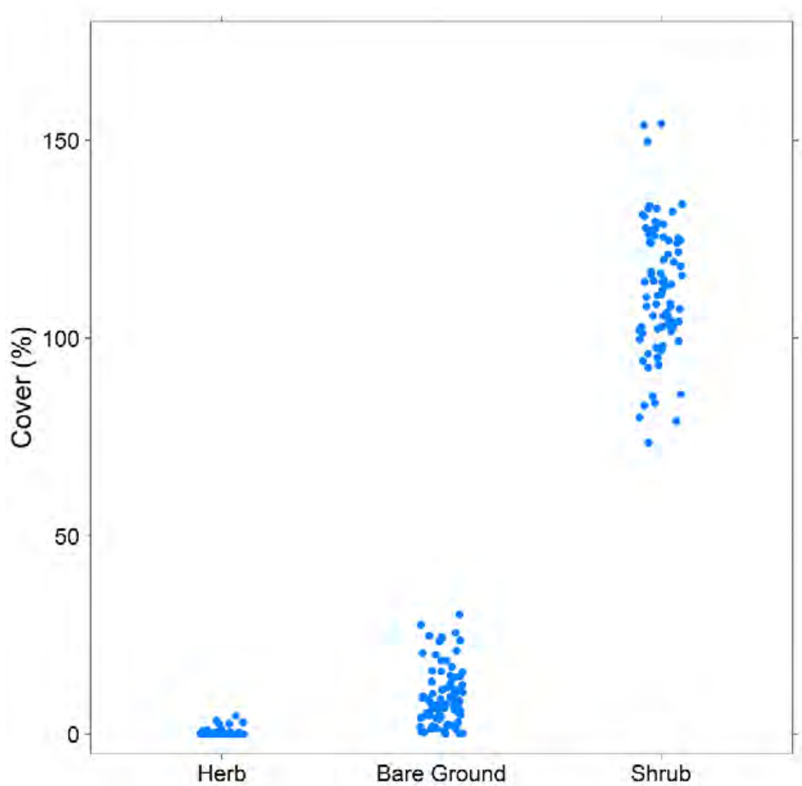

Figure 3-8. Baseline Unit Total Cover by Vegetation Stratum (2018). Eighty-three shrub transects ($n_{Unit\ 13}$=13 transects, $n_{Unit\ 17}$=51 transects, $n_{Unit\ 20}$=19 transects) were surveyed in Baseline Units.

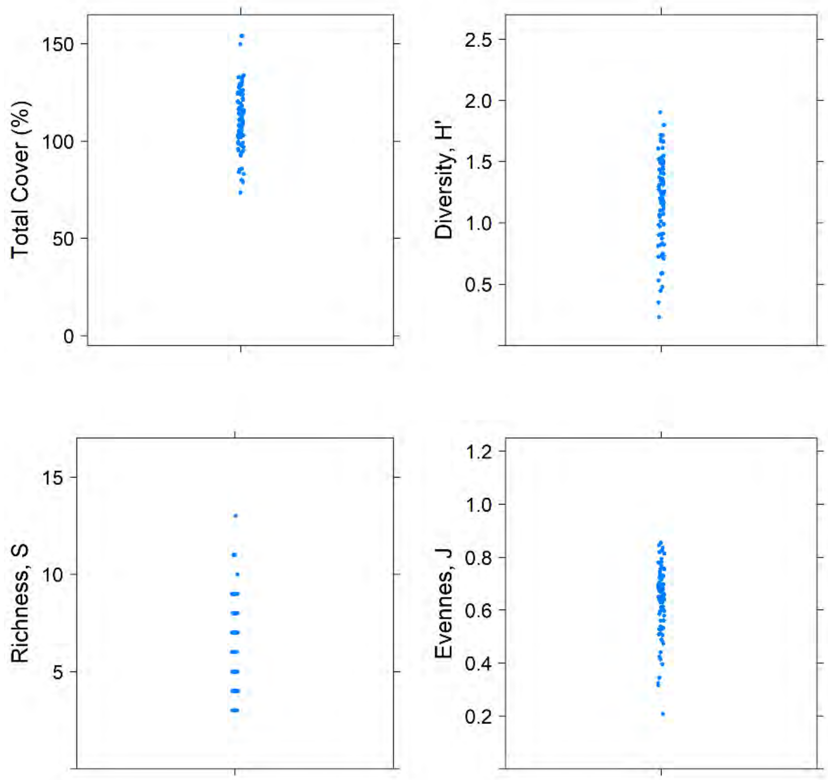

Figure 3-9. Baseline Units (2018) Community Metrics Including Total Cover, Species Diversity, Species Richness, and Species Evenness. Eighty-three shrub transects ($n_{Unit\ 13}$=13 transects, $n_{Unit\ 17}$=51 transects, $n_{Unit\ 20}$=19 transects) were surveyed in Baseline Units.

The dominant species in the pre-burn shrub association were chamise and shaggy-barked manzanita (Figure 3-10). Mean chamise cover was 39.9% and it occurred on 97.6% of transects. Mean shaggy-barked manzanita cover was 37.9% cover and it occurred on 80.7% of transects.

Other notable species included Toro manzanita, Monterey ceanothus, black sage, and Hooker's manzanita. Toro manzanita averaged 11.7% cover and occurred on 67.5% of transects. Monterey ceanothus averaged 6.95% cover and occurred on 69.9% of transects. Black sage averaged 6.65% cover and occurred on 73.5% of transects. Hooker's manzanita averaged 2.56% cover and occurred on 33.7% of transects.

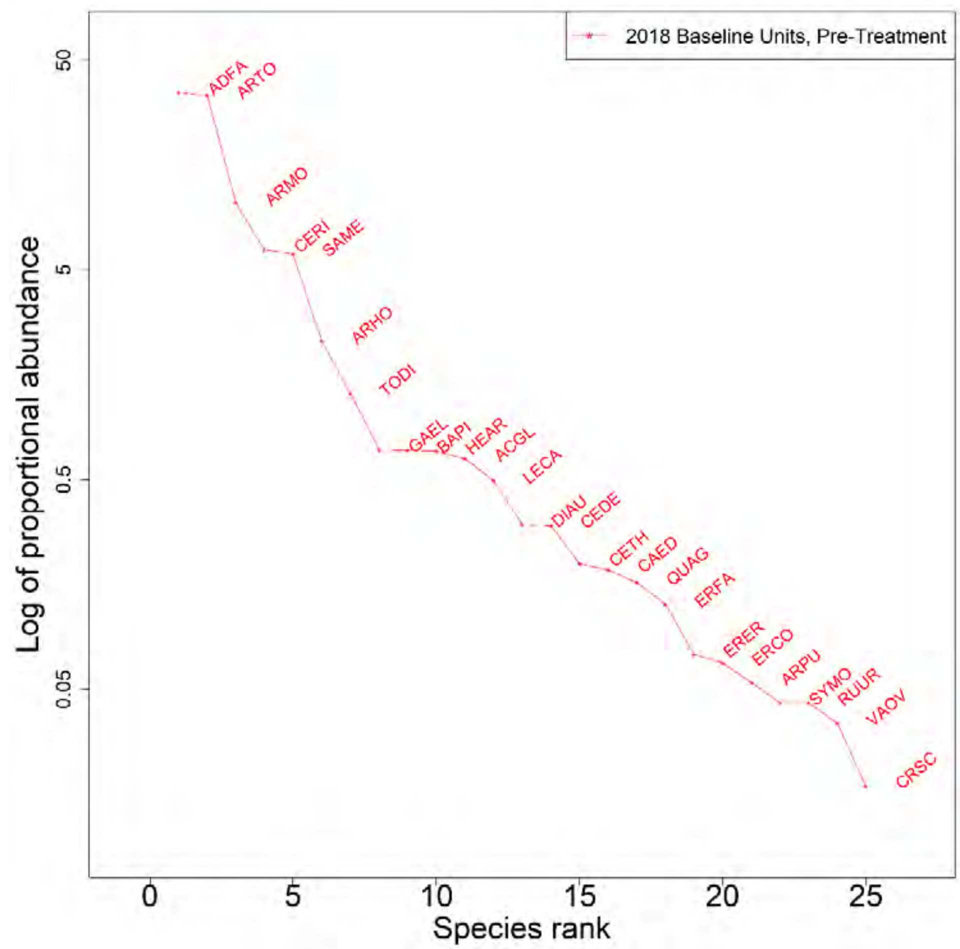

Figure 3-10. Rank Abundance Curve for Baseline Units. Note that the y-axis is in log-10 scale and the number of transects was eighty-three (*n*$_{Unit\ 13}$=13 transects, *n*$_{Unit\ 17}$=51 transects, *n*$_{Unit\ 20}$=19 transects).

Three groups of transects were identified as having different community composition characteristics. Results of hierarchical clustering and the associated dendrogram identified these three distinct groups of transects (Figure 3-11).

Group 1 comprised a single transect which was coastal sage scrub community. This transect was characterized by black sage dominance (82.6% cover) and lack of chamise, shaggy-barked manzanita, or any HMP shrubs. While pockets of coastal sage scrub exist within baseline units, it is not a dominant plant community. Since coastal scrub is not a protected plant community in the HMP, and the success criteria listed in the Revised Protocol do not apply to it, this Group 1 transect will be removed from future analysis (Tetra Tech and EcoSystems West, 2015b).

Group 2 transects were characterized as Shrub Association A (shaggy-barked manzanita dominated), with 71.1% mean cover of shaggy-barked manzanita and 100% occurrence (Tetra Tech and EcoSystems West 2015b). These transects were observed as having mean chamise cover of 21.8% with 100% occurrence, mean Monterey ceanothus cover of 5.74% with 77% occurrence, and mean Toro manzanita cover of 3.95% with 48% occurrence.

Group 3 transects were characterized as Shrub Association B (chamise dominated), with 50.7% mean cover of chamise and 100% occurrence (Tetra Tech and EcoSystems West 2015b). These transects were observed as having mean shaggy-barked manzanita cover of 18.5% with 84% occurrence, mean Toro manzanita cover of 16.6% with 80% occurrence, and mean Monterey ceanothus cover of 7.82% with 67% occurrence.

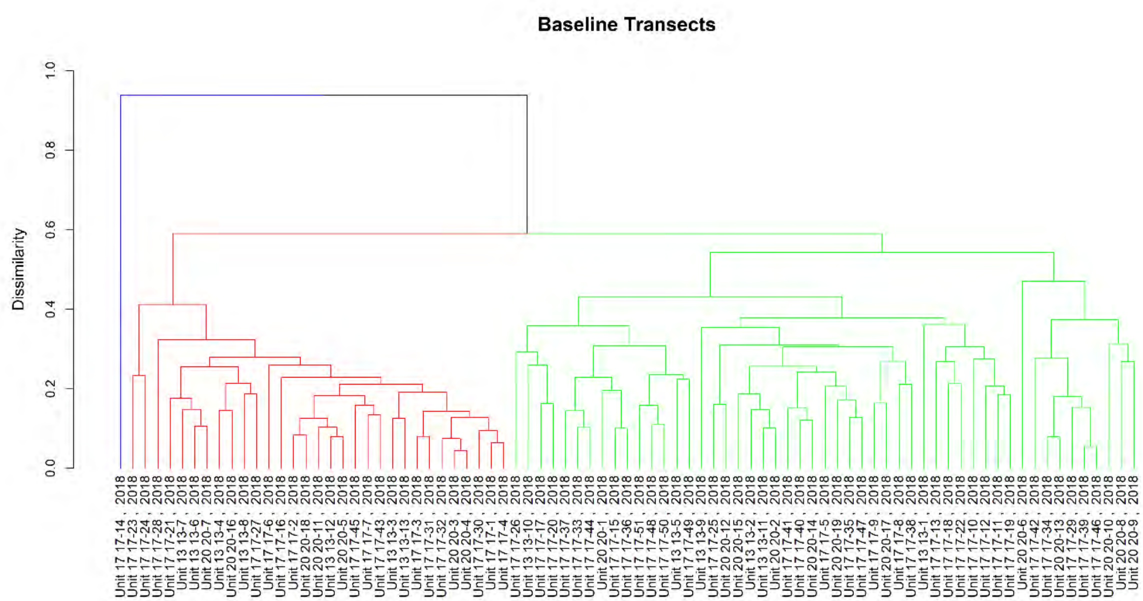

Figure 3-11. Dendrogram for Baseline (2018) Transects. Group 1 is Identified by Blue Dendrogram Arms, Group 2 is Identified by Red, and Group 3 is identified by Green. Group 2 Corresponds to Shrub Association A and Group 3 corresponds to Shrub Association B (Tetra Tech and EcoSystems West 2015b). Group 1 was co-dominated by deerweed and black sage. Eighty-three shrub transects ($n_{Unit\ 13}$=13 transects, $n_{Unit\ 17}$=51 transects, $n_{Unit\ 20}$=19 transects) were surveyed in Baseline Units.

The HMP shrub compositions by dendrogram group are shown in Figure 3-12. No HMP shrub species were observed on the Group 1 transect which has been removed from Figure 3-12. Group 2 transects were observed as having higher mean cover of Eastwood's goldenbush, while Group 3 transects were observed as having higher mean cover of Toro manzanita, Monterey ceanothus, Hooker's manzanita, and sandmat manzanita.

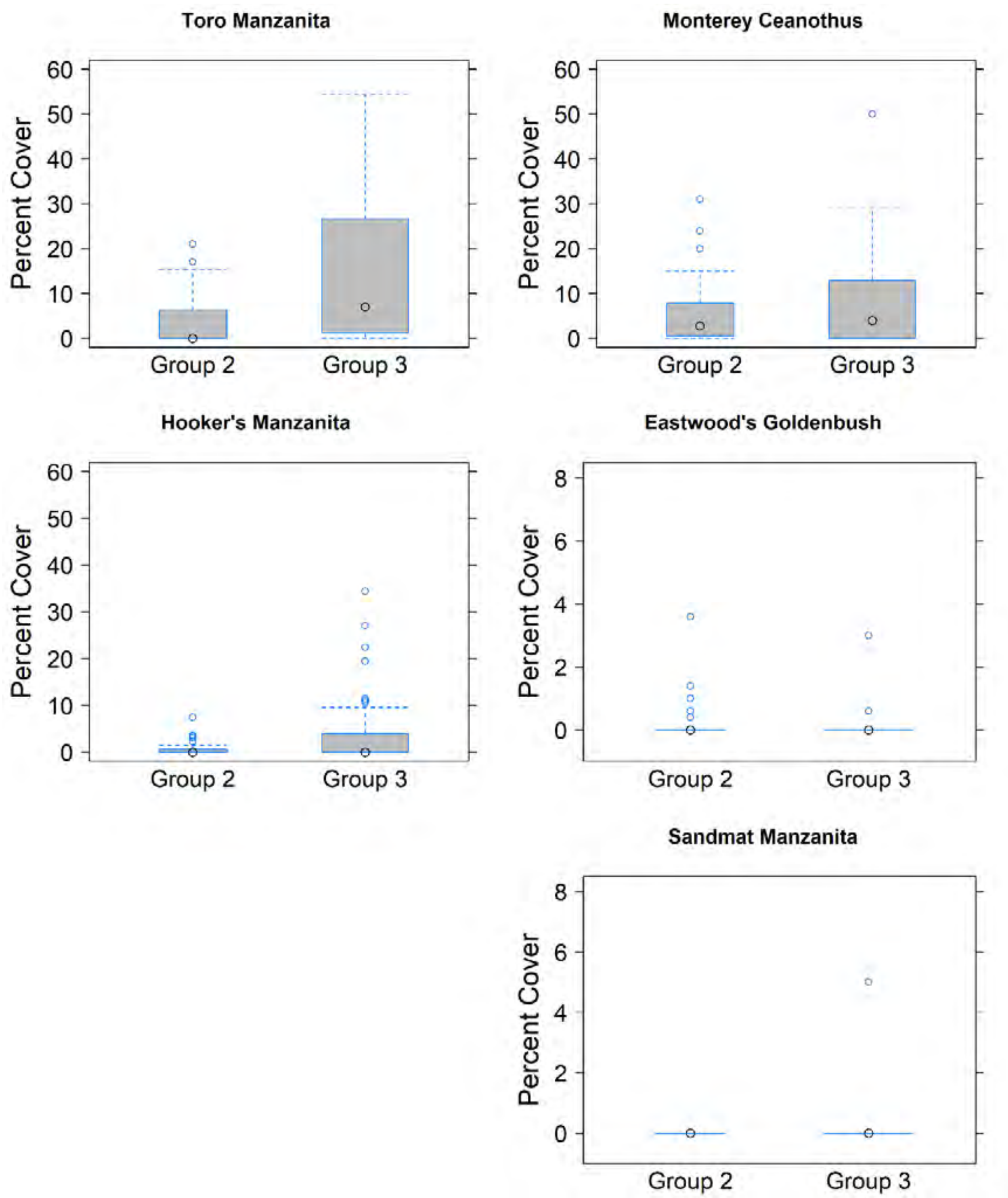

Figure 3-12. Baseline unit HMP shrub species mean cover by dendrogram group. The dashed line is a mean line and illustrates the differences in means between groups. Group 1 was omitted since it was comprised of coastal sage scrub. Eighty-three shrub transects ($n_{Unit\ 13}$=13 transects, $n_{Unit\ 17}$=51 transects, $n_{Unit\ 20}$=19 transects) were surveyed in Baseline Units.

NMDS ordination analysis confirmed the clustering of these transects in the dendrogram (Figure 3-13). Use of Indicator Species Analysis and measures of importance and constancy supported the identification of dominant species in each group and confirmed differences in composition between the three groups (Dufrene and Legendre, 1997; Roberts, 2016).

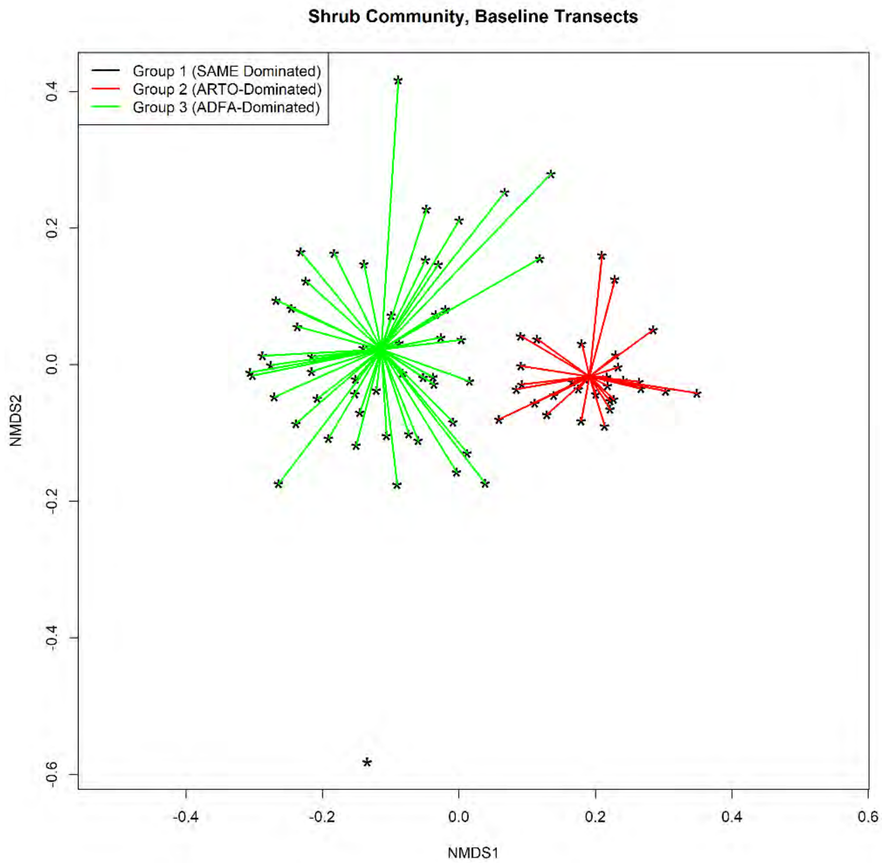

Figure 3-13. NMDS ordination for Baseline transects (2018). Group 1 is represented by only one transect and appears near the bottom edge of the figure as a single point. Eighty-three shrub transects ($n_{Unit\ 13}$=13 transects, $n_{Unit\ 17}$=51 transects, $n_{Unit\ 20}$=19 transects) were surveyed in Baseline Units.

3.4.6 Annual Grass Monitoring

Non-native annual grasses were observed and mapped within the Containment Lines and roadside fuel breaks of Units 13 and 20 (Appendix D; Figures D-1 and D-2). Estimated areas occupied by each density class are summarized in Table 3-2. The density class with the largest areal extent in Unit 13 was density class 3 (>25% cover) and comprised an area of approximately 12.32 acres. The density class with the largest areal extent in Unit 20 was density class 2 (6–25% cover) and comprised an area of approximately 5.58 acres.

Table 3-2. Estimated Area Occupied (Acres) by Annual Grasses in Baseline Surveys.

Cover Class	Baseline Unit 13 (acres)	Baseline Unit 20 (acres)
1 (Low) = 1 – 5% Cover	2.20	0.72
2 (Medium) = 6 – 25% Cover	4.17	5.58
3 (High) = > 25% Cover	12.32	5.40
Total Acreage	**18.69**	**11.70**

3.4.7 Invasive and Non-Native Species Monitoring

Of the target invasive species, iceplant and pampas grass were observed in all Baseline Units in 2018 (Appendix E, Figures E-1 through E-3). There were 37, 28, and 9 patches of iceplant in Units 13, 17, and 20, respectively. There were 5, 16, and 25 patches of pampas grass in Units 13, 17, and 20, respectively. There were no occurrences of non-native herbaceous cover observed during transect monitoring in Units 13, 17, and 20.

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4 YEAR 1 VEGETATION SURVEYS: BLM AREA B-3 WEST, AND BLM AREA B SUBAREAS A AND B CONTAINMENT LINES

4.1 Introduction

Year 1 Units included BLM Area B-3 West, and BLM Area B Subareas A and B Containment Lines (Figure 4-1). These areas were masticated in 2017 to prepare Units B and C for prescribed burns, and to facilitate environmental cleanup operations involving MEC removal. Subsequently, portions of containment lines in Unit B were burned. Baseline monitoring for these areas was conducted in 2015 and included meandering transect surveys to map areas of occurrence of HMP herbaceous species; density monitoring for the HMP annual species sand gilia, seaside bird's-beak, and Monterey spineflower; transect surveys to sample shrub composition in the maritime chaparral; and annual grass monitoring within the planned primary containment lines surrounding these Units (Burleson, 2016).

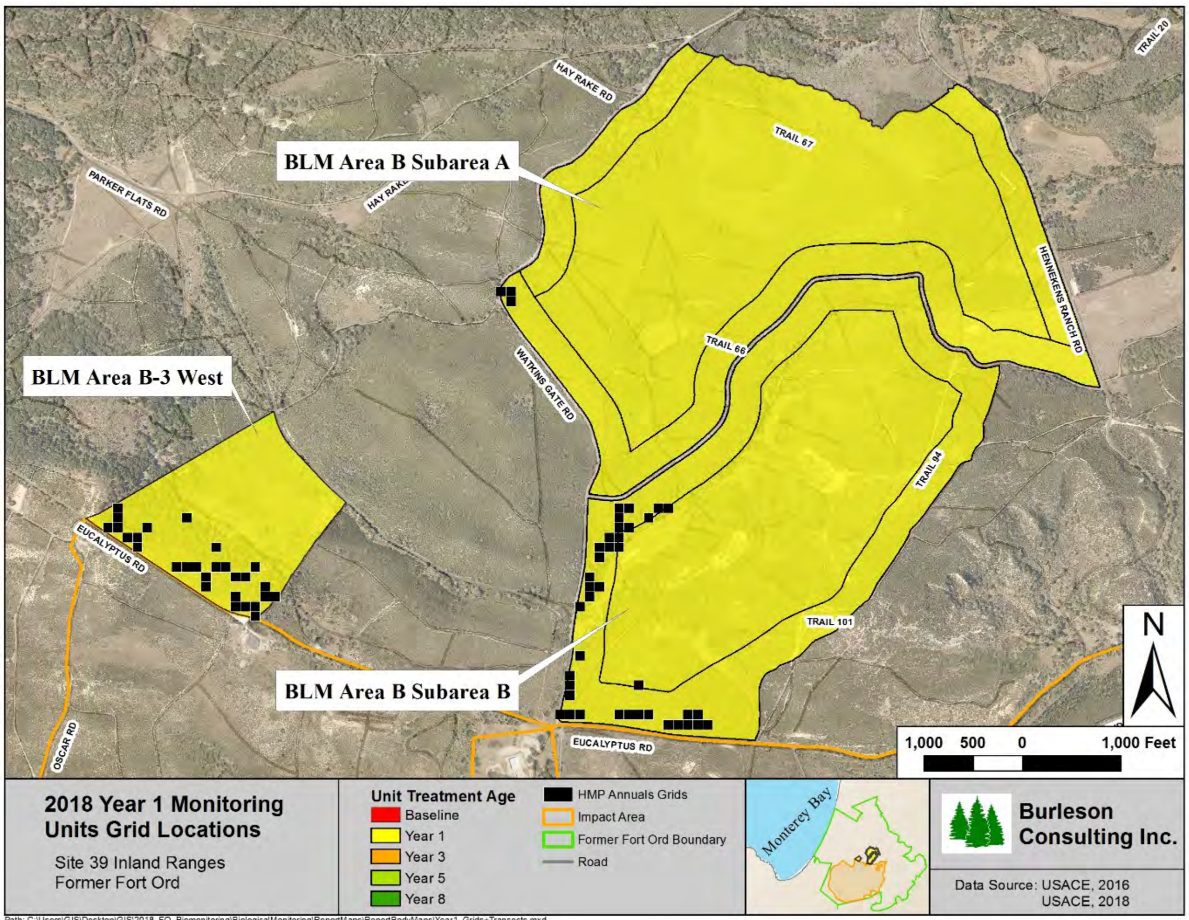

Figure 4-1. BLM Area B Subareas A and B, and BLM Area B-3 West HMP Annuals Grids Surveyed for Year 1 in 2018.

4.2 BLM Area B-3 West, and BLM Area B Subareas A and B Containment Lines: Setting

BLM Area B is a 1,646-acre area and is part of the publicly accessible lands on the Fort Ord National Monument. This irregularly configured area is located immediately north and east of the Impact Area

Units and is divided into eight subareas. BLM Area B is roughly bordered by Watkins Gate Road and Parker Flats Road to the west, Eucalyptus Road to the south, Barloy Canyon Road to the east, and Gigling Road to the north. Portions of this area are currently managed by the Bureau of Land Management (BLM) and contain numerous maintained trails and roads publicly accessible for biking and hiking, providing access to the interior portions of many of these areas. BLM Area B varies greatly in physiognomy, vegetation community composition, and topography.

BLM Area B-3 West is largely dominated by oak woodland and grassland with maritime chaparral limited primarily to the northern and southern boundaries. This Unit is 64 acres in size. Chaparral habitat in the southern portion of this area is dominated primarily by sandmat manzanita and other lower growing shrubs and may indicate an affinity to the sandy aeolian soils or reflect relatively recent disturbance.

Subarea A is in the northernmost portion of BLM Area B and is bisected by several trails and roads. This area contains a diverse array of maritime chaparral, coast live oak woodland, blueblossom ceanothus-poison oak scrub, native grass prairie, and wet meadow habitats. The Subarea A Containment Line was the only portion surveyed in 2018 and comprises 65 acres.

Subarea B is dominated by a low-lying, hummocky valley comprised grassland and shallow vernal pools. This valley is bordered by a mosaic of maritime chaparral and coast live oak woodland to the west and a steep, somewhat eroded slope containing oak woodland, chaparral, and disturbed unvegetated, highly-eroded openings to the east. The Subarea B Containment Line was the only portion surveyed in 2018 and comprises 106 acres. This subarea contains many abandoned roads and trails that are deteriorated and unmaintained in a badlands appearance. This subarea also contains several vernal pools with populations of Contra Costa goldfields, a federally endangered plant species.

The U.S. Department of Agriculture (USDA, 2018) maps three soil types as occurring in the Year 1 areas. Arnold-Santa Ynez complex is mapped as occurring in the majority of BLM Area B-3 West and Subareas A and B Containment Lines. Antioch fine sandy loam is located in portions of BLM Area B Subareas A and B Containment Lines, while Oceano loamy sound is found in BLM Area B Subareas B-3 West and A Containment Lines. Characteristics of these soil types are presented in Table 2-1.

It is apparent in the field that at least two distinct types of soil occur in the Year 1 areas where the soil is mapped as Arnold-Santa Ynez complex as well as elsewhere in the portion of the base where munitions and explosives removal are currently being conducted. One type of this 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. Soils supporting HMP herbaceous plants in BLM Area B are primarily situated along a north to south gradient along Watkins Gate Road.

4.3 BLM Area B-3 West, and BLM Area B Subareas A and B Containment Lines: Methods

Following methods outlined in the Revised Protocol and Section 2 in this report, the 2018 Year 1 vegetation monitoring surveys in BLM Area B-3 West, and BLM Area B Subareas A and B Containment Lines consisted of the following components:

- Density monitoring for three HMP annual species: sand gilia, seaside bird's-beak, and Monterey spineflower. This survey effort was conducted to evaluate how the density of these species responded to treatment within the monitored grids.
- Macroplot surveys for three HMP annual species: sand gilia, seaside bird's-beak, and Monterey spineflower. This survey effort was conducted to assess changes in the distribution of HMP annual species in response to treatment and evaluate what factors influence those changes.
- Mapping of non-native annual grasses within the primary containment areas. This survey effort was conducted to assess expansion or contraction of these populations over time after disturbance.
- Mapping of invasive species including iceplant, pampas grass, and French broom, where encountered. This survey effort was conducted to support ongoing management.

4.4 BLM Area B-3 West, and BLM Area B Subareas A and B Containment Lines: Results and Discussion

Burleson surveyed 69 HMP monitoring grids in the Year 1 Units in 2018, with 28 grids in BLM Area B-3 West ($n_{masticated}$=28), 38 grids in the Containment Line of BLM Area B Subarea B ($n_{masticated}$=15; $n_{masticated\&burned}$=6; n_{mixed}=17), and 3 grids in the Containment Line of BLM Area B Subarea A ($n_{masticated}$=3). Maps of survey grids for the sampled Units are provided in Appendix B (Figures B-10 through B-18).

4.4.1 Sand Gilia

Sand gilia was observed in BLM Area B Subarea B Containment in 2018 and the Baseline year, but not in BLM Area B-3 West or BLM Area Subarea A Containment in either year (Figure 4-2; Figures B-12, B-15, and B-18). The frequency of occurrence in BLM Area B Subarea B Containment increased from 21% in 2015 (8 of 38 grids) to 32% in 2018 (12 of 38 grids).

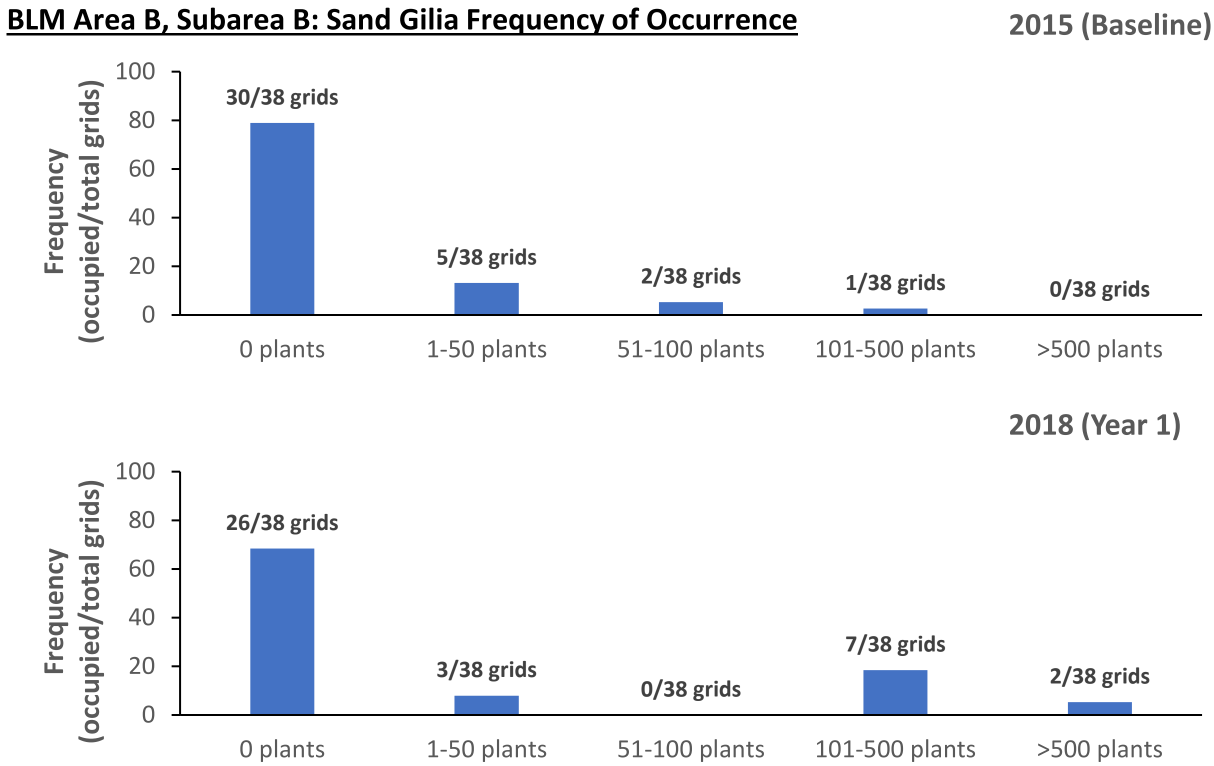

Figure 4-2. BLM Area B Subarea B Containment Sand Gilia Occurrence in Surveyed Grids (*n*=38) for Baseline (2015) and Year 1 (2018).

4.4.2 Seaside Bird's-Beak

Seaside bird's-beak was present in BLM Area B Subarea B Containment in 2018, but not in BLM Area B-3 West or BLM Area B Subarea A Containment (Figure 4-3; Figures B-11, B-14, and B-17). No grids contained seaside bird's beak in Baseline in any unit. The frequency of occurrence in monitored plots in BLM Area B Subarea B Containment was 0% in 2015 (0 of 38 grids) and 3% in 2018 (1 of 38 grids).

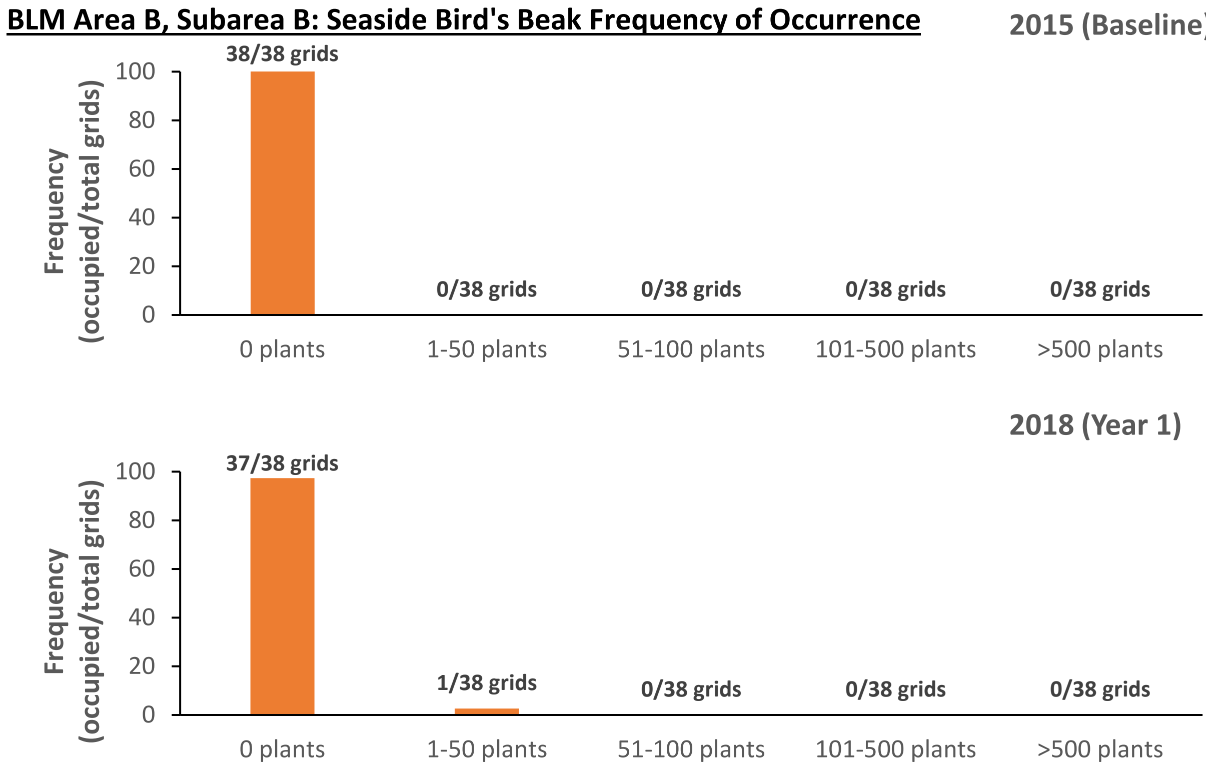

Figure 4-3. BLM Area B Subarea B Containment Seaside Bird's Beak Occurrence in Surveyed Grids (*n*=38) for Baseline (2015) and Year 1 (2018).

4.4.3 Monterey Spineflower

Monterey spineflower was present in all Year 1 Units (Figures 4-4 through 4-6; Figures B-10, B-13, and B-16). The frequency of occurrence in BLM Area B-3 West was 100% in 2015 (28 of 28 grids) and 89% in 2018 (25 of 28 grids). The frequency of occurrence in BLM Area B Subarea A Containment was 100% in 2015 (3 of 3 grids) and 66% in 2018 (2 of 3 grids). The frequency of occurrence in BLM Area B Subarea B Containment was 100% in 2015 (38 of 38 grids) and 89% in 2018 (34 of 38 grids).

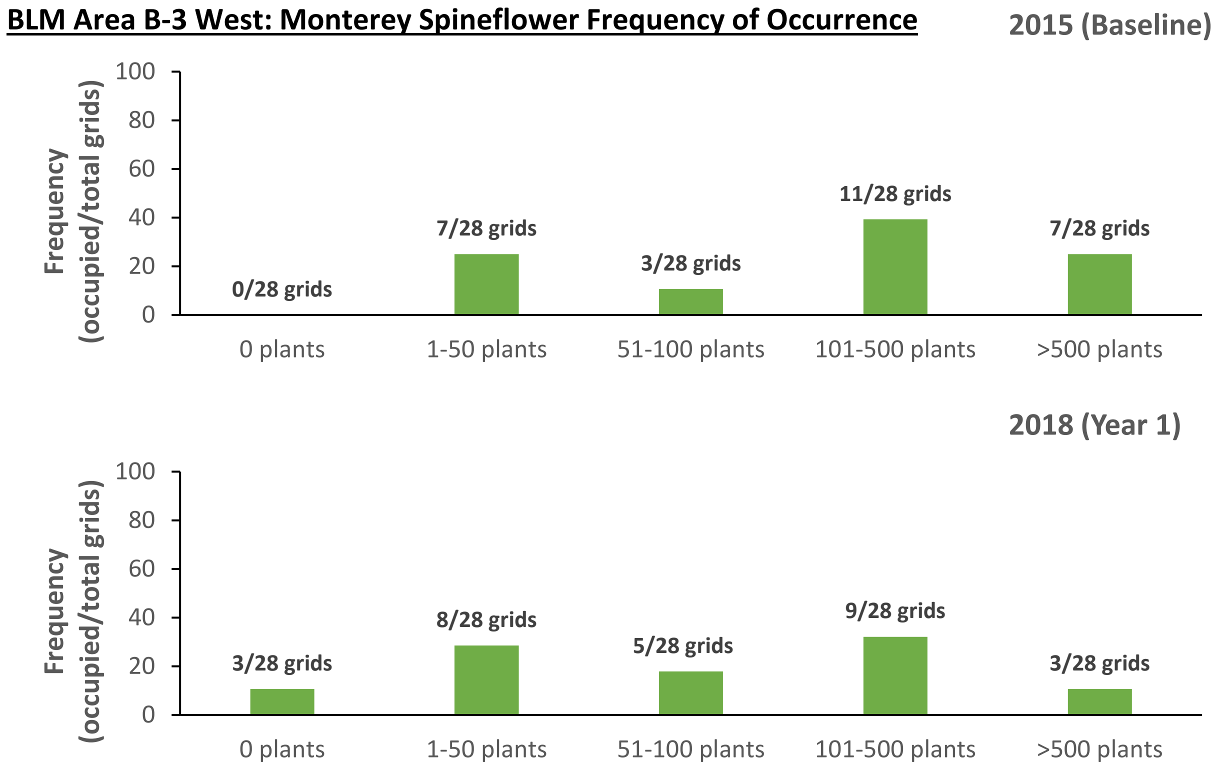

Figure 4-4. BLM Area B-3 West Monterey Spineflower Occurrence in Surveyed Grids (*n*=28) for Baseline (2015) and Year 1 (2018).

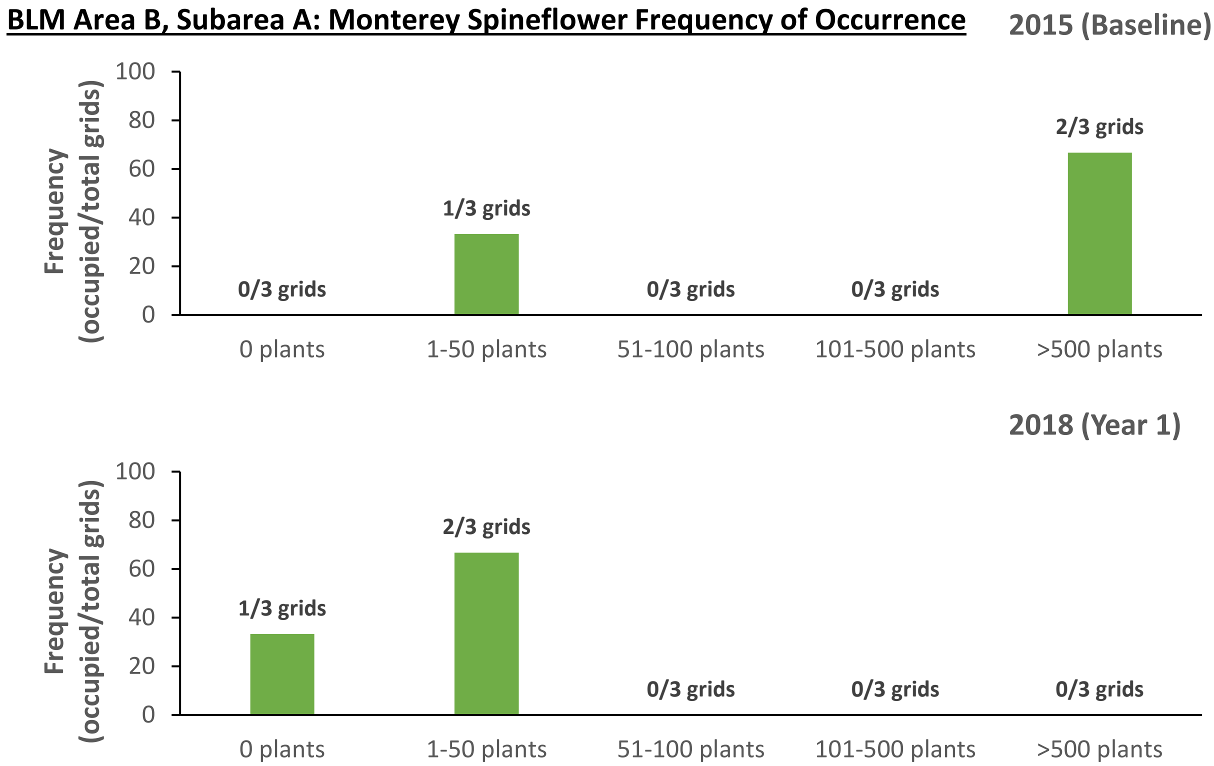

Figure 4-5. BLM Area B Subarea A Containment Monterey Spineflower Occurrence in Surveyed Grids (*n*=3) for Baseline (2015) and Year 1 (2018).

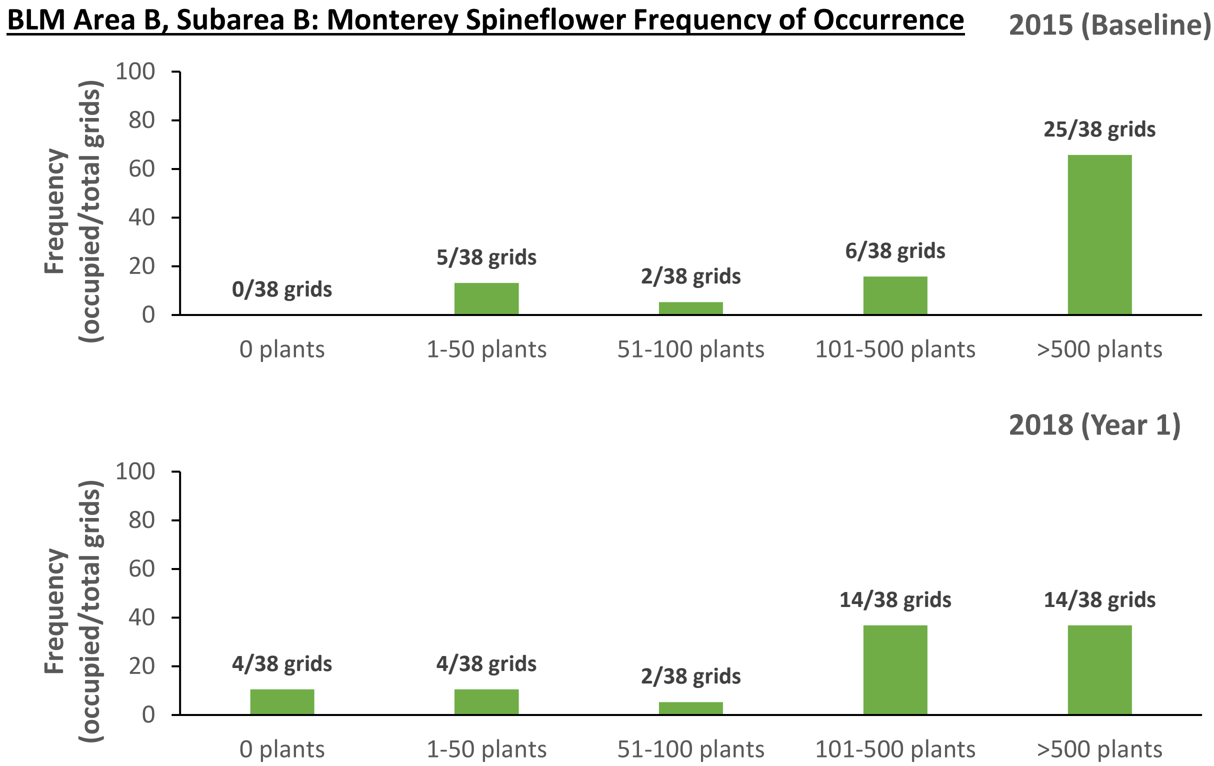

Figure 4-6. BLM Area B Subarea B Containment Monterey Spineflower Occurrence in Surveyed Grids (*n*=38) for Baseline (2015) and Year 1 (2018).

4.4.4 Yadon's Piperia

Yadon's piperia was observed in the BLM Area B Subarea B Containment Line, but not in BLM Area B-3 West or BLM B Subarea A Containment Line during the 2018 surveys. The occurrence in BLM Area B Subarea B was a single-plant occurrence in the northwest corner of the Unit (Figure E-6).

4.4.5 Effect of Treatment on HMP Density

The effect of treatment type on HMP annuals density was evaluated in the BLM Area B Subarea B Containment Line. BLM Area B-3 West and the BLM Area B Subarea A Containment Line could not be evaluated for differential effects due to treatment since only mastication occurred in these areas.

Two-way PERMANOVA was conducted to evaluate the effect due to Treatment and Age on the distribution of sand gilia, seaside bird's beak, and Monterey spineflower in the BLM Area B Subarea B Containment Line (Tables 4-1 through 4-3). No significant differences were observed in density classes of sand gilia, seaside bird's beak, or Monterey spineflower in BLM Area B Subarea B Containment Line between Treatments, there was a significant difference between Age for sand gilia, and there were no significant interactions for any species.

The distributions across density classes for each HMP annual species by Treatment and Age are shown in Figures 4-7 through 4-9.

Table 4-1. Two-way PERMANOVA results for sand gilia in the BLM Area Subarea B Containment Lines, based on Jaccard distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	15.3	1.00e-04*
Treat	1.40	0.209
Treat*Age	1.38	0.213

Table 4-2. Two-way PERMANOVA results for seaside bird's beak in the BLM Area Subarea B Containment Lines, based on Jaccard distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*P*
Age	0.676	1.00
Treat	0.982	1.00
Treat*Age	0.675	1.00

Table 4-3. Two-way PERMANOVA results for Monterey spineflower in the BLM Area Subarea B Containment Lines, based on Jaccard distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	1.72	0.156
Treat	0.738	0.590
Treat*Age	0.870	0.495

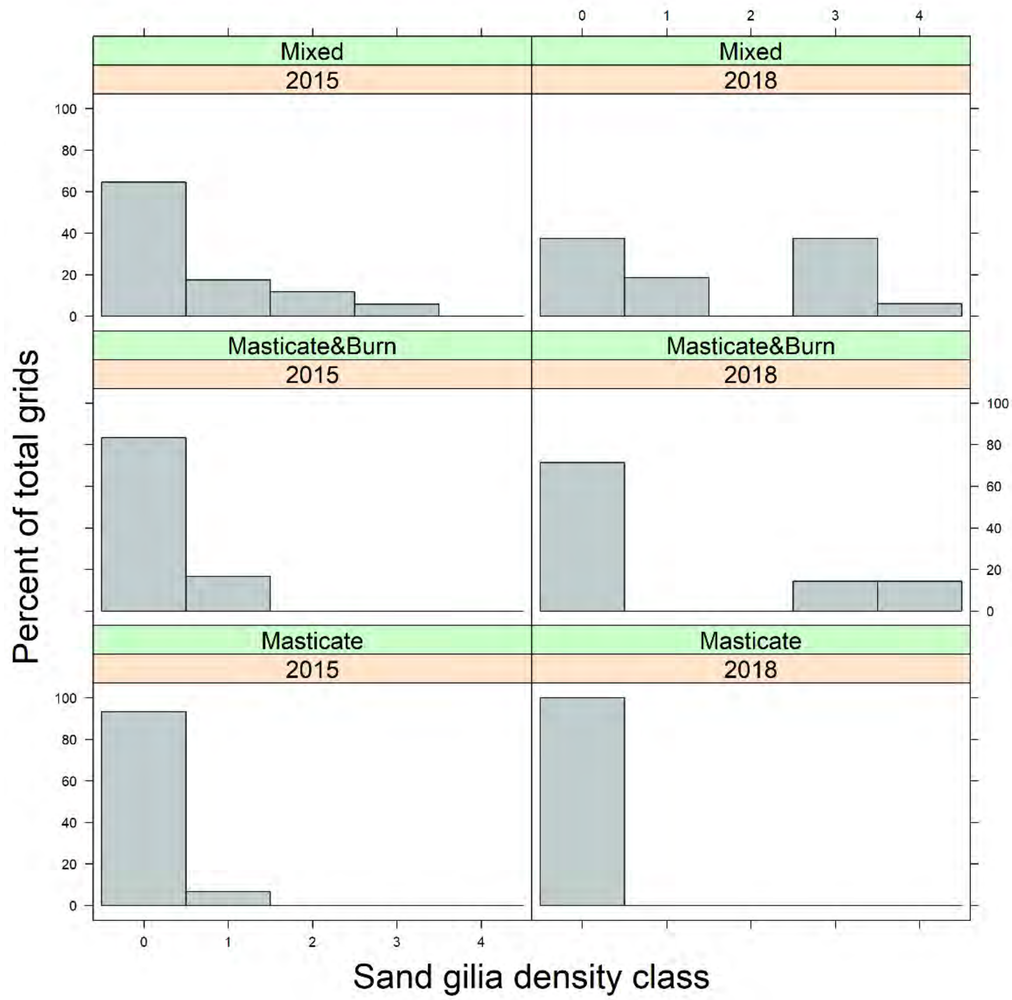

Figure 4-7. Percent of Total Grids for Sand Gilia Density Classes for All Treatment Types in Baseline (2015) and Year 1 (2018) in BLM Area B Subarea B Containment Lines.

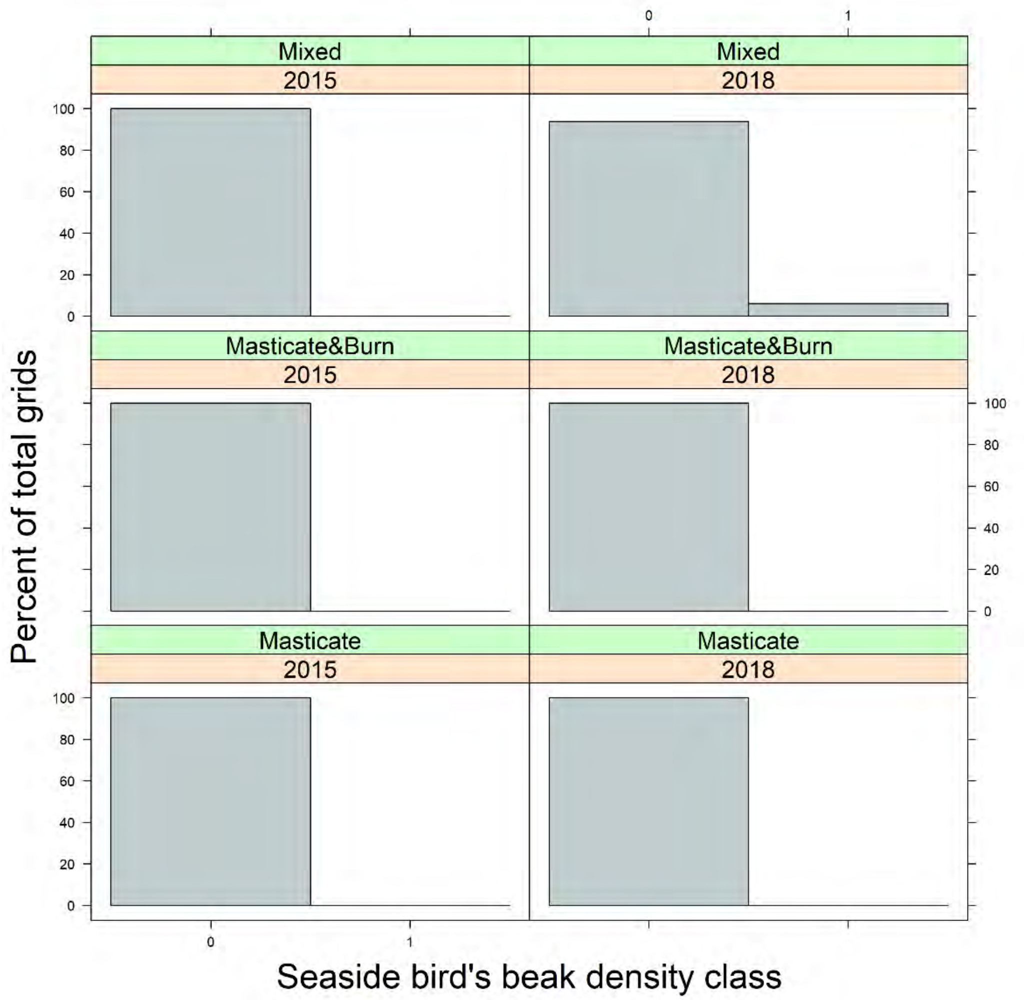

Figure 4-8. Percent of Total Grids for Seaside Bird's Beak Density Classes for All Treatment Types in Baseline (2015) and Year 1 (2018) in BLM Area B Subarea B Containment Lines.

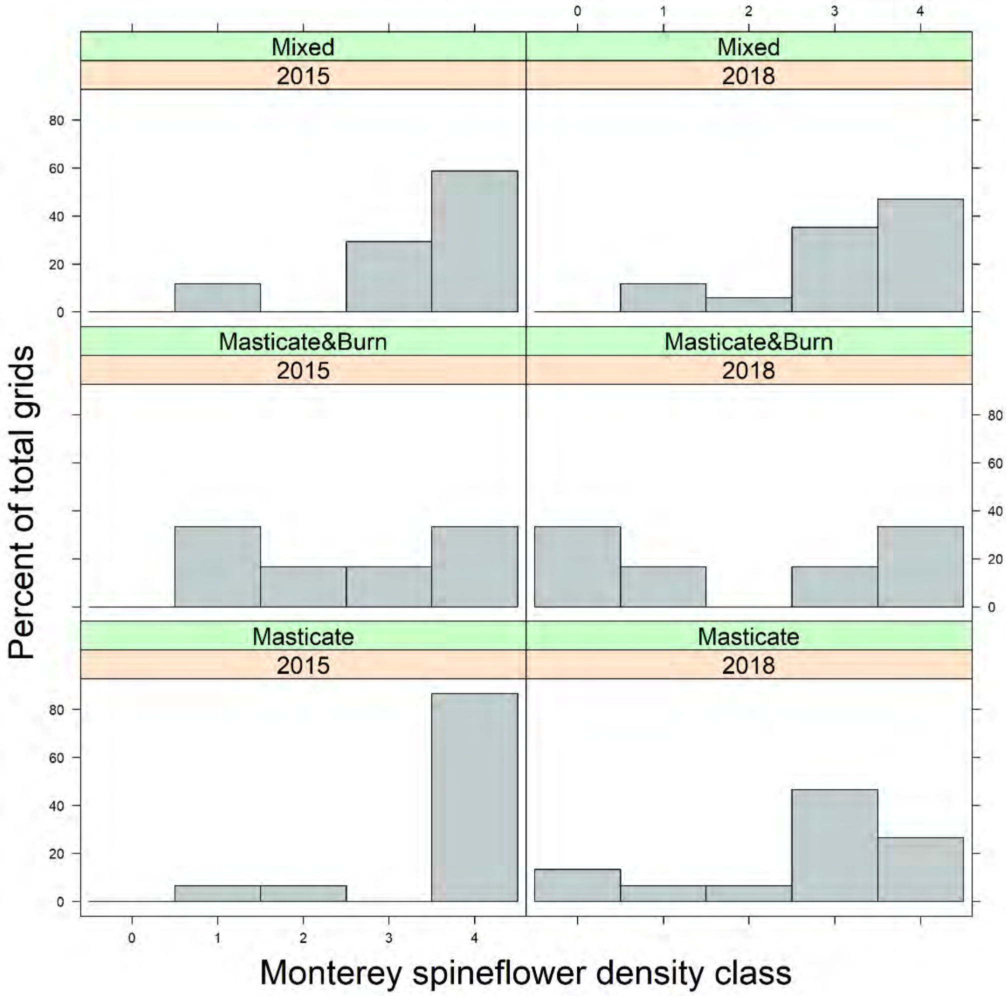

Figure 4-9. Percent of Total Grids for Monterey Spineflower Density Classes for All Treatment Types in Baseline (2015) and Year 1 (2018) in BLM Area B Subarea B Containment Lines.

4.4.6 Annual Grass Monitoring

Non-native annual grasses were observed and mapped within the Containment Lines and roadside fuel breaks of BLM Area B-3 West, Subarea A, and Subarea B (Appendix D; Figures D-3 through D-5). Estimated areas occupied by each density class are summarized in Table 4-4. BLM Area B-3 West and Subarea B annual grass cover increased between Baseline and Year 1, while Subarea A decreased. The density class with the largest areal extent in the BLM Area B-3 West was density class 3 (>25% cover) and comprised an area of approximately 14.61 acres. The density class with the largest areal extent in the BLM Area B Subarea A Containment Line was density class 3 and comprised an area of approximately 19.73 acres. The density class with the largest areal extent in the BLM Area B Subarea B Containment Line was density class 2 (6-25% cover) and comprised an area of approximately 15.64 acres.

Table 4-4. Estimated Area Occupied (Acres) by Annual Grasses in Year 1 Surveys.

Cover Class	Baseline BLM Area B-3 West (acres)	Year 1 BLM Area B-3 West (acres)	Baseline BLM Area B Subarea A Containment Line (acres)	Year 1 BLM Area B Subarea A Containment Line (acres)	Baseline BLM Area B Subarea B Containment Line (acres)	Year 1 BLM Area B Subarea B Containment Line (acres)
1 (Low) = 1 – 5% Cover	22.61	9.25	22.12	3.38	3.56	14.61
2 (Medium) = 6 – 25% Cover	1.98	3.98	4.76	2.35	7.31	15.64
3 (High) = > 25% Cover	2.24	14.61	17.05	19.73	8.94	10.03
Total Acreage	**26.83**	**27.84**	**43.93**	**25.46**	**19.81**	**40.28**

4.4.7 Invasive and Non-Native Species Monitoring

None of the Year 1 Units were observed as having iceplant, French broom, or pampas grass.

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5 YEAR 3 VEGETATION SURVEYS: UNITS 5A, 9, 23, AND 28

5.1 Introduction

Year 3 Units included the entirety of Units 5A, 9, 23, and 28 (see Figure 3-1). These Units were masticated in 2015. Unit 23N was initially masticated in 2011 to support a planned prescribed burn and re-masticated during the larger effort to clear MEC from the remainder of Unit 23 to the south in 2015. Baseline monitoring for Units 5A, 9, and 28 was conducted in 2011 and included meandering transect surveys to map areas of occurrence of HMP herbaceous species; density monitoring for the HMP annual species sand gilia, seaside bird's-beak, and Monterey spineflower; transect surveys to sample shrub composition in the maritime chaparral; and annual grass monitoring (Tetra Tech and EcoSystems West, 2012). Baseline shrub transect monitoring was conducted for Unit 23 in 2003, while Baseline density monitoring in Unit 23 for the HMP annual species sand gilia, seaside bird's-beak, and Monterey spineflower was conducted in 2011 (MACTEC, 2004; Tetra Tech and EcoSystems West, 2012).

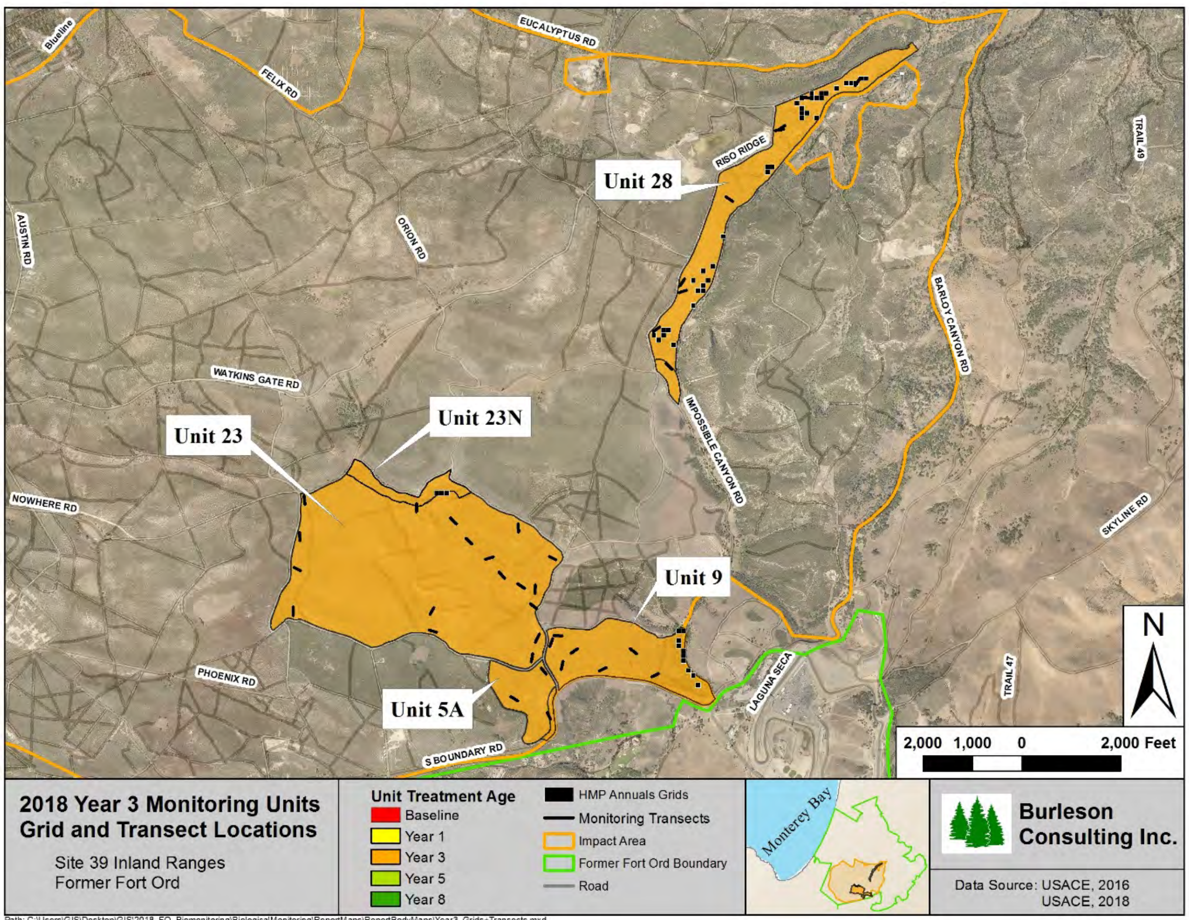

Figure 5-1. Units 5A, 9, 23, and 28 HMP Annuals Grids and HMP Shrub Transects Surveyed for Year 3 in 2017.

5.2 Units 5A, 9, 23, and 28: Setting

Unit 5A encompasses an area of 33 acres (see Figure 5-1). The Unit is located south of Darwin Road and is bordered by South Boundary Road to the east and south. Unit 5A is contiguous with Unit 5 to the west. The terrain is mostly gently rolling to moderately steep. In pre-treatment condition, Unit 5A was dominated by mature maritime chaparral vegetation varying considerably in physiognomy and species composition. The majority of chaparral vegetation was very dense, particularly in the south and central portions of the Unit with limited clearings. The chaparral shrubs ranged in height from low (3-4 feet) to tall (12-15 feet), and shrub density ranged from relatively open, to essentially 100 percent areal cover. As in maritime chaparral throughout Fort Ord, shaggy-barked manzanita is the most characteristic dominant, and is 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.

Unit 9 encompasses an area of 77 acres (see Figure 5-1). This Unit is located at the south end of former Fort Ord. The terrain is mostly gently rolling to moderately steep. In pre-treatment condition, this Unit was vegetated primarily with mature maritime chaparral largely dominated by shaggy-barked manzanita. Other dominants sometimes include Hooker's manzanita, Toro manzanita, chamise, and black sage (*Salvia mellifera*). The far east end of Unit 9 is vegetated with coast live oak woodland, interspersed with smaller patches of maritime chaparral and intermediate habitat between the two.

Units 23 encompass an area of 367 acres (see Figure 5-1). These Units are located near the southern end of former Fort Ord. The terrain is gently rolling to locally steep. In pre-treatment condition, these Units were vegetated primarily with mature maritime chaparral largely dominated by shaggy-barked manzanita. Pond 54, a large vernal pool containing emergent vegetation and known to support federally threatened California tiger salamander (*Ambystoma californiense*), is in the northeastern corner of Unit 23, near the intersection of Nowhere Road and Orion Road.

Unit 28 encompasses an area of 103 acres (see Figure 5-1). This long narrow unit is delineated by a portion of Impossible Canyon as well as portions of the adjacent southeast-facing slopes of Riso Ridge and Tongue (Dallas) Ridge. The terrain is gently rolling to very steep. In pre-treatment condition, Unit 28 was vegetated primarily with mature maritime chaparral, but also included numerous areas of coast live oak woodland of various sizes. Toro manzanita is prevalent in this unit and was flagged to be omitted from fall 2015 mastication efforts. Localized erosion areas also occurred in this unit. Part of the northern end of this unit was burned in an accidental fire in 2003.

Collectively, these Units have rolling to steep topography. Arnold-Santa Ynez complex soil type is mapped in Units 5A, 9, 23, and 28 (USDA, 2018). Xerorthents, dissected area mapped in small portions on the eastern edges of Units 9 and 23. The distribution of soils in the Year 3 survey areas and characteristics of these soils are presented in Table 2-1.

5.3 Units 5A, 9, 23, and 28: Methods

Following methods outlined in the Revised Protocol (Tetra Tech and EcoSystems West, 2015b) and Section 2 of this report, the 2018 Year 3 follow-up monitoring in Units 5A, 9, 23, and 28 consisted of the following activities:

- Density monitoring for three HMP annual species: sand gilia, seaside bird's-beak, and Monterey spineflower. This survey effort was conducted to evaluate how the density of these species responded to treatment.
- Macroplot surveys for three HMP annual species: sand gilia, seaside bird's-beak, and Monterey spineflower. This survey effort was conducted to assess changes in the distribution of HMP annual species in response to treatment and evaluate what factors influence those changes.

- Repeated sampling of transects that were monitored in 2003 and 2011 surveys (MACTEC, 2004; Tetra Tech and EcoSystems West, 2012). This survey effort was conducted to assess shrub species composition of the sensitive maritime chaparral community after treatment.

- Mapping of non-native annual grasses. This survey effort was conducted to assess expansion or contraction of these populations over time after disturbance.

- Mapping of invasive species, including iceplant, pampas grass, and French broom, where encountered. This survey effort was conducted to support ongoing management.

5.4 Units 5A, 9, 23, and 28: Results and Discussion

Burleson surveyed 50 HMP monitoring grids in the Year 3 Units, with 10 grids in Unit 9, 3 grids in Unit 23, and 37 grids in Unit 28. No HMP monitoring grids were surveyed in Unit 5A as no HMP annuals were found in baseline surveys in this Unit (Tetra Tech and EcoSystems West, 2012). Maps of survey grids for the sampled Units are provided in Appendix B (Figures B-19 through B-27). All HMP grids in these Units have been masticated.

5.4.1 Sand Gilia

Sand gilia was present in Unit 28, but not in Units 23 or 9 (Figure 5-2, B-21, B-24 and B-27). The frequency of occurrence in monitored plots in Unit 28 was 35% in 2011 (13 of 37 grids), 76% in 2016 (28 of 37 grids) and 59% in 2018 (22 of 37 grids).

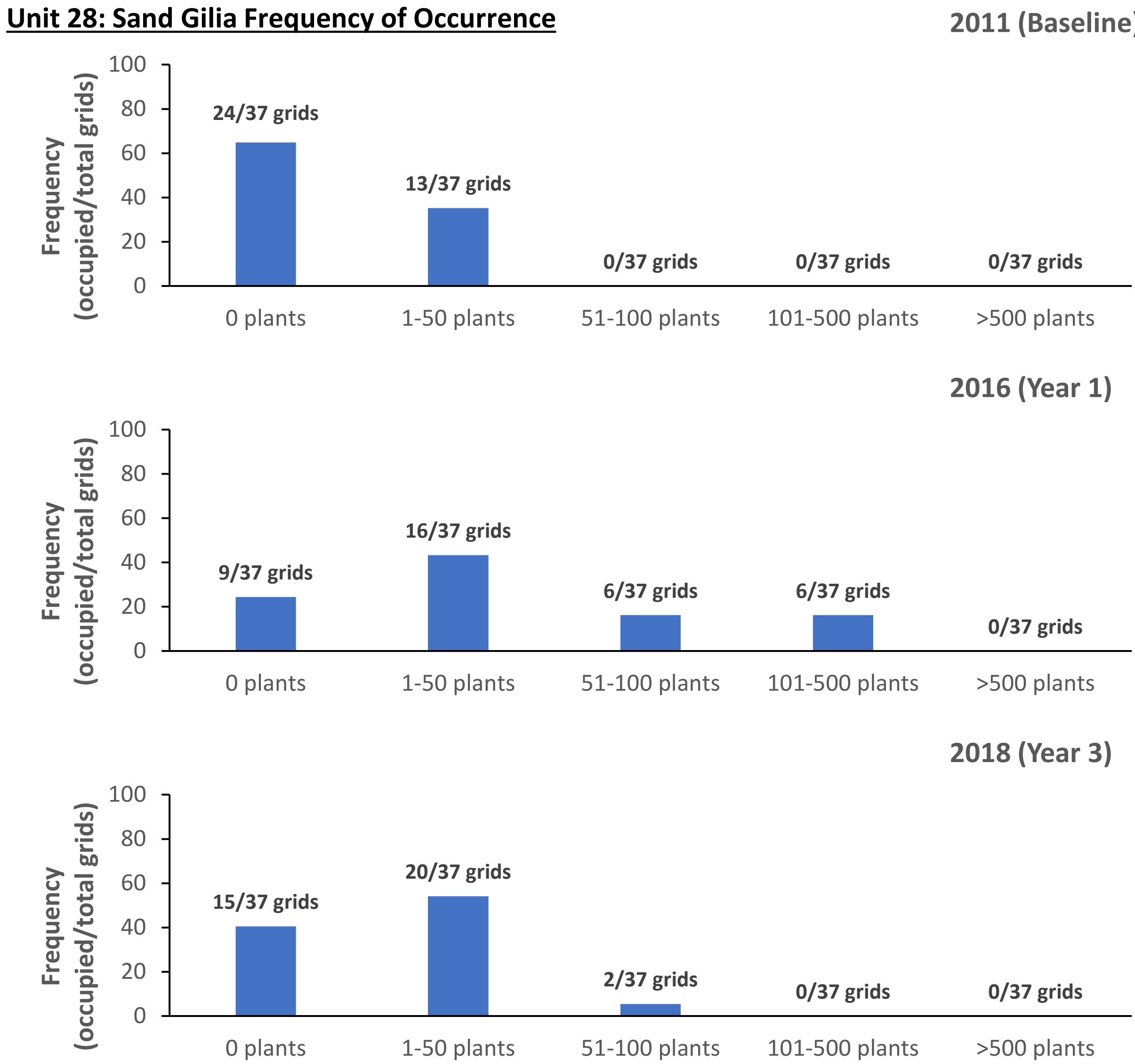

Figure 5-2. Unit 28 Sand Gilia Occurrence in Surveyed Grids (*n*=37) Between Baseline (2011) and Year 3 (2018).

5.4.2 Seaside Bird's-Beak

Seaside bird's-beak was not present in any Year 3 Unit (Figures B-20, B-23 and B-26).

5.4.3 Monterey Spineflower

Monterey spineflower was present in all Year 3 Units (Figures 5-3 through 5-5; Figures B-19, B-22 and B-25). The frequency of occurrence in monitored plots in Unit 9 was 100% in 2011 (10 of 10 grids), 90% in 2016 (9 of 10 grids), and 70% in 2018 (7 of 10 grids). The frequency of occurrence in monitored plots in Unit 23 was 100% in 2011 (3 of 3 grids), 100% in 2016 (3 of 3 grids), and 100% in 2018 (3 of 3 grids). The frequency of occurrence in monitored plots in Unit 28 was 100% in 2011 (37 of 37 grids), 97% in 2016 (36 of 37 grids), and 89% in 2018 (33 of 37 grids).

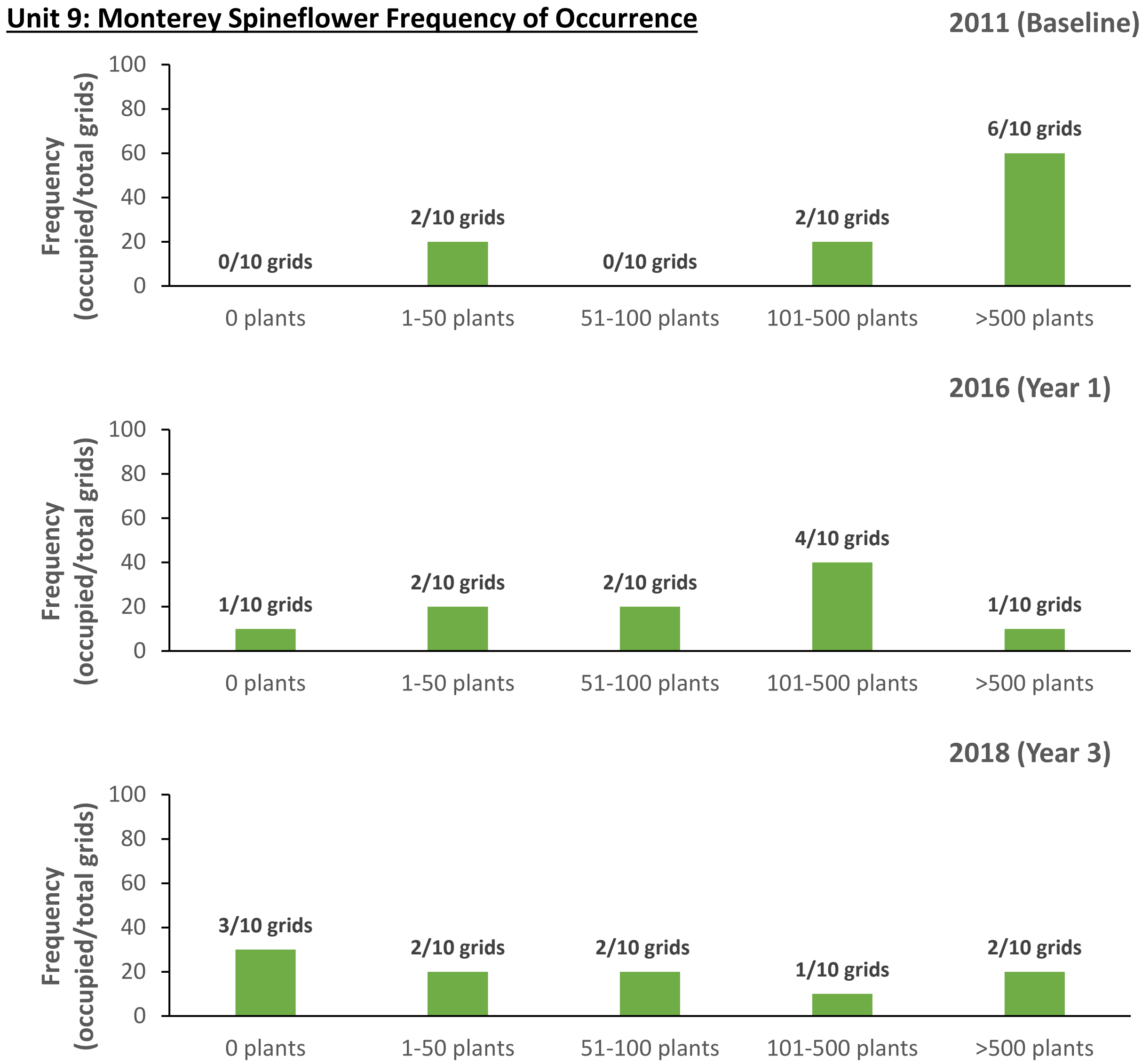

Figure 5-3. Unit 9 Monterey Spineflower Occurrence in Surveyed Grids (*n*=10) Between Baseline (2011) and Year 3 (2018).

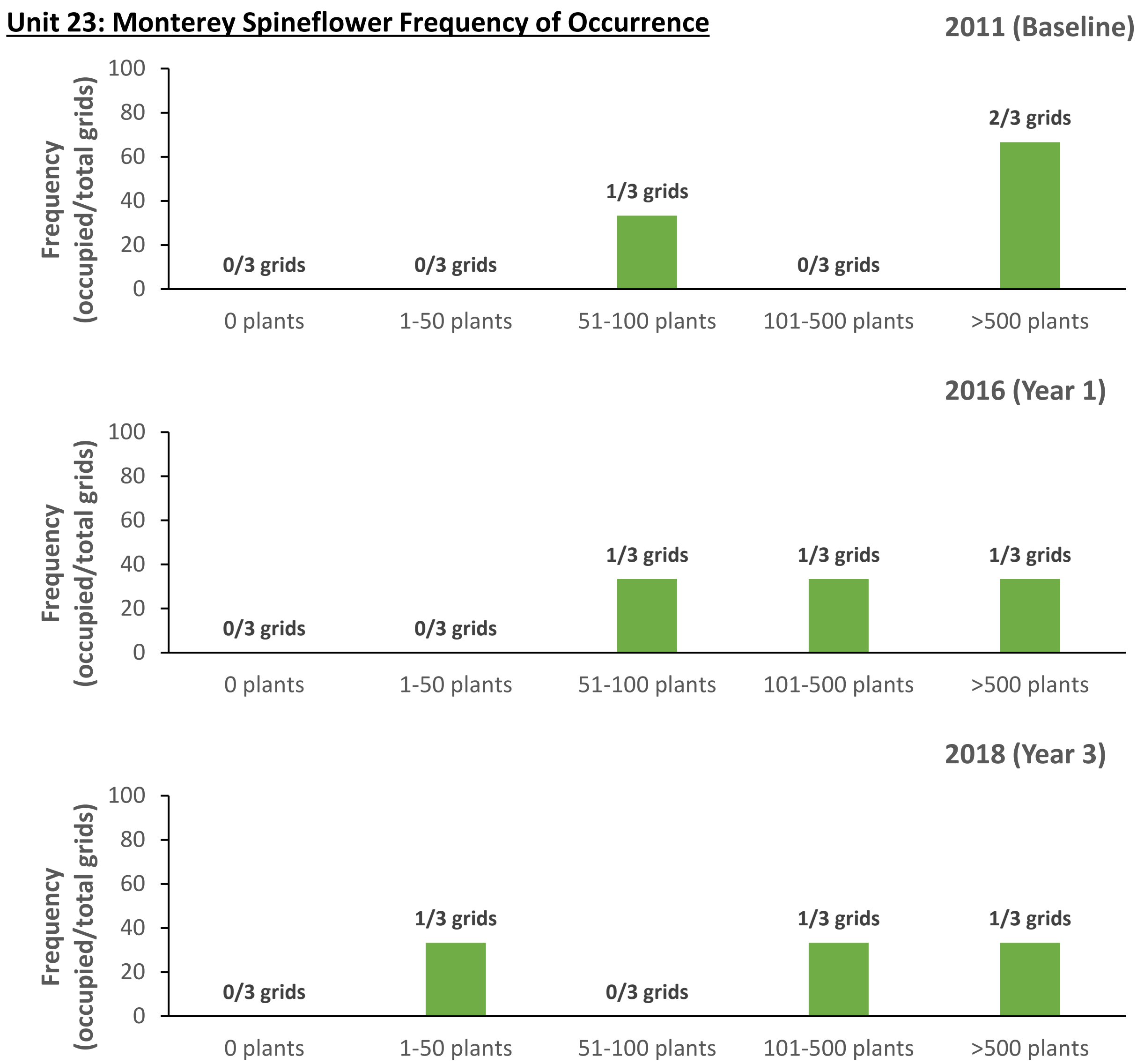

Figure 5-4. Unit 23 West Monterey Spineflower Occurrence in Surveyed Grids (*n*=3) Between Baseline (2011) and Year 3 (2018).

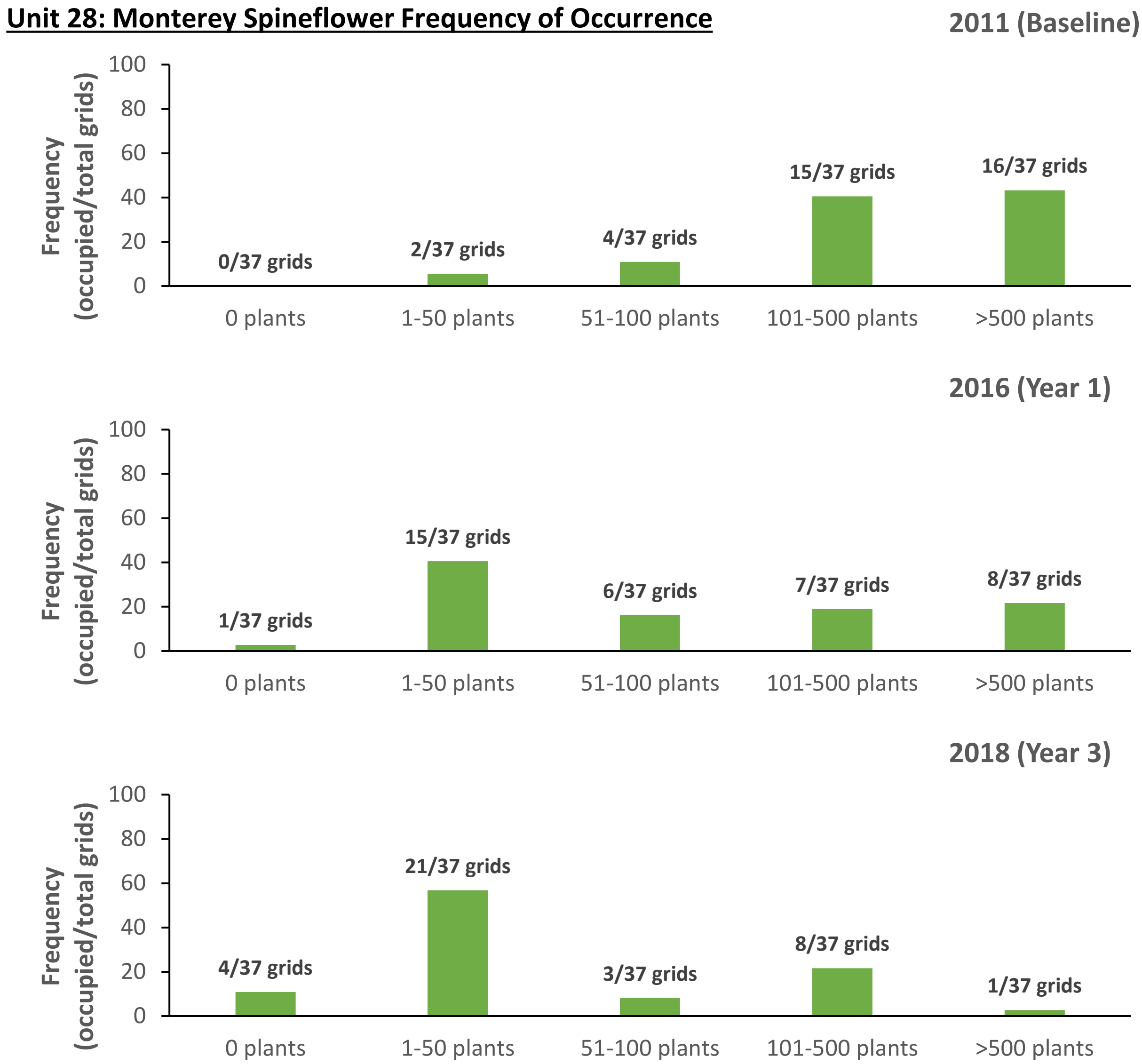

Figure 5-5. Unit 28 Monterey Spineflower Occurrence in Surveyed Grids (*n*=37) Baseline (2011) and Year 3 (2018).

5.4.4 Yadon's Piperia

Yadon's piperia was not observed in any Year 3 Unit in 2018.

5.4.5 Effect of Treatment on HMP Density

The effect of treatment type on HMP annuals density could not be evaluated in the Year 3 Units since these areas were masticated only, with no prescribed burns.

5.4.6 Shrub Transect Monitoring

Shrub transects were sampled in Units 5A (*n*=3), 9 (*n*=7), 23 (*n*=20), and 28 (*n*=9) in 2018 (Appendix C; Figures C-4 through C-7). Baseline transects were collected in 2011 for Units 5A, 9, and 28, and in 2003 for Unit 23 (Tetra Tech and EcoSystems West, 2011; MACTEC, 2004). Additionally, three Baseline transects were collected in Units 5A and 9 in 2005 as part of the South Boundary Road Vegetation Clearance Project (MACTEC, 2005). When transects were collected in 2018 but not in another year, those transects were not included in analyses. This reduced effective sample sizes for Units 5A (*n*=2), 9 (*n*=5), and 23 (*n*=17).

The temporal patterns of broad scale community response to mastication were generally congruent with past observations of the neighboring Units in the MRA (Tetra Tech and EcoSystems West, 2011 through 2015b; Burleson, 2016 through 2018). Community structure parameters in all Year 3 Units changed through time similarly in most cases.

Mixed-design ANOVAs were conducted to compare the effect of Unit and Age on mean percent cover, species richness, species evenness, and species diversity for Year 3 Units. The changes in mean percent cover and species richness were not significantly different between Units, the changes in species evenness and species diversity were significantly different between Units, all metrics were significantly different through time except for species evenness, and there were no significant interactions between Unit and Age for any metric (Table 5-1).

Table 5-1. Mixed-design ANOVA results for Units 5A, 9, 23, and 28. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Unit	0.670	0.560	2.78	0.059	3.80	0.021*	5.57	0.038*
Age	138	1.46e-12*	15.6	4.52e-04*	0.004	0.953	5.53	0.026*
Unit*Age	2.79	0.058	1.48	0.241	0.498	0.686	0.941	0.434

Year 3 Units significantly decreased in shrub cover between Baseline and 2018, three years after mastication (Figures 5-6 through 5-9; Table 5-1). Unit 5A cover decreased from 135% in 2011 to 73.3%. Unit 9 cover decreased from 113% in 2011 to 74.9%. Unit 23 cover decreased from 111% in 2003 to 80.7%. Unit 28 decreased from 107% in 2011 to 70.4%.

Year 3 Units were significantly different in species richness between Baseline and 2018, three years after mastication, where Unit 5A decreased and all other Year 3 Units increased (Figures 5-6 through 5-9; Table 5-1). Unit 5A richness decreased from 8.0 species in 2011 to 7.5 species by 2018. Unit 9 richness increased from 5.2 species in 2011 to 8.8 species by 2018. Unit 23 richness increased from 7.3 species in 2003 to 10 species by 2018. Unit 28 richness increased from 6.2 species in 2011 to 9.0 species by 2018.

Year 3 Units were not significantly different in species evenness between Baseline and 2018, though Units 5A and 9 decreased slightly and Units 23 and 28 increased slightly (Figures 5-6 through 5-9; Table 5-1). Unit 5A evenness decreased from 0.77 in 2011 to 0.71 by 2018. Unit 9 evenness decreased from 0.56 in 2011 to 0.54 by 2018. Unit 23 evenness increased from 0.68 in 2003 to 0.69 by 2018. Unit 28 increased from 0.65 in 2011 to 0.71 by 2018.

Year 3 Units were significantly different in species diversity between their Baseline and 2018, three years after mastication (Figures 5-6 through 5-9; Table 5-1). Unit 5A diversity decreased from 1.55 in 2011 to 1.43 by 2018. Unit 9 diversity increased from 0.911 in 2011 to 1.17 by 2018. Unit 23 diversity increased from 1.33 in 2003 to 1.62 by 2018. Unit 28 diversity increased from 1.16 in 2011 to 1.51 by 2018.

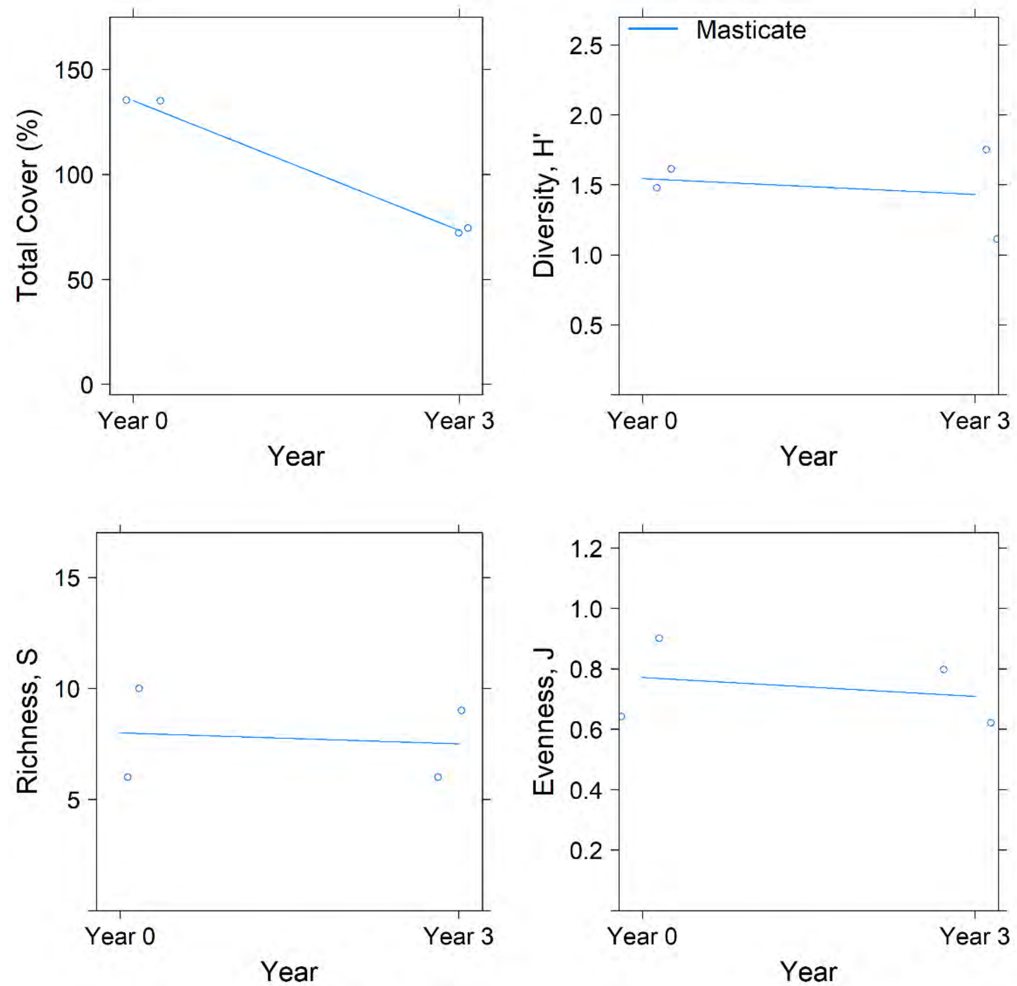

Figure 5-6. Unit 5A Community Structure from Baseline (2011) to Three Years After Mastication (2018). Two masticated transects were analyzed in Unit 5A.

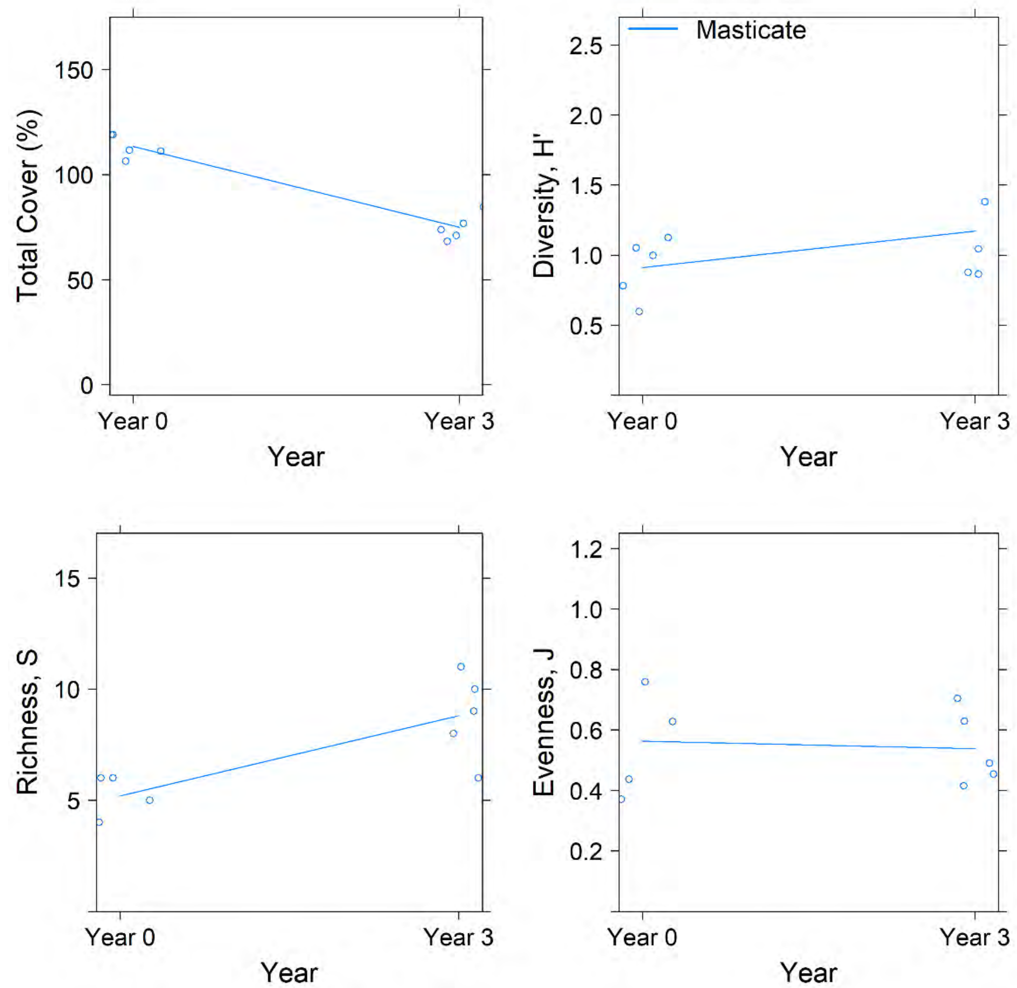

Figure 5-7. Unit 9 Community Structure from Baseline (2011) to Three Years After Mastication (2018). Five masticated transects were analyzed in Unit 9.

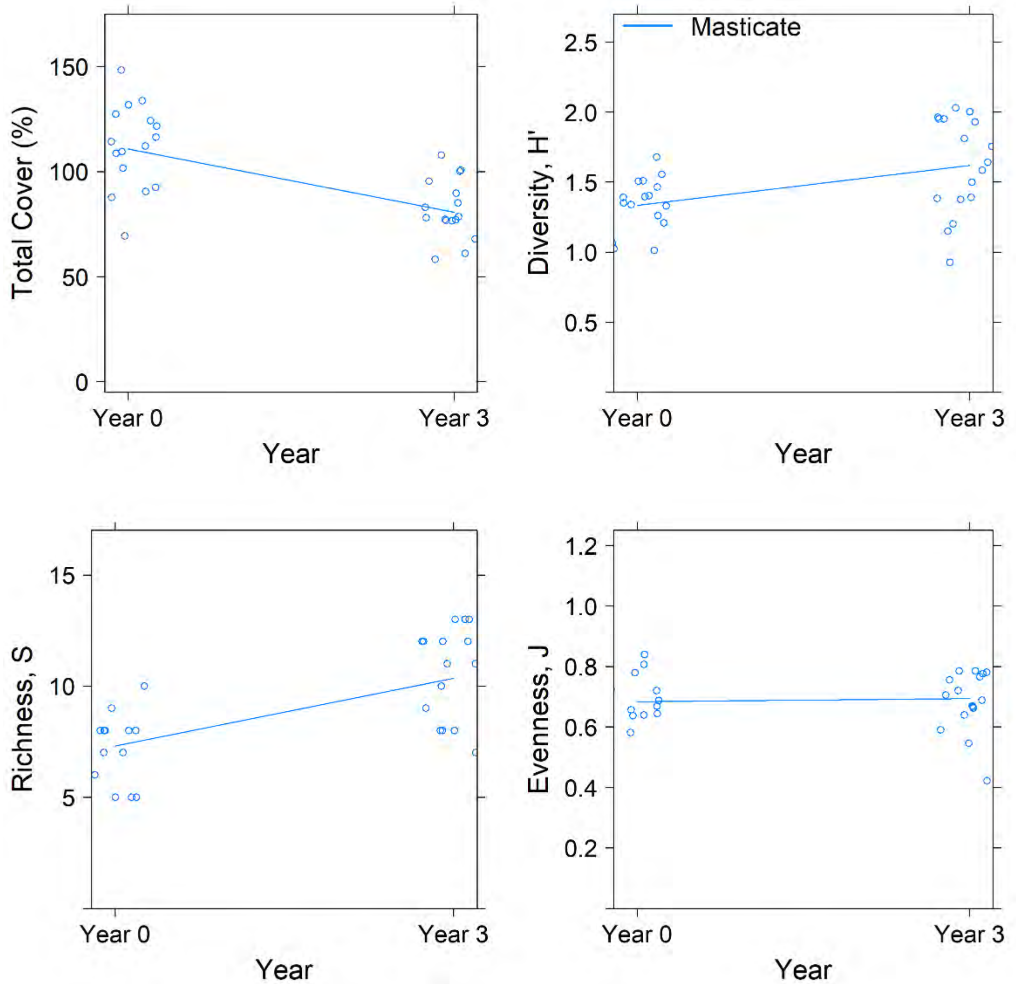

Figure 5-8. Unit 23 Community Structure from Baseline (2003) to Three Years After Mastication (2018). Seventeen masticated transects were analyzed in Unit 23.

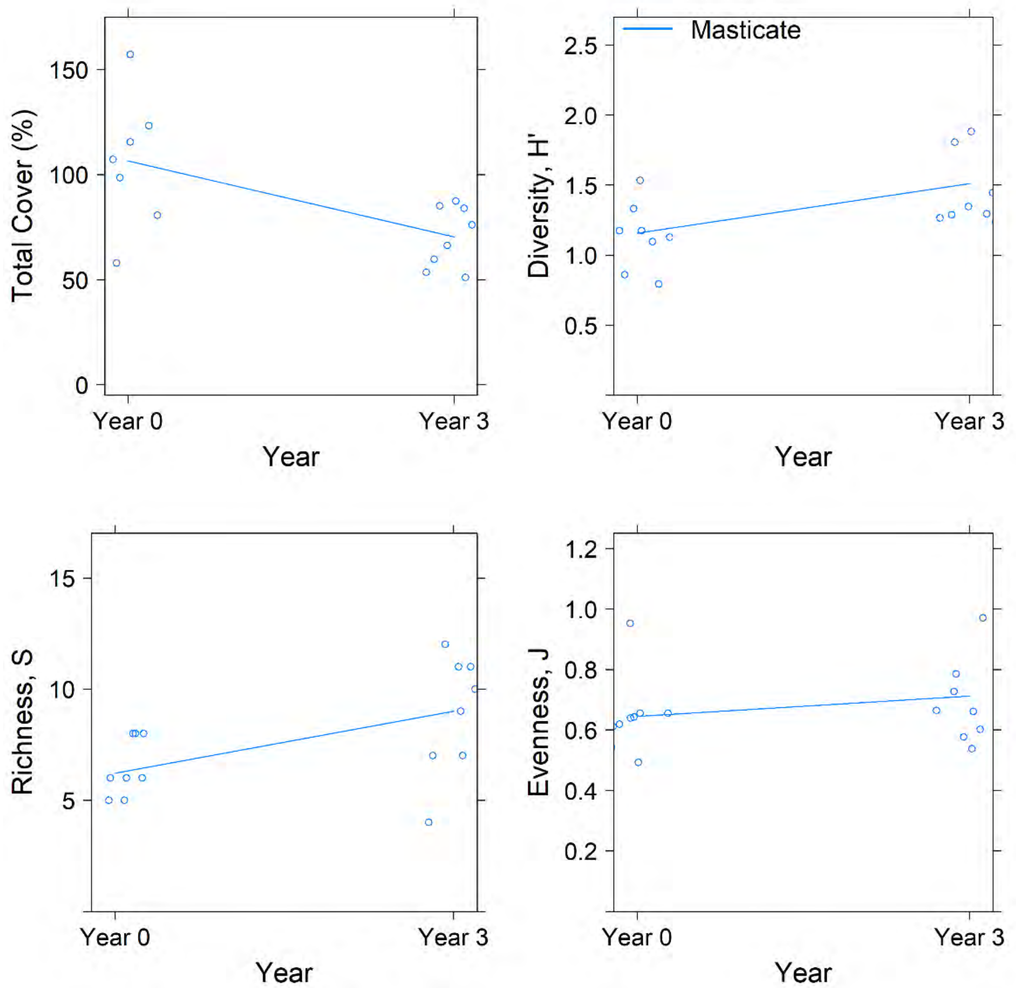

Figure 5-9. Unit 28 Community Structure from Baseline (2011) to Three Years After Mastication (2018). Nine masticated transects were analyzed in Unit 28.

Bare ground and herbaceous cover changed through time similarly for Year 3 Units (Figure 5-10 through 5-13). Mixed-design ANOVAs were conducted to compare the effect of Unit and Age on mean percent bare ground and mean percent herbaceous cover. The changes in bare ground and herbaceous cover were not significantly different between Units, were significantly different through time, and there was an interaction between Unit and Age for bare ground cover (Table 5-2). These results suggest that bare ground and herbaceous cover responded similarly to mastication in the Year 3 Units.

Table 5-2. Mixed-design ANOVA results for Units 5A, 9, 23, and 28 bare ground and herbaceous cover. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*p*
Unit	1.03	0.396	1.87	0.156
Age	96.7	9.63e-11*	7.83	0.009*
Unit*Age	4.64	0.009*	1.88	0.156

Year 3 Units significantly increased in bare ground between their Baseline and 2018, three years after mastication (Figures 5-10 through 5-13; Table 5-2). Unit 5A bare ground increased from 1.2% in 2011 to 37% by 2018. Unit 9 bare ground increased from 3.2% in 2011 to 31% by 2018. Unit 23 bare ground increased from 14% in 2003 to 27% by 2018. Unit 28 bare ground increased from 13% in 2011 to 34% by 2018.

Year 3 Units significantly increased in herbaceous cover between their Baseline and 2018, three years after mastication (Figures 5-10 through 5-13; Table 5-2). Unit 5A herbaceous cover increased from 0.0% in 2011 to 3.6% by 2018. Unit 9 herbaceous cover increased from 0.0% in 2011 to 3.2% by 2018. Unit 23 herbaceous cover increased from 1.8% in 2003 to 12% by 2018. Unit 28 herbaceous cover increased from 4.1% in 2011 to 9.5% by 2018.

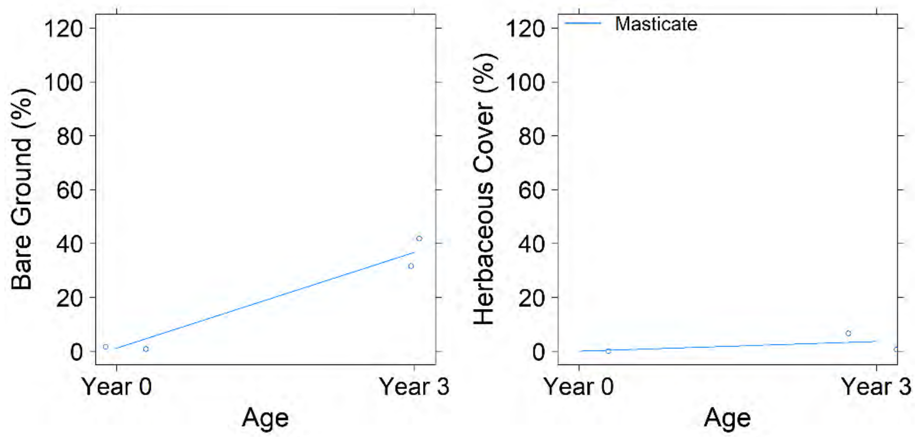

Figure 5-10. Unit 5A Bare Ground and Herbaceous Cover Between Baseline (2011) and Year 3 (2018). Two masticated transects were analyzed in Unit 5A.

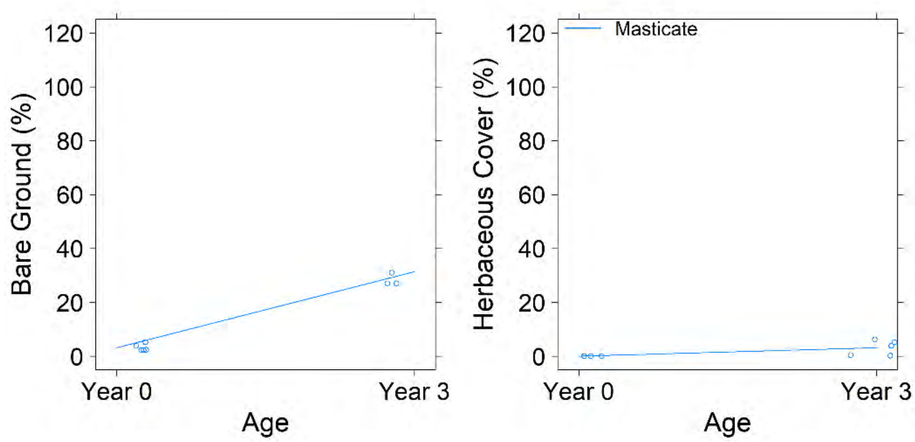

Figure 5-11. Unit 9 Bare Ground and Herbaceous Cover from baseline (2011) and Year 3 (2018). Five masticated transects were analyzed in Unit 9.

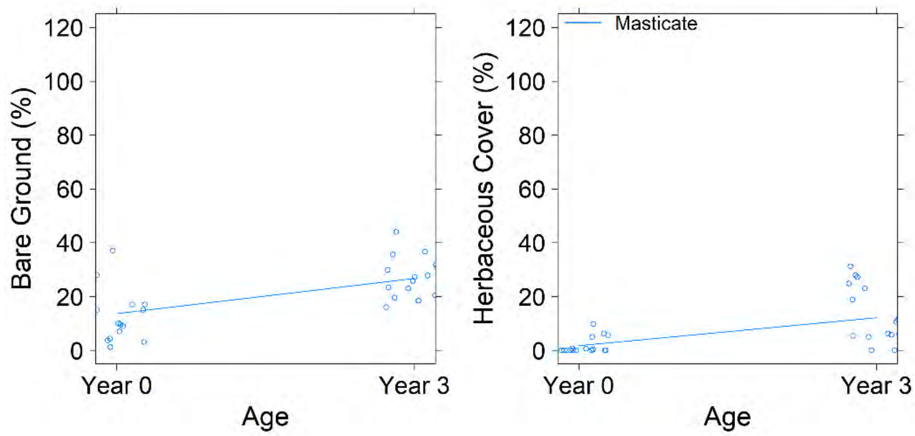

Figure 5-12. Unit 23 Bare Ground and Herbaceous Cover from baseline (2003) and Year 3 (2018). Seventeen masticated transects were analyzed in Unit 23.

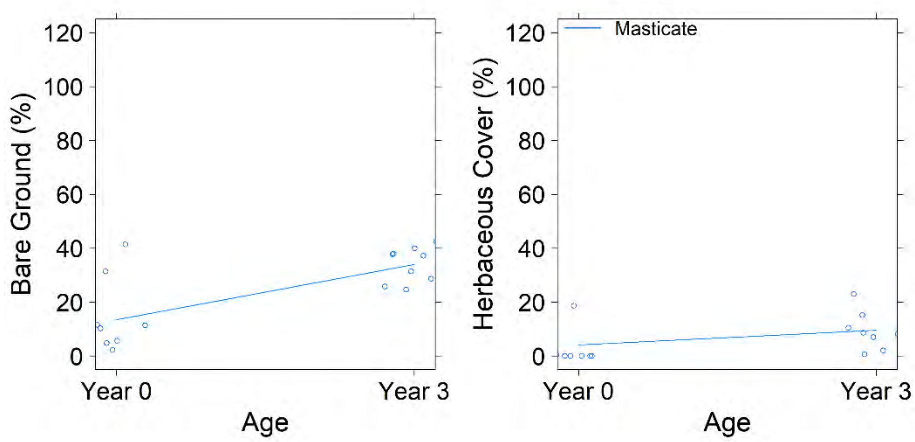

Figure 5-13. Unit 28 Bare Ground and Herbaceous Cover from baseline (2011) and Year 3 (2018). Nine masticated transects were analyzed in Unit 28.

While the community structure parameters were similar in some cases among Year 3 Units, community composition differed between Units. Community composition also differed between years. Burleson conducted PERMANOVA to examine differences in community composition (Table 5-3). These results suggest that overall community composition was significantly different between Units and Age, with no significant interaction. This indicates that the types and abundance of species present within each Unit were different, and changed after treatment. Rank abundance curves illustrate the species composition in each Unit through time (Figures 5-14 through 5-17).

Table 5-3. Two-way PERMANOVA results for Units 5A, 9, 23, and 28 community compositions, based on Bray-Curtis distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	12.1	1.00e-04*
Unit	6.91	3.00e-04*
Unit*Age	1.00	0.401

While Year 3 Units have different overall compositions, they were all dominated by shaggy-barked manzanita during their Baseline year (Figures 5-14 through 5-17; c_{5A}=59%, c_9=78%, c_{23}=45%, and c_{28}=50%). By Year 3, Units 5A and 9 were still dominated by shaggy-barked manzanita (c_{5A}=35%, c_9=48%), Unit 23 was dominated by chamise (c_{23}=29%), and Unit 28 was co-dominated by shaggy-barked manzanita and chamise ($c_{shaggy\text{-}barked\ manzanita}$=21%, $c_{chamise}$=18%).

The HMP shrub species Hooker's manzanita and Monterey ceanothus were present in all Year 3 Units, sandmat manzanita was present in all Year 3 Units except Unit 9, and Toro manzanita was present in Units 5A and 9.

HMP species have generally recovered at a slower rate than the dominant species in all Year 3 Units (Figures 5-18 through 5-21). Monterey ceanothus is recovering in all Year 3 Units. Sandmat manzanita is recovering in Units 5A and 28 but was not observed after mastication in Unit 23 where it was observed in Baseline. Toro manzanita was not observed in Units 5A or 9 after mastication. Hooker's manzanita was observed in all Year 3 Units in Baseline; however, it wasn't present on transects in any Unit except Unit 23.

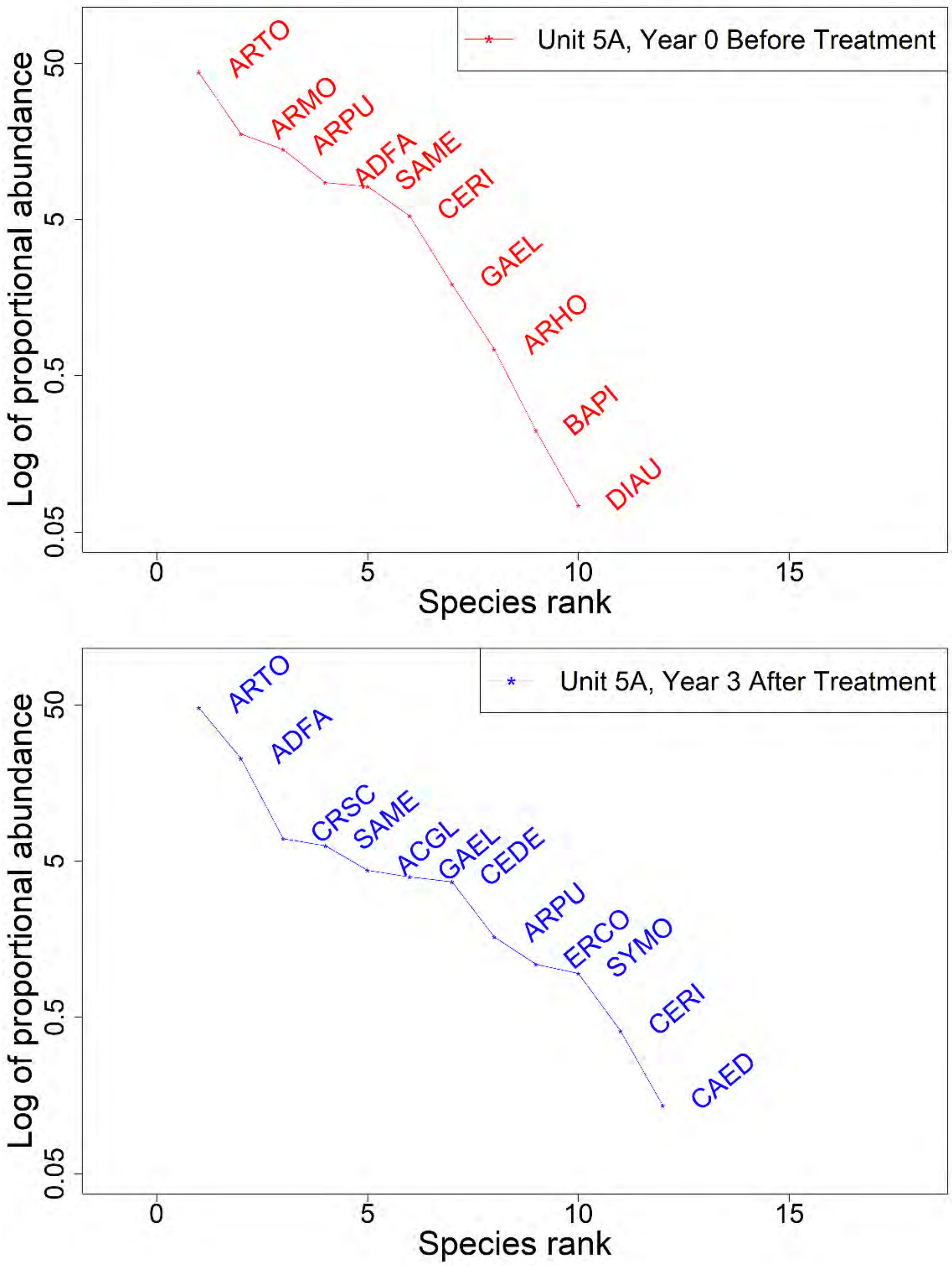

Figure 5-14. Unit 5A Rank Abundance Curves Between Pre-mastication (2011) and Year 3 (2018). Note that the y-axis is log-10 scale. Two masticated transects were analyzed in Unit 5A.

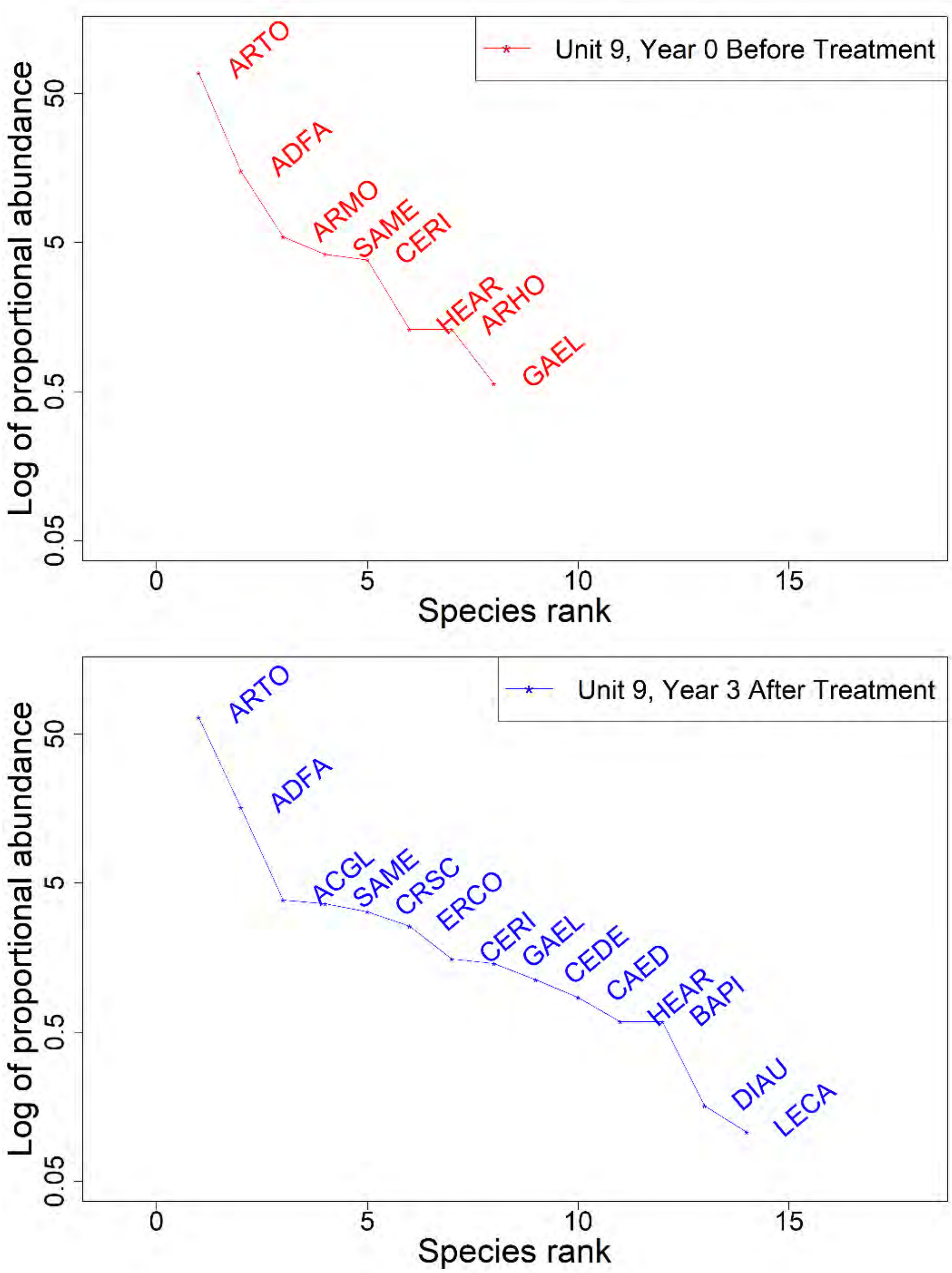

Figure 5-15. Unit 9 Rank Abundance Curves Between Pre-mastication (2011) and Year 3 (2018). Note that the y-axis is log-10 scale. Five masticated transects were analyzed in Unit 9.

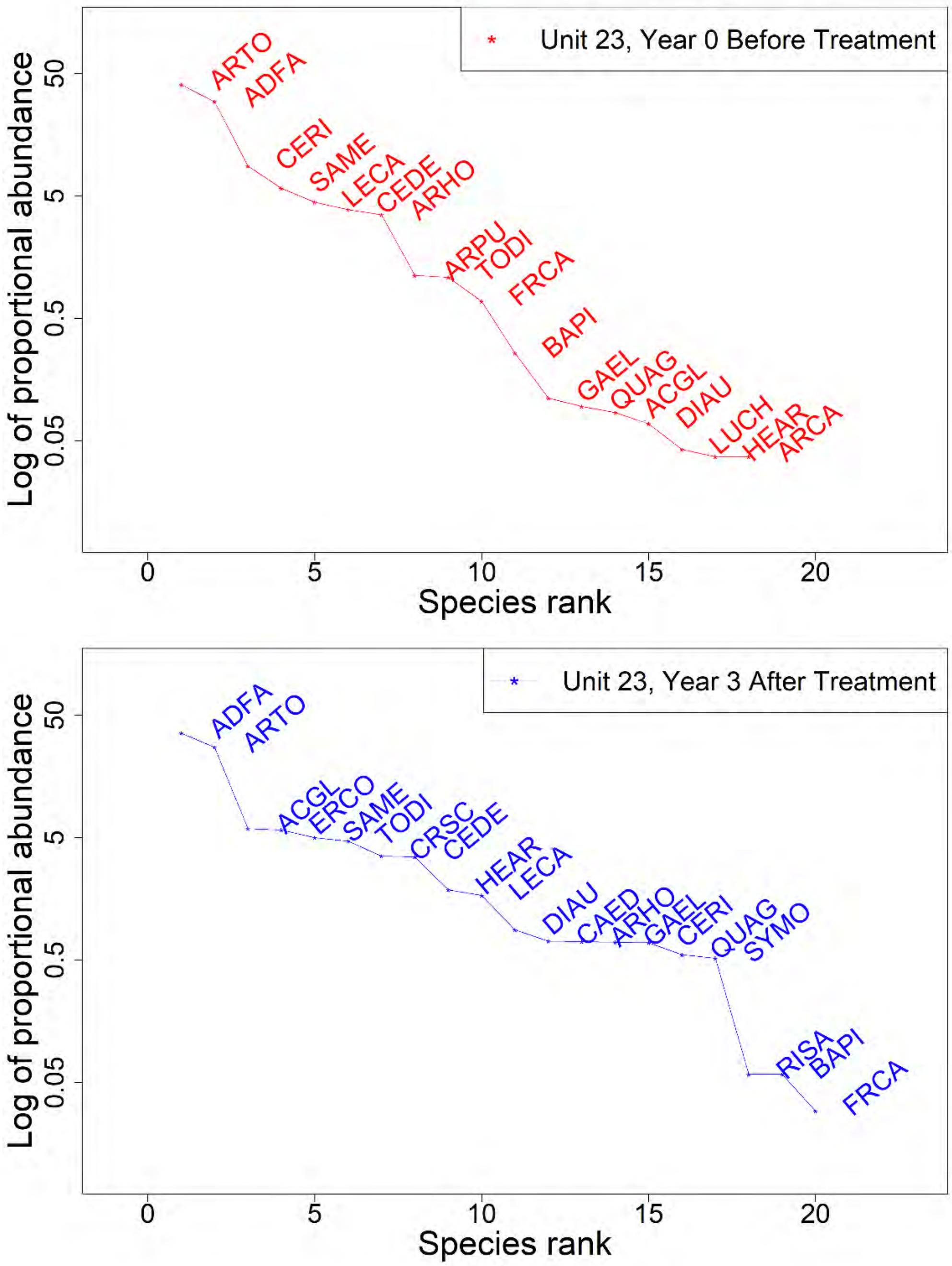

Figure 5-16. Unit 23 Rank Abundance Curves Between Pre-mastication (2003) and Year 3 (2018). Note that the y-axis is log-10 scale. Seventeen masticated transects were analyzed in Unit 23.

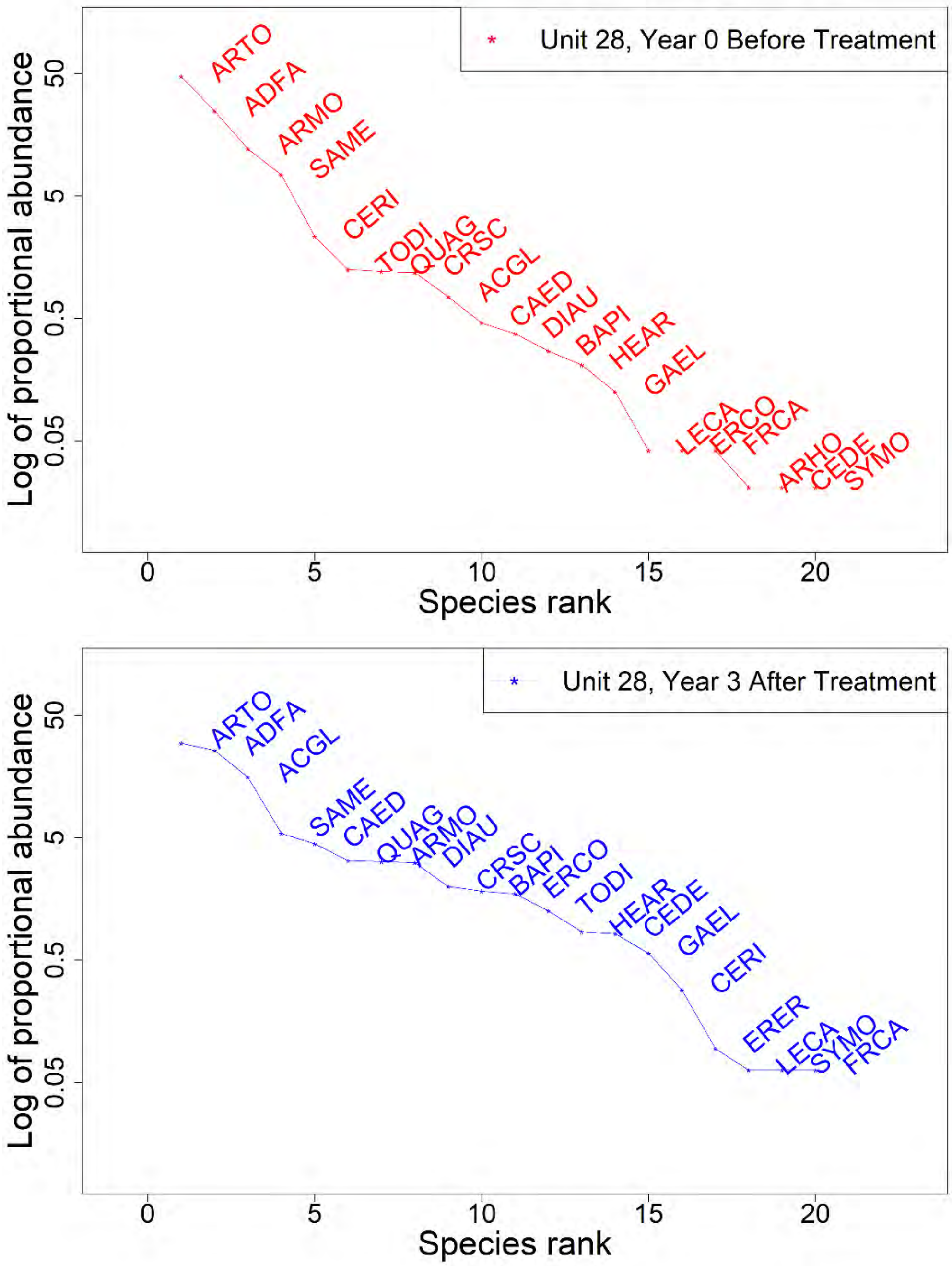

Figure 5-17. Unit 28 Rank Abundance Curves Between Pre-mastication (2011) and Year 3 (2018). Note that the y-axis is log-10 scale. Nine masticated transects were analyzed in Unit 28.

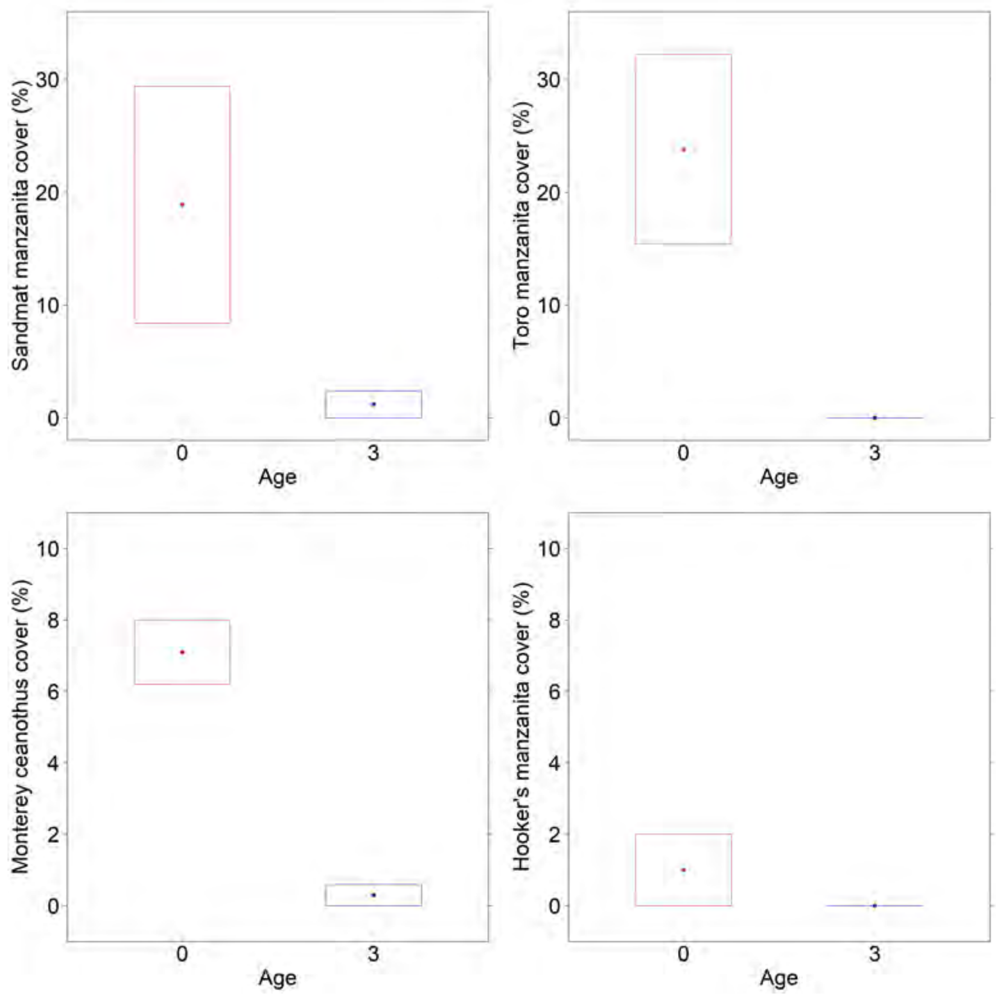

Figure 5-18. Unit 5A HMP Shrub Species Cover Between Baseline (2011) and Year 3 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Two masticated transects were analyzed in Unit 5A.

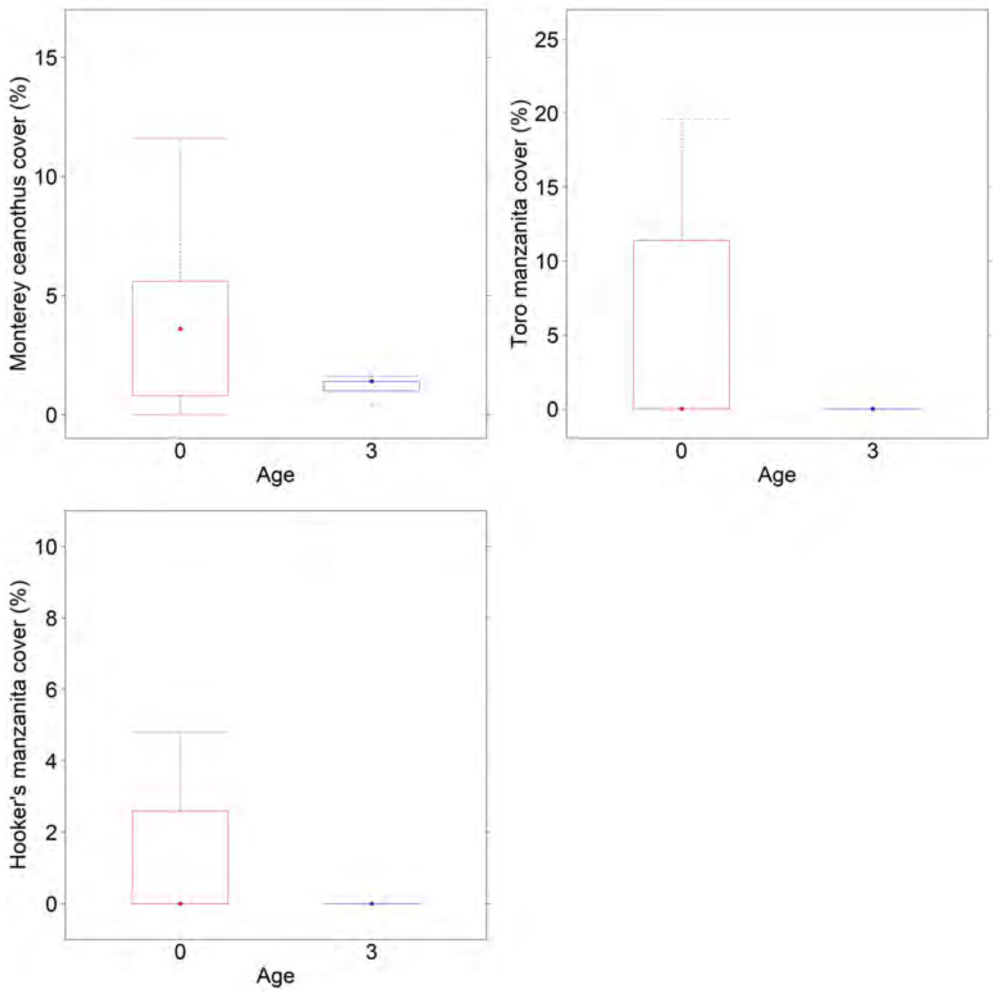

Figure 5-19. Unit 9 HMP Shrub Species Cover Between Baseline (2011) and Year 3 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Five masticated transects were analyzed in Unit 9.

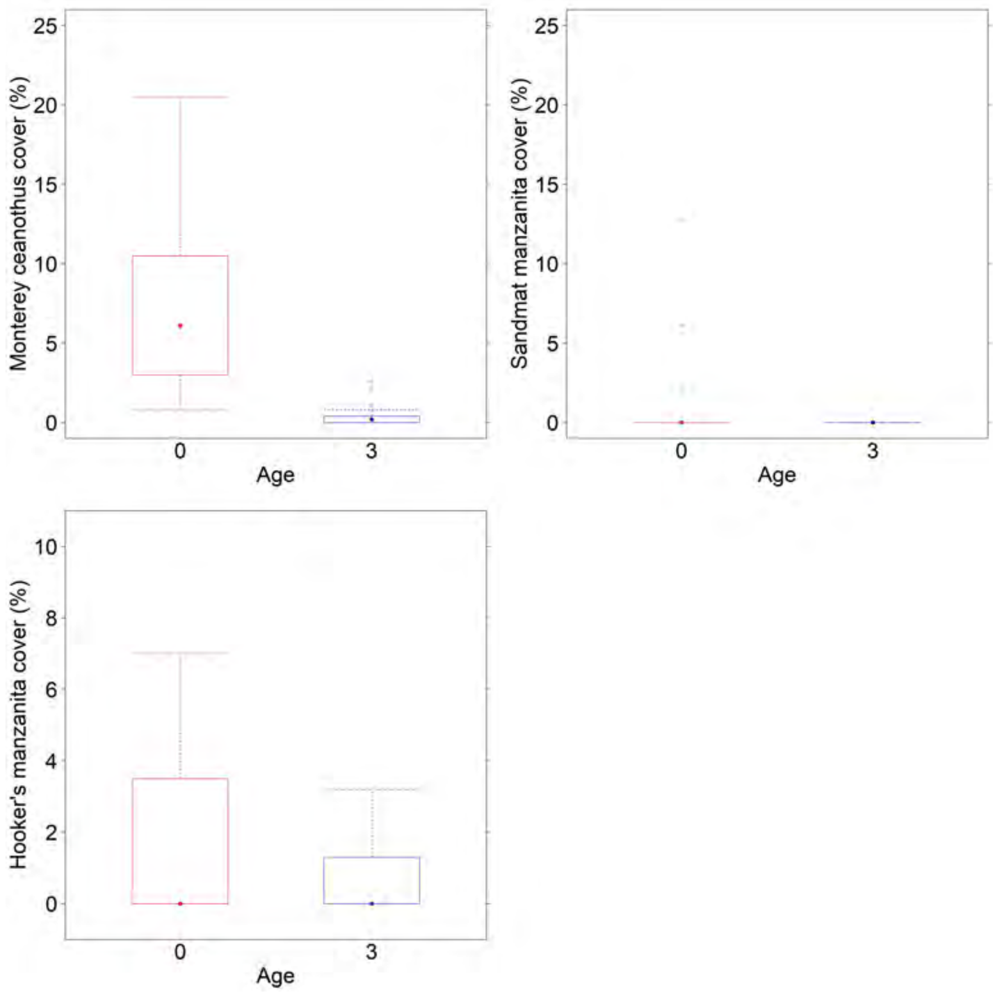

Figure 5-20. Unit 23 HMP Shrub Species Cover Between Baseline (2003) and Year 3 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Seventeen masticated transects were analyzed in Unit 23.

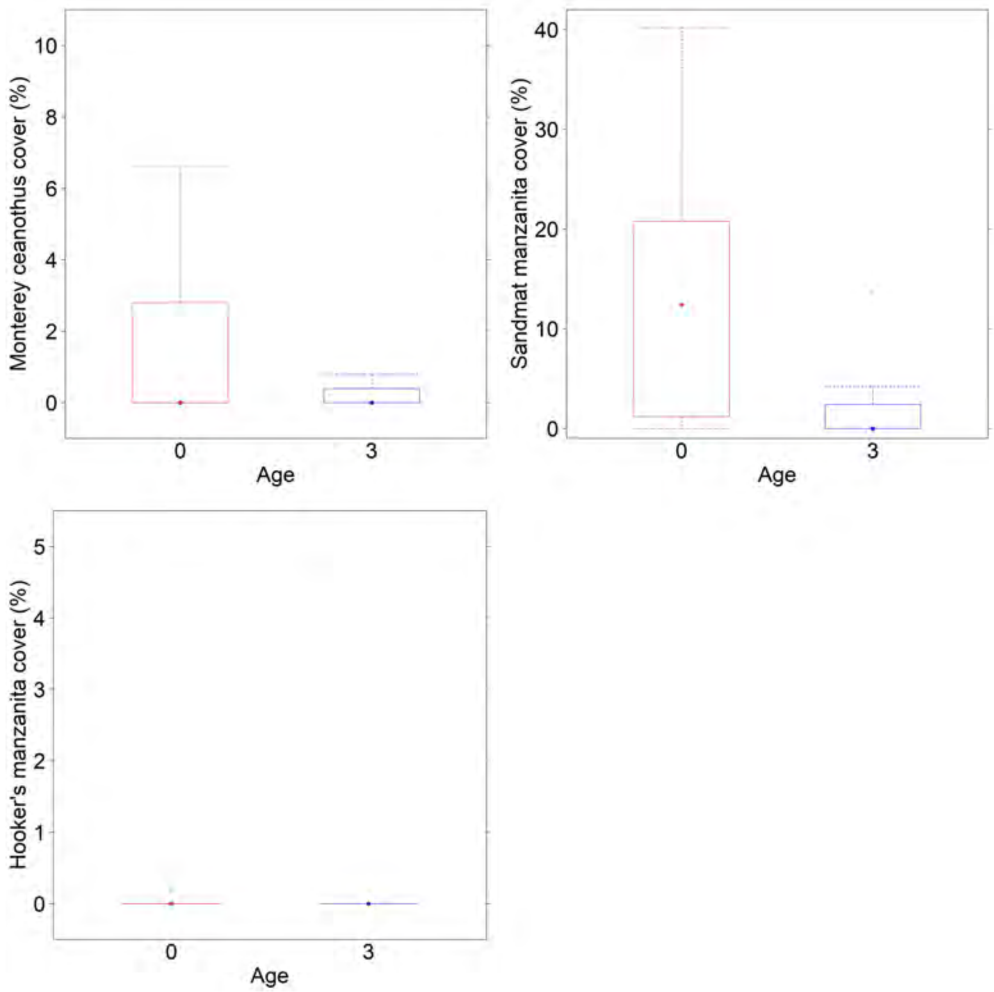

Figure 5-21. Unit 28 HMP Shrub Species Cover Between Baseline (2003) and Year 3 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Nine masticated transects were analyzed in Unit 28.

NMDS ordinations illustrate that the 2018 community compositions for Units 5A, 9, 23, and 28 have diverged from their respective Baseline compositions (Figures 5-22 through 5-25). Community composition is represented by the shape and location of ellipses in the ordination space, where ellipses with similar shape and location imply similar community composition.

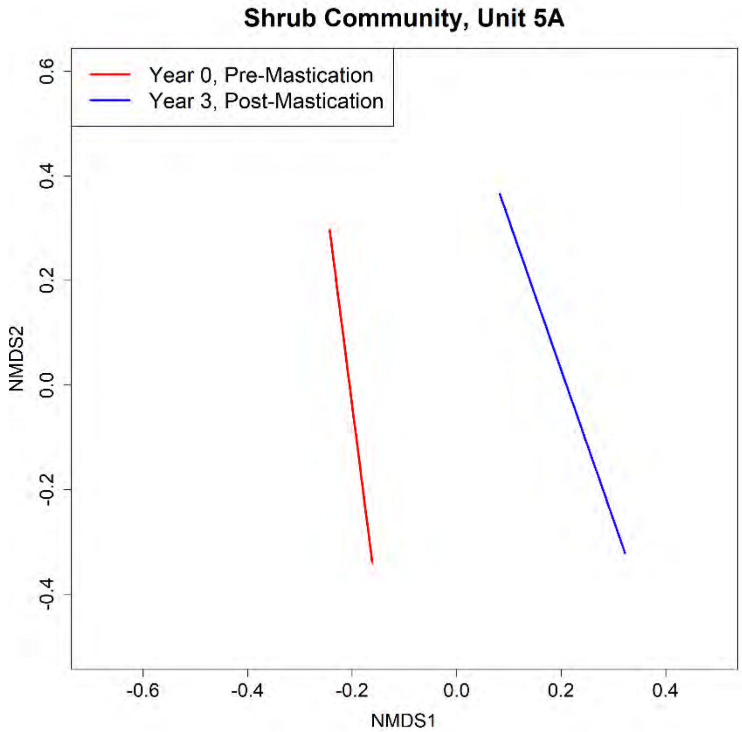

Figure 5-22. NMDS Ordination Plot Showing Unit 5A Community Composition Changes Between Baseline Surveys (2011) and Year 3 Surveys (2018). These Appear as Lines Instead of Ellipses Due to Small Sample Sizes in Each Survey Year. Two masticated transects were analyzed in Unit 5A.

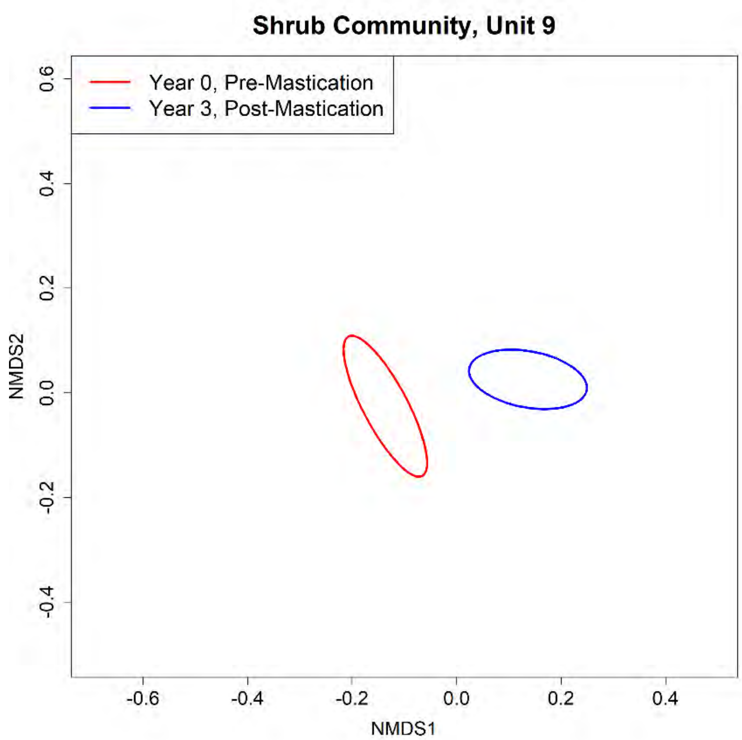

Figure 5-23. NMDS Ordination Plot Showing Unit 9 Community Composition Changes Between Pre-mastication Surveys (2011) and Year 3 Surveys (2018). Five masticated transects were analyzed in Unit 9.

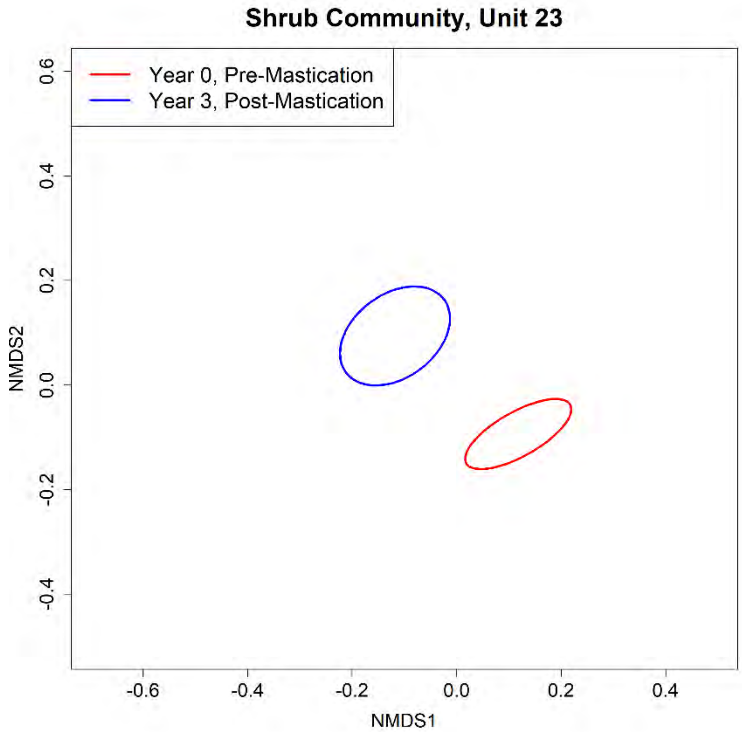

Figure 5-24. NMDS Ordination Plot Showing Unit 23 Community Composition Changes Between Pre-mastication Surveys (2003) and Year 3 Surveys (2018). Seventeen masticated transects were analyzed in Unit 23.

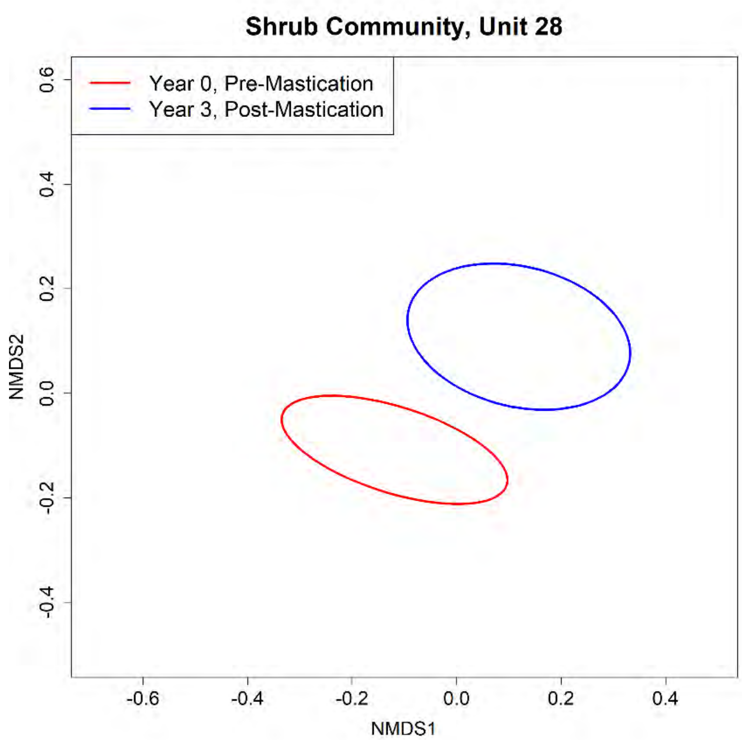

Figure 5-25. NMDS Ordination Plot Showing Unit 28 Community Composition Changes Between Pre-mastication Surveys (2011) and Year 3 Surveys (2018). Nine masticated transects were analyzed in Unit 28.

5.4.7 Annual Grass Monitoring

Non-native annual grasses were not mapped in any Year 3 Unit.

5.4.8 Invasive and Non-Native Species Monitoring

Of the target invasive species, only iceplant was observed in Year 3 Units (Appendix E, Figures E-4 and E-5). Iceplant covered large portions of Units 9 and 28. These areas were estimated using aerial imagery since GPS mapping was not feasible due to the large patch size. The patch in Unit 9 covered approximately 1.45 acres, and the patch in Unit 28 covered approximately 1.18 acres. Additionally, minor occurrences of non-native herbaceous cover were observed during transect monitoring in Units 9 and 23 (Appendix G, Tables G-1 and G-2).

6 YEAR 5 VEGETATION SURVEYS: UNITS 1 EAST, 6, 7, 10, WATKINS GATE BURNED AREA, AND MOUT BUFFER

6.1 Introduction

Year 5 Units included Units 1 East, 6, 7, 10, Watkins Gate Burned Area (WGBA), and MOUT Buffer. Units 1 East, 6, WGBA, MOUT Buffer, and the Containment Lines of Unit 7 were masticated in 2013 (Burleson, 2017). The Containment Lines of Unit 10 were masticated in 2012. Prescribed burned were conducted in the interiors of Units 7 and 10 in the Fall of 2013.

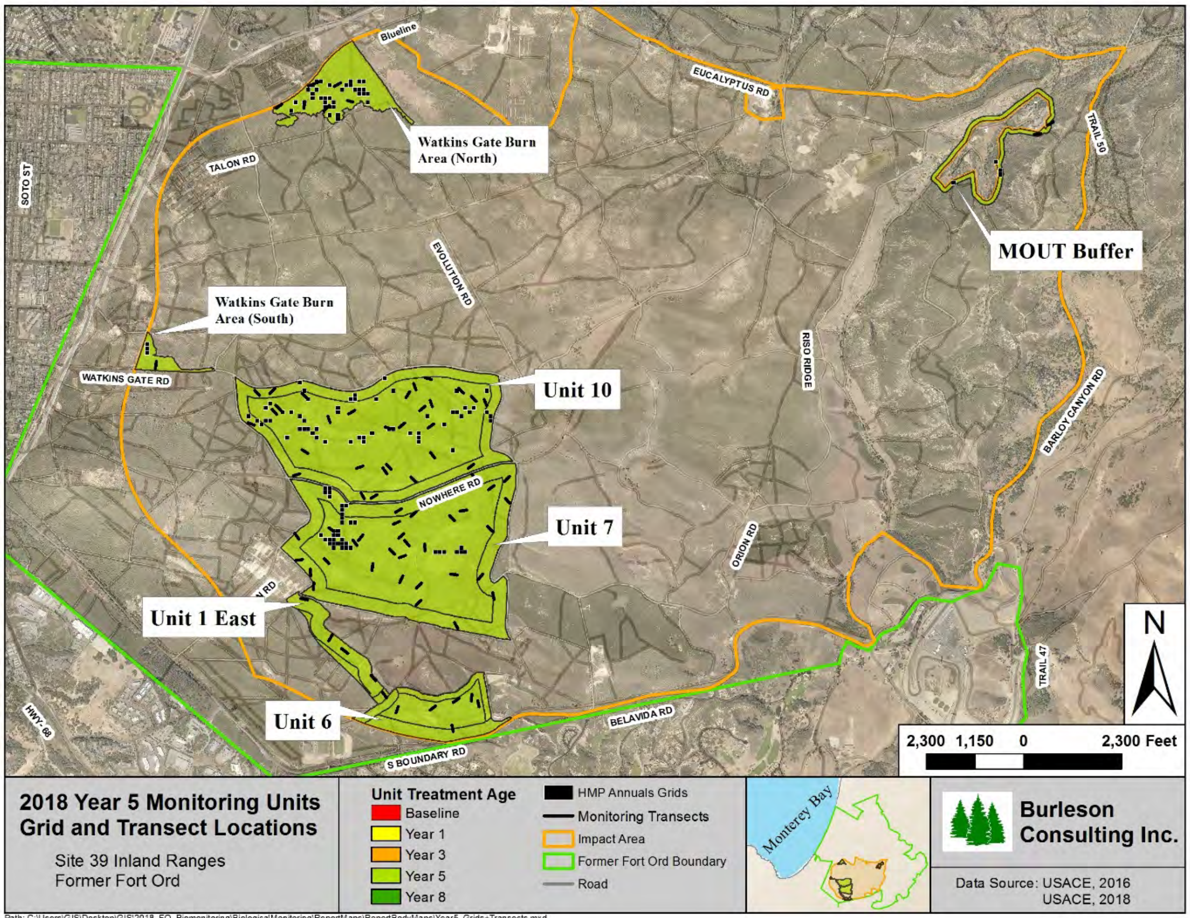

Figure 6-1. Map of Units 1 East, 6, 7, 10, MOUT Buffer, and Watkins Gate Burn Area HMP Annuals Grids and HMP Shrub Transects. Containment Lines Can be Seen Outlined in Black Where the Annual Grass Surveys Occurred.

Unit 1 East and part of Unit 6 were masticated in 2013, with concurrence from USFWS, to create a containment line for prescribed burns in Units 7 and 10 (USFWS, 2013).

Baseline data for herbaceous HMP plants were not gathered for Unit 1 East following methods outlined in the Vegetation Monitoring Protocol (Burleson, 2009a). Rather, baseline monitoring was conducted in this unit by Harding Lawson Associates in 1997 and included shrub transect sampling and broad-scale mapping of HMP annuals not associated with survey grids. No HMP annuals were identified in Unit 1 East during baseline monitoring.

Baseline monitoring was conducted in spring and early summer 2011 for Unit 6, MOUT Buffer and WGBA, in 2012 for Unit 10, and in 2013 for Unit 7 (Tetra Tech and EcoSystems West, 2012, 2013 and 2014). Baseline monitoring included meandering transect surveys to map areas of occurrence of HMP herbaceous species; density monitoring for the HMP annual species sand gilia, seaside bird's-beak, and Monterey spineflower; transect surveys to sample shrub composition in the maritime chaparral; and annual grass monitoring in Unit 6, MOUT Buffer, and the primary containment areas around the perimeters of Units 7 and 10.

Except for Units 1 East and 6, where no HMP annual species were observed during baseline monitoring, Year 1 follow-up monitoring was conducted in the spring and early summer of 2013. This is due to the need to assess recovery of the three HMP annual species in these units during 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, including HMP annual density, shrub transect, and annual grass monitoring, was conducted in these units in spring 2016.

6.2 Units 1 East, 6, 7, 10, Watkins Gate Burned Area, and MOUT Buffer: Setting

Unit 1 East encompasses 33 acres and is situated in the southwest portion of the Fort Ord Impact Area (see Figure 6-1). In pre-treatment condition, this Unit consisted of structurally heterogeneous maritime chaparral reflecting varying levels of disturbance from past military staging activities. No wetlands or oak woodland is located within this Unit, but maritime chaparral begins to transition to coastal scrub and disturbed grassland. Dense infestations of pampas grass and iceplant were present towards the south and west portions of the Unit.

Unit 6 encompasses an area of 72 acres and is located at the south-central end of the former Fort Ord with the base boundary forming part of the southern boundary of the Unit (see Figure 6-1). 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 to a 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. Small arms range HA 27A is located in this area and is in a process of being restored. Vegetation of disturbed areas in Baseline condition ranged from areas dominated by non-native annual grass and herb species, to a sizable sparsely vegetated bare area near the center of the Unit. 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. The density of pampas grass in the area has been considerably reduced in recent years through weed 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.

Unit 7 encompasses an area of 347 acres, of which 124 acres are within the 316-ft primary containment mastication area (see Figure 6-1). The remaining 216 acres are in the interior of the Unit for which prescribed burning only, without mastication, was conducted. 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 except for 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 (*Toxicodendron diversilobum*). 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. This area is a vernal pool and referred to as Pond 71. In years of average to above average rainfall, standing water typically forms a contiguous seasonal pond lasting into spring which was present during the 2016 monitoring due to slightly above average seasonal rainfall. 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 limited 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, referred to as HA 26, is currently undergoing habitat restoration activities.

Unit 10 encompasses a total area of 320 acres, of which approximately 87 acres are within the 239-ft primary containment mastication area and the remaining 233 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 (see Figure 6-1). 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 in height from low (3-4 ft) to tall (12-15 ft), and shrub density ranged from relatively open, with numerous openings of various sizes, to essentially 100% 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. Like 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.

The MOUT Buffer Area encompasses an area of approximately 20 acres (see Figure 6-1). This area consists of a 100 ft wide buffer 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. A portion of this area was burned in an accidental fire in 2003.

The WGBA encompasses 73 acres, divided into two non-contiguous portions (see Figure 6-1; Tetra Tech and EcoSystems West, 2012). The larger northern portion is in the northeast corner of the WGBA, west of the north end of Evolution Road; the smaller southern portion is in the southwest corner of the WGBA, north of Watkins Gate Road. The terrain is level to gently rolling, with mostly low local relief. In Baseline condition, the northern area was vegetated primarily with mature maritime chaparral in its western portion, with smaller areas of coast live oak woodland interspersed. The eastern portion was vegetated primarily with dense coast live oak woodland, interspersed with areas of maritime chaparral of varying sizes. 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, except for a small seasonal wetland adjacent to Blueline Road.

The U.S. Department of Agriculture maps the Arnold-Santa Ynez complex as occurring in all of the Year 5 Units (USDA, 2018). The soil in the northwest corner of Unit 10 and remaining portions of WGBA is mapped as Baywood sand with 2 to 15 percent slopes. A more complex mosaic of unique soil types occurs in the MOUT Buffer Area, where aquic xerofluvents, Arnold loamy sand, 15 to 50 percent slopes, and xerorthents, dissected are also found. The distribution of soils in the Year 5 survey areas and characteristics of these soils are presented in Table 2-1.

6.3 Units 1 East, 6, 7, 10, Watkins Gate Burned Area, and MOUT Buffer: Methods

Following methods outlined in the Revised Protocol (Tetra Tech and EcoSystems West, 2015b) and Section 2 of this report, the 2018 Year 5 follow-up monitoring in Units 1 East, 6, 7, 10, WGBA, and MOUT Buffer consisted of the following activities:

- Density monitoring for three HMP annual species: sand gilia, seaside bird's-beak, and Monterey spineflower. This survey effort was conducted to evaluate how the density of these species responded to treatment.

- Macroplot surveys for three HMP annual species: sand gilia, seaside bird's-beak, and Monterey spineflower. This survey effort was conducted assess changes in the distribution of HMP annual species in response to treatment and evaluate what factors influence those changes.

- Repeated sampling of transects that were sampled for Baseline in 1997, 2007, 2011, 2012, or 2013 depending on the Unit (HLA, 1997; Shaw, 2008; Tetra Tech and EcoSystems West, 2012, 2013, and 2014). The 2018 survey effort was conducted to assess shrub species composition of the sensitive maritime chaparral community that is recovering from the respective treatments in these Units.

- Mapping of invasive species, including iceplant, pampas grass, and French broom, where encountered. This survey effort was conducted to support ongoing management.

- Mapping of non-native annual grasses. This survey effort was conducted to assess expansion or contraction of these populations over time after disturbance.

6.4 Units 1 East, 6, 7, 10, Watkins Gate Burned Area, and MOUT Buffer: Results and Discussion

A total of 135 HMP monitoring grids were sampled in Units 7, 10, WGBA, and the MOUT Buffer, with 38 in Unit 7, 55 in Unit 10, 38 in WGBA, and four in the MOUT Buffer. Maps of grids for the surveyed Units are provided in Appendix B (Figures B-28 through B-39).

6.4.1 Sand Gilia

Sand gilia was present in all Year 5 Units (Figures 6-2 through 6-5, B-30, B-33, B-36, and B-39). The frequency of occurrence in surveyed plots in Unit 7 was 5% in 2013 (2 of 38 grids), 8% in 2014 (3 of 38 grids), 8% in 2016 (3 of 38 grids), and 3% in 2018 (1 of 38 grids). The frequency of occurrence in surveyed plots in Unit 10 was 29% in 2012 (16 of 55 grids), 69% in 2014 (38 of 55 grids), 71% in 2016 (39 of 55 grids), and 49% in 2018 (27 of 55 grids). The frequency of occurrence in surveyed plots in WGBA was 3% in 2011 (1 of 38 grids), 3% in 2014 (1 of 38 grids), 3% in 2016 (1 of 38 grids), and 5% in 2018 (2 of 38 grids). The frequency of occurrence in surveyed plots in the MOUT Buffer was 75% in 2011 (3 of 4 grids), 50% in 2014 (2 of 4 grids), 75% in 2016 (3 of 4 grids), and 75% in 2018 (3 of 4 grids).

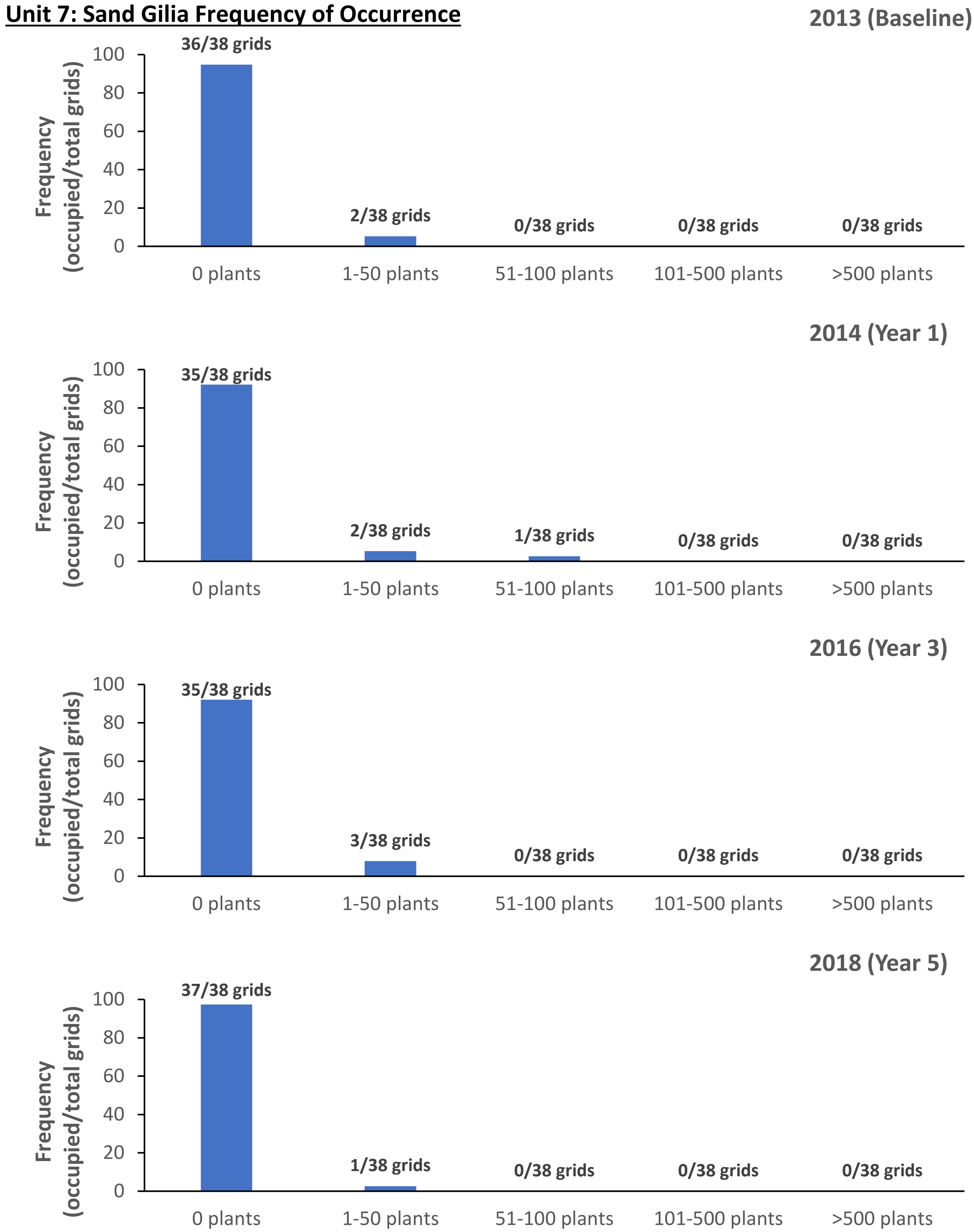

Figure 6-2. Unit 7 Sand Gilia Frequency of Occurrence in Surveyed Grids (*n*=38) Between Baseline (2013) and Year 5 (2018).

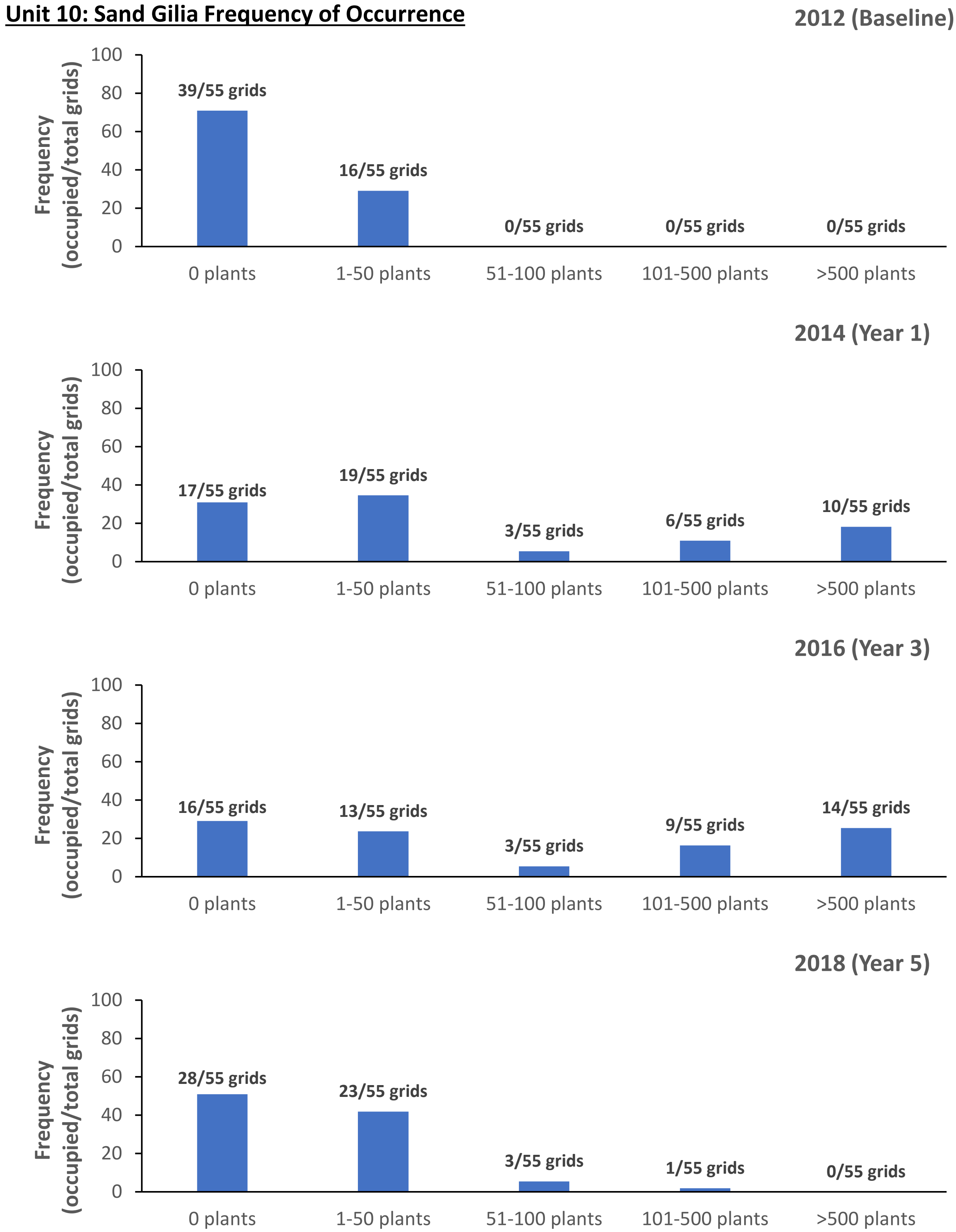

Figure 6-3. Unit 10 Sand Gilia Frequency of Occurrence in Surveyed Grids (n=55) Between Baseline (2012) and Year 5 (2018).

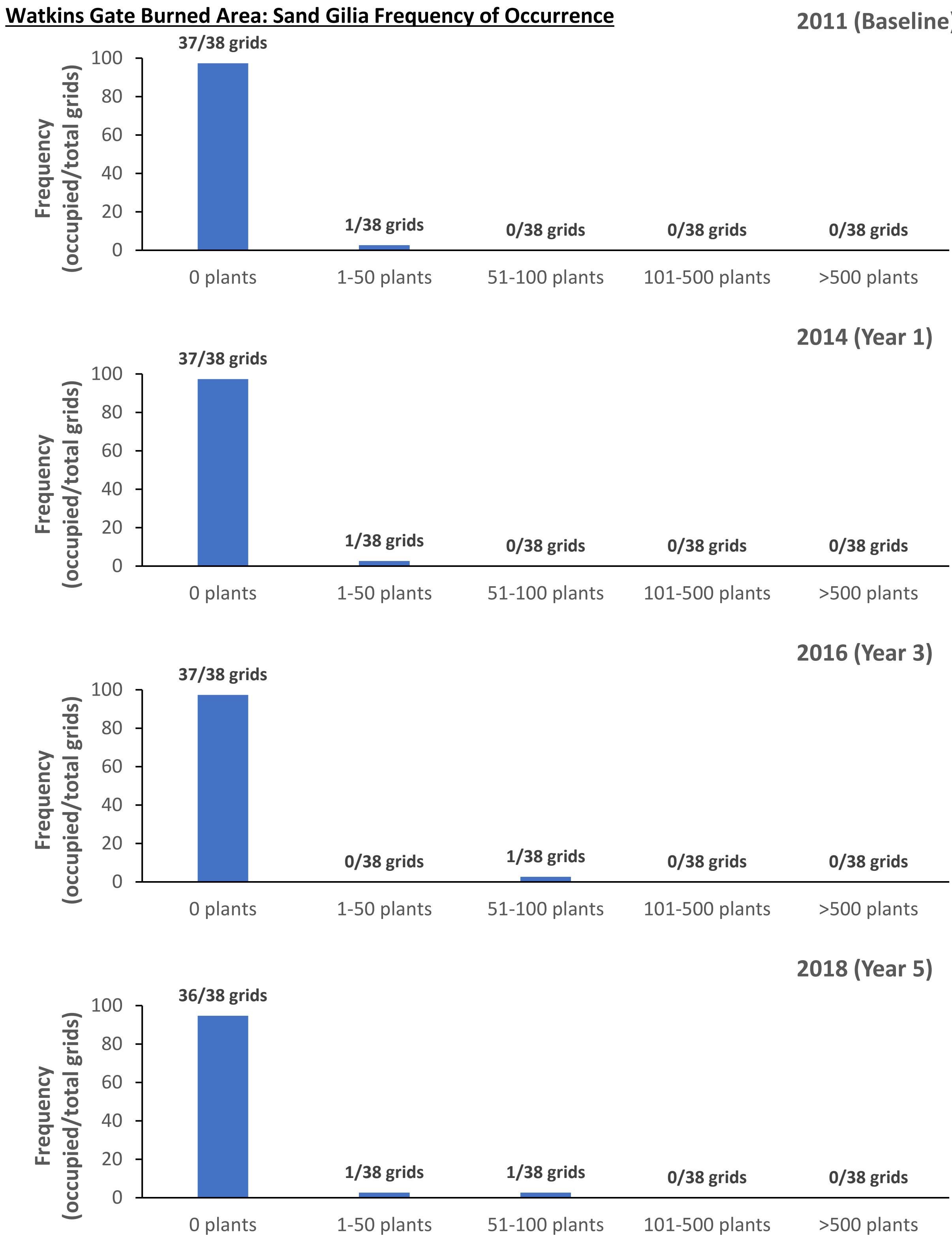

Figure 6-4. WGBA Sand Gilia Frequency of Occurrence in Surveyed Grids (*n*=55) Between Baseline (2011) and Year 5 (2018).

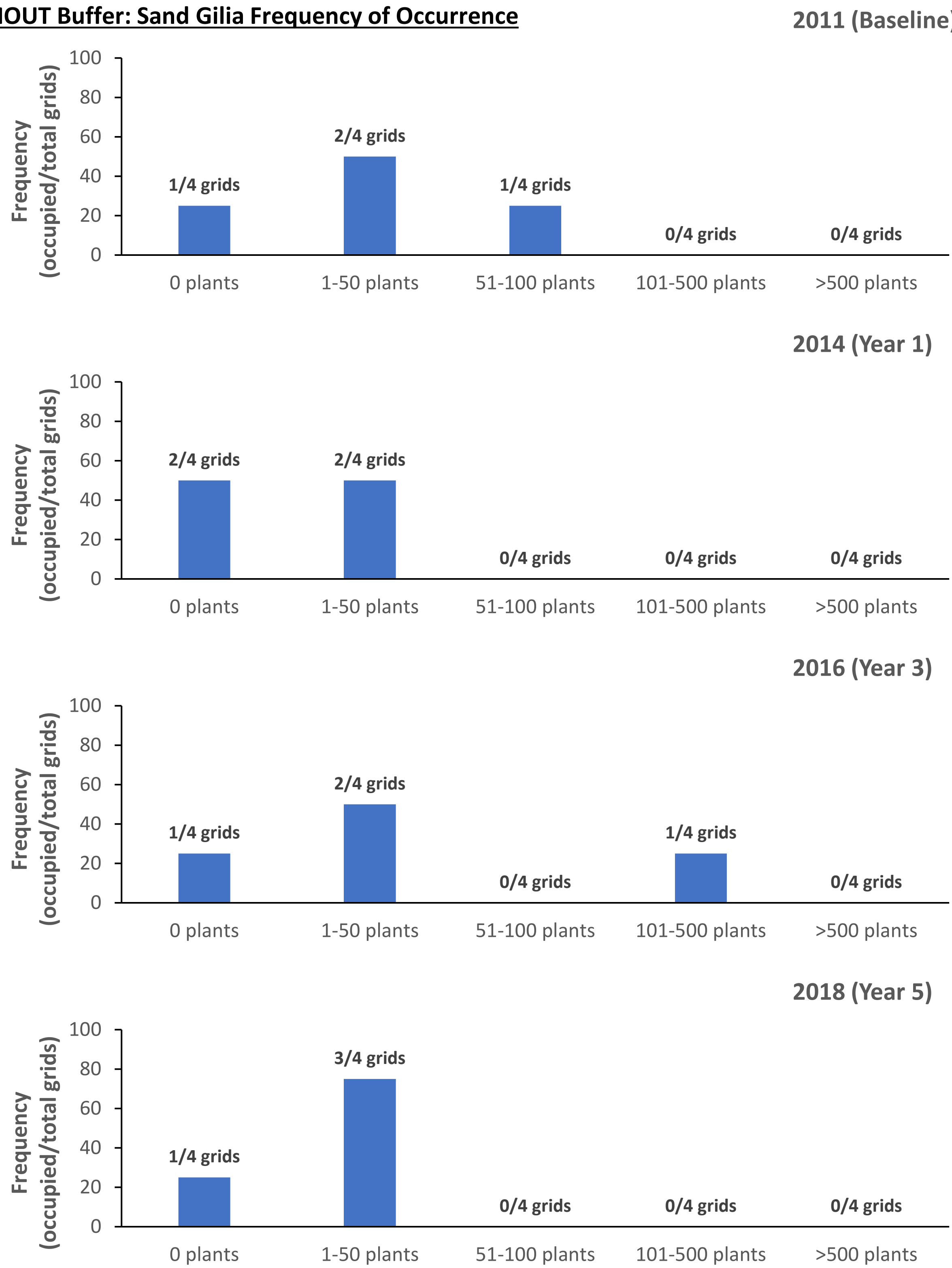

Figure 6-5. MOUT Buffer Sand Gilia Frequency of Occurrence in Surveyed Grids (*n*=4) Between Baseline (2011) and Year 5 (2018).

6.4.2 Seaside Bird's-Beak

Seaside bird's-beak was observed in Unit 7, 10 and WGBA (Figures 6-6 through 6-8, B-29, B-32, B-35, and B-38). The frequency of occurrence in surveyed plots in Unit 7 was 0% in 2013 (0 of 38 grids), 3% in 2014 (1 of 38 grids), 11% in 2016 (4 of 38 grids), and 8% in 2018 (3 of 38 grids). The frequency of occurrence in surveyed plots in Unit 10 was 0% in 2012 (0 of 55 grids), 4% in 2014 (2 of 55 grids), 2% in 2016 (1 of 55 grids), and 0% in 2018 (0 of 55 grids). The frequency of occurrence in surveyed plots in WGBA was 0% in 2011 (0 of 38 grids), 0% in 2014 (0 of 38 grids), 0% in 2016 (0 of 38 grids), and 3% in 2018 (1 of 38 grids).

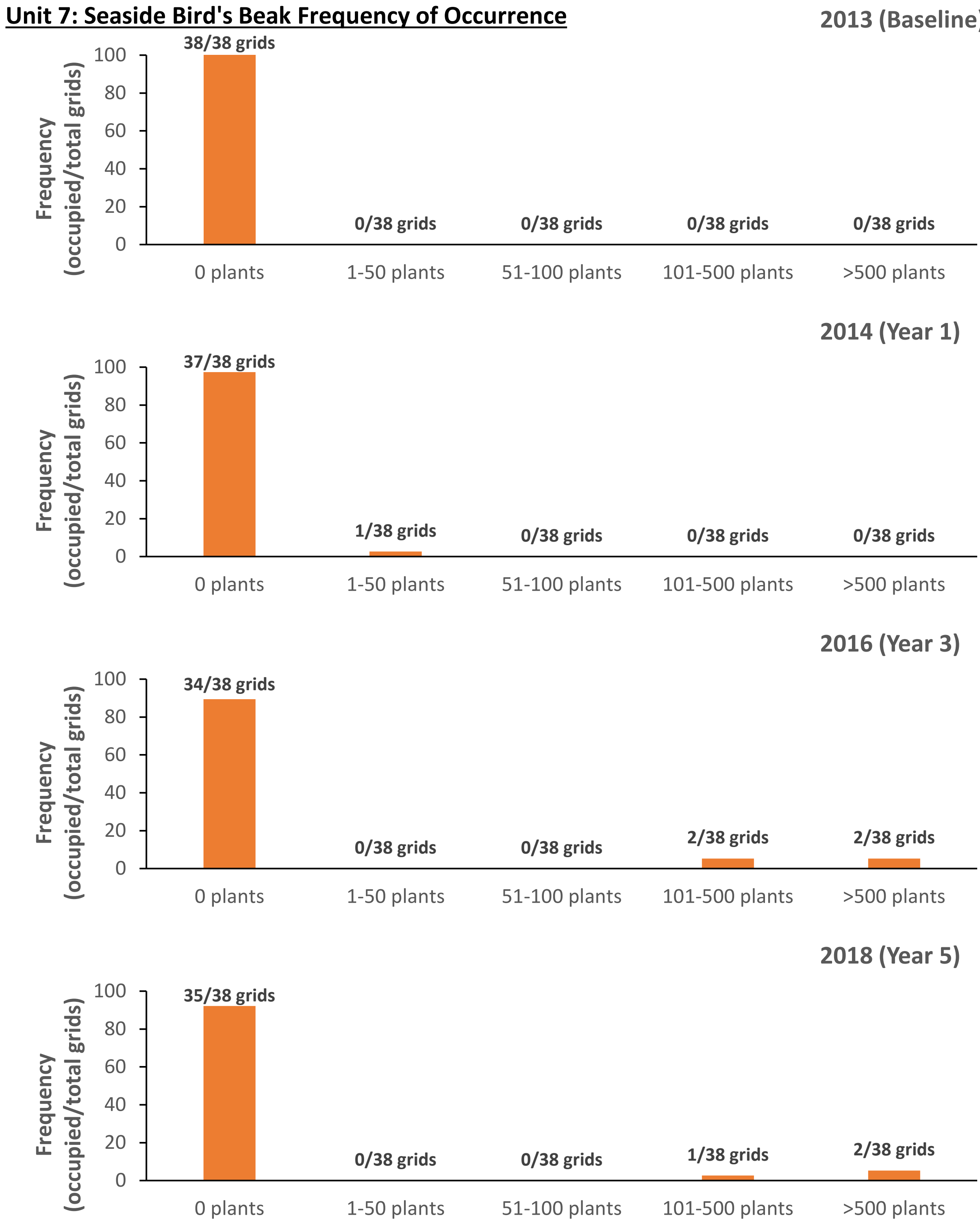

Figure 6-6. Unit 7 Seaside Bird's Beak Frequency of Occurrence in Surveyed Grids (*n*=38) Between Baseline (2013) and Year 5 (2018).

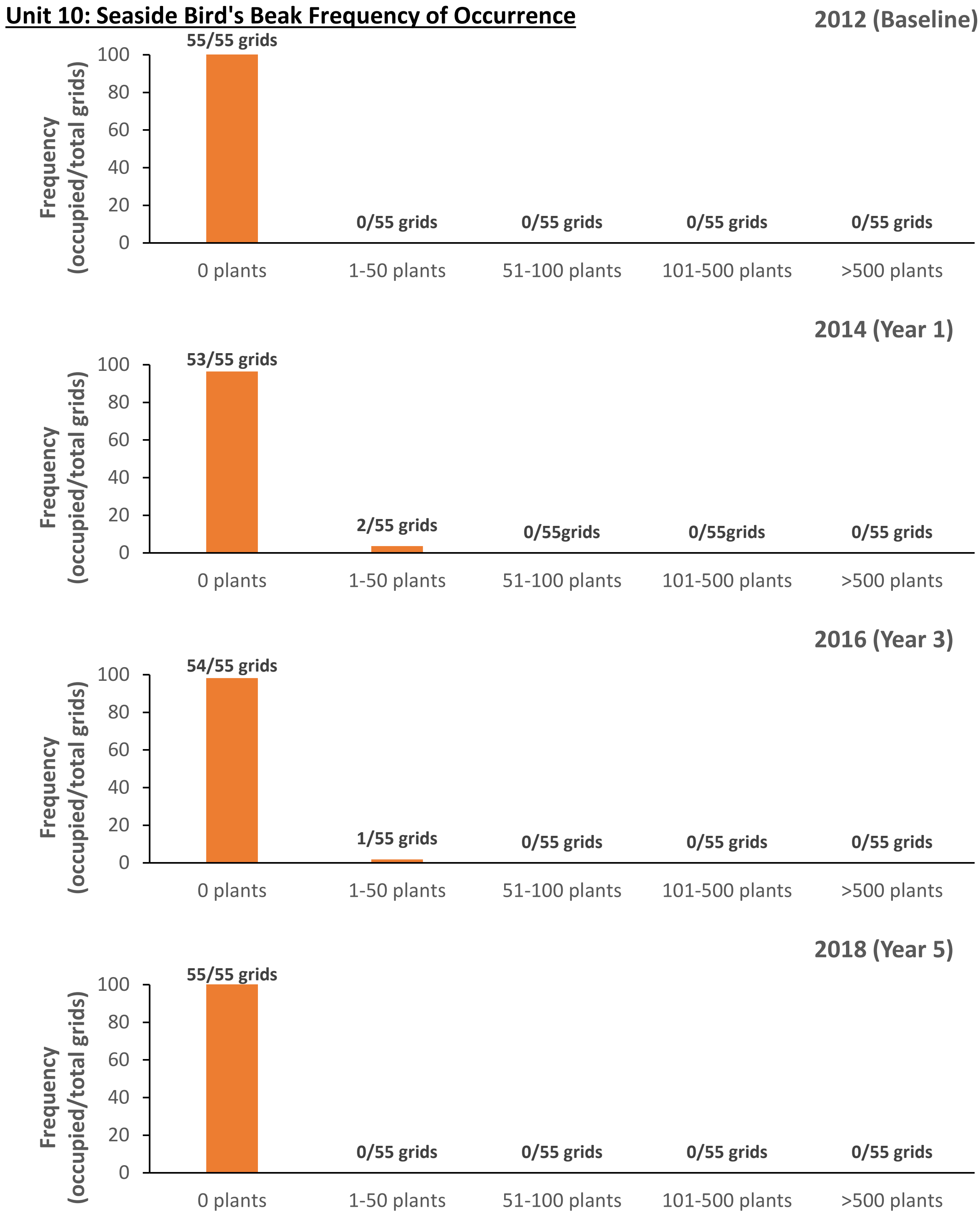

Figure 6-7. Unit 10 Seaside Bird's Beak Frequency of Occurrence in Surveyed Grids (*n*=55) Between Baseline (2012) and Year 5 (2018).

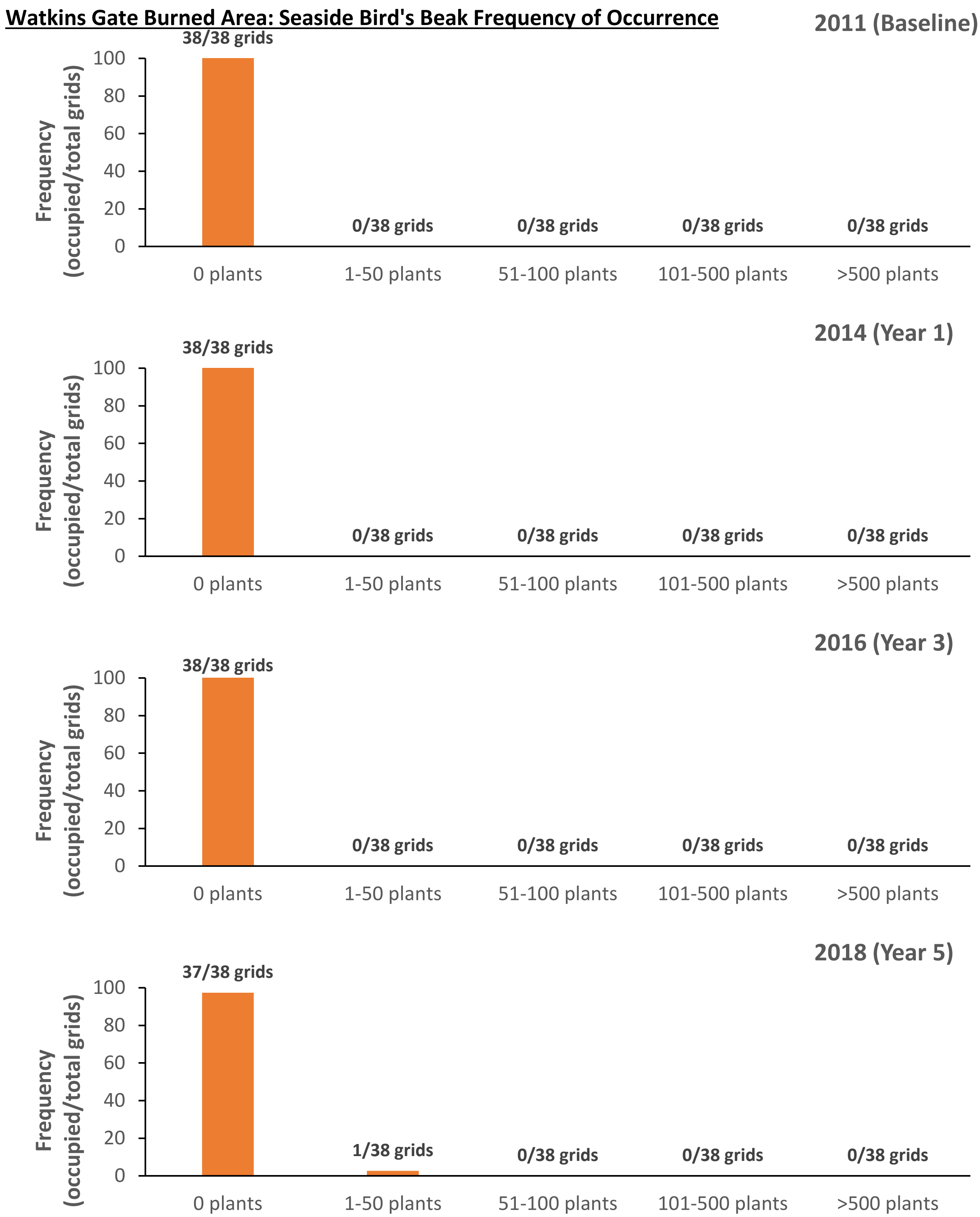

Figure 6-8. WGBA Seaside Bird's Beak Frequency of Occurrence in Surveyed Grids (*n*=38) Between Baseline (2011) and Year 5 (2018).

6.4.3 Monterey Spineflower

Monterey spineflower was present in all Year 5 Units (Figures 6-9 through 6-12, B-28, B-31, B-34 and B-37). The frequency of occurrence in surveyed plots in Unit 7 was 97% in 2013 (37 of 38 grids), 95% in 2014 (36 of 38 grids), 82% in 2016 (31 of 38 grids), and 84% in 2018 (32 of 38 grids). The frequency of occurrence in surveyed plots in Unit 10 was 100% in 2012 (55 of 55 grids), 93% in 2014 (51 of 55 grids), 91% in 2016 (50 of 55 grids), and 91% in 2018 (50 of 55 grids). The frequency of occurrence in surveyed plots in WGBA was 100% in 2011 (38 of 38 grids), 97% in 2014 (37 of 38 grids), 92% in 2016 (35 of 38 grids), and 92% in 2018 (35 of 38 grids). The frequency of occurrence in surveyed plots in the MOUT Buffer was 100% in 2011 (4 of 4 grids), 100% in 2014 (4 of 4 grids), 100% in 2016 (4 of 4 grids), and 75% in 2018 (3 of 4 grids).

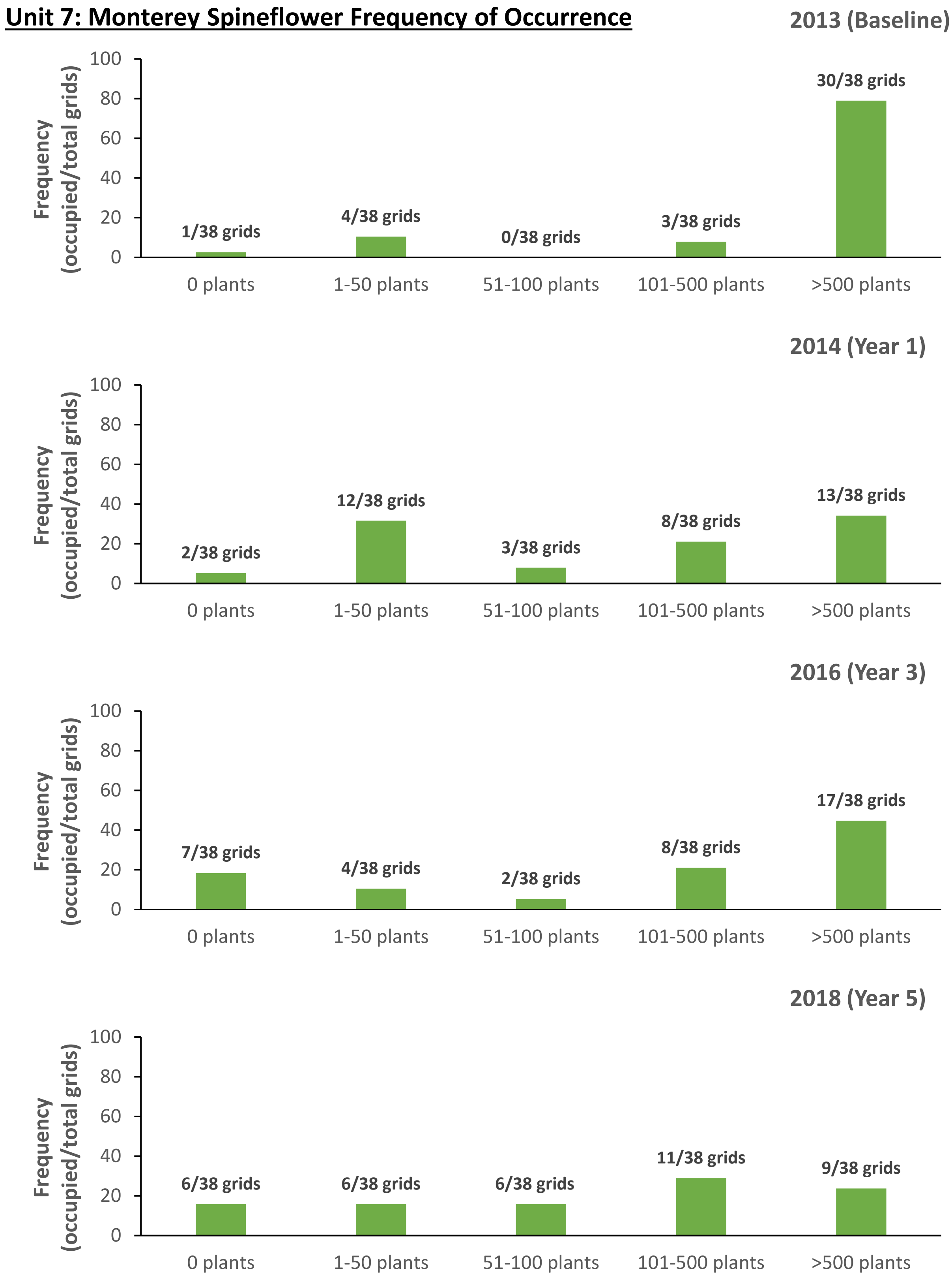

Figure 6-9. Unit 7 Monterey Spineflower Frequency of Occurrence in Surveyed Grids (*n*=38) Between Baseline (2013) and Year 5 (2018).

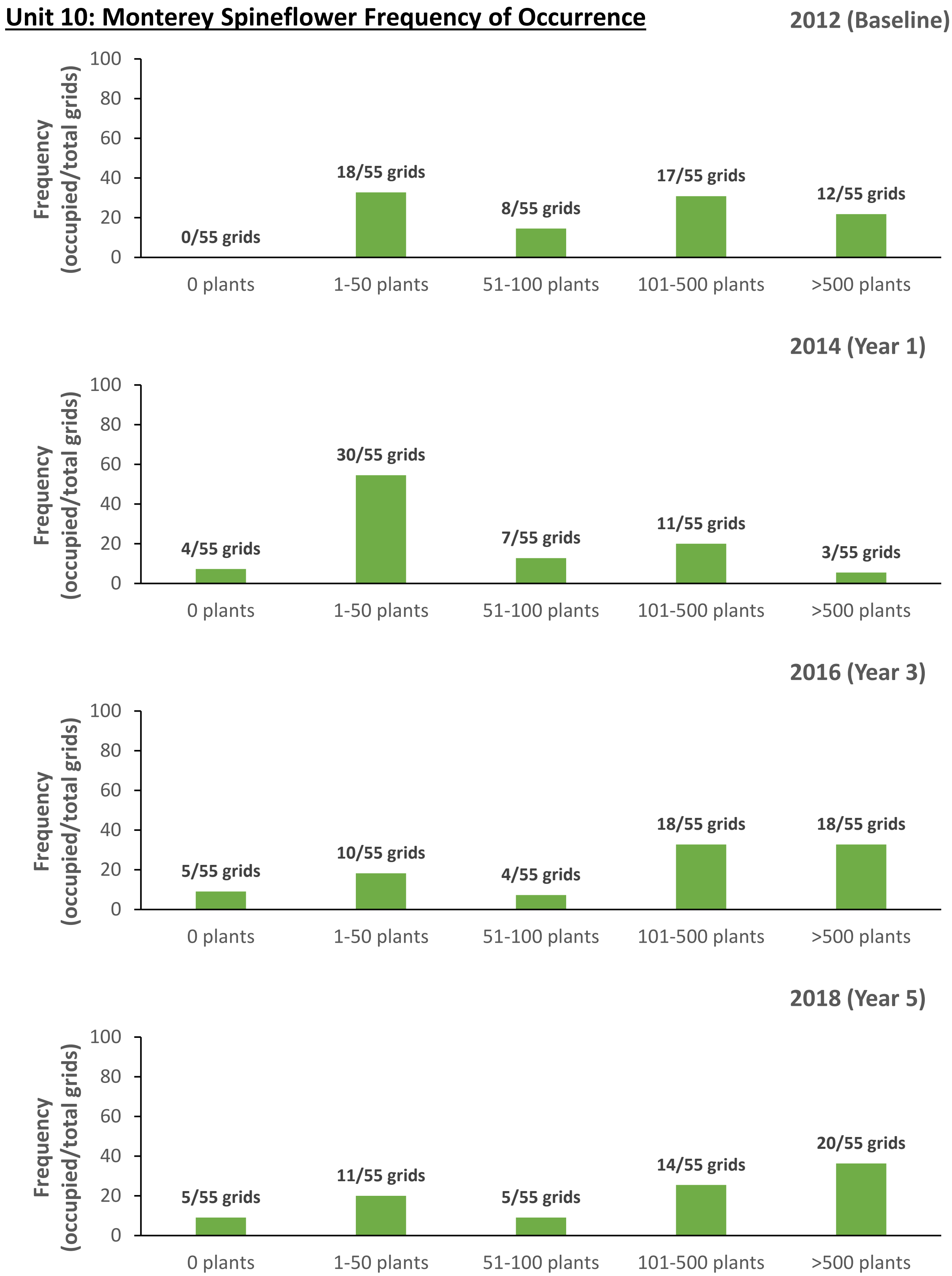

Figure 6-10. Unit 10 Monterey Spineflower Frequency of Occurrence in Surveyed Grids (*n*=55) Between Baseline (2012) and Year 5 (2018).

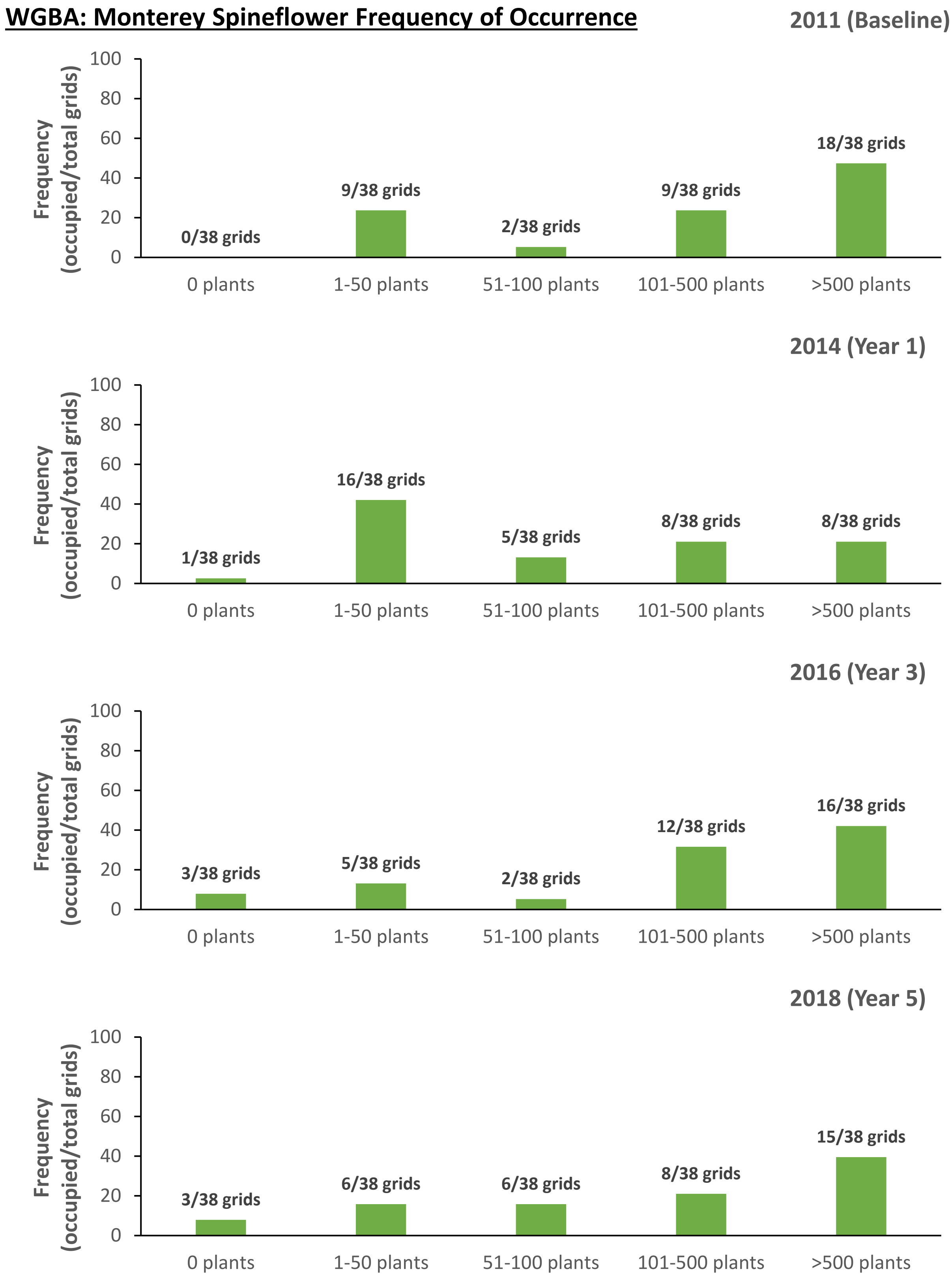

Figure 6-11. WGBA Monterey Spineflower Frequency of Occurrence in Surveyed Grids (*n*=38) Between Baseline (2011) and Year 5 (2018).

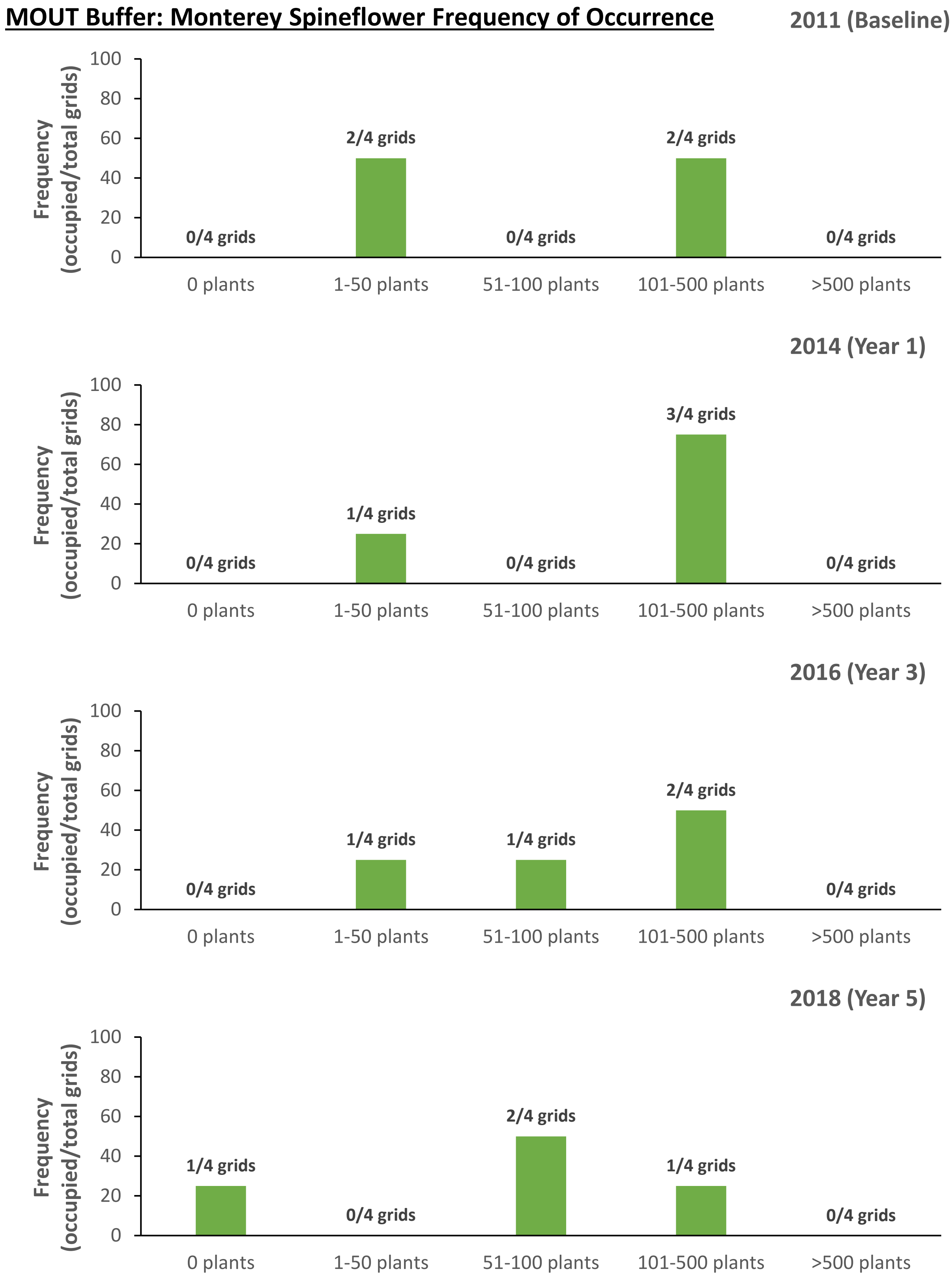

Figure 6-12. MOUT Buffer Monterey Spineflower Frequency of Occurrence in Surveyed Grids (*n*=4) Between Baseline (2011) and Year 5 (2018).

6.4.4 Yadon's Piperia

Yadon's piperia was not observed in any Year 5 Unit in 2018.

6.4.5 Effect of Treatment on HMP Density

The effect of treatment type on HMP annuals density was evaluated in Units 7 and 10 collectively. The MOUT Buffer and WGBA could not be evaluated for differential effects due to treatment since only mastication occurred in these areas.

Two-way PERMANOVA was conducted to evaluate the effect due to Treatment and Age on the distribution of sand gilia, seaside bird's beak, and Monterey spineflower in Units 7 and 10 (Tables 6-1 through 6-3). No significant differences were observed in density classes of sand gilia, seaside bird's beak, or Monterey spineflower between Treatments in Units 7 and 10, there was a significant difference between Age for all species, and there was a significant interaction between Treatment and Age for sand gilia but not seaside bird's beak or Monterey spineflower.

It should be noted that Unit 7 (n_{burned}=29; $n_{masticated}$=5; $n_{masticated\&burned}$=2; n_{mixed}=2) and Unit 10 (n_{burned}=43; $n_{masticated}$=9; $n_{masticated\&burned}$=3) have unbalanced data by treatment types. The different sample sizes by treatment type may affect statistical results.

The distributions across density classes for each HMP annual species by Treatment and Age are shown in Figures 6-13 through 6-15.

Table 6-1. Two-way PERMANOVA results for sand gilia in Units 7 and 10, based on Jaccard distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	12.1	1.00e-04*
Treat	1.88	0.072
Treat*Age	1.77	0.024*

Table 6-2. Two-way PERMANOVA results for seaside bird's beak in Units 7 and 10, based on Jaccard distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*P*
Age	3.67	9.00e-04*
Treat	0.308	0.912
Treat*Age	0.353	0.759

Table 6-3. Two-way PERMANOVA results for Monterey spineflower in Units 7 and 10, based on Jaccard distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	6.16	1.00e-04*
Treat	0.509	0.890
Treat*Age	1.03	0.426

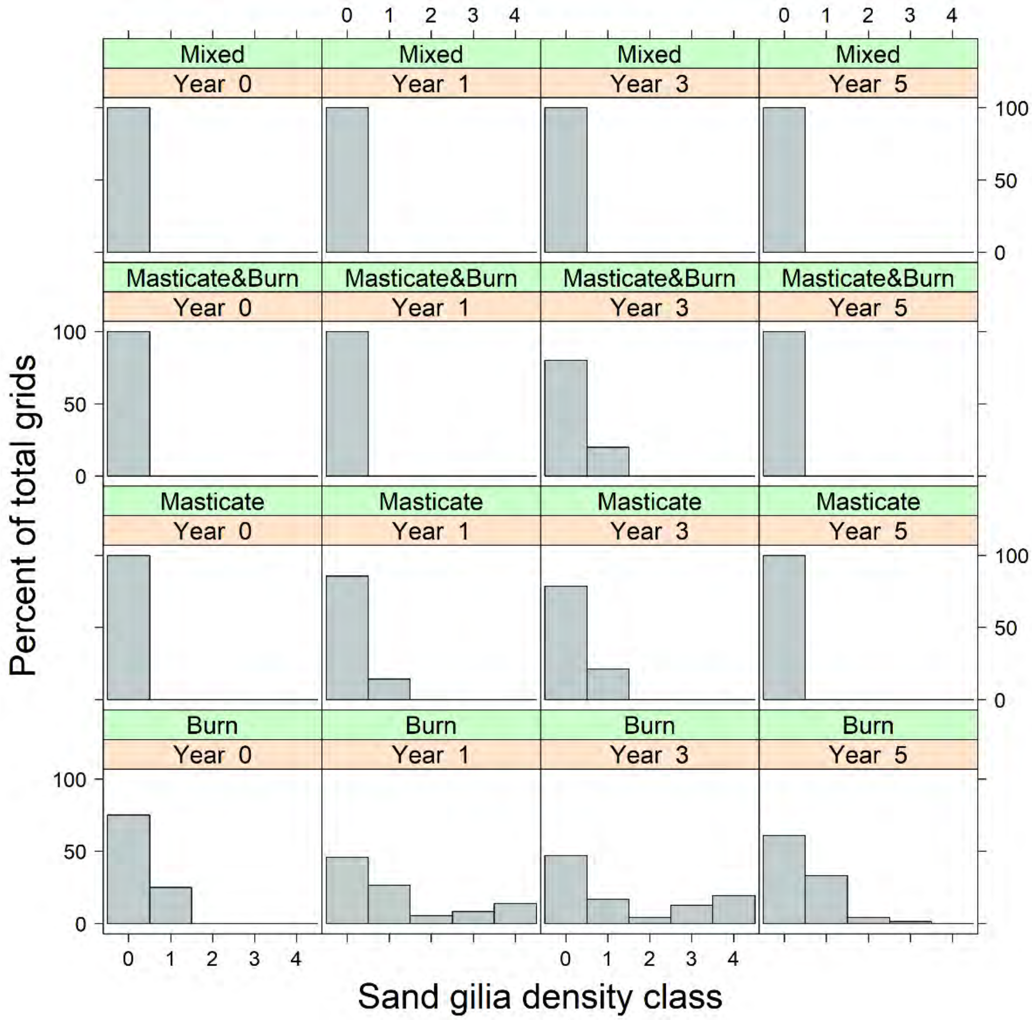

Figure 6-13. Percent of Total Grids for Sand Gilia Density Classes for All Treatment Types in Baseline through Year 5 (2018) in Units 7 and 10. Sample sizes for each treatment were *n*=2 for mixed, *n*=5 for Masticate&Burn, *n*=14 for Masticate, and *n*=72 for Burn.

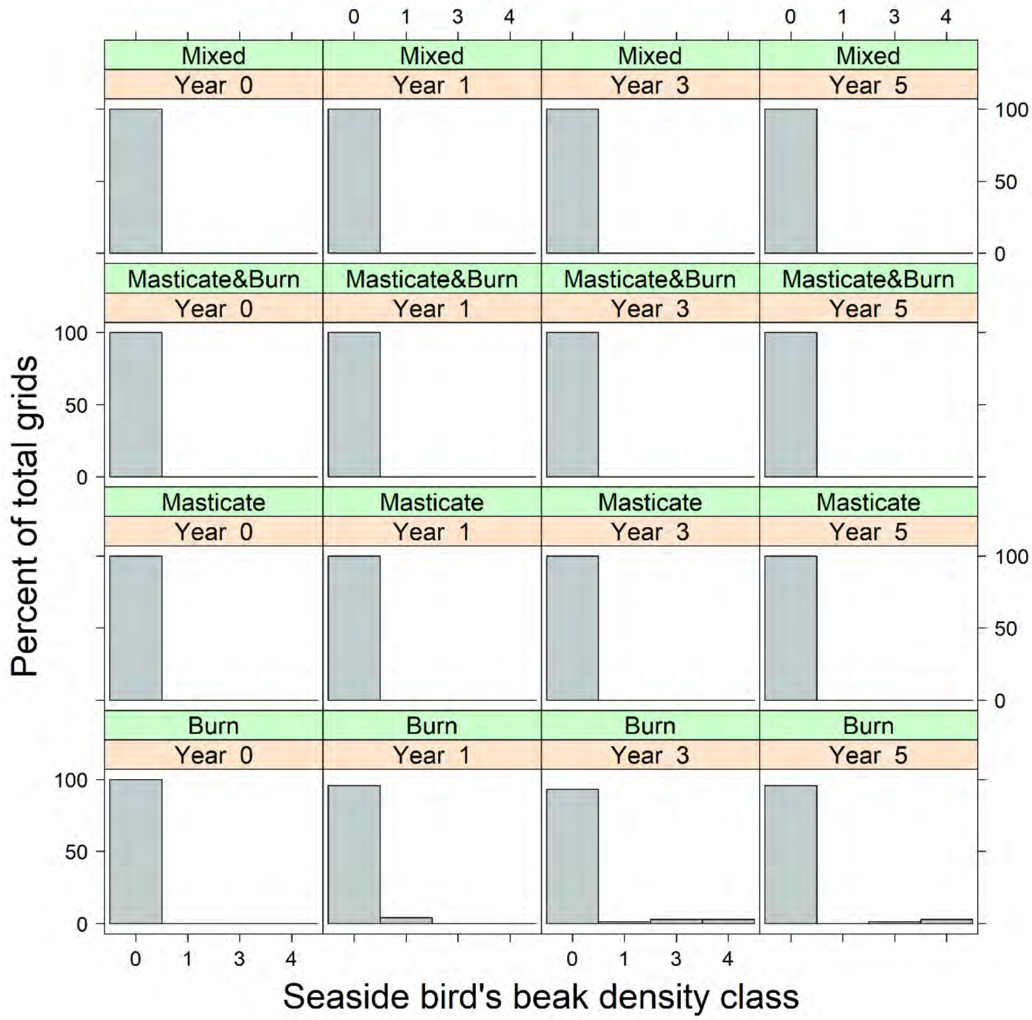

Figure 6-14. Percent of Total Grids for Seaside Bird's Beak Density Classes for All Treatment Types in Baseline through Year 5 (2018) in Units 7 and 10. Sample sizes for each treatment were *n*=2 for mixed, *n*=5 for Masticate&Burn, *n*=14 for Masticate, and *n*=72 for Burn.

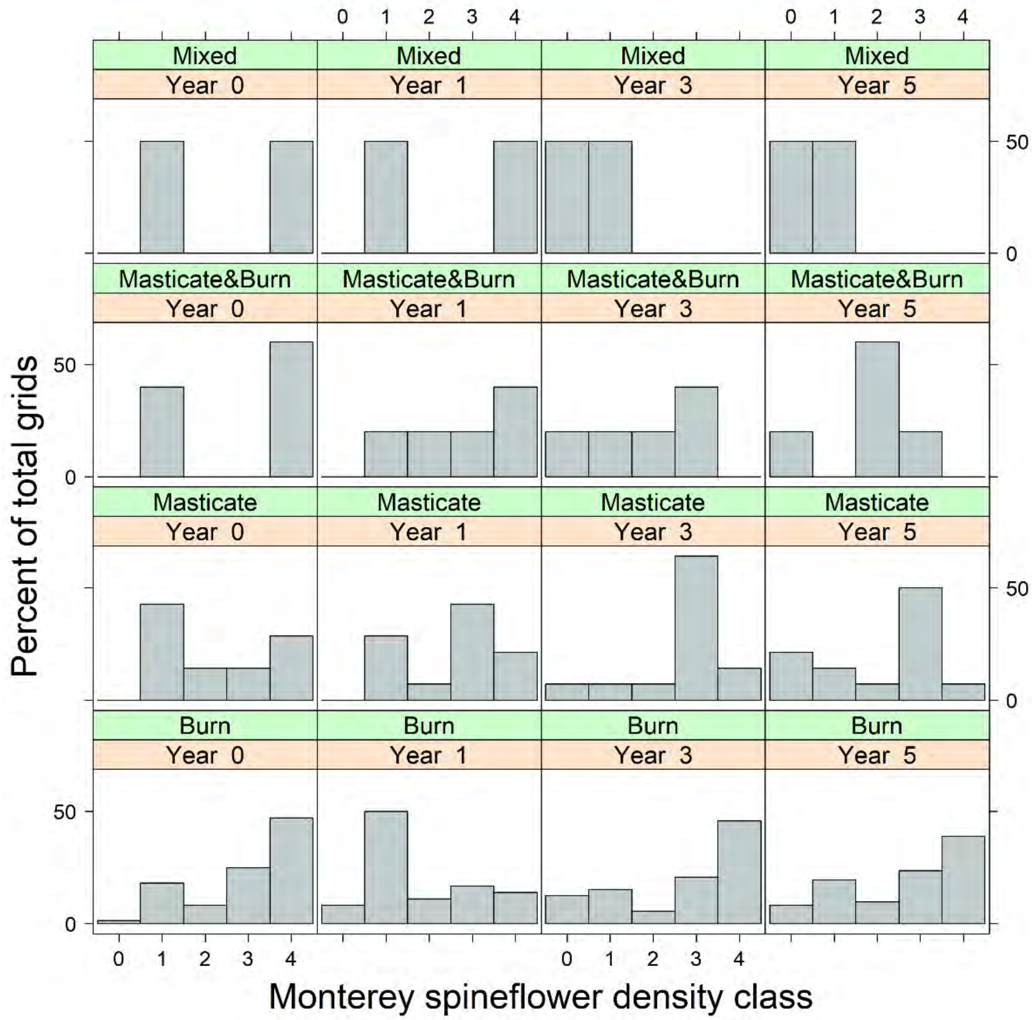

Figure 6-15. Percent of Total Grids for Monterey Spineflower Density Classes for All Treatment Types in Baseline through Year 5 (2018) in Units 7 and 10. Sample sizes for each treatment were *n*=2 for mixed, *n*=5 for Masticate&Burn, *n*=14 for Masticate, and *n*=72 for Burn.

6.4.6 Shrub Transect Monitoring

Shrub transects were sampled in Units 1 East (*n*=5), 6 (*n*=5), 7 (*n*=31), 10 (*n*=29), WGBA (*n*=7) and MOUT Buffer (*n*=2) in 2018 (Appendix C; Figures C-8 through C-13). Baseline transects were collected in 1997 and 2007 for Unit 1 East, 2011 for MOUT Buffer and WGBA, 2012 for Units 6 and 10, and 2013 for Unit 7. When transects were not collected in all years, those transects were not included in analyses. This reduced effective sample size for Unit 6 (*n*=4).

The temporal patterns of broad scale community response to treatment were generally congruent with past observations of the neighboring Units in the MRA (Tetra Tech and EcoSystems West, 2011 through 2015a; Burleson, 2016 through 2018).

Mixed-design ANOVAs were conducted to compare the effect of Unit and Age on mean percent cover, species richness, species evenness and species diversity for Year 5 Units. The changes in all metrics were significantly different between Units except species evenness, all were significantly different through time, and there were significant interactions between Unit and Age for species richness and species diversity (Table 6-4). These results suggest that the response of the Year 5 Units to treatment was variable by Unit and Age.

Mixed design ANOVAs were conducted on Units 7 and 10 to compare the effect of Treatment through time on mean percent cover, species richness, species evenness and species diversity. The changes in mean percent cover in Unit 7 and species evenness in Unit 10 were significantly different among Treatments (Tables 6-5 and 6-6). No other community metrics were significantly different among Treatments and there were no interactions between Treatment and Age. It should be noted that Unit 7 (n_{burned}=20; $n_{masticated}$=2; $n_{masticated\&burned}$=7; n_{mixed}=2) and Unit 10 (n_{burned}=22; $n_{masticated}$=2; $n_{masticated\&burned}$=5) have unbalanced data by treatment types. The different sample sizes by treatment type may affect statistical results.

Table 6-4. Mixed-design ANOVA results for Units 1 East, 6, 7, 10, MOUT Buffer, and WGBA. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Unit	5.35	3.07e-04*	6.12	8.82e-05*	2.00	0.089	5.48	2.51e-04*
Age	4.75	0.010*	23.8	2.46e-08*	5.92	0.005*	28.1	3.47e-10*
Unit*Age	0.841	0.590	3.48	0.001*	0.926	0.503	3.43	7.99e-04*

Table 6-5. Mixed-design ANOVA results for Unit 7. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Treatment	16.3	3.05e-06*	0.300	0.825	1.43	0.255	0.887	0.460
Age	2.89	0.064	61.4	1.25e-14*	2.03	0.141	41.7	1.12e-11*
Treatment*Age	1.46	0.209	1.49	0.201	0.448	0.843	0.076	0.998

Table 6-6. Mixed-design ANOVA results for Units 10. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Treatment	0.165	0.849	3.31	0.053	4.64	0.019*	1.32	0.284
Age	0.308	0.692	44.3	5.94e-12*	7.13	0.005*	35.4	1.93e-08*
Treatment*Age	0.428	0.750	2.28	0.073	1.75	0.174	0.534	0.664

Units 1 East, 6, and WGBA decreased in shrub cover between Baseline ($c_{1East,\ Baseline}$=121%; $c_{6,\ Baseline}$=94%; $c_{WGBA,\ Baseline}$=94%) and Year 5 ($c_{1East,\ Year\ 5}$=93%; $c_{6,\ Year\ 5}$=73%; $c_{WGBA,\ Year\ 5}$=76%) (Figures 6-16, 6-17, and 6-21). MOUT Buffer decreased between Baseline ($c_{MOUT,\ Baseline}$=91%) and Year 3 ($c_{MOUT,\ Year\ 3}$=73%) with a subsequent increase between Year 3 and Year 5 ($c_{MOUT,\ Year\ 5}$=91%) (Figure 6-20). Unit 7 and 10 shrub cover varied by Age and Treatment (Figures 6-18 and 6-19). Unit 7 shrub cover on the burned transects was 112% in Baseline, 114% in Year 3, and 111% in Year 5; on the masticated transects was 77% in Baseline, 52% in Year 3, and 77% in Year 5; on the masticated and burned transects was 112% in

Baseline, 105% in Year 3, and 100% in Year 5; and on the mixed transects was 128% in Baseline, 107% in Year 3, and 91% in Year 5. Unit 10 shrub cover on the burned transects was 104% in Baseline, 107% in Year 3, and 104% in Year 5; on the masticated transects was 99% in Baseline, 97% in Year 3, and 98% in Year 5; and on the masticated and burned transects was 114% in Baseline, 103% in Year 3, and 100% in Year 5.

The species diversity in Year 5 Units responded variably in response to treatment. Unit 1 East diversity increased between Baseline and Year 5 by 0.17 (Figure 6-16). Unit 6 diversity increased between Baseline and Year 3 by 0.51 with a subsequent decrease between Year 3 and Year 5 by 0.06 (Figure 6-17). Species diversity in WGBA increased between Baseline and Year 5 by 0.39 (Figure 6-21). Species diversity in MOUT Buffer decreased between Baseline and Year 5 by 0.12 (Figure 6-20). Units 7 and 10 species diversity change varied by Treatment (Figures 6-18 and 6-19). Unit 7 species diversity on the burned transects was 1.06 in Baseline, 1.63 in Year 3, and 1.58 in Year 5; on the masticated transects was 0.95 in Baseline, 1.54 in Year 3, and 1.44 in Year 5; on the masticated and burned transects was 1.01 in Baseline, 1.57 in Year 3, and 1.58 in Year 5; and on the mixed transects was 1.20 in Baseline, 1.74 in Year 3, and 1.72 in Year 5. Unit 10 species diversity on the burned transects was 1.19 in Baseline, 1.67 in Year 3, and 1.70 in Year 5; on the masticated transects was 1.06 in Baseline, 1.81 in Year 3, and 1.76 in Year 5; and on the masticated and burned transects was 1.36 in Baseline, 1.87 in Year 3, and 1.84 in Year 5.

The species richness in Year 5 Units species richness responded variably in response to treatment. Units 1 East and 6 richness increased between Baseline ($S_{1\ East}$=8.4 species; S_6=5.8 species) and Year 3 ($S_{1\ East}$=9.6 species; S_6=7.0 species) and remained constant between Year 3 and Year 5 (Figures 6-16 and 6-17). Species richness in MOUT Buffer and WGBA increased between Baseline (S_{WGBA}=5.6 species; S_{MOUT}=9.5 species) and Year 5 (S_{WGBA}=7.4 species; S_{MOUT}=11 species) (Figures 6-20 and 6-21). Units 7 and 10 species richness change varied by Treatment (Figures 6-18 and 6-19). Unit 7 species richness on the burned transects was 5.6 in Baseline, 9.0 in Year 3, and 8.5 in Year 5; on the masticated transects was 4.5 in Baseline, 9.0 in Year 3, and 9.5 in Year 5; on the masticated and burned transects was 5.1 in Baseline, 10 in Year 3, and 9.1 in Year 5; and on the mixed transects was 5.0 in Baseline, 9.0 in Year 3, and 9.0 in Year 5. Unit 10 species richness on the burned transects was 6.4 in Baseline, 9.2 in Year 3, and 9.1 in Year 5; on the masticated transects was 7.5 in Baseline, 12 in Year 3, and 13 in Year 5; and on the masticated and burned transects was 5.4 in Baseline, 10 in Year 3, and 9.2 in Year 5.

The species evenness in Year 5 Units species evenness responded variably in response to treatment. Units 1 East and WGBA evenness increased between Baseline ($S_{1\ East}$=0.72; S_{WGBA}=0.59) and Year 5 ($S_{1\ East}$=0.76; S_{WGBA}=0.70) (Figures 6-16 and 6-21). Unit 6 evenness increased between Baseline and Year 3 by 0.17 and decreased between Year 3 and Year 5 by 0.03 (Figure 6-17). Species evenness in MOUT Buffer decreased between Baseline (S_{MOUT}=0.72) and Year 5 (S_{MOUT}=0.62) (Figure 6-20). Units 7 and 10 species evenness change varied by Treatment (Figures 6-18 and 6-19). Unit 7 species evenness on the burned transects was 0.64 in Baseline, 0.75 in Year 3, and 0.74 in Year 5; on the masticated transects was 0.64 in Baseline, 0.70 in Year 3, and 0.64 in Year 5; on the masticated and burned transects was 0.63 in Baseline, 0.68 in Year 3, and 0.72 in Year 5; and on the mixed transects was 0.74 in Baseline, 0.79 in Year 3, and 0.78 in Year 5. Unit 10 species evenness on the burned transects was 0.65 in Baseline, 0.76 in Year 3, and 0.78 in Year 5; on the masticated transects was 0.52 in Baseline, 0.74 in Year 3, and 0.69 in Year 5; and on the masticated and burned transects was 0.81 in Baseline, 0.81 in Year 3, and 0.83 in Year 5.

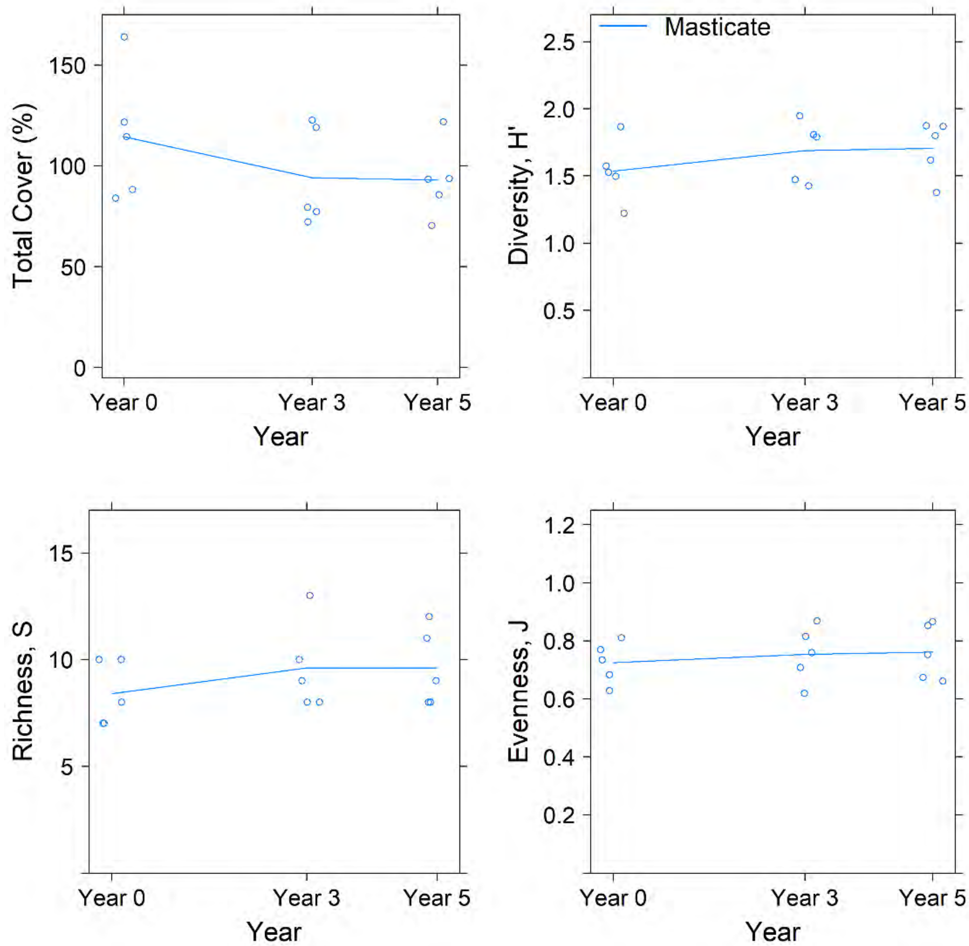

Figure 6-16. Unit 1 East Community Structure from Baseline (1997 and 2007) to Five Years After Mastication (2018). Five masticated transects were analyzed in Unit 1 East.

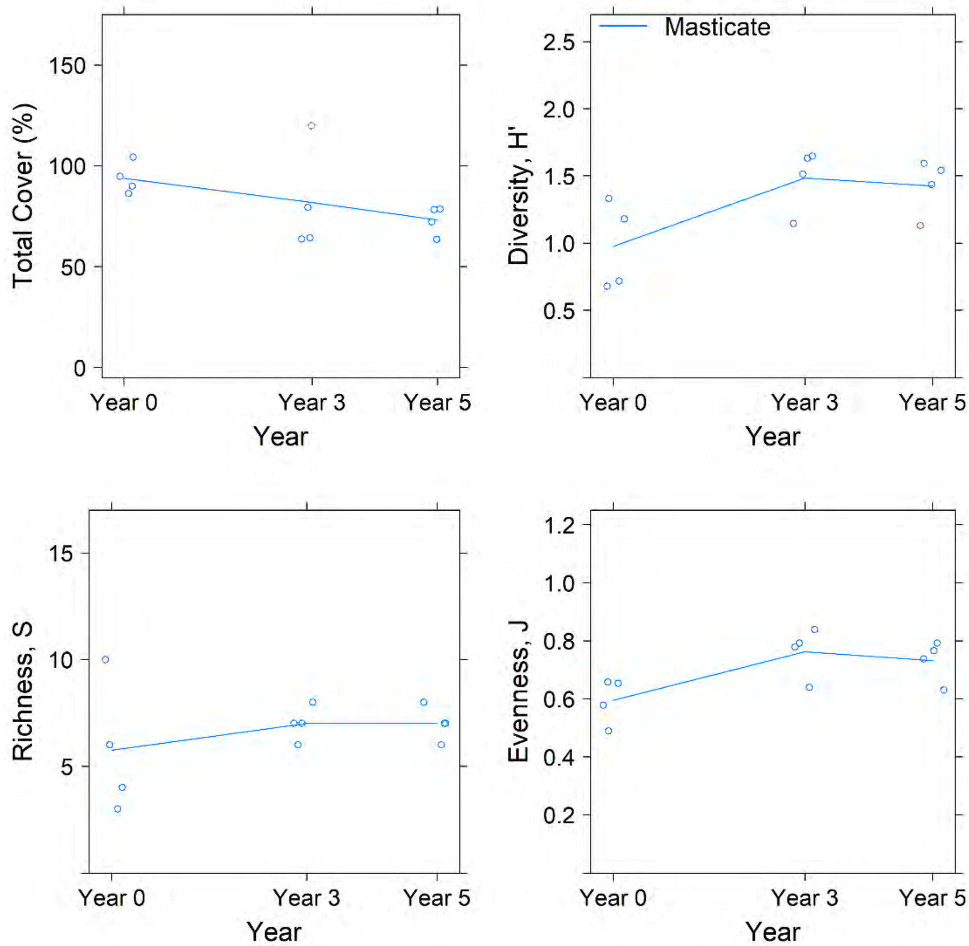

Figure 6-17. Unit 6 Community Structure from Baseline (2012) to Five Years After Mastication (2018). Four masticated transects were analyzed in Unit 6.

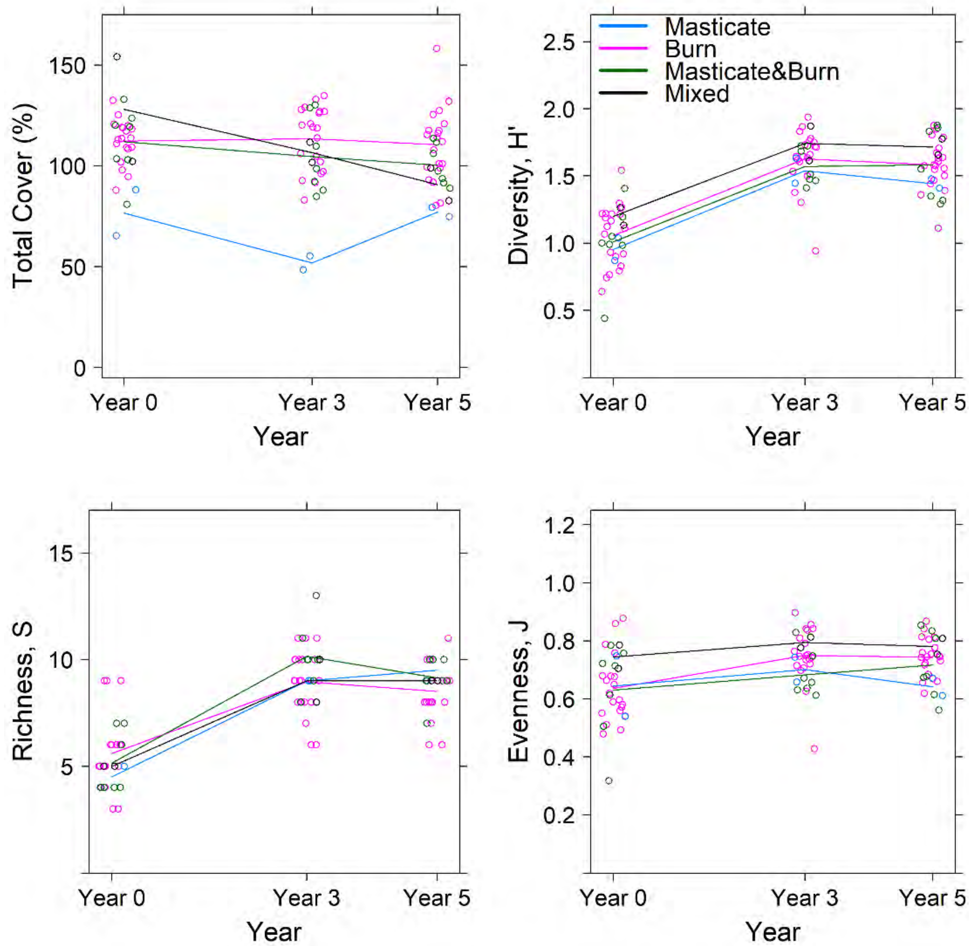

Figure 6-18. Unit 7 Community Structure from Baseline (2013) to Five Years After Treatment (2018). Twenty burned transects, two masticated transects, seven masticated and burned transects, and two mixed transects were analyzed in Unit 7.

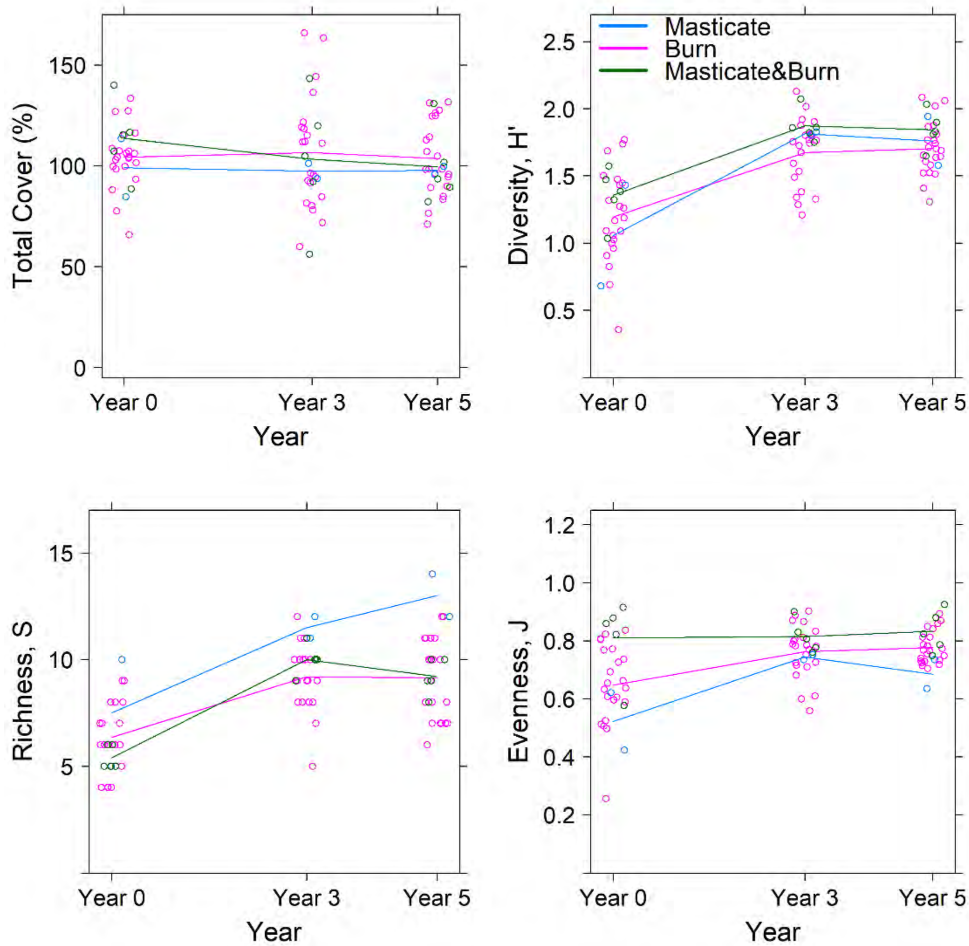

Figure 6-19. Unit 10 Community Structure from Baseline (2012) to Five Years After Treatment (2018). Twenty-two burned transects, two masticated transects, and five masticated and burned transects were analyzed in Unit 10.

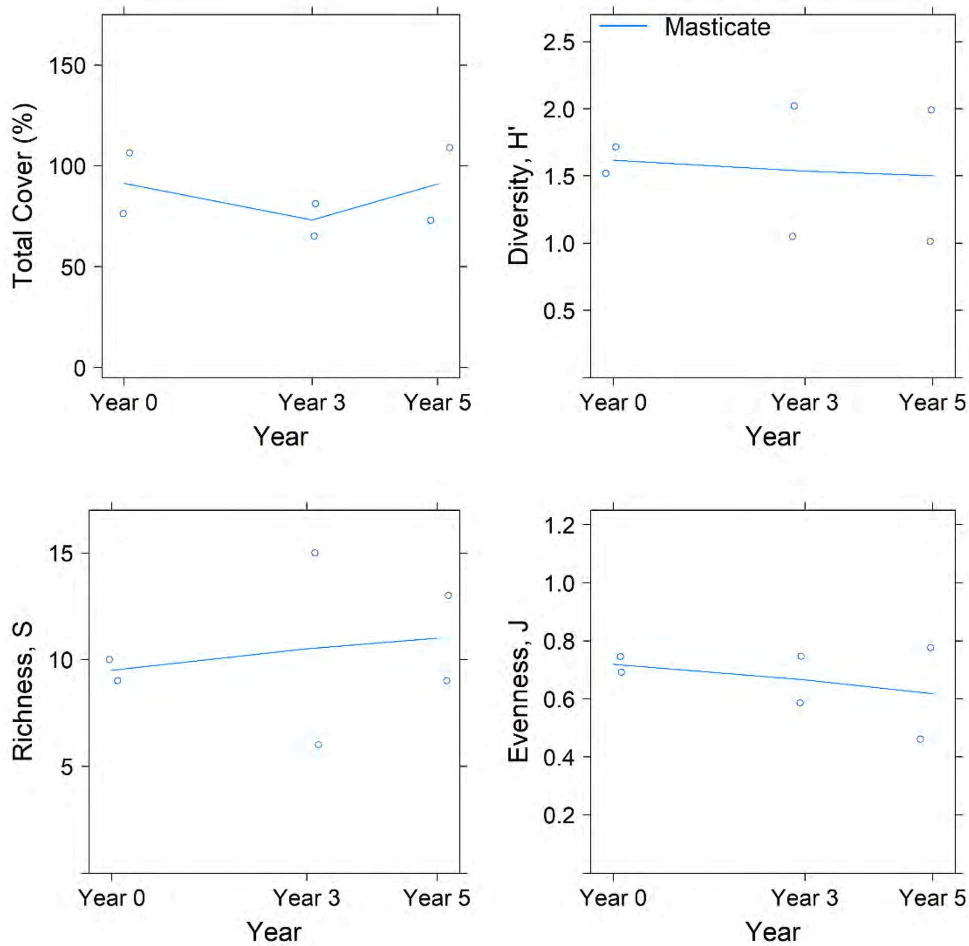

Figure 6-20. MOUT Buffer Community Structure from Baseline (2011) to Five Years After Mastication (2018). Two masticated transects were analyzed in MOUT Buffer.

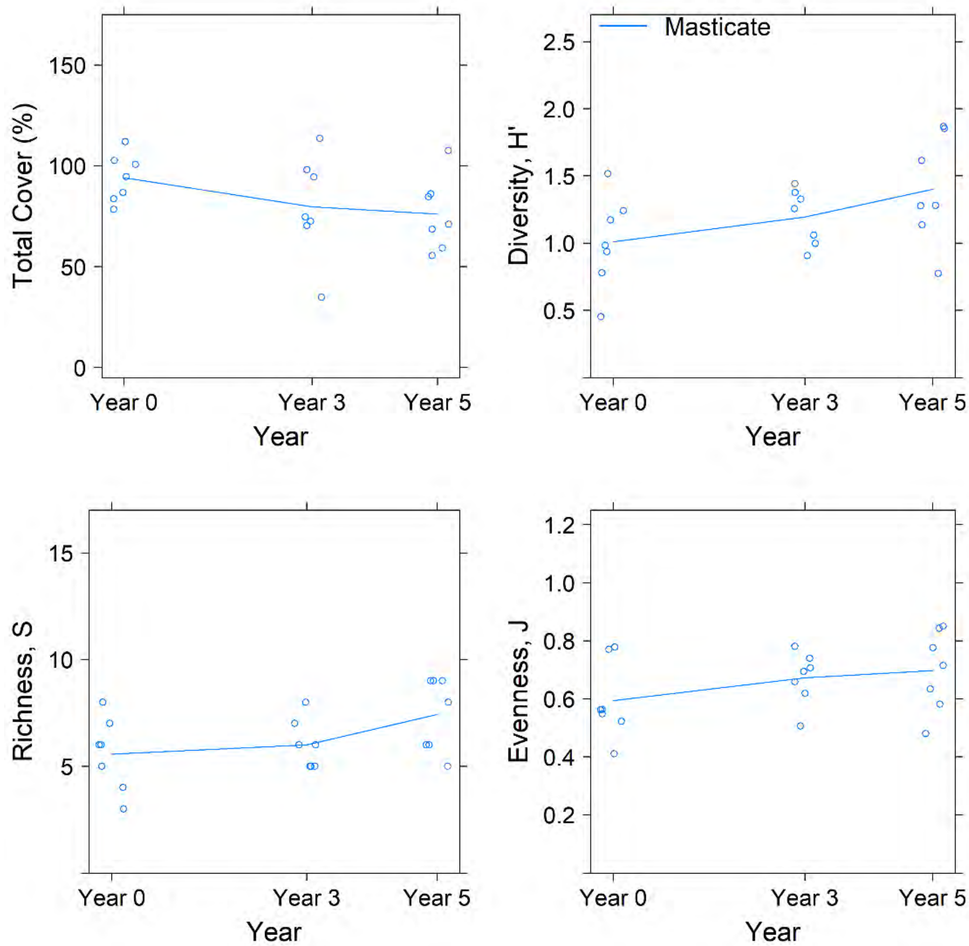

Figure 6-21. WGBA Community Structure from Baseline (2011) to Five Years After Mastication (2018). Seven masticated transects were analyzed in WGBA.

Mixed-design ANOVAs were conducted to compare the effect of Unit and Age on bare ground and herbaceous cover for Year 5 Units. The changes in both metrics were significantly different between Units, were significantly different through time, and there was a significant interaction between Unit and Age for herbaceous cover but not bare ground (Table 6-7). These results suggest that the response of the Year 5 Units to treatment was variable.

Mixed design ANOVAs were conducted on Units 7 and 10 to compare the effect of Treatment through time on bare ground and herbaceous cover. The changes in both metrics were significantly different between Treatment within Units except for bare ground in Unit 10, were significantly different through time, and there was a significant interaction between Treatment and Age for herbaceous cover but not bare ground in both Units (Table 6-8 and 6-9). These results suggest that herbaceous cover varied by Treatment and Age in both Units, and that bare ground varied by Age for both Units but by Treatment only in Unit 7. It should be noted that Unit 7 (n_{burned}=20; $n_{masticated}$=2; $n_{masticated\&burned}$=7; n_{mixed}=2) and Unit 10 (n_{burned}=22; $n_{masticated}$=2; $n_{masticated\&burned}$=5) have unbalanced data by treatment types. The different sample sizes by treatment type may affect statistical results.

Table 6-7. Mixed-design ANOVA results for Units 1 East, 6, 7, 10, MOUT Buffer, and WGBA bare ground and herbaceous cover. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*p*
Unit	3.34	0.009*	14.9	5.33e-10*
Age	19.0	4.60e-08*	56.0	1.52e-14*
Unit*Age	0.771	0.657	9.70	1.23e-09*

Table 6-8. Mixed-design ANOVA results for Unit 7 bare ground and herbaceous cover. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*p*
Treatment	15.3	5.31e-06*	15.6	4.44e-06*
Age	12.9	2.68e-05*	66.5	2.00e-11*
Treatment*Age	1.37	0.245	23.2	5.74e-10*

Table 6-9. Mixed-design ANOVA results for Unit 10 bare ground and herbaceous cover. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*p*
Treatment	0.111	0.895	10.9	3.71e-04*
Age	4.25	0.020*	51.7	4.63e-10*
Treatment*Age	0.325	0.860	8.58	2.16e-04*

The bare ground cover in Year 5 Units responded variably in response to treatment. Unit 1 East and MOUT Buffer bare ground increased between Baseline and Year 3 by 17% and 3.2%, respectively (Figures 6-22 and 6-26). The bare ground in Unit 1 East and MOUT Buffer subsequently decreased between Year 3 and Year 5 by 3.1% and 0.40%, respectively. Unit 6 and WGBA bare ground increased between Baseline and Year 5 by 15% and 19%, respectively (Figures 6-23 and 6-27). Units 7 and 10 bare ground change varied by Treatment (Figures 6-24 and 6-25). Unit 7 bare ground on the burned transects was 9.1% in Baseline, 19% in Year 3, and 18% in Year 5; on the masticated transects was 33% in Baseline, 45% in Year 3, and 32% in Year 5; on the masticated and burned transects was 7.9% in Baseline, 24% in Year 3, and 21% in Year 5; and on the mixed transects was 4.9% in Baseline, 22% in Year 3, and 27% in Year 5. Unit 10 bare ground on the burned transects was 13% in Baseline, 21% in Year 3, and 22% in Year 5; on the masticated transects was 17% in Baseline, 20% in Year 3, and 22% in Year 5; and on the masticated and burned transects was 12% in Baseline, 26% in Year 3, and 24% in Year 5.

The herbaceous cover in Year 5 Units responded variably in response to treatment. Unit 1 East, MOUT Buffer and WGBA herbaceous cover increased between Baseline and Year 3 by 6.3%, 4.5% and 28%, respectively (Figures 6-22, 6-26, and 6-27). The herbaceous cover in Unit 1 East, WGBA, and MOUT Buffer subsequently decreased between Year 3 and Year 5 by 4.9%, 2.2% and 13%, respectively. Unit 6 herbaceous cover increased between Baseline and Year 5 by 3.6% (Figure 6-23). Units 7 and 10 herbaceous cover change varied by Treatment (Figures 6-24 and 6-25). Unit 7 herbaceous cover on the burned transects was 0.00% in Baseline, 0.83% in Year 3, and 0.28% in Year 5; on the masticated transects was 0.00% in Baseline, 11% in Year 3, and 0.90% in Year 5; on the masticated and burned transects was 0.00% in Baseline, 1.6% in Year 3, and 0.29% in Year 5; and on the mixed transects was 0.00% in Baseline, 1.5% in Year 3, and 0.40% in Year 5. Unit 10 herbaceous cover on the burned transects was 0.28% in Baseline, 3.6% in Year 3, and 0.55% in Year 5; on the masticated transects was 0.00% in Baseline, 15% in Year 3, and 4.9% in Year 5; and on the masticated and burned transects was 0.08% in Baseline, 4.5% in Year 3, and 0.20% in Year 5.

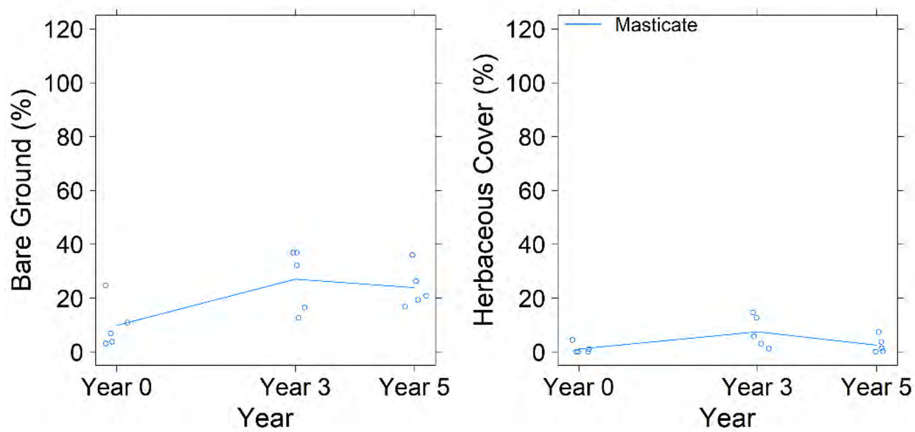

Figure 6-22. Unit 1 East Bare Ground and Herbaceous Cover from Baseline to Year 5 After Mastication. Five masticated transects were analyzed in Unit 1 East.

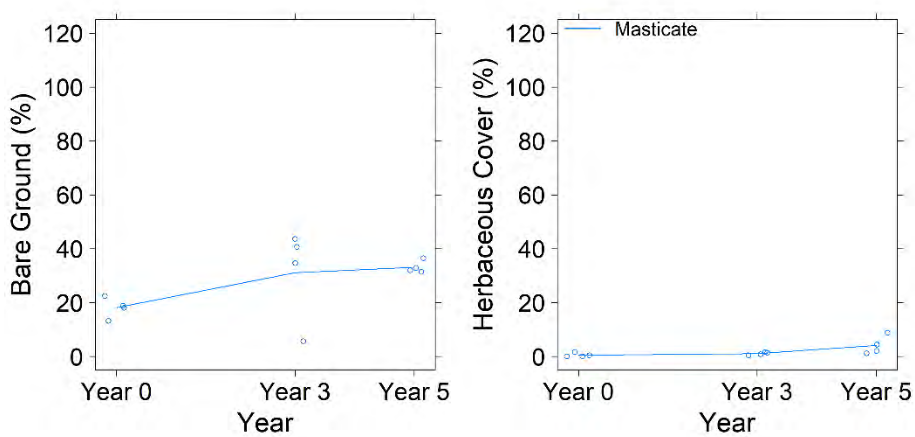

Figure 6-23. Unit 6 Bare Ground and Herbaceous Cover from Baseline to Year 5 After Mastication. Four masticated transects were analyzed in Unit 6.

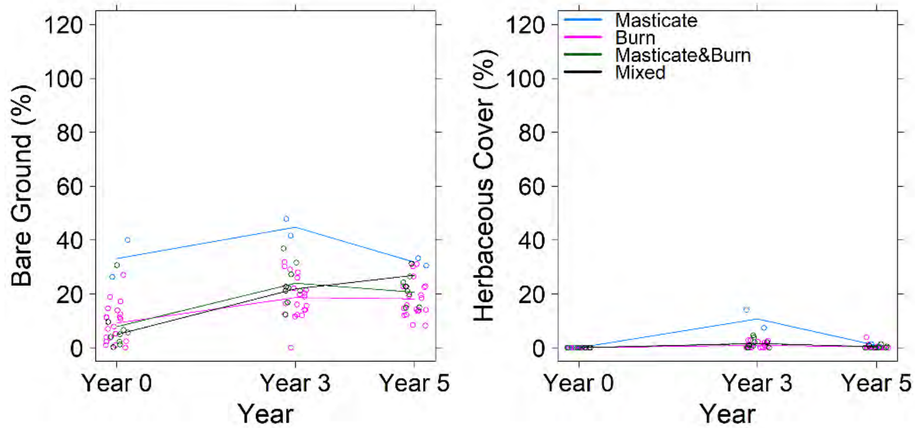

Figure 6-24. Unit 7 Bare Ground and Herbaceous Cover from Baseline (2013) to Year 5 (2018) After Treatment. Twenty burned transects, two masticated transects, seven masticated and burned transects, and two mixed transects were analyzed in Unit 7.

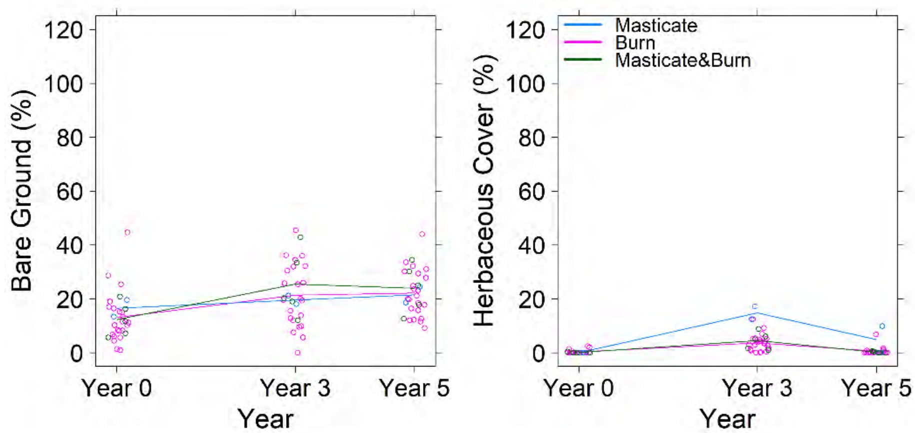

Figure 6-25. Unit 10 Bare Ground and Herbaceous Cover from Baseline (2012) to Year 5 (2018) After Treatment. Twenty two burned transects, two masticated transects, and five masticated and burned transects were analyzed in Unit 10.

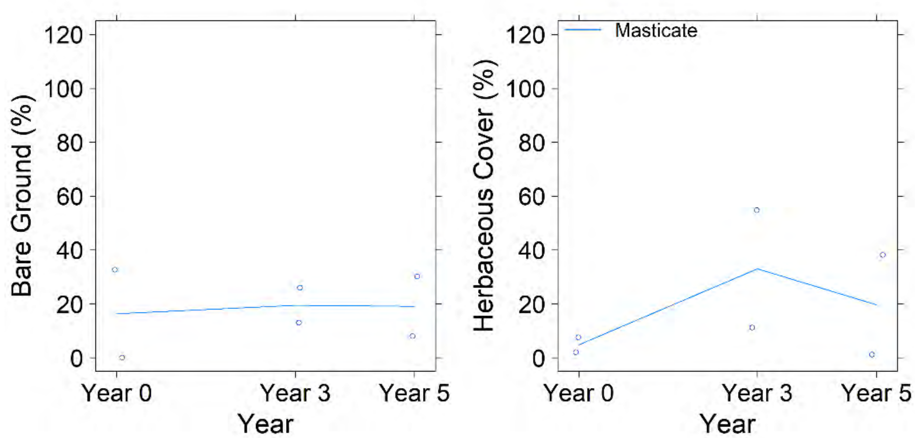

Figure 6-26. MOUT Buffer Bare Ground and Herbaceous Cover from Baseline to Year 5 After Mastication. Two masticated transects were analyzed in MOUT Buffer.

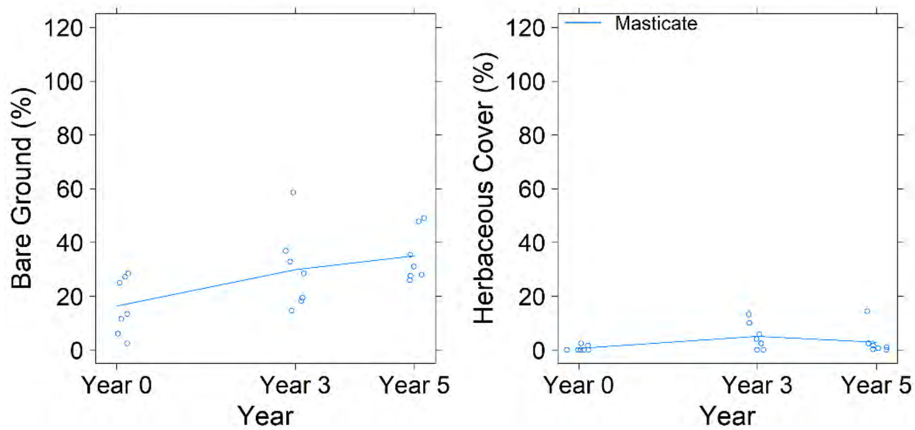

Figure 6-27. WGBA Bare Ground and Herbaceous Cover from Baseline to Year 5 After Mastication. Seven masticated transects were analyzed in WGBA.

Burleson conducted PERMANOVA to examine differences in community composition among Age, Treatment, and Unit (Table 6-10). These results suggest that overall community composition was significantly different between Units, Treatment, and Age, and there were no significant interactions. This indicates that the types and abundances of species within each Unit were different, and that composition varied significantly through time. The community compositions for each Unit are shown in Figures 6-28 through 6-33. PERMANOVAs were conducted to evaluate differences in community composition among treatments in Units 7 and 10 where more than one treatment was applied. Community composition was significantly different between Treatment in Unit 10, but not in Unit 7 (Tables 6-11 and 6-12).

Table 6-10. Three-way PERMANOVA results for Year 5 Unit community compositions, based on Bray-Curtis distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	48.8	0.001*
Unit	2.84	0.014*
Treat	3.13	0.016*
Unit*Age	0.220	0.965
Unit*Treat	1.70	0.138
Age*Treat	1.53	0.186
Unit*Age*Treat	0.215	0.967

Table 6-11. Two-way PERMANOVA results for Unit 7 community compositions, based on Bray-Curtis distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	36.9	0.001*
Treat	1.86	0.093
Age*Treat	0.593	0.641

Table 6-12. Two-way PERMANOVA results for Unit 10 community compositions, based on Bray-Curtis distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	29.8	0.001*
Treat	2.83	0.028*
Age*Treat	0.466	0.808

Community composition differs between Year 5 Units and between Treatments and Age (Figures 6-28 through 6-33). Units 1 East, 6, WGBA, and MOUT were dominated by shaggy-barked manzanita (c_{1East}=51%, c_6=56%, c_{WGBA}=54%, and c_{MOUT}=30%) in their Baseline year. Units 1 East, 6, and WGBA remained dominated by shaggy-barked manzanita (c_{1East}=32%, c_6=34%, c_{WGBA}=32%) by Year 5 with deerweed dominance (c_{1East}=30%, c_6=27%, c_{WGBA}=38%) in the intervening Year 3. Whereas, the MOUT Buffer composition changed by Year 5 to chamise-dominated (c_{MOUT}=32%), with shaggy-barked manzanita being a second dominant species (c_{MOUT}=26%).

Since composition was not significantly different among Treatments in Unit 7, and as such it was evaluated for all Treatments collectively. Unit 7 was dominated by shaggy-barked manzanita (c_7=58%) in Baseline, deerweed (c_7=27%) in Year 3, and dwarf ceanothus (*Ceanothus dentatus)* (c_7=32%) by Year 5 (Figure 6-30).

Unit 10 compositions were significantly different among Treatments and were evaluated separately (Figure 6-31). Dwarf ceanothus appears to have been promoted by the prescribed burns in Unit 10, where the species became the dominant after treatment in the burned areas and in the masticated and burned areas. The dominant species in Unit 10 on the burned transects was shaggy-barked manzanita (c=59%) in Baseline, deerweed (c=26%) in Year 3, and dwarf ceanothus (c=27%) in Year 5. The dominant species in Unit 10 on the masticated transects was shaggy-barked manzanita in all Age classes ($c_{Baseline}$=64%, $c_{Year\ 3}$=28%, and $c_{Year\ 5}$=40%). The dominant species in Unit 10 on the burned and masticated transects was shaggy-barked manzanita (c=50%) in Baseline and dwarf ceanothus in Year 3 (c=22%) and Year 5 (c=29%).

The HMP species present in Year 5 Units varied by Unit and Treatment, and their recovery tended to occur at a slower rate than the dominant species (Figures 6-34 through 6-39). Unit 1 East HMP species in Baseline comprised Monterey ceanothus, sandmat manzanita, and Eastwood's goldenbush, which are all present by Year 5 with sandmat manzanita recovering the best. Unit 6 East HMP species in Baseline comprised Toro manzanita, sandmat manzanita, and Monterey ceanothus, and only Toro manzanita was observed by Year 5. The only HMP species present in Baseline in WGBA was sandmat manzanita, which was present in Year 5 and appears to be recovering well. The HMP species present during Baseline in MOUT Buffer were Monterey ceanothus and Toro manzanita. By Year 5, Toro manzanita was not observed, but Monterey ceanothus is recovering well, and Hooker's manzanita was observed for the first time in the Unit.

Unit 7 HMP species were not evaluated separately by Treatment since composition did not differ by Treatment. Monterey ceanothus is the only HMP shrub species that appears to be recovering well, while the others are not present after Treatment or are recovering slowly. All five HMP shrub species were present in the Baseline in Unit 7. By Year 3, only Monterey ceanothus and Eastwood's goldenbush were present. By Year 5, Monterey ceanothus and sandmat manzanita were present. Toro and Hooker's manzanitas tend to recover slower than other species and could return in future years in Unit 7.

Unit 10 had different Treatments applied, and the HMP species recovery varied by Treatment in some cases (Figures 6-37). Monterey ceanothus appears to have recovered well in Unit 10 for all Treatments. Sandmat manzanita appeared to recover well on masticated transects but not on burned or masticated and burned transects; however, the Baseline cover on burned and masticated and burned transects was lower than that of masticated transects. The corresponding Year 5 cover values can be expected to be lower as well. Hooker's manzanita was only found on burn transects in Baseline surveys and so far was not observed on any transects after the prescribed burn. Eastwood's goldenbush was only on burned transects and is recovering well. The burned transects contained four of five HMP shrubs in Baseline: Monterey ceanothus, sandmat manzanita, Hooker's manzanita, and Eastwood's goldenbush. By Years 3 and 5, all these species were still observed on these transects except Hooker's manzanita. The HMP shrubs present on the masticated transects in Baseline were sandmat manzanita and Monterey ceanothus, which were both present by Year 5. The HMP shrubs present on the masticated and burned transects were Monterey ceanothus and sandmat manzanita, but by Year 5 only Monterey ceanothus was present.

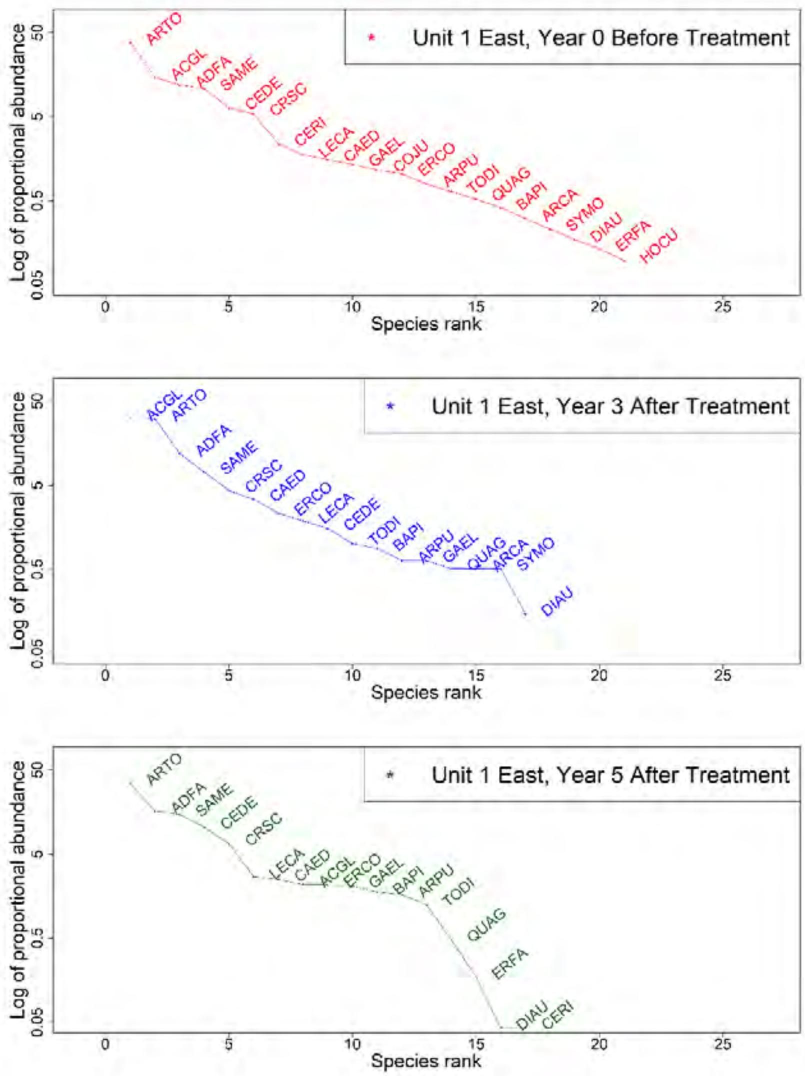

Figure 6-28. Unit 1 East Rank Abundance Curves Between Baseline (1997 and 2007) and Year 5 (2018). Note that the y-axis is log-10 scale. Five masticated transects were analyzed in Unit 1 East.

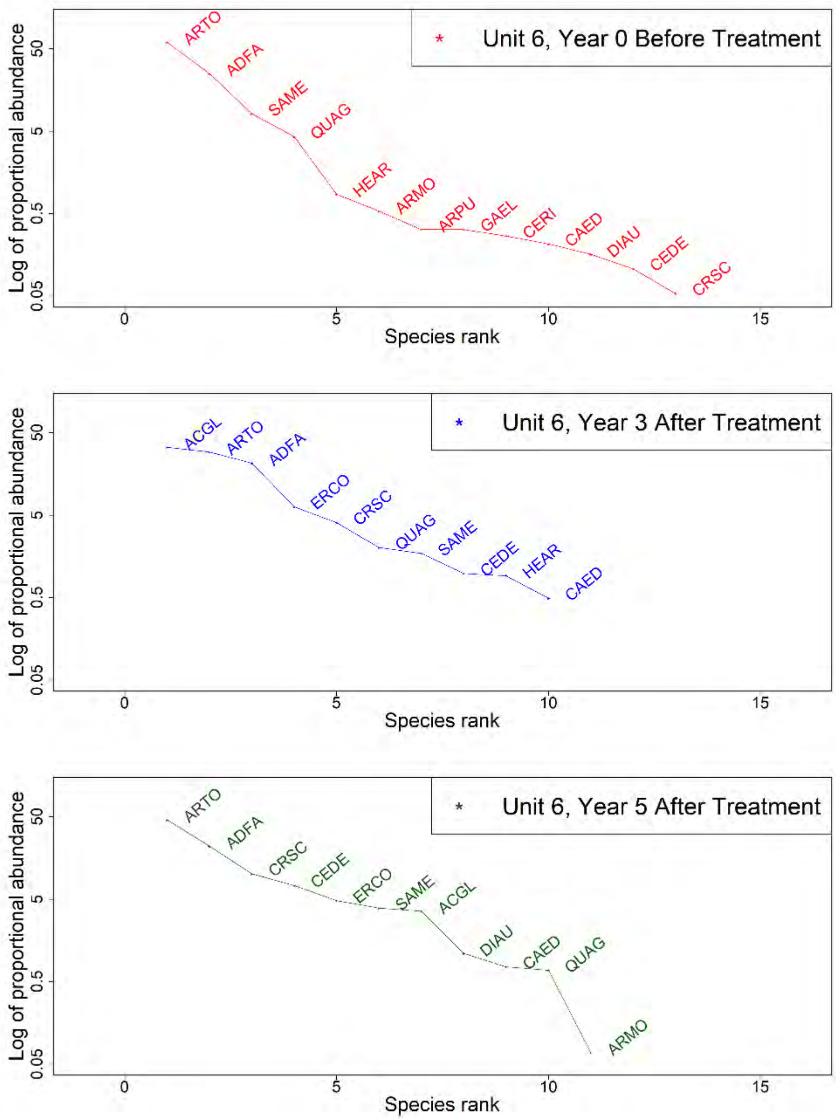

Figure 6-29. Unit 6 Rank Abundance Curves Between Baseline (2012) and Year 5 (2018). Note that the y-axis is log-10 scale. Four masticated transects were analyzed in Unit 6.

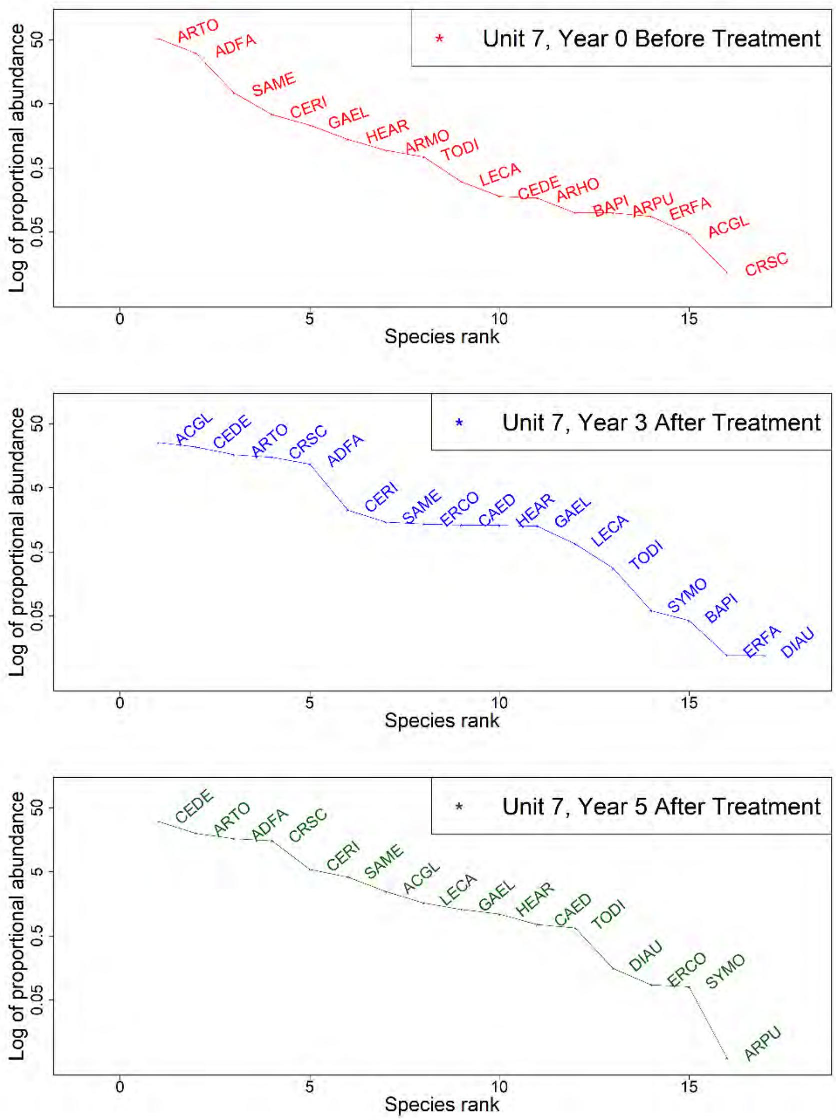

Figure 6-30. Unit 7 Rank Abundance Curves Between Baseline (2013) and Year 5 (2018). Note that the y-axis is log-10 scale. Twenty burned transects, two masticated transects, seven masticated and burned transects, and two mixed transects were analyzed in Unit 7; however, since community composition was not significantly different between treatment types, they were not analyzed separately.

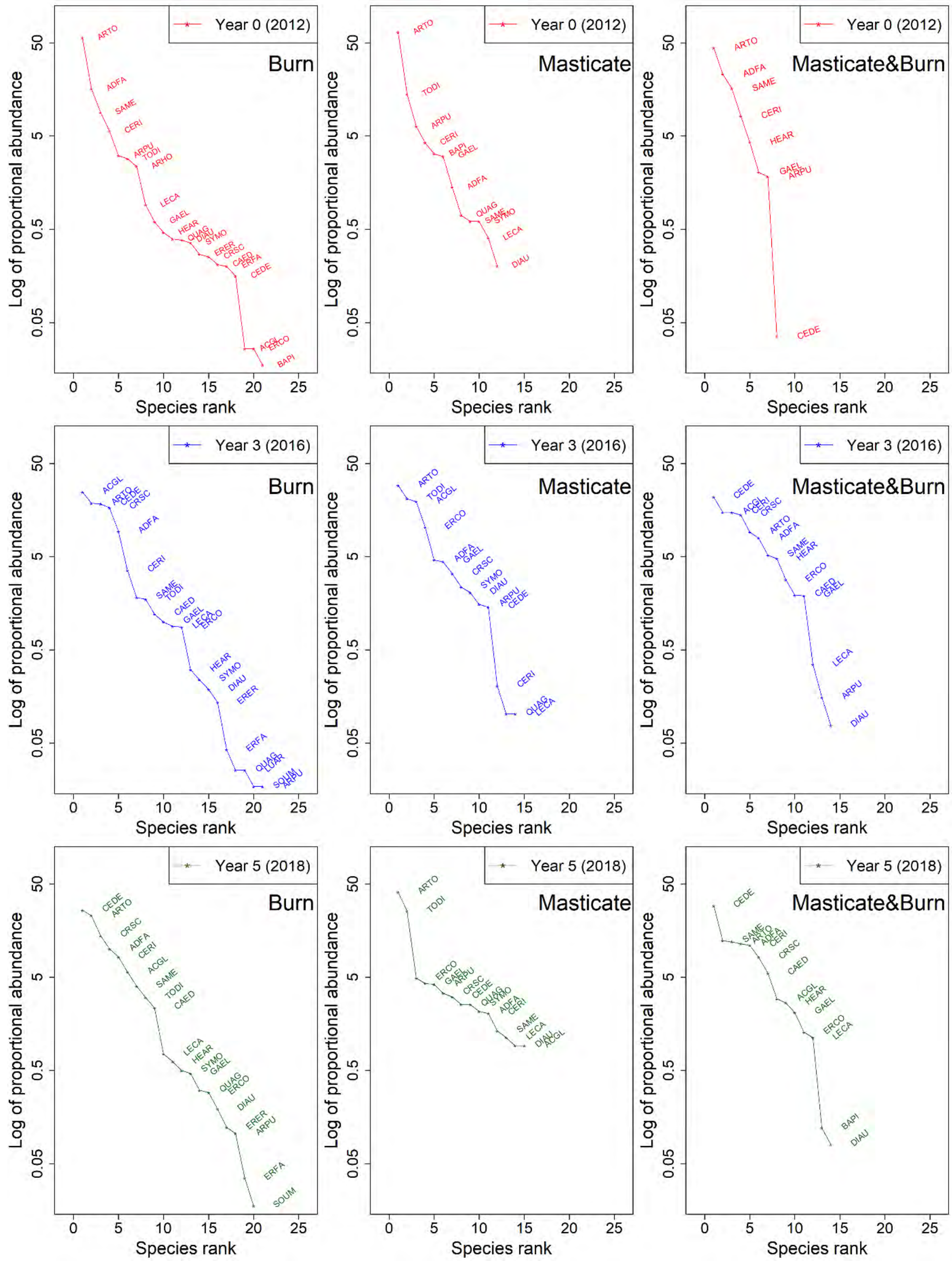

Figure 6-31. Unit 10 Rank Abundance Curves Between Baseline (2012) and Year 5 (2018). Note that the y-axis is log-10 scale. The left column represents burned transects (*n*=22), the middle column represents masticated transects (*n*=2), and the right column represents masticated and burned transects (*n*=5).

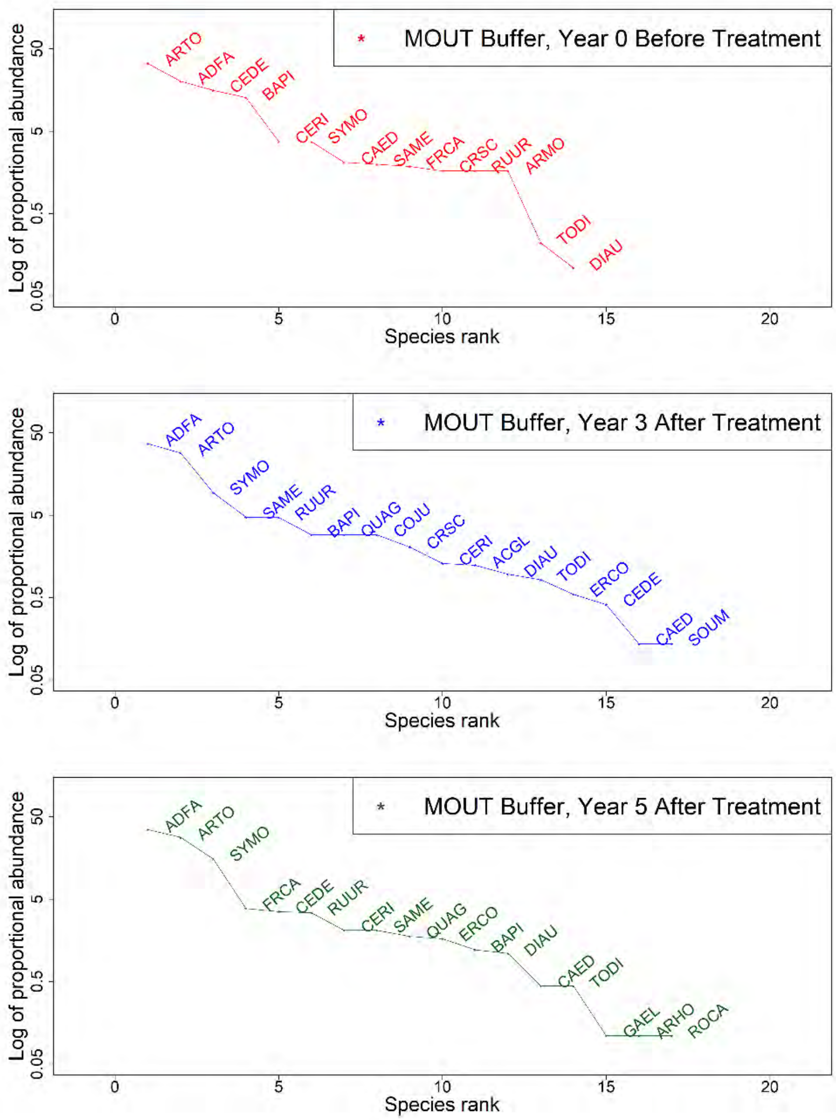

Figure 6-32. MOUT Buffer Rank Abundance Curves Between Baseline (2011) and Year 5 (2018). Note that the y-axis is log-10 scale. Two masticated transects were analyzed in MOUT Buffer.

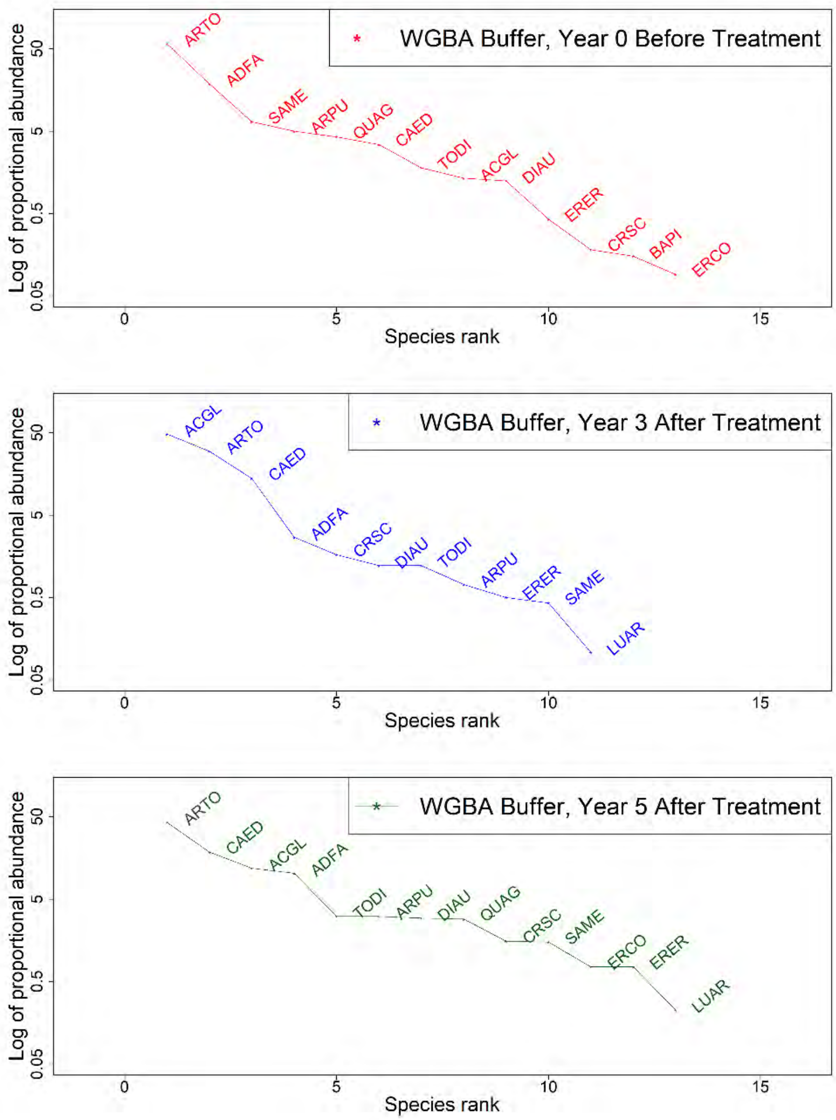

Figure 6-33. WGBA Rank Abundance Curves Between Baseline (2011) and Year 5 (2018). Note that the y-axis is log-10 scale. Seven masticated transects were analyzed in WGBA.

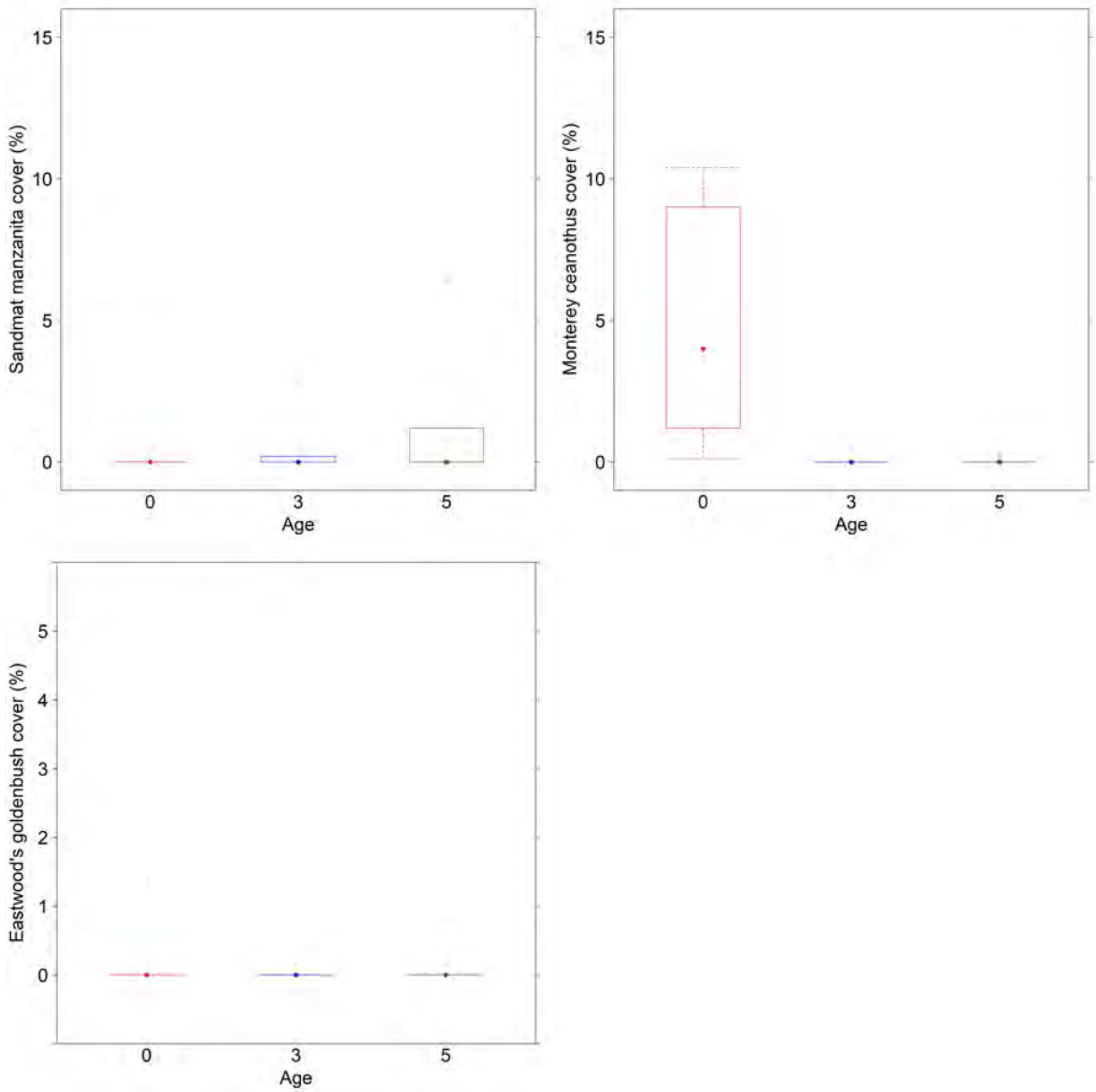

Figure 6-34. Unit 1 East HMP Shrub Species Cover Between Baseline (1997 and 2007) and Year 5 (2018). Hooker's manzanita and Toro manzanita were not present in any year. Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Five masticated transects were analyzed in Unit 1 East.

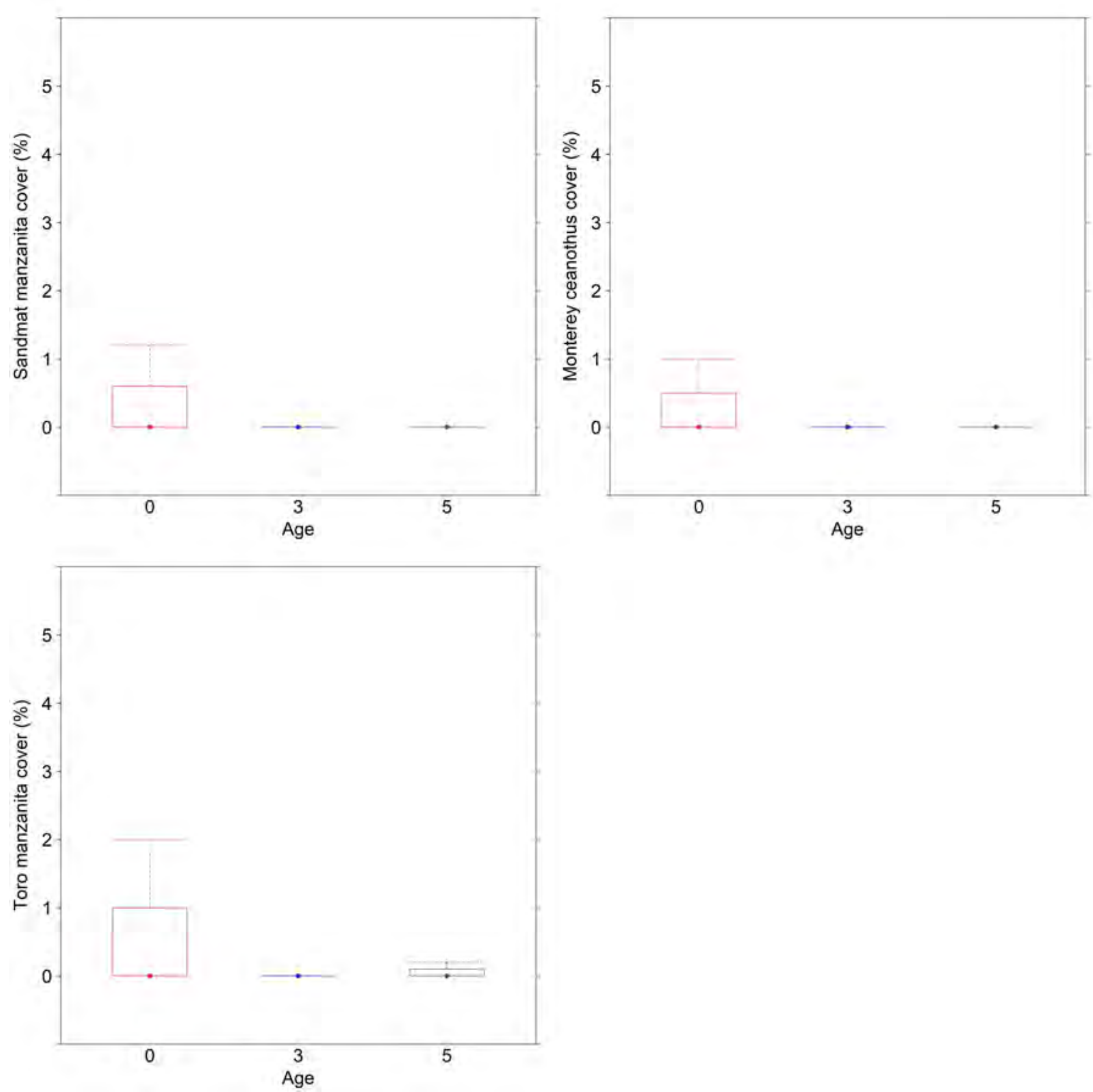

Figure 6-35. Unit 6 HMP Shrub Species Cover Between Baseline (2011) and Year 5 (2018). Hooker's manzanita and Eastwood's goldenbush were not present in any year. Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Four masticated transects were analyzed in Unit 6.

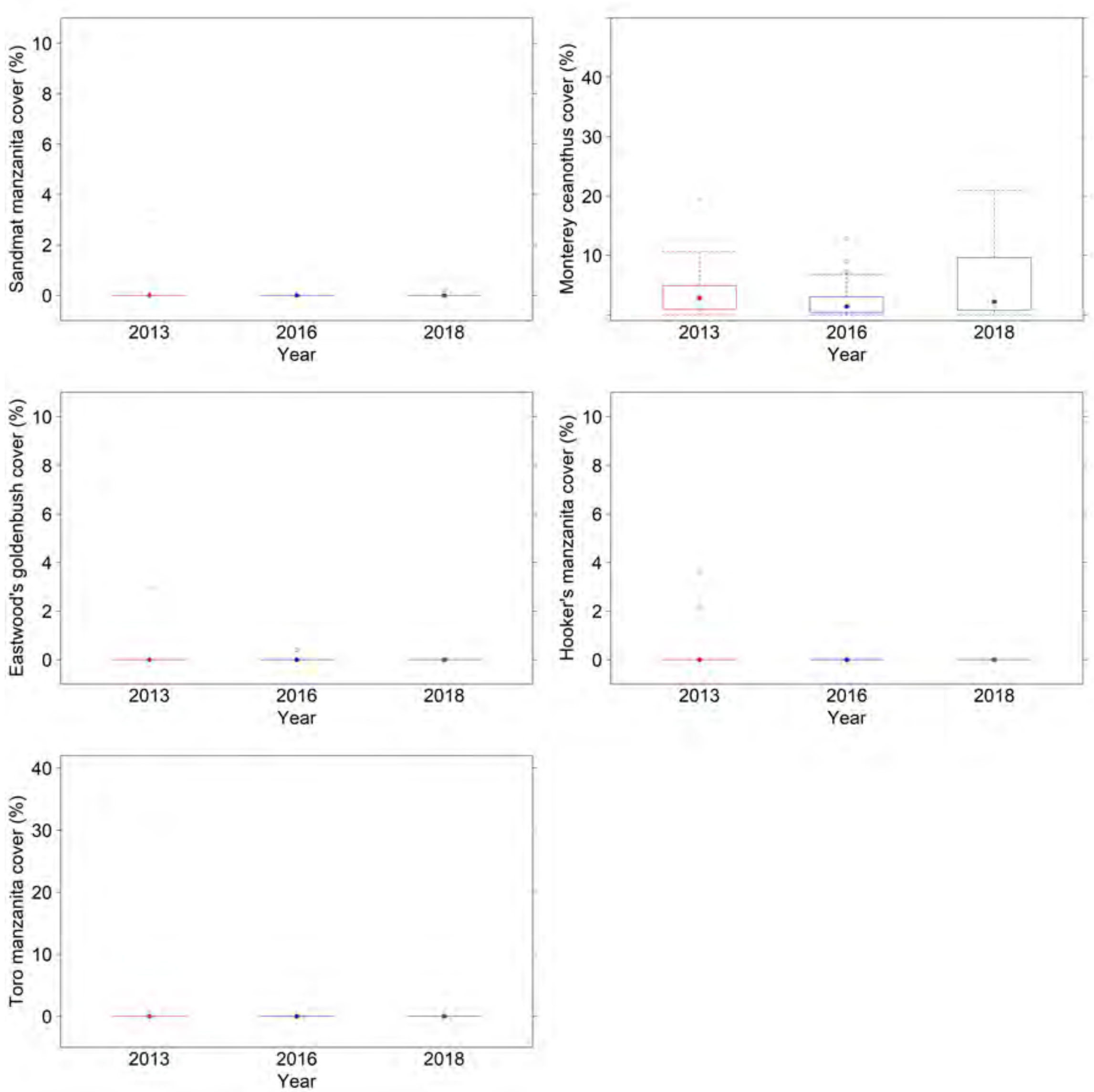

Figure 6-36. Unit 7 HMP Shrub Species Cover Between Baseline (2013) and Year 5 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Twenty burned transects, two masticated transects, seven masticated and burned transects, and two mixed transects were analyzed in Unit 7; however, since community composition was not significantly different between treatment types, they were not analyzed separately.

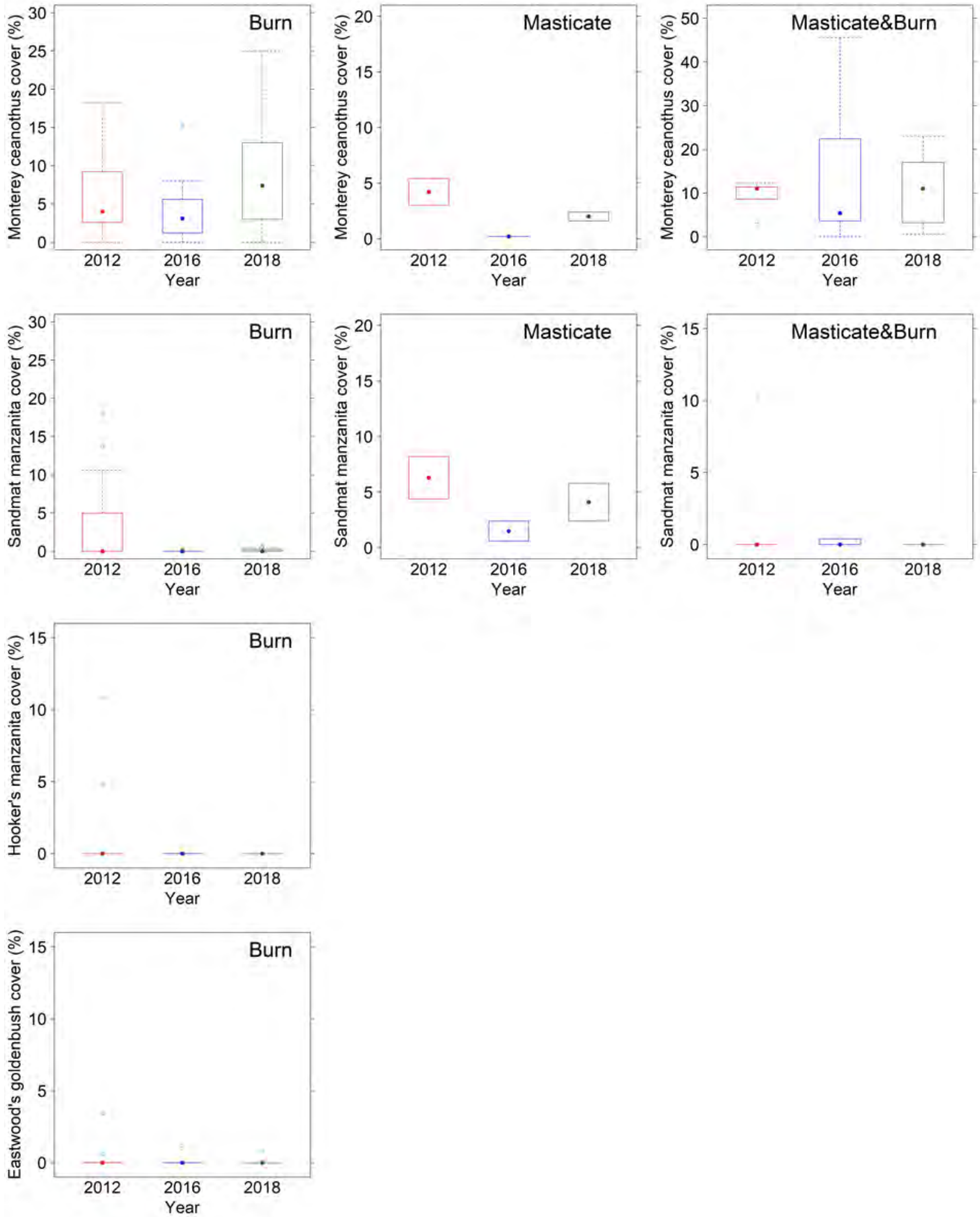

Figure 6-37. Unit 10 HMP Shrub Species Cover Between Baseline (2012) and Year 5 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Twenty two burned transects, two masticated transects, and five masticated and burned transects were analyzed in Unit 10.

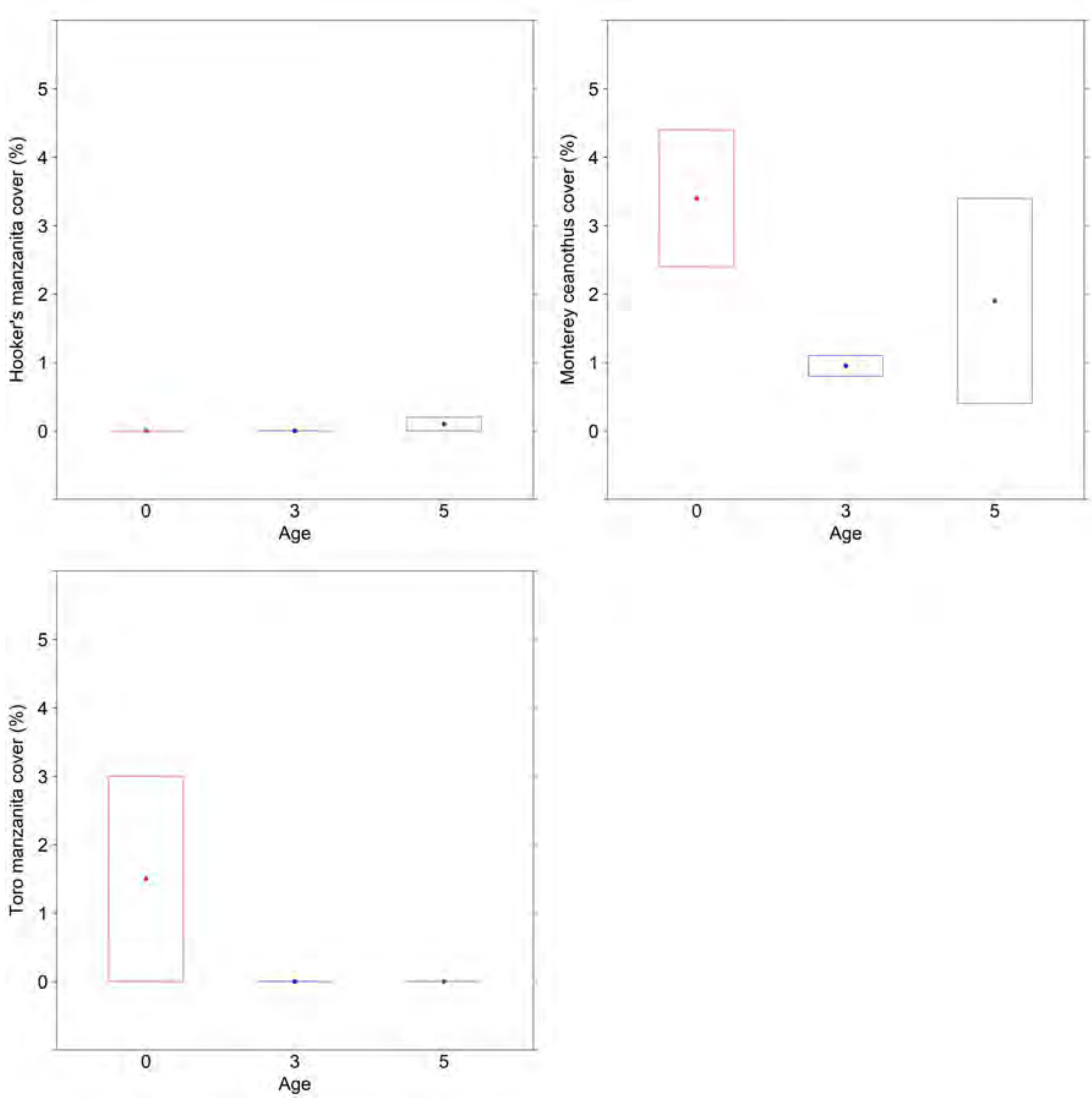

Figure 6-38. MOUT Buffer HMP Shrub Species Cover Between Baseline (2011) and Year 5 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Two masticated transects were analyzed in MOUT Buffer.

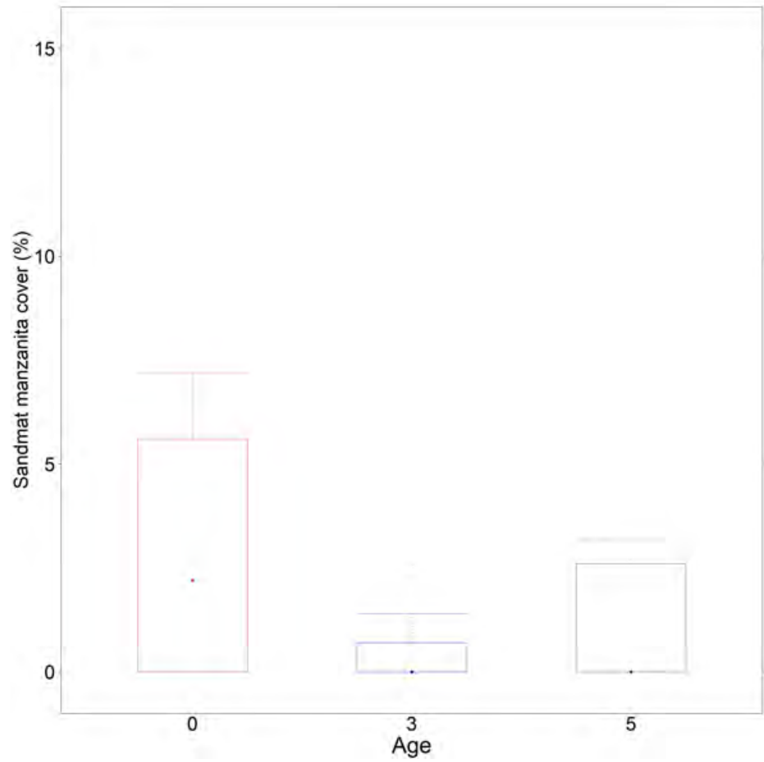

Figure 6-39. WGBA HMP Shrub Species Cover Between Baseline (2011) and Year 5 (2018). Sandmat manzanita was the only HMP species present in WGBA in any year. Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Seven masticated transects were analyzed in WGBA.

NMDS ordinations for Year 5 Units illustrate that the community compositions by Year 5 were on trajectory towards Baseline composition (Figure 6-40 through 6-45). Community composition is represented by the shape and location of ellipses in the ordination space, where ellipses with similar shape and location imply similar community composition. In Year 3 after treatment, ellipses are typically located in a different location on the ordination than the Baseline ellipses since composition has shifted. By Year 5, the location of ellipses typically shifts back towards the Baseline ellipse location, implying that community composition is more similar to Baseline by Year 5 than in Year 3. In some cases when sample sizes are only two transects, the ellipses become lines.

Community compositions were different among treatments in Unit 10, which was supported by the PERMANOVA results (Figure 6-43; Table 6-12). Community composition was not visualized by treatment in Unit 7 since PERMANOVA suggested no significant difference among treatment types (Figure 6-42).

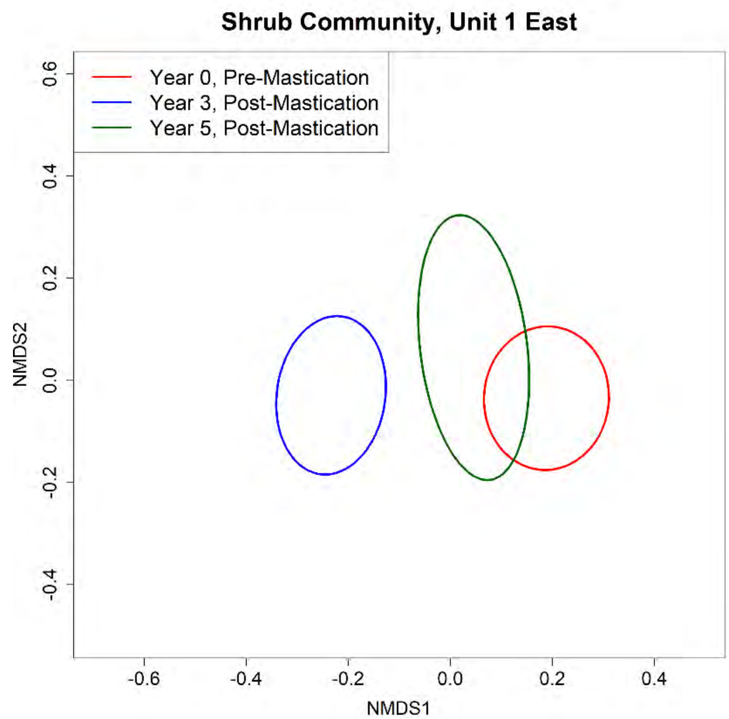

Figure 6-40. NMDS Ordination Plot Showing Unit 1 East Community Composition Changes Between Baseline and Year 5. Five masticated transects were analyzed in Unit 1 East.

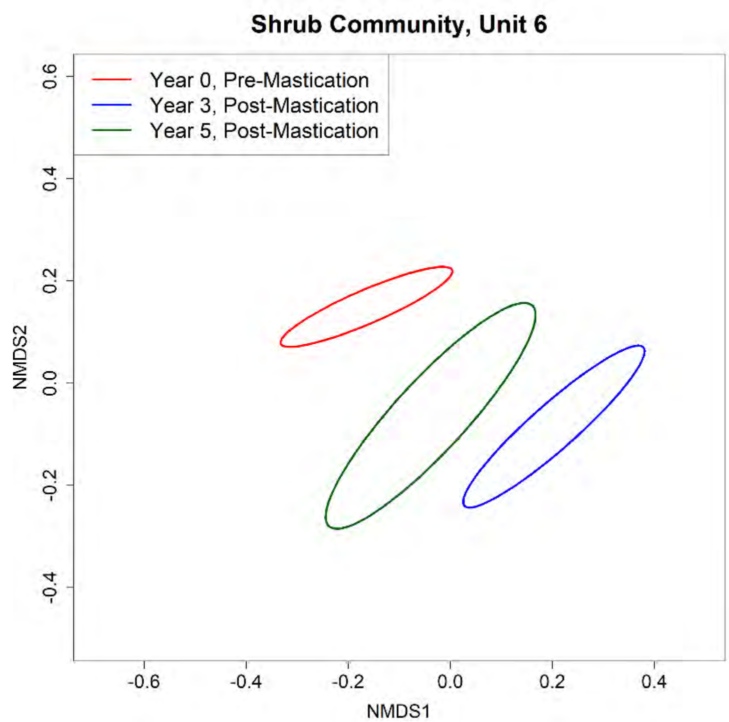

Figure 6-41. NMDS Ordination Plot Showing Unit 6 Community Composition Changes Between Baseline and Year 5. Four masticated transects were analyzed in Unit 6.

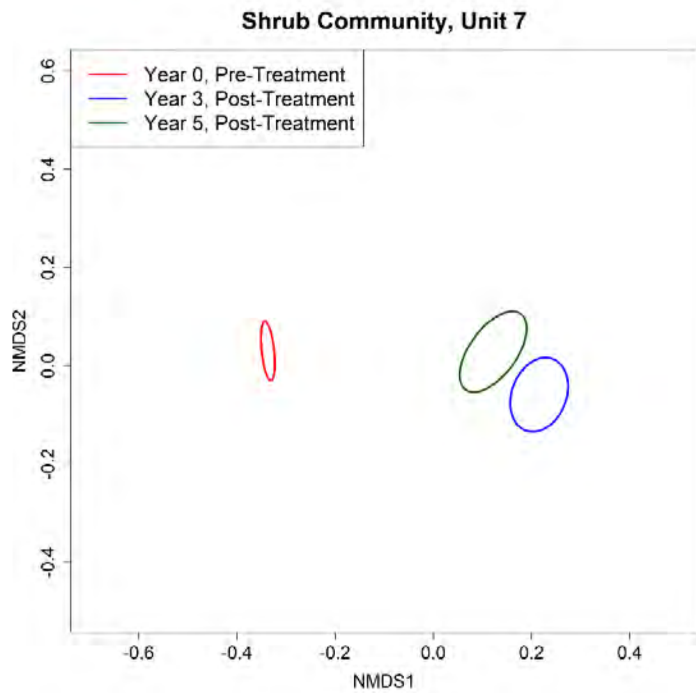

Figure 6-42. NMDS Ordination Plot Showing Unit 7 Community Composition Changes Between Baseline and Year 5. Different treatment types are not visualized since the PERMANOVA suggests that there is no significant effect due to treatment. Twenty burned transects, two masticated transects, seven masticated and burned transects, and two mixed transects were analyzed in Unit 7.

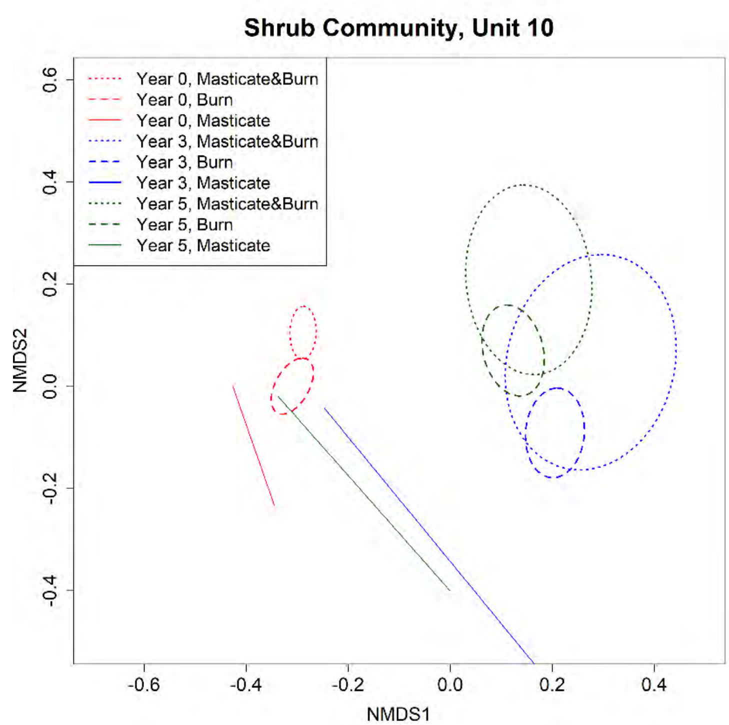

Figure 6-43. NMDS Ordination Plot Showing Unit 10 Community Composition Changes Between Baseline and Year 5. Twenty-two burned transects (dashed lines), two masticated transects (solid lines), and five masticated and burned transects (dotted lines) were analyzed in Unit 10.

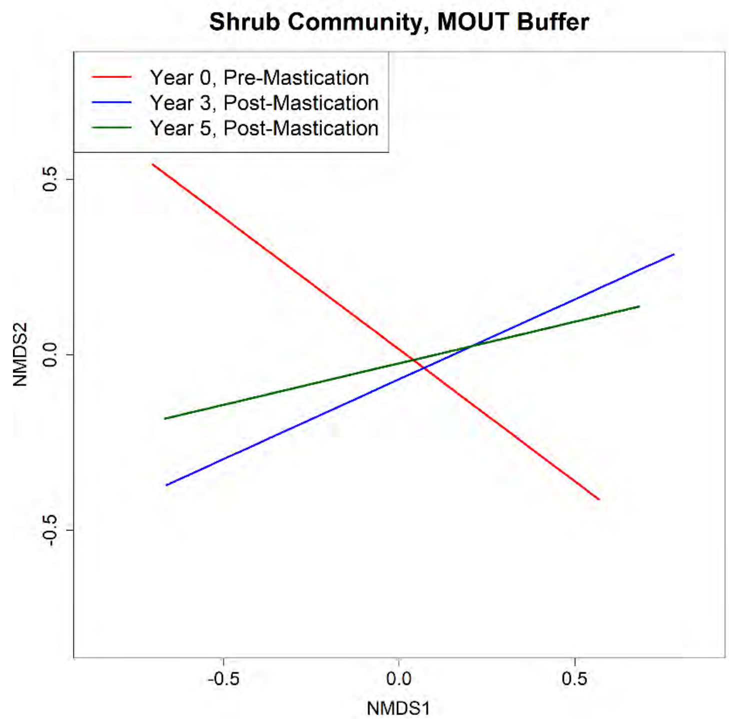

Figure 6-44. NMDS Ordination Plot Showing MOUT Buffer Community Composition Changes Between Baseline and Year 5. Two masticated transects were analyzed in MOUT Buffer.

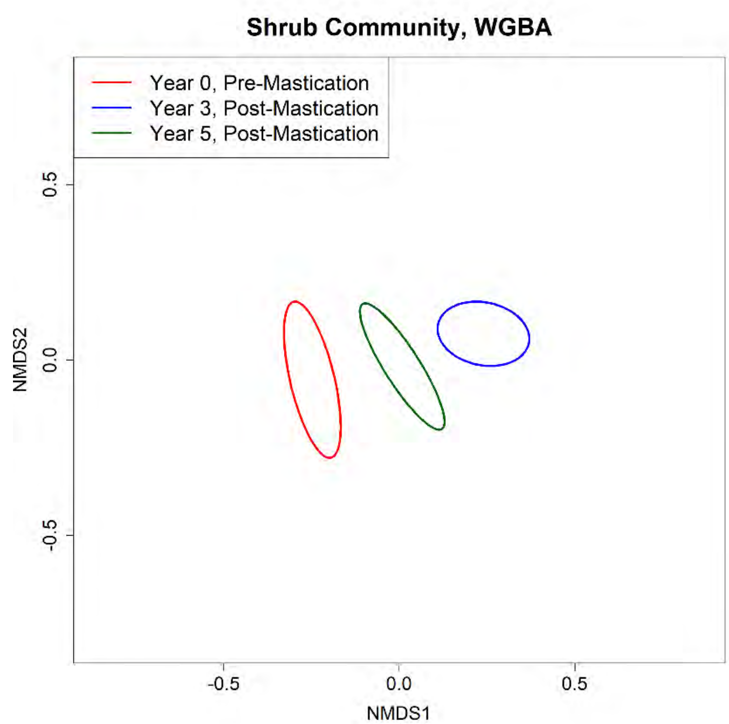

Figure 6-45. NMDS Ordination Plot Showing WGBA Community Composition Changes Between Baseline and Year 5. Seven masticated transects were analyzed in WGBA.

6.4.7 Annual Grass Monitoring

Non-native annual grasses were observed and mapped within the Containment Lines and roadside fuel breaks of Units 6, 7, 10, and MOUT Buffer (Appendix D, Figures D-6 through D-9). Total area occupied by annual grasses increased between Baseline and Year 1 or Year 3 depending on the Unit, with subsequent decreases by Year 5 for all Units. Unit 6 was not monitored in Year 3. The cover class with the largest areal extent in Year 5 for Units 6, 7, 10, and MOUT Buffer were cover class 3 (12.05 acres), 3 (6.96 acres), 2 (3.90 acres), and 3 (7.37 acres), respectively. Units 6 and 10 had a large expansion of annual grass cover between Baseline and Year 1, and large decreases by Year 5. Estimated areas occupied by each density class are summarized in Tables 6-13 and 6-14.

Table 6-13. Estimated Area Occupied (Acres) by Annual Grasses Between Baseline and Year 5 for Units 6 and 7

Cover Class	Baseline Unit 6 (acres)	Year 1 Unit 6 (acres)	Year 5 Unit 6 (acres)	Baseline Unit 7 (acres)	Year 1 Unit 7 (acres)	Year 3 Unit 7 (acres)	Year 5 Unit 7 (acres)
1 (Low) = 1 – 5% Cover	5.08	9.82	0.24	2.34	3.95	4.54	3.07
2 (Medium) = 6 – 25% Cover	2.29	13.51	2.80	2.44	1.97	3.58	1.47
3 (High) = > 25% Cover	2.81	16.27	12.05	4.65	4.77	8.69	6.96
Total Acreage	**10.18**	**39.60**	**15.09**	**9.43**	**10.69**	**16.81**	**11.5**

Table 6-14. Estimated Area Occupied (Acres) by Annual Grasses Between Baseline and Year 5 for Units 10 and MOUT Buffer.

Cover Class	Baseline Unit 10 (acres)	Year 1 Unit 10 (acres)	Year 3 Unit 10 (acres)	Year 5 Unit 10 (acres)	Baseline MOUT Buffer (acres)	Year 1 MOUT Buffer (acres)	Year 3 MOUT Buffer (acres)	Year 5 MOUT Buffer (acres)
1 (Low) = 1 – 5% Cover	0.55	39.50	45.24	3.59	3.43	5.76	4.89	3.86
2 (Medium) = 6 – 25% Cover	0.41	10.50	8.00	3.90	3.10	5.04	3.93	4.97
3 (High) = > 25% Cover	1.01	8.97	9.79	2.47	7.65	8.62	10.25	7.37
Total Acreage	**1.97**	**58.97**	**63.03**	**9.96**	**14.18**	**19.42**	**19.07**	**16.20**

6.4.8 Invasive and Non-Native Species Monitoring

Of the target invasive species, iceplant and French broom were observed in Year 5 Units (Appendix E, Figures E-7 through E-11). For all Year 5 Units where iceplant was observed, the species was ubiquitous and covered large areas. The extent of these iceplant patches made mapping with GPS unfeasible, and the reported values are estimated using aerial imagery. There were two patches of iceplant observed in Unit 6 covering approximately 7.82 acres. There was one patch of iceplant observed in Unit 7 covering approximately 1.94 acres. There were two patches of iceplant observed in Unit 10 covering approximately 6.48 acres. Two patches of iceplant equaling approximately 4.45 acres occurred in the MOUT Buffer, while one patch of previously sprayed dead French broom equaling approximately 0.08 acres was found. Three patches of iceplant were observed in WGBA covering approximately 29.77 acres. The entirety of the southern portion of WGBA had occurrences of sparse iceplant. Additionally, there were minor occurrences of non-native herbaceous cover observed during transect monitoring in all Year 5 Units (Appendix G, Tables G-3 through G-8).

7 YEAR 8 VEGETATION SURVEYS: UNITS 15, 21, 32 AND 34

7.1 Introduction

In fall 2010, a prescribed burn was conducted in Units 15 and 21, while portions of Units 32 (except in the eastern section) and Unit 34 were masticated and burned (Tetra Tech and EcoSystems West, 2012). Following mastication, cut vegetation in portions of Units 32 and 34 were hand-burned with a terra-torch. Baseline monitoring was conducted prior to these treatments within these four Units in spring 2010 (Tetra Tech and EcoSystems West, 2011). This baseline monitoring included transect surveys to sample shrub composition in the maritime chaparral and annual grass monitoring in the primary containment areas around the perimeters of the four Units (Figure 7-1). No HMP density monitoring was conducted in Unit 32 because no HMP annuals were observed in that Unit in meandering transect surveying. Year 1 follow-up monitoring was conducted in the spring and early summer of 2011 in order to assess recovery of the three HMP annual species in the first season after burning. In the spring and early summer of 2013, Year 3 follow-up monitoring of shrub transects, HMP annual species, and annual grasses was conducted in Units 15, 21, 32 and 34 (Tetra Tech and EcoSystems West, 2014). In the spring and early summer of 2015, Year 5 follow-up surveys of shrub transects, HMP annual species, and annual grasses were conducted in Units 15, 21, 32, and 34 (Burleson, 2016).

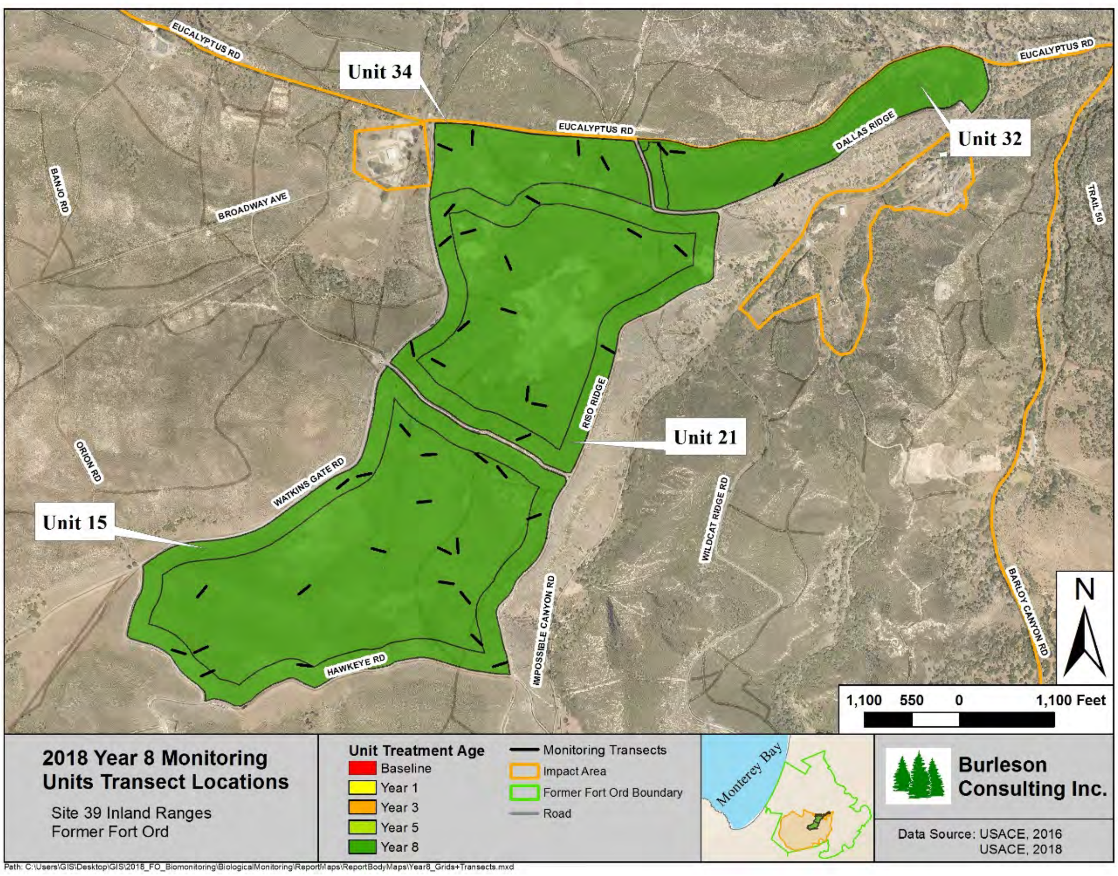

Figure -1. Map of Units 15, 21, 32 and 34 HMP Shrub Transects. Containment Lines Can be Seen Outlined in Black Where the Annual Grass Surveys Occurred.

7.2 Units 15, 21, 32, and 34: Setting

Unit 15 encompasses an area of 238 acres, where 167 acres comprise the interior and 71 acres comprise the Containment Line; Unit 21 encompasses an area of 169 acres, where 110 acres comprise the interior and 59 acres comprise the Containment Line; Unit 32 encompasses an area of 57 acres; and Unit 34 encompasses an area of 39 acres (see Figure 7-1). The terrain is gently rolling to locally steep. In pre-treatment condition, Units 15 and 34 were vegetated primarily with mature maritime chaparral, with some localized disturbed areas. Unit 21 was also largely vegetated with mature maritime chaparral, but with more extensive areas of past disturbance., with outbuildings in various states of decay and disrepair, many of which have been removed. This Unit also contained several contaminated soil remediation areas (HAs 36, 37, and 38) with active restoration located immediately west of a vernal pool (Pond 10) and on the ridgeline between the vernal pool and Watkins Gate Road. The western portion of Unit 32 (approximately 2/3 of the Unit) and its southeastern portion were vegetated primarily with mature maritime chaparral with some localized areas of woodland dominated by coast live oak and open grassland. Coast live oak woodland also predominates in the northeastern portion of this Unit. This portion of the Unit also includes some areas dominated by grasses and herbs, some of which may be disturbance-related, along with a large seasonal pond.

The soils in Units 15, 21, 34, and the southern and extreme western portions of Unit 32 are mapped by USDA (2018) as Arnold-Santa Ynez complex. The southern portion of Unit 32 (except the extreme western portion) is mapped as Arnold loamy sand, 9 to 15 percent slopes. Characteristics of these soils are presented in Table 2-1.

7.3 Units 15, 21, 32, and 34: Methods

Following methods outlined in Section 2 of this report, the 2018 Year 8 follow-up monitoring in Units 15, 21, 32, and 34 consisted of the following activities:

- Repeat monitoring of line intercept transects previously sampled in 2010 (Tetra Tech and EcoSystems West, 2011), 2013 (Tetra Tech and EcoSystems West, 2014), and 2015 (Burleson, 2016) to sample shrub species composition in the maritime chaparral that is recovering from the 2010 prescribed burn.

- Mapping of non-native annual grasses within the primary containment areas which comprise portions of the Unit perimeters. This survey effort was conducted to assess expansion or contraction of these populations over time after disturbance.

- Mapping of invasive species including iceplant, pampas grass, and French broom, where encountered. This survey effort was conducted to support ongoing management.

Per the revised protocol for vegetation monitoring (Tetra Tech and EcoSystems West, 2015b), no HMP annual surveys are required in Year 8 Units.

7.4 Units 15, 21, 32, and 34: Results and Discussion

A total of 44 shrub transects were monitored in the Year 8 Units, with 21 in Unit 15, 15 in Unit 21, four in Unit 32, and four in Unit 34. Maps of monitored transects are provided in Appendix C (Figures C-14 through C-17).

7.4.1 Yadon's Piperia

Yadon's piperia was not observed in any Year 8 Unit in 2018.

7.4.2 Shrub Transect Monitoring

Shrub transects were sampled in Units 15 (*n*=21), 21 (*n*=15), 32 (*n*=4), and 34 (*n*=4) in 2018 (Appendix C; Figures C-14 through C-17). The temporal patterns of broad scale community response to treatment since 2009 were generally congruent with past observations of the neighboring Units in the MRA (Tetra Tech and EcoSystems West, 2011 through 2015a; Burleson, 2016 through 2018).

Units 15, 21, 32, and 34 community structures and compositions are progressing towards their Baseline conditions. While some differences between treatment types were observed, successional patterns were generally similar between treatment types in Units 15, 21, and 32. The effects of treatment could not be analyzed for Unit 34 because all transects were masticated and then burned.

Total shrub cover, bare ground cover, herbaceous cover and community composition were significantly different between treatment types in Unit 15. Community composition was significantly different between treatment types in Unit 21 and 32. It should be noted that Unit 15 (n_{burned}=14 and $n_{masticated}$=7), Unit 21 (n_{burned}=9 and $n_{masticated}$=6), and Unit 32 (n_{mixed}=1 and $n_{masticated}$=3) have unbalanced data by treatment types. The different sample sizes by treatment type may affect statistical results.

Past reports have classified all Unit 32 transects as receiving mastication and burning treatment (Tetra Tech and Ecosystems West, 2014; Burleson, 2016). For this report, treatment shapefiles were examined and revealed that one transect in the Unit received mixed treatment (a portion was burned while a portion was masticated), while three transects in the Unit were masticated. These treatment types have been re-allocated to transects and the differences between treatment types examined for all Unit 32 analyses.

Mixed-design ANOVAs were conducted to compare the effect of Unit and Age on mean percent cover, species richness, species evenness and species diversity. All metrics were not significantly different between Units except for species richness, all were significantly different through time, and there were no significant interactions between Unit and Age except for species evenness (Table 7-1). These results suggest that Units 15, 21, 32, and 34 generally responded similarly through time.

Table 7-1. Mixed-design ANOVA results for Units 15, 21, 32, and 34. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Unit	0.631	0.599	2.86	0.049*	1.70	0.182	1.83	0.157
Age	54.1	3.39e-22*	67.1	1.53e-25*	14.1	1.40e-06*	50.1	4.51e-21*
Unit*Age	1.49	0.157	1.79	0.077	2.81	0.011*	1.43	0.179

Year 8 Units decreased in shrub cover between Baseline and Year 3, and the burned portions of Units 15 and 21 decreased until Year 5 (Figures 7-2 through 7-5). Subsequently, the shrub cover increased between Year 3 or Year 5 and Year 8. Mean Year 8 Unit shrub cover decreased between Baseline and Year 3 by 31.2% and subsequently increased between Year 3 and Year 8 by 22.7%.

Year 8 Units increased sharply in species diversity between Baseline and Year 3 and remained relatively static between Year 3 and Year 8 (Figures 7-2 through 7-5). Year 8 Unit species diversity increased between Baseline and Year 3 by 0.63, increased very slightly between Year 3 and Year 5 by 0.06, and decreased very slightly between Year 5 and Year 8 by 0.08.

Year 8 Units increased sharply in species richness between Baseline and Year 3 (4.2 species) and remained relatively static between Year 3 and Year 8 (Figures 7-2 through 7-5). Newly observed species in Year 3 in these units included California blackberry (*Rubus ursinus*), California wild rose (*Rosa californica*), blue witch (*Solanum umbelliferum*), yerba santa (*Eriodictyon californicum*), huckleberry (*Vaccinium ovatum*), pampas grass, and arroyo willow (*Salix lasiolepis*). These are all native species with the exception of pampas grass. The notable species loss occurred between Year 5 and Year 8 when mock heather (*Ericameria ericoides*) was no longer observed by Year 8.

Year 8 Units increased in species evenness between Baseline and Year 8 with most of the increase occurring between Baseline and Year 3 (Figures 7-2 through 7-5). Evenness increased by 0.14 between Baseline and Year 3, by 0.03 between Year 3 and Year 5, and then decreased by 0.03 between Year 5 and Year 8. The mean species evenness in Year 8 Units increased after treatment except for Unit 32, where it is slightly less than Baseline.

Mixed-design ANOVAs were conducted to compare the effect of Treatment and Age in Units 15, 21, and 32 on mean percent cover, species richness, species evenness and species diversity. The changes in all metrics in Unit 15 were significantly different through time, most were not significantly different by Treatment except for mean cover, and there were no significant interactions between Treatment and Age except for mean cover (Table 7-2). In Unit 21, all metrics were significantly different through time, were not significantly different by treatment type, and there were no significant interactions between Treatment and Age (Table 7-3). In Unit 32, all metrics were not significantly different through time except species richness, were not significantly different by treatment type, and there were no significant interactions between Treatment and Age (Table 7-4).

These results, coupled with Figures 7-2 through 7-5, suggest that the Year 8 units generally responded similarly through time, Unit 15 responded similarly whether burned or masticated except for mean cover, Unit 21 responded similarly when burned or masticated, Unit 32 responded similarly when masticated or mixed treatment was applied, and interactions between treatment and time were minimal for Units 15, 21, and 32. However, it should be noted that for Units 15, 21, and 32, the sample designs were unbalanced between treatment types.

Table 7-2. Mixed-design ANOVA results for Unit 15. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Treatment	21.2	1.96e-04*	3.57	0.074	0.388	0.541	1.04	0.320
Age	32.4	2.37e-12*	44.2	6.70e-15*	13.6	3.26e-05*	41.5	2.30e-14*
Treatment*Age	3.65	0.018*	0.911	0.442	0.073	0.931	0.050	0.985

Table 7-3. Mixed-design ANOVA results for Units 21. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Treatment	2.04	0.177	0.589	0.457	0.068	0.798	0.047	0.832
Age	21.0	2.89e-08*	23.9	5.95e09*	24.0	5.77e-09*	34.0	5.61e-11*
Treatment*Age	0.932	0.434	1.44	0.247	1.01	0.399	1.63	0.198

Table 7-4. Mixed-design ANOVA results for Units 32. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Treatment	1.16	0.394	0.769	0.473	1.68	0.324	1.81	0.311
Age	6.41	0.124	10.6	0.008*	0.514	0.687	2.77	0.134
Treatment*Age	0.642	0.510	1.15	0.404	0.577	0.651	1.11	0.415

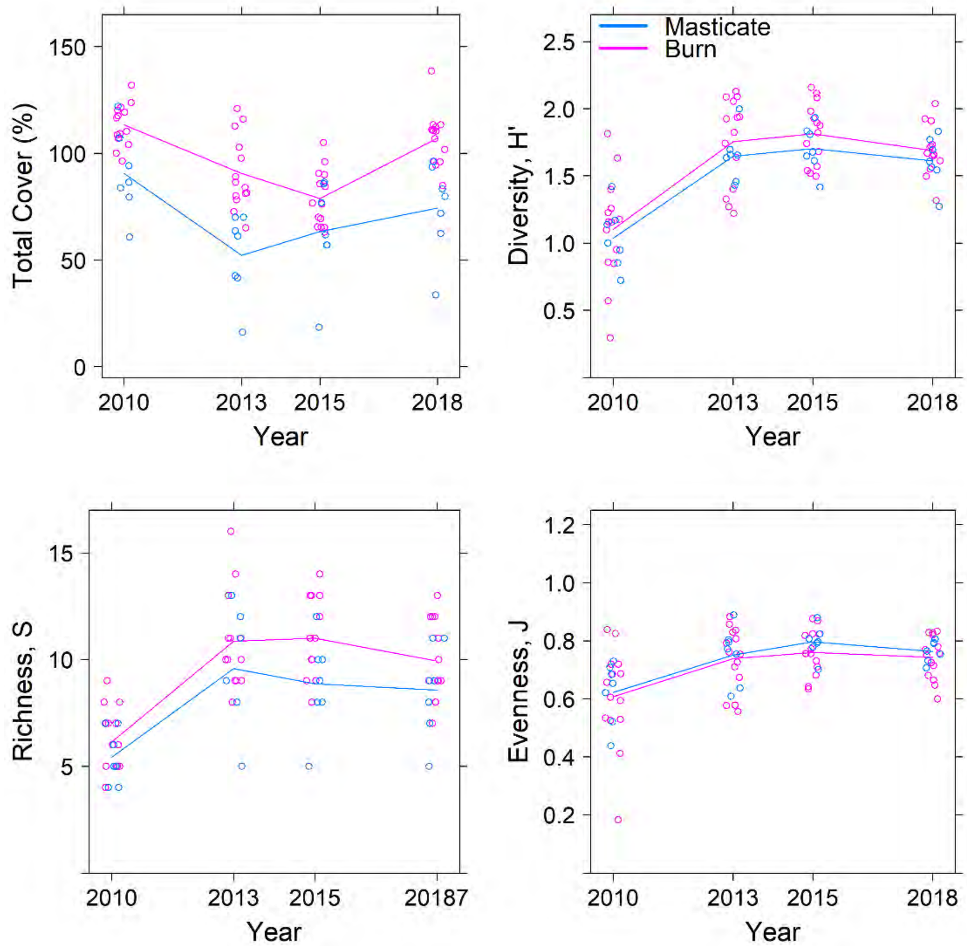

Figure 7-2. Unit 15 Community Structure from Baseline (2010) to Eight Years After Treatment (2018). The pink dots and line represent burned transects (*n*=14), while the blue line and dots represent masticated transects (*n*=7).

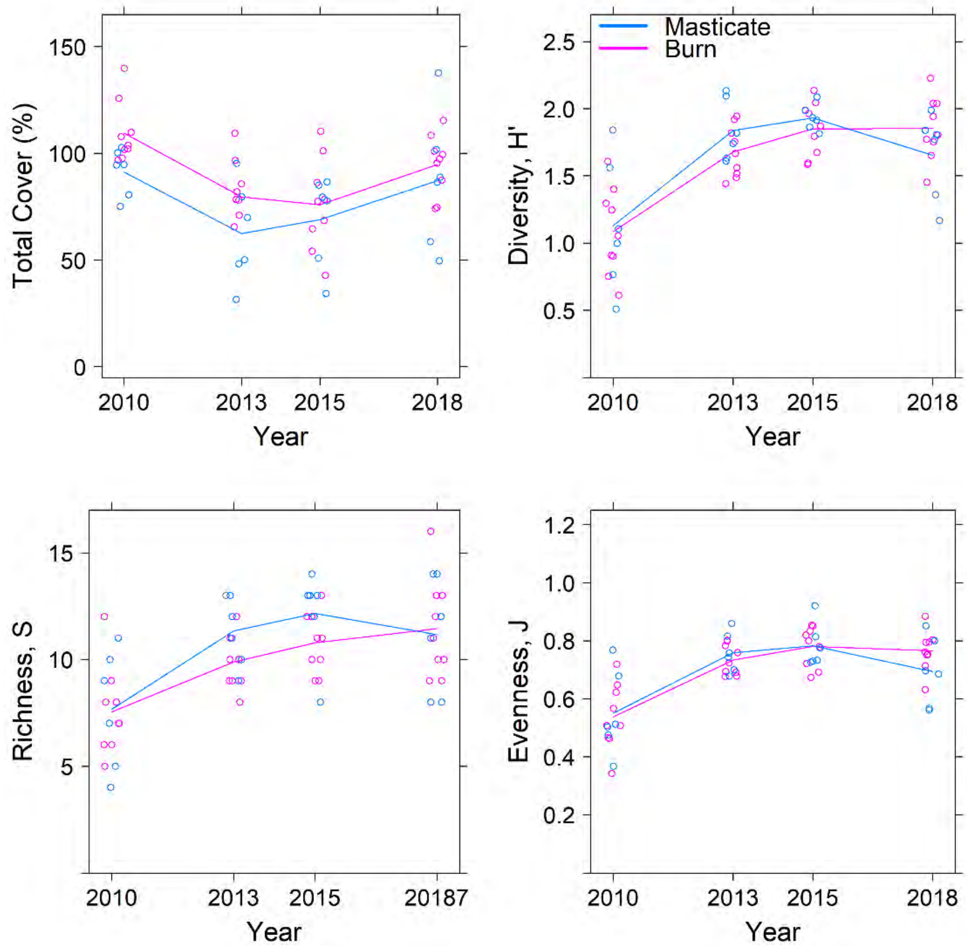

Figure 7-3. Unit 21 Community Structure from Baseline (2010) to Eight Years After Treatment (2018). The blue dots and line represent masticated transects (*n*=6), while the pink line and dots represent burned transects (*n*=9).

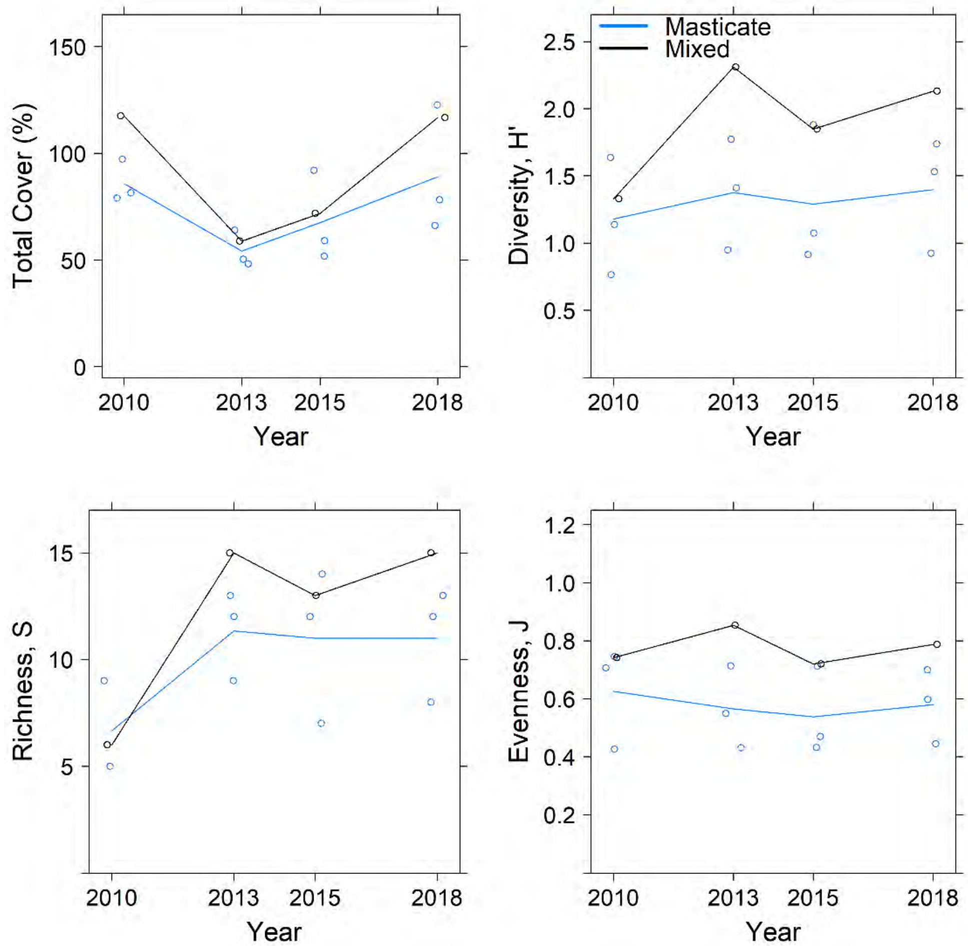

Figure 7-4. Unit 32 Community Structure from Baseline (2010) to Eight Years After Mastication and Burning (2018). The blue dots and line represent masticated transects (*n*=3), while the black line and dots represent mixed transects (*n*=1).

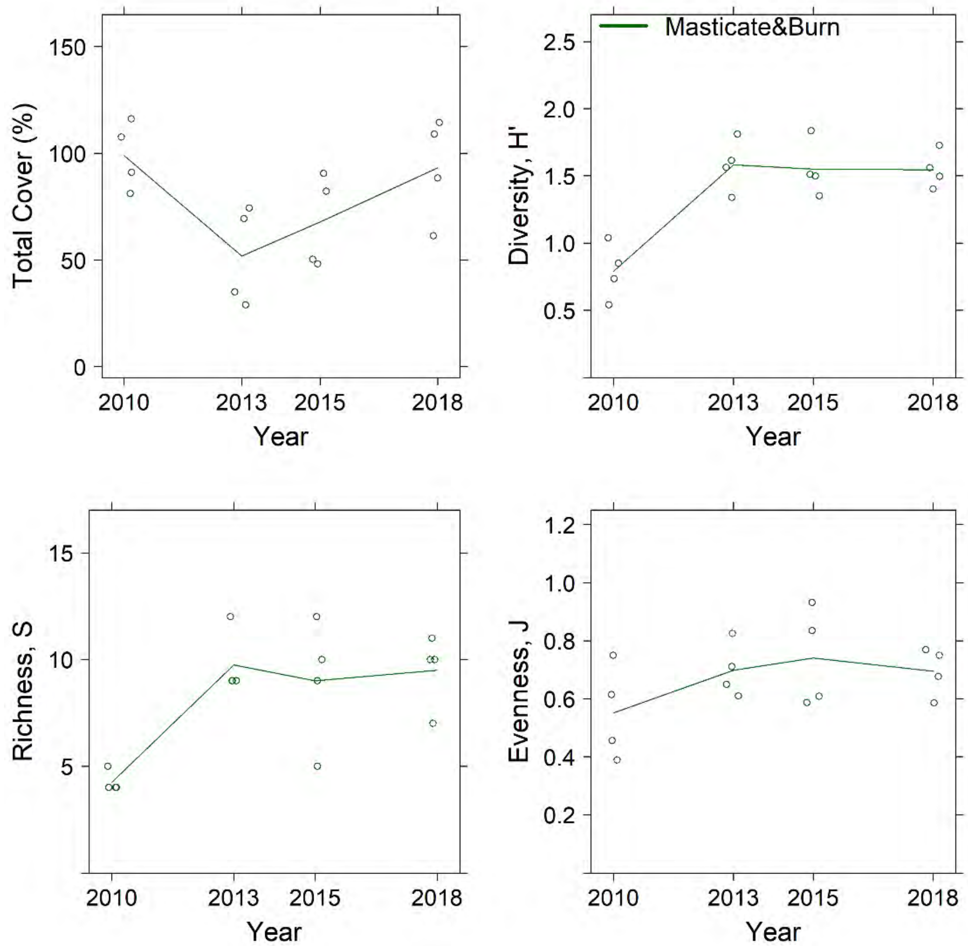

Figure 7-5. Unit 34 Community Structure from Baseline (2010) to Eight Years After Mastication and Burning (2018). Four masticated and burned transects were analyzed in Unit 34.

Bare ground and herbaceous cover changed through time similarly for Year 8 Units (Figures 7-6 through 7-9). Mixed-design ANOVAs were conducted to compare the effect of Unit and Age on mean percent bare ground and mean percent herbaceous cover. The changes in bare ground cover were not significantly different between Units while the changes in herbaceous cover were significantly different (Table 7-5). The changes in these metrics were significantly different through time and there were significant interactions.

Table 7-5. Mixed-design ANOVA results for Units 15, 21, 32, and 34 bare ground and herbaceous cover. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*p*
Unit	0.091	0.964	13.9	2.27e-06*
Age	89.3	1.99e-30*	7.09	0.001*
Unit*Age	2.36	0.017*	3.25	0.005*

All Year 8 Units and Treatment types increased in bare ground cover between Baseline and Year 3 (Unit $15_{Masticated}$ = 30%; Unit 15_{Burned} = 23%; Unit $21_{Masticated}$ = 31%; Unit 21_{Burned} = 23%; Unit $32_{Masticated}$ = 28%; Unit 15_{Mixed} = 33%; Unit $34_{Masticated}$ = 42%), and subsequently decreased by Year 8 (Unit $15_{Masticated}$ = -15%; Unit 15_{Burned} = -7.3%; Unit $21_{Masticated}$ = -19%; Unit 21_{Burned} = -4.8%; Unit $32_{Masticated}$ = -23%; Unit 15_{Mixed} = -26%; Unit $34_{Masticated}$ = -24%) (Figures 7-6 through 7-9).

Herbaceous cover change in Year 8 Units was variable by Unit and Treatment. The masticated portions of Unit 15 increased between Baseline and Year 3 (2.63%), decreased between Year 3 and Year 5 (-0.86%), and then increased again between Year 5 and Year 8 (3.2%). The burned portions of Unit 15 increased between Baseline and Year 5 (1.97%) and decreased between Year 5 and Year 8 (-2.03%). The masticated portions of Unit 21 increased between Baseline and Year 5 (3.5%) and decreased between Year 5 and Year 8 (-3.4%). The burned portions of Unit 21 increased between Baseline and Year 3 (3.0%) and decreased between year 3 and Year 8 (2.45%). The masticated portions of Unit 32 decreased between Baseline and Year 3 (-7.4%), increased between Year 3 and Year 5 (4.67%), and decreased between Year 5 and Year 8 (-5.6%). The mixed portions of Unit 32 increased between Baseline and Year 5 (17.0%) and decreased between Year 5 and Year 8 (-18.8%). Unit 34 herbaceous cover decreased between Baseline and Year 3 (-2.6%), increased between Year 3 and Year 5 (4.8%), and decreased again between Year 5 and Year 8 (-8.9%).

Bare ground cover and herbaceous cover responded differently between Treatments in Unit 15, but not Unit 21 or 32. The changes in bare ground cover and herbaceous cover were significant between Treatment and through time in Unit 15, with an interaction between Treatment and Age for herbaceous cover (Table 7-6). The changes in bare ground cover and herbaceous cover were not significant between Treatments in Units 21 and 32, were significant through time for Units 21 and 32 except for herbaceous cover in Unit 32, and there was no significant interaction between Treatment and Age in either Unit (Table 7-6 and 7-7).

Table 7-6. Mixed-design ANOVA results for Unit 15 bare ground and herbaceous cover. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*P*
Treatment	17.1	5.64e-04*	11.4	0.003*
Age	66.6	6.70e-15*	7.05	0.002*
Treatment*Age	3.03	0.051	9.74	2.84e-04*

Table 7-7. Mixed-design ANOVA results for Unit 21 bare ground and herbaceous cover. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*P*
Treatment	2.99	0.108	9.29e-04	0.976
Age	35.1	3.62e-11*	7.47	4.55e-04*
Treatment*Age	1.91	0.144	0.113	0.952

Table 7-8. Mixed-design ANOVA results for Unit 32 bare ground and herbaceous cover. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*P*
Treatment	2.28	0.270	0.201	0.698
Age	7.51	0.019*	2.20	0.190
Treatment*Age	0.074	0.972	2.03	0.212

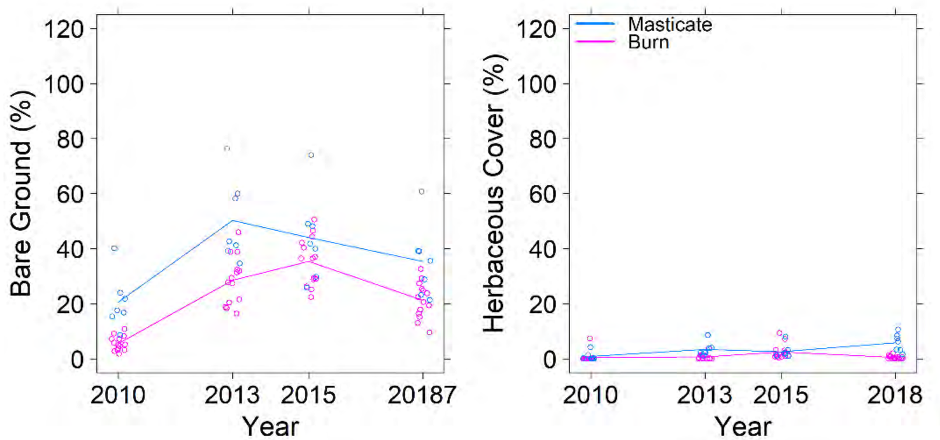

Figure 7-6. Unit 15 Bare Ground and Herbaceous Cover from Baseline (2010) to Eight Years After Treatment (2018). The pink dots and line represent burned transects (*n*=14), while the blue line and dots represent masticated transects (*n*=7).

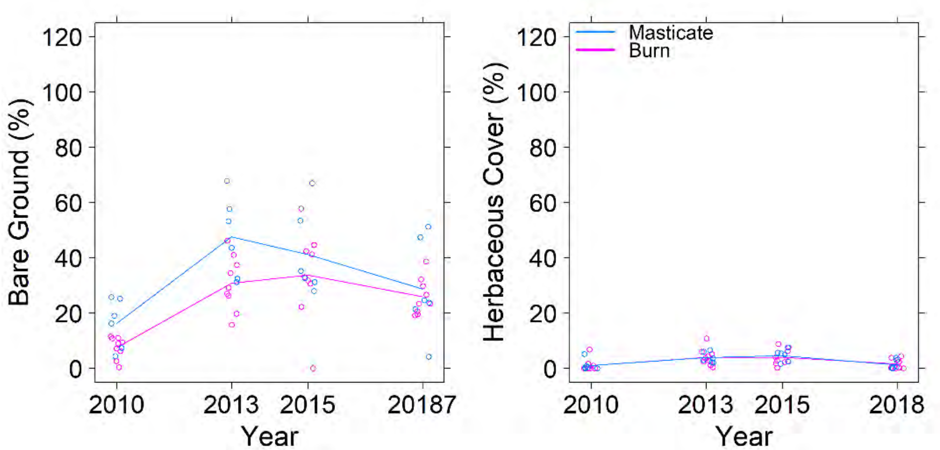

Figure 7-7. Unit 21 Bare Ground and Herbaceous Cover Baseline (2010) to Eight Years After Treatment (2018). The pink dots and line represent burned transects (*n*=9), while the blue line and dots represent masticated transects (*n*=6).

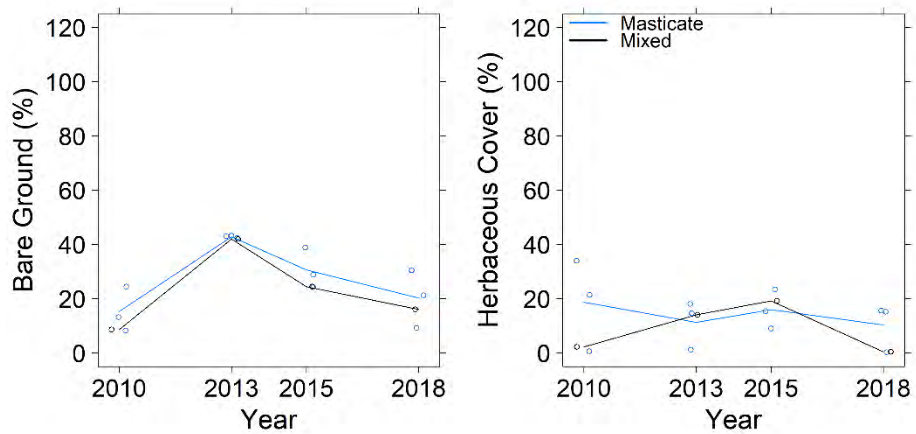

Figure 7-8. Unit 32 Bare Ground and Herbaceous Cover Baseline (2010) to Eight Years After Treatment (2018). The blue dots and line represent masticated transects (*n*=3), while the black line and dots represent mixed transects (*n*=1).

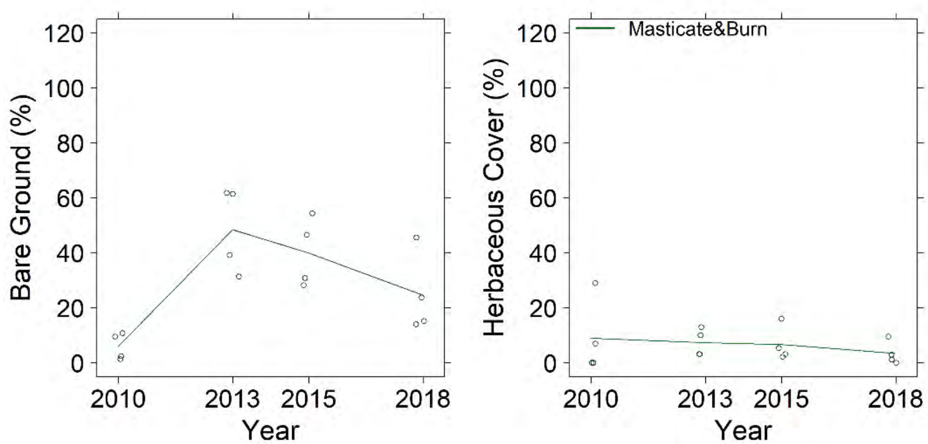

Figure 7-9. Unit 34 Bare Ground and Herbaceous Cover Baseline (2010) to Eight Years After Treatment (2018). Four masticated and burned transects were analyzed in Unit 34.

PERMANOVAs suggest community composition differed between Age, Unit, and Treatment. The three-way PERMANOVA results show that overall community composition was significantly different between Units, Age, and Treatment, and there was a significant interaction between Unit and Treatment (Table 7-9). In Units 15 and 21, two-way PERMANOVAs suggest composition was significantly different between Treatments and through time, and in Unit 32 significantly different between Treatment (Tables 7-10 through 7-12).

These results indicate that the types and abundance of the species present were different between Units, Treatments in Units 15, 21, and 32, and through time in all Year 8 Units. Rank abundance curves illustrate the species compositions through time for each Unit, and Treatment in Units 15, 21, and 32 (Figures 7-10 through 7-13).

Table 7-9. Three-way PERMANOVA results for Units 15, 21, 32, and 34 community compositions, based on Bray-Curtis distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	10.6	0.001*
Unit	6.20	0.001*
Treatment	3.86	0.001*
Age*Unit	0.011	0.999
Age*Treatment	0.832	0.550
Unit*Treatment	4.80	0.001*
Age*Unit*Treatment	0.681	0.687

Table 7-10. Two-way PERMANOVA results for Unit 15 community compositions, based on Bray-Curtis distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	5.95	0.001*
Treatment	6.06	0.001*
Age*Treatment	0.453	0.849

Table 7-11. Two-way PERMANOVA results for Unit 21 community compositions, based on Bray-Curtis distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	3.66	0.002*
Treatment	5.67	0.001*
Age*Treatment	1.01	0.408

Table 7-12. Two-way PERMANOVA results for Unit 32 community compositions, based on Bray-Curtis distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	2.02	0.079
Treatment	3.59	0.015*
Age*Treatment	0.513	0.741

All Year 8 Units were shrub association A in 2010 prior to treatment (Figures 7-10 through 7-13). However, the post-treatment shrub associations were sometimes different among units and treatment types.

Unit 15, on average, was dominated by shaggy-barked manzanita (shrub association A) in 2010 (c=55.0%). By 2018, on average, the burned portion of the Unit was dominated by chamise (shrub association B) (c=29.4%) while the masticated portion of the Unit was dominated by shaggy-barked manzanita (c=20.1%).

Unit 21, on average, was dominated by shaggy-barked manzanita in 2010 (c=51.9%). By 2018, on average, the burned portion of the Unit was still dominated by shaggy-barked manzanita (c=27.6%) while the masticated portion of the Unit was dominated by both chamise (c=24.6%) and shaggy-barked manzanita (c=23.2%).

Unit 32, on average, was dominated by shaggy-barked manzanita in both 2010 (c=39.4%) and in 2018 (c=49.1%), with an increase cover of the species. By 2018, on average, the masticated portion (c=53.7%) and the portion which received mixed treatment (c=35.0%) were dominated by shaggy-barked manzanita.

Unit 34, on average, was dominated by shaggy-barked manzanita in 2010 (c=64.7%). By 2018, on average, the Unit was dominated by dwarf ceanothus (c=33.6%).

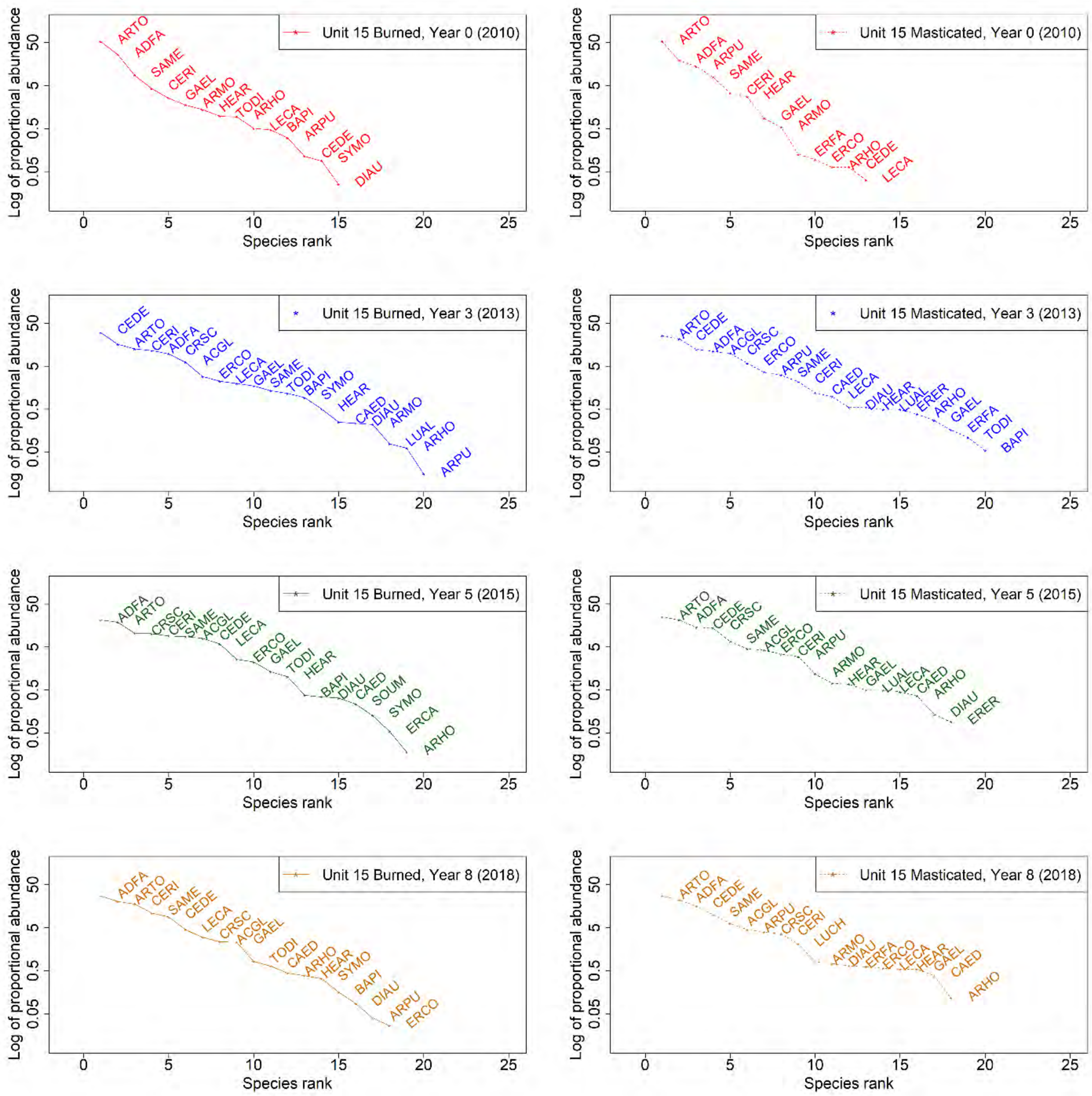

Figure 7-10. Unit 15 Rank Abundance Curves Between Baseline (2010) and Year 8 (2018). Note that the y-axis is log-10 scale. The left column of curves show transects which were burned (*n*=14), while the right column of curves show transects which were masticated (*n*=7).

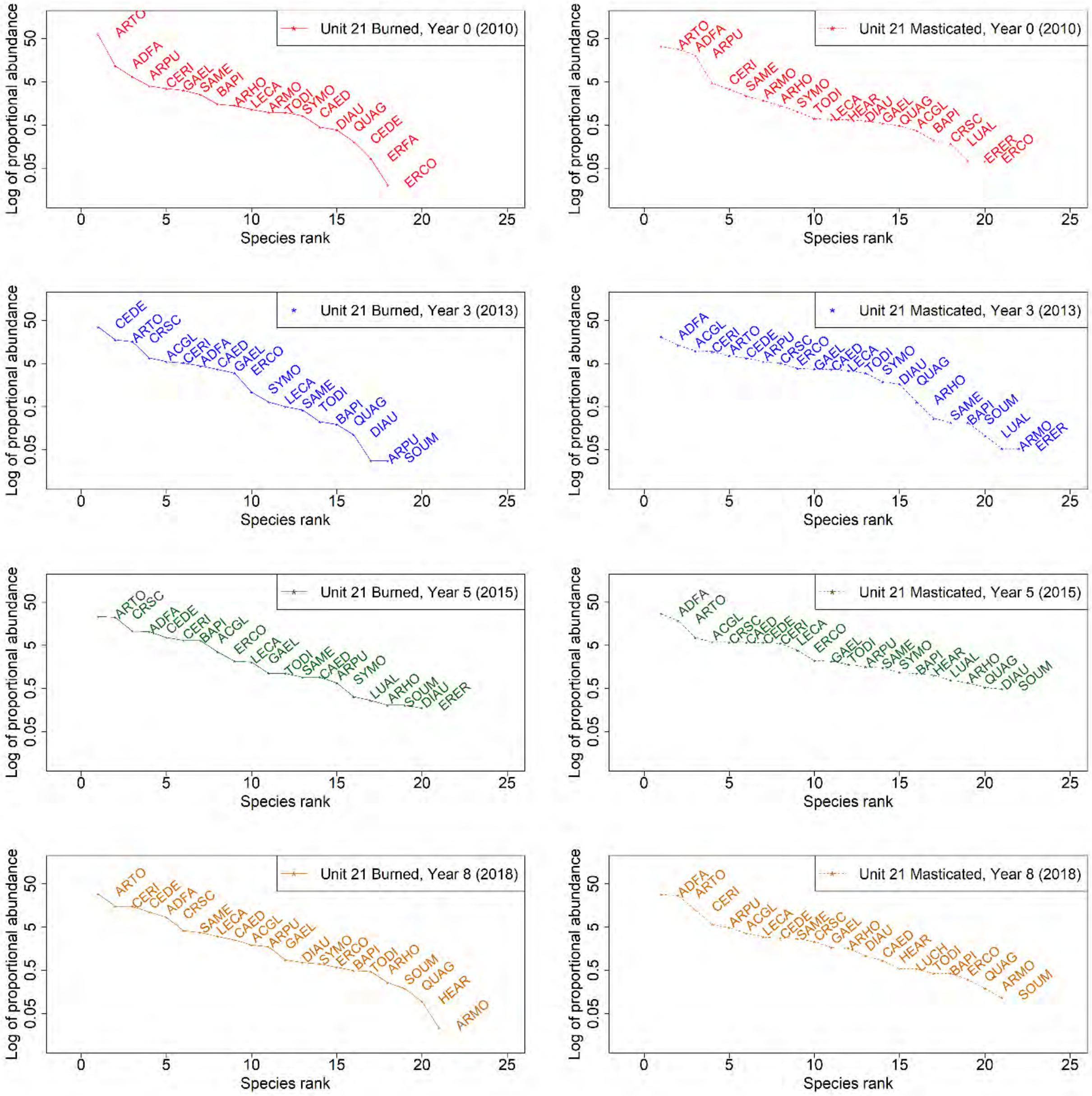

Figure 7-11. Unit 21 Rank Abundance Curves Between Baseline (2010) and Year 8 (2018). Note that the y-axis is log-10 scale. The left column of curves show transects which were burned (*n*=9), while the right column of curves show transects which were masticated (*n*=6).

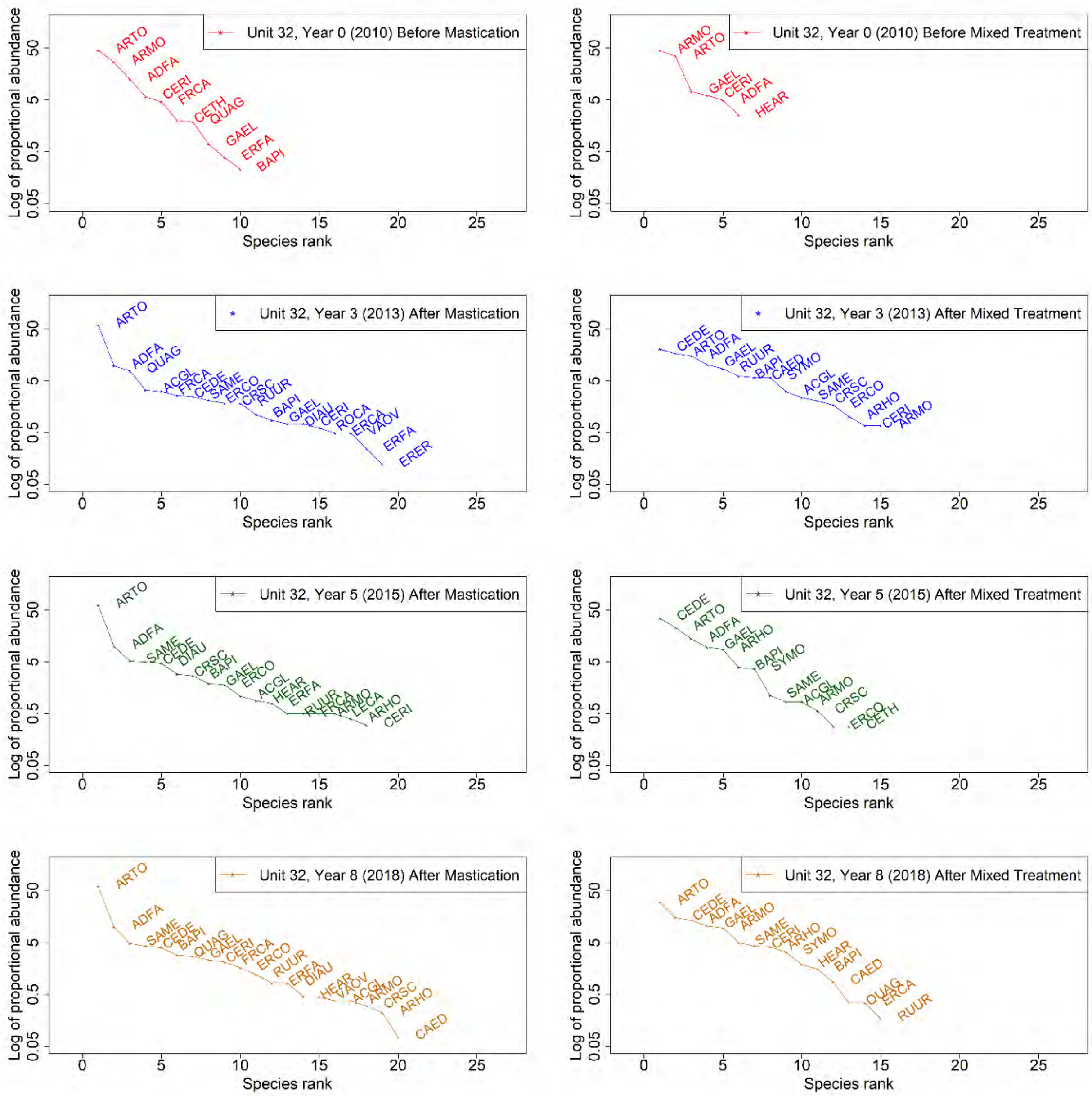

Figure 7-12. Unit 32 Rank Abundance Curves Between Baseline (2010) and Year 8 (2018). Note that the y-axis is log-10 scale. The left column of curves show transects which were masticated (*n*=3), while the right column of curves show the transect which received mixed treatment (*n*=1).

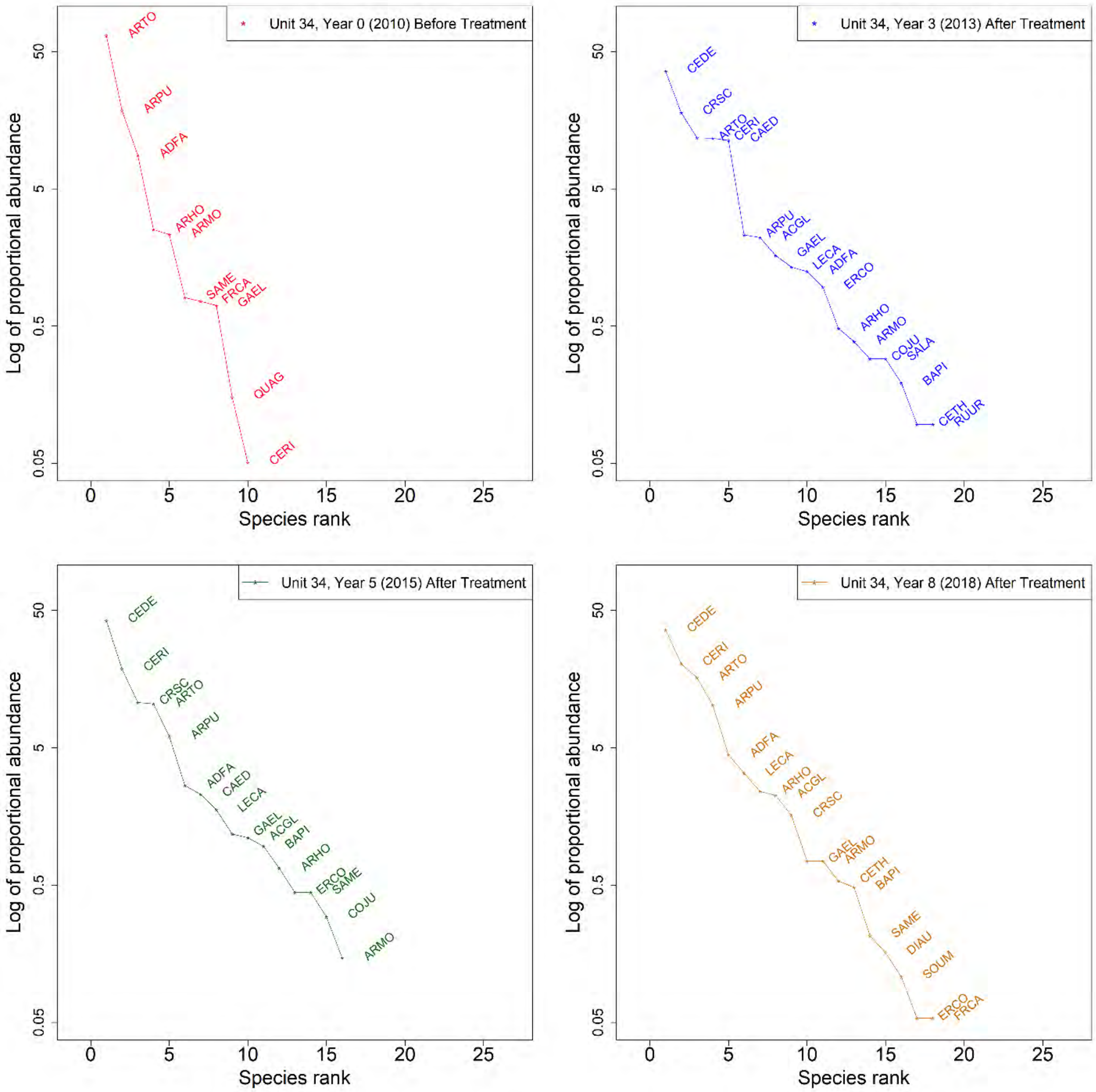

Figure 7-13. Unit 34 Rank Abundance Curves Between Baseline (2010) and Year 8 (2018). Note that the y-axis is log-10 scale. Four masticated and burned transects were analyzed in Unit 34.

Mixed-design ANOVAs were conducted to examine differential response to treatments for all Year 8 transects. These tests suggest that Monterey ceanothus and Toro manzanita covers were significantly different through time, and Eastwood's goldenbush and Toro manzanita were significantly different between treatments when all Year 8 units were examined together (Tables 7-13 through 7-17). Sandmat manzanita and Monterey ceanothus covers were marginally significantly different between treatments (Table 7-13 and 7-14). Monterey ceanothus and Toro manzanita covers had a significant interaction between Age and Treatment (Table 7-14 and 7-17). HMP species have recovered at different rates than the dominant species and each other (Figures 7-10 through 7-17).

Table 7-13. Mixed-design ANOVA results for sandmat manzanita cover in Year 8 Units. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	2.37	0.129
Treatment	2.42	0.081
Age*Treatment	1.34	0.274

Table 7-14. Mixed-design ANOVA results for Monterey ceanothus cover in Year 8 Units. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	7.34	0.002*
Treatment	2.80	0.053
Age*Treatment	5.18	2.50e-04*

Table 7-15. Mixed-design ANOVA results for Eastwood's goldenbush cover in Year 8 Units. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 and an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	0.165	0.801
Treatment	2.86	0.049*
Age*Treatment	0.847	0.518

Table 7-16. Mixed-design ANOVA results for Hooker's manzanita cover in Year 8 Units. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	3.58	0.052
Treatment	2.09	0.117
Age*Treatment	2.41	0.060

Table 7-17. Mixed-design ANOVA results for Toro manzanita cover in Year 8 Units. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	30.5	1.82e-06*
Treatment	14.5	1.54e-06*
Age*Treatment	9.14	8.74e-05*

The significant treatment results shown in Tables 7-15 and 7-17, and the significant interactions in Tables 7-14 and 7-17 warranted further within-unit mixed-design ANOVA testing to examine effects due to treatment on the HMP shrub species with significant differences from the mixed-design ANOVAs conducted on combined Year 8 Units. We conducted testing on Monterey ceanothus, Eastwood's goldenbush, and Toro manzanita for Units 15, 21, and 32 individually.

There were significant differences in Monterey ceanothus cover between Treatments in Unit 15 and a significant interaction between Treatment and Age (Tables 7-18). These differences are seen in Figure 7-14, where Monterey ceanothus cover is higher in Years 3, 5, and 8 in the burned transects than in the masticated transects, implying there is a differential response in these levels of Age. There were no significant differences between Treatments or interactions between Treatment and Age for Units 21 or 32 (Tables 7-19 and 7-20).

There were significant differences in Eastwood's goldenbush cover between Treatments in Unit 15 and no significant interaction between Treatment and Age in any unit (Tables 7-21 through 7-23). The significant difference between Treatments is because Eastwood's goldenbush was not observed on the burned transects in any survey year while it was found on masticated transects.

There were no significant differences in Toro manzanita cover between Treatments in Units 15, 21, or 32, and there were no interaction between Treatment and Age in any unit (Tables 7-24 through 7-26).

Table 7-18. Mixed-design ANOVA results for Monterey ceanothus cover in Unit 15. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	***F***	***p***
Age	11.2	3.37e-05*
Treatment	14.1	0.001*
Age*Treatment	11.7	2.27e-05*

Table 7-19. Mixed-design ANOVA results for Monterey ceanothus cover in Unit 21. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	***F***	***p***
Age	8.24	0.009
Treatment	0.040	0.844
Age*Treatment	0.640	0.464

Table 7-20. Mixed-design ANOVA results for Monterey ceanothus cover in Unit 32. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	***F***	***p***
Age	8.32	0.067
Treatment	0.648	0.505
Age*Treatment	0.654	0.535

Table 7-21. Mixed-design ANOVA results for Eastwood's goldenbush cover in Unit 15. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	3.43	0.068
Treatment	7.35	0.014*
Age*Treatment	3.43	0.068

Table 7-22. Mixed-design ANOVA results for Eastwood's goldenbush cover in Unit 21. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	1.12	0.351
Treatment	1.12	0.308
Age*Treatment	1.12	0.351

Table 7-23. Mixed-design ANOVA results for Eastwood's goldenbush cover in Unit 32. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	0.072	0.973
Treatment	0.934	0.436
Age*Treatment	0.072	0.973

Table 7-24. Mixed-design ANOVA results for Toro manzanita cover in Unit 15. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	0.591	0.463
Treatment	0.016	0.901
Age*Treatment	0.618	0.453

Table 7-25. Mixed-design ANOVA results for Toro manzanita cover in Unit 21. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	5.40	0.036*
Treatment	0.598	0.453
Age*Treatment	0.347	0.569

Table 7-26. Mixed-design ANOVA results for Toro manzanita cover in Unit 32. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	5.78	0.138
Treatment	1.74	0.318
Age*Treatment	0.853	0.453

Magnitude of Year 8 mean sandmat manzanita cover varied between Units and Treatment due to variation during the Baseline year. However, the species has recovered well in all areas where it was present ($c_{Y8,\ Unit\ 15\ Burn}$=0.05%, $c_{Y8,\ Unit\ 15\ Masticated}$=13%, $c_{Y8,\ Unit\ 21\ Burn}$=1.8%, $c_{Y8,\ Unit\ 21\ Masticated}$=5.0%,

$c_{Y8,\ Unit\ 34}$=9.6%). The cover of the species has increased between Year 3 post-treatment and Year 8 post-treatment in all Units where it was present; however, Year 8 cover values were below Baseline values, which can be common for sandmat manzanita (Tetra Tech and EcoSystems West, 2011 through 2015a; Burleson, 2016 through 2018).

Monterey ceanothus has recovered well in all Year 8 Units and appears to have been stimulated by the prescribed burns, which has been found in other studies (Pierce *et al*., 2016). The cover of the species was higher by Year 8 than in Baseline in the burned portions of Units 15 and 21, and the masticated and burned portions of 34 ($c_{Y8,\ Unit\ 15\ Burn}$=19%, $c_{Y8,\ Unit\ 21\ Burn}$=14%, $c_{Y8,\ Unit\ 34\ Masticate\&Burn}$=19%; $c_{Y0,\ Unit\ 15\ Burn}$=4.8%, $c_{Y0,\ Unit\ 21\ Burn}$=4.3%, $c_{Y0,\ Unit\ 34\ Masticate\&Burn}$=0.05%). The Monterey ceanothus covers in the masticated portions of Units 15 and 21, the masticated portion of Unit 32, and the mixed portion of Unit 32 have not increased above Baseline values but are recovering well ($c_{Y8,\ Unit\ 15\ Masticate}$=2.7%, $c_{Y8,\ Unit\ 21\ Masticate}$=11%, $c_{Y8,\ Unit\ 32\ Masticate}$ =2.1%, $c_{Y8,\ Unit\ 32\ Mixed}$ =5.0%; $c_{Y0,\ Unit\ 15\ Masticate}$=3.0%, $c_{Y0,\ Unit\ 21\ Masticate}$=4.2%, $c_{Y0,\ Unit\ 32\ Masticate}$ =4.9%, $c_{Y0,\ Unit\ 32\ Mixed}$ =7.2%).

Eastwood's goldenbush has recovered very well in two of the three areas it was present in during Baseline: Unit 15 masticated areas and Unit 32 masticated areas ($c_{Y8,\ Unit\ 15\ Masticate}$=0.49%, $c_{Y8,\ Unit\ 32\ Masticate}$=0.73%; $c_{Y0,\ Unit\ 15\ Masticate}$=0.11%, $c_{Y0,\ Unit\ 32\ Masticate}$=0.33%). The species did not recover well in Unit 21 burned areas where it was not observed after treatment; however, the species was present on only two Burn transects in Baseline with very low cover, which may have contributed to lack of presence by Year 8 ($c_{Y8,\ Unit\ 21\ Burn}$=0.00%; $c_{Y0,\ Unit\ 21\ Burn}$=0.09%).

Hooker's manzanita has recovered well in all Year 8 Units; however, cover was low in most Units and survey years ($c_{Y8,\ Unit\ 15\ Burn}$=0.47%, $c_{Y8,\ Unit\ 15\ Masticate}$=0.09%, $c_{Y8,\ Unit\ 21\ Burn}$=0.44%, $c_{Y8,\ Unit\ 21\ Masticate}$=1.5%, $c_{Y8,\ Unit\ 32\ Masticate}$=0.20%, $c_{Y8,\ Unit\ 32\ Mixed}$=4.8%, $c_{Y8,\ Unit\ 34}$=2.3%; $c_{Y0,\ Unit\ 15\ Burn}$=1.1%, $c_{Y0,\ Unit\ 15\ Masticate}$=0.06%, $c_{Y0,\ Unit\ 21\ Burn}$=1.6%, $c_{Y0,\ Unit\ 21\ Masticate}$=1.7%, $c_{Y0,\ Unit\ 32\ Masticate}$=0.00%, $c_{Y0,\ Unit\ 32\ Mixed}$=0.00%, $c_{Y0,\ Unit\ 34}$=2.5%). The species was newly observed in Unit 32 after mastication and mixed treatment. These results contrast with those from the 2017 surveys where the species was not observed by Year 8 in Units 14 or 19 (Burleson, 2018). Hooker's manzanita is documented as having variable and often slow response to either burning or mastication (Burleson, 2009a).

Toro manzanita is recovering in all areas where it was present during Baseline, except for the burned portions of Unit 15 where it was not observed by Year 8 ($c_{Y8,\ Unit\ 15\ Burn}$=0.00%, $c_{Y8,\ Unit\ 15\ Masticate}$=0.60%, $c_{Y8,\ Unit\ 21\ Burn}$=0.02%, $c_{Y8,\ Unit\ 21\ Masticate}$=0.17%, $c_{Y8,\ Unit\ 32\ Masticate}$=0.33%, $c_{Y8,\ Unit\ 32\ Mixed}$=11.2%, $c_{Y8,\ Unit\ 34}$=0.70%; $c_{Y0,\ Unit\ 15\ Burn}$=2.0%, $c_{Y0,\ Unit\ 15\ Masticate}$=0.49%, $c_{Y0,\ Unit\ 21\ Burn}$=1.2%, $c_{Y0,\ Unit\ 21\ Masticate}$=2.1%, $c_{Y0,\ Unit\ 32\ Masticate}$=23%, $c_{Y0,\ Unit\ 32\ Mixed}$=52%, $c_{Y0,\ Unit\ 34}$=2.3%). The cover was high in Unit 32 during Baseline surveys (most notably on the mixed transect), which has only been seen in the eastern portions of the Impact Area and BLM Area B (Tetra Tech and Ecosystems West, 2011 through 2015a; Burleson, 2016 through 2018).

While there is a general lack of literature examining these species and their responses to treatment or their reproductive strategies, overall, these species have responded in similar ways as previously observed in the MRA (Tetra Tech and EcoSystems West, 2011 through 2015a; Burleson, 2016 through 2018).

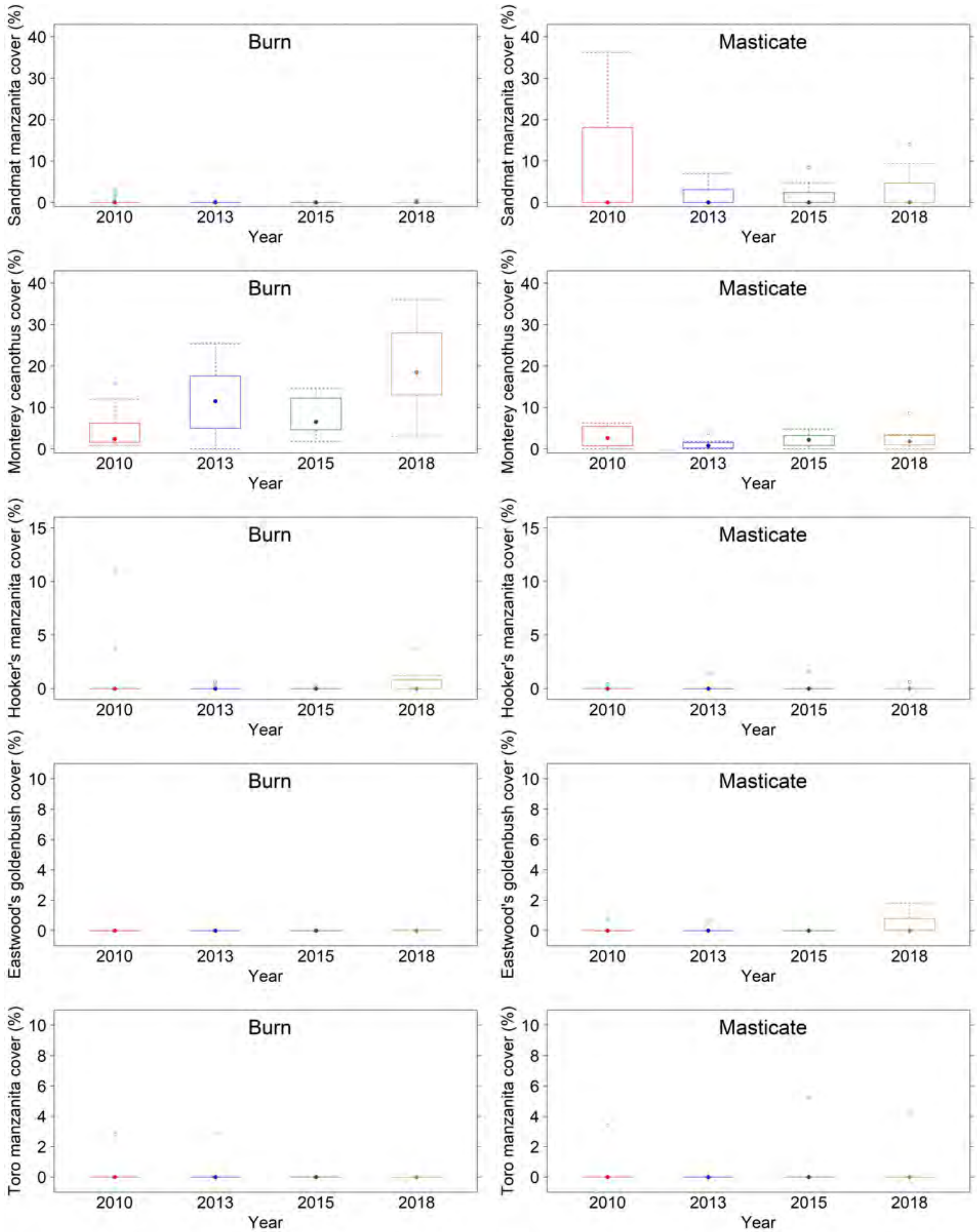

Figure 7-14. Unit 15 HMP Shrub Species Cover Between Baseline (2010) and Year 8 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Dots plotted outside the whiskers represent outliers. Fourteen burned transects and seven masticated transects were analyzed in Unit 15.

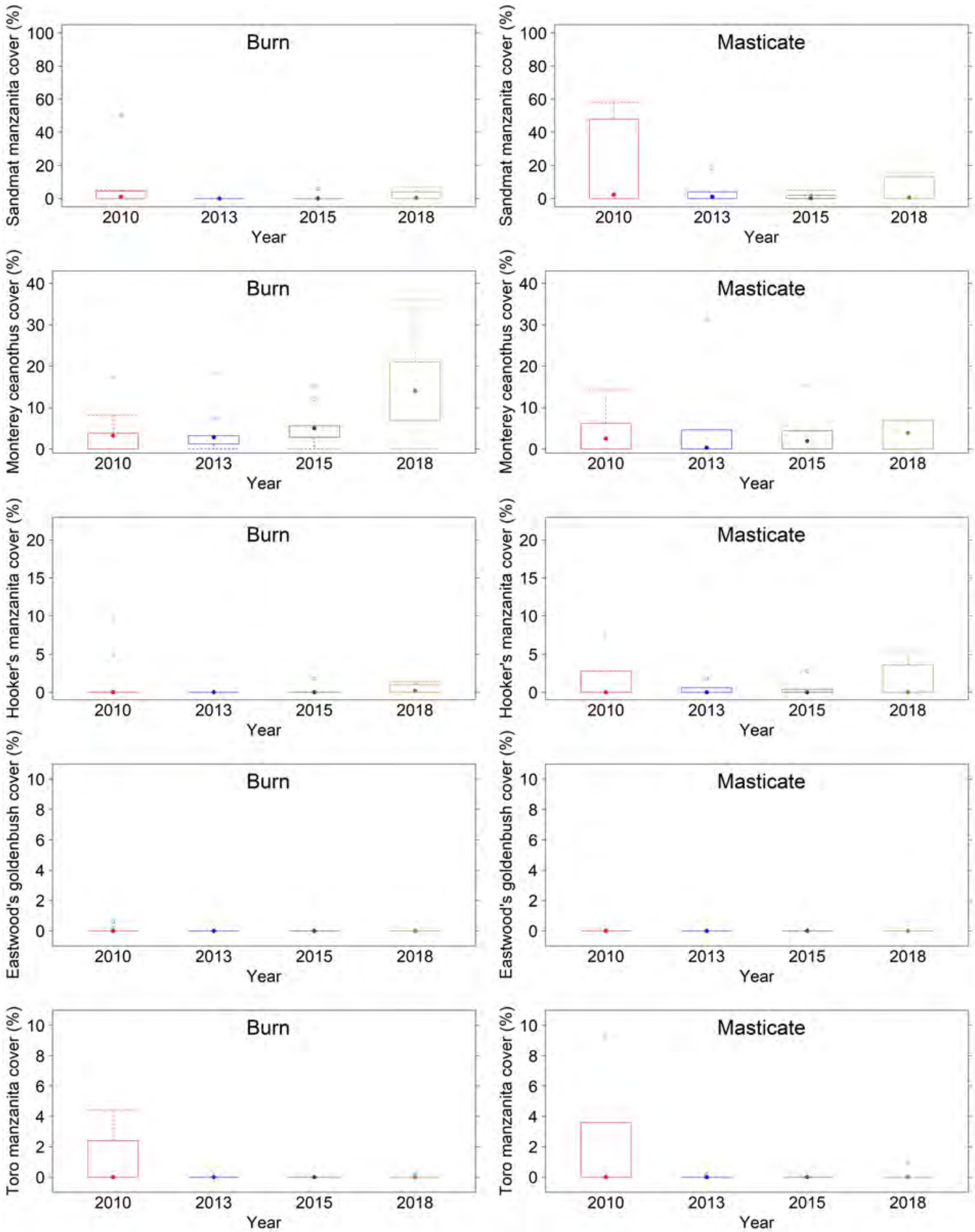

Figure 7-15. Unit 21 HMP Shrub Species Cover Between Baseline (2010) and Year 8 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Dots plotted outside the whiskers represent outliers. Nine burned transects and six masticated transects were analyzed in Unit 21.

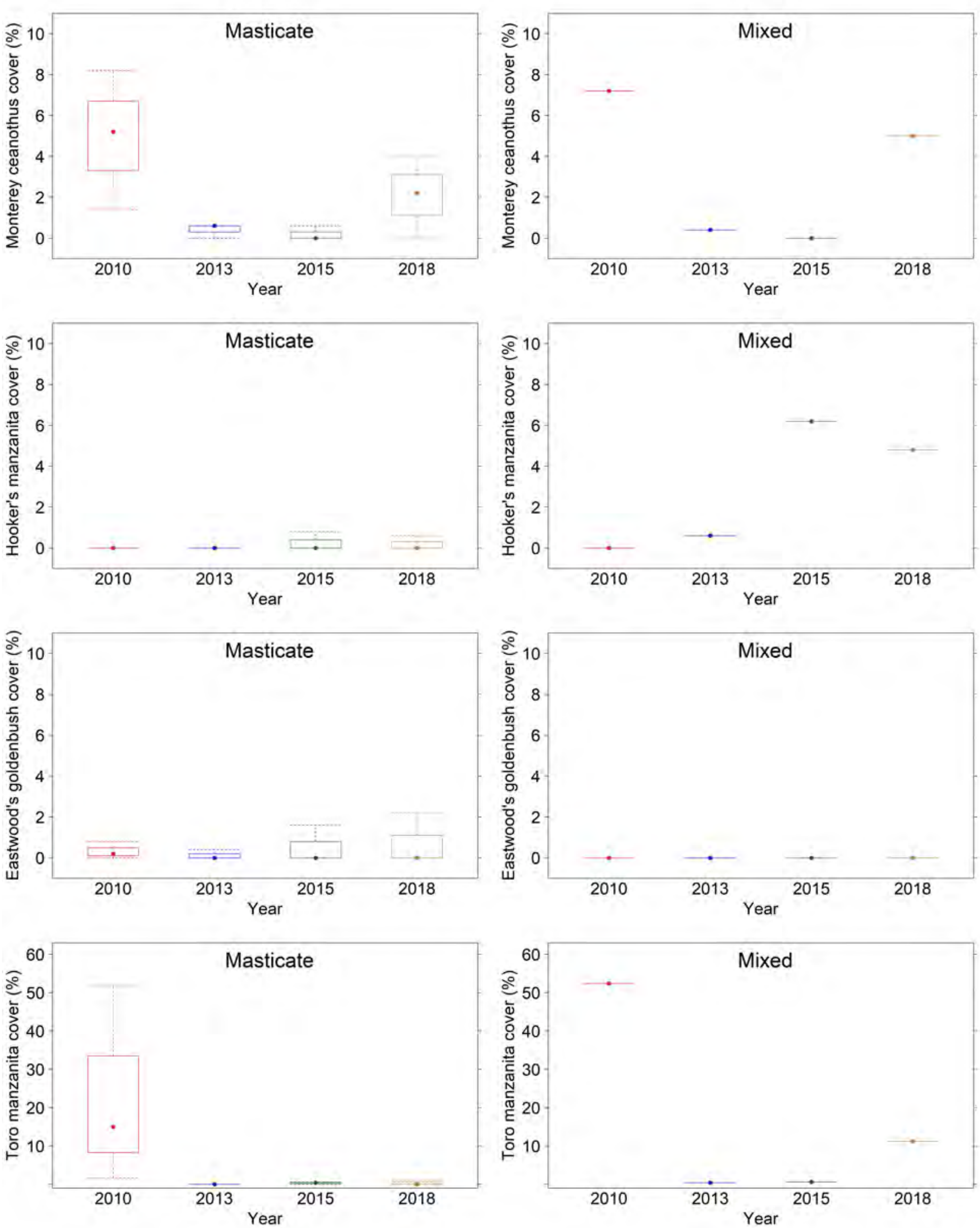

Figure 7-16. Unit 32 HMP Shrub Species Cover Between Baseline (2010) and Year 8 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Dots plotted outside the whiskers represent outliers. Three masticated transects and one mixed transect were analyzed in Unit 32.

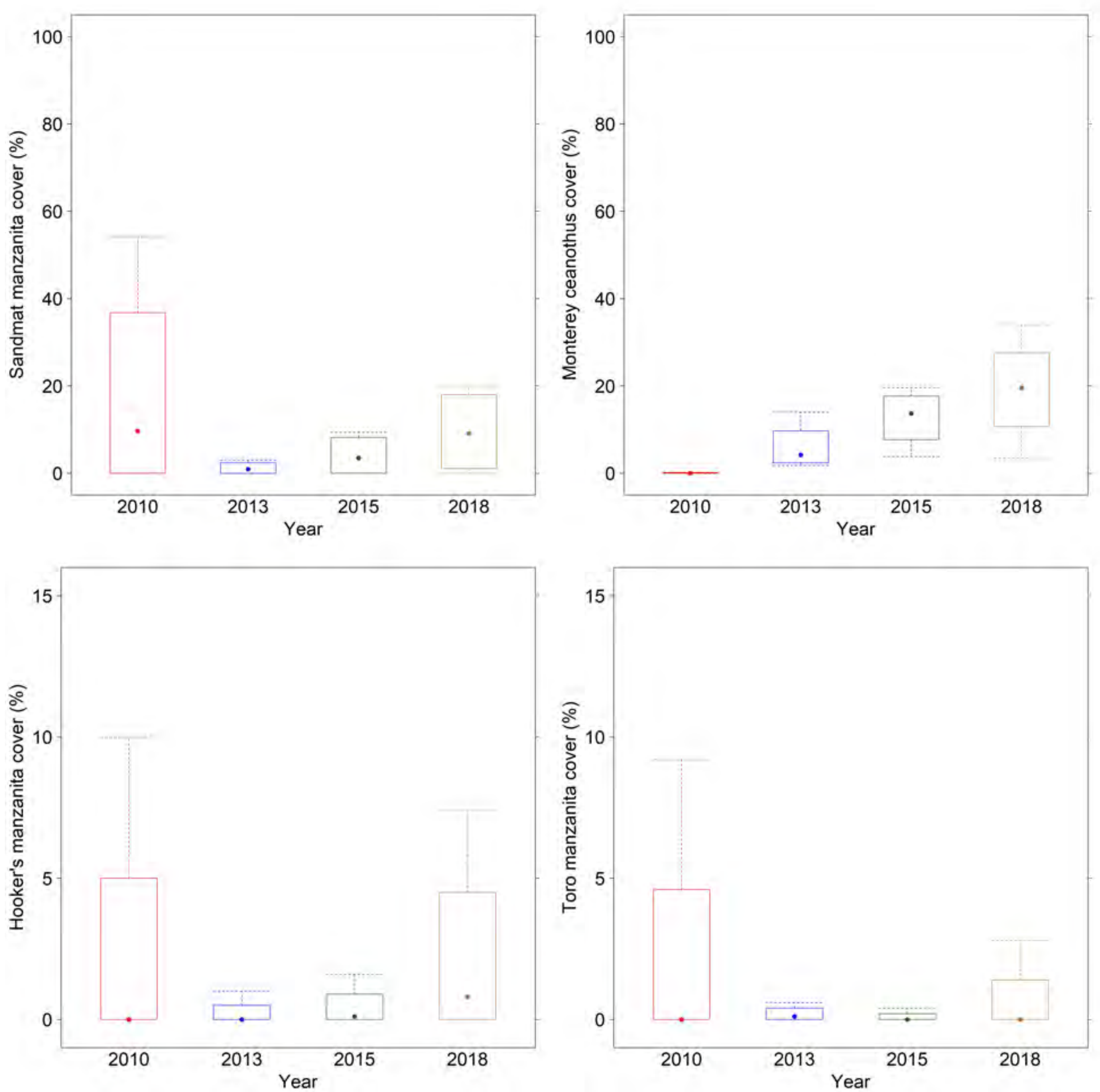

Figure 7-17. Unit 34 HMP Shrub Species Cover Between Baseline (2010) and Year 8 (2018). Scales Not Equivalent. The solid colored dots represent the median; top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Dots plotted outside the whiskers represent outliers. Four masticated and burned transects were analyzed in Unit 34.

NMDS ordinations illustrate that the 2018 community compositions for Units 15, 21, 32, and 34 are on trajectories towards their respective Baseline compositions (Figures 7-18 through 7-21). Community composition is represented by the shape and location of ellipses in the ordination space, where ellipses with similar shape and location imply similar community composition.

The Unit 15 and 21 ordinations illustrate the masticated transects and burned transects (Figures 7-18 and 7-19). The masticated ellipses show more variable community composition (indicated by larger ellipses where individual transects are separated by more ordination space) than the burned ellipses for both units, suggesting different compositions between Treatments. This corroborates the PERMANOVA results which indicated a significant difference between community compositions from different Treatments. Considering that the compositions were different prior to treatment, it is unclear that the differing compositions are due to treatment type. Different treatments could not be visualized for Unit 32 since sample sizes of one cannot be visualized with the *vegan* package (Oksanen, 2017; Figure 7-20).

Community composition response to treatment in all Year 8 Units followed similar patterns of succession as previously documented in other portions of the Impact Area (Tetra Tech and EcoSystems West, 2011 – 2015a; Burleson, 2016 – 2018).

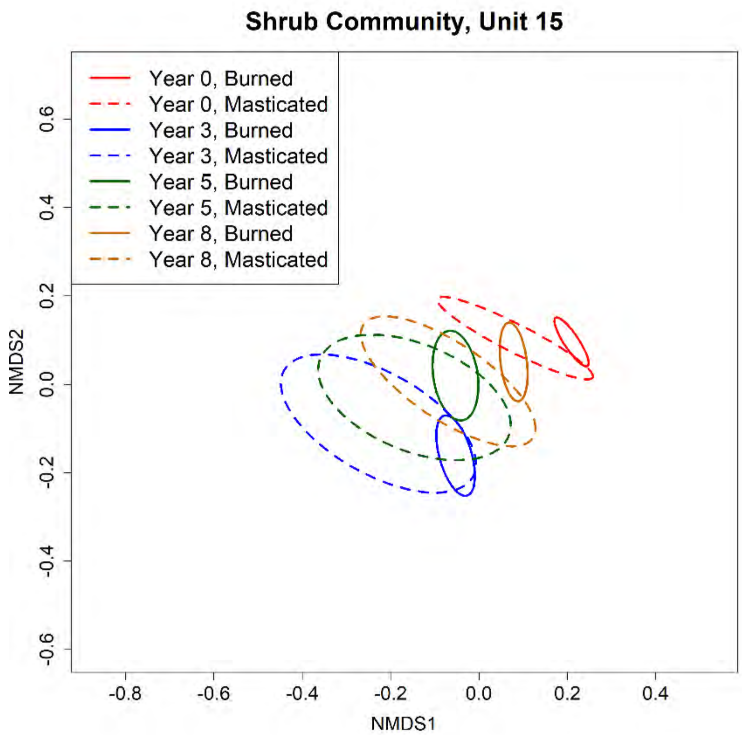

Figure 7-18. NMDS Ordination Plot Showing Unit 15 Community Composition Changes Between 2010 and 2018. Dashed lines represent masticated transects (*n*=7) while solid lines represent burned transects (*n*=14).

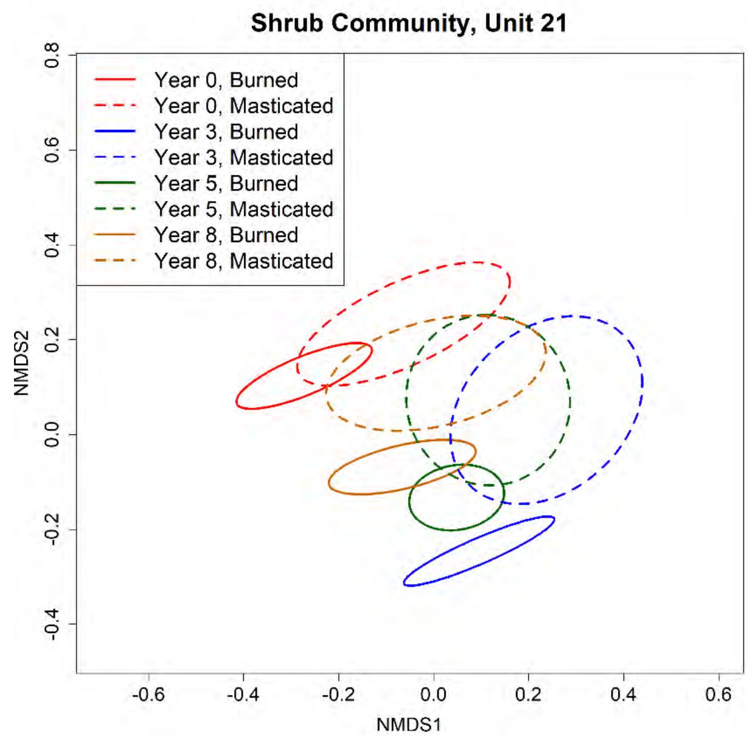

Figure 7-19. NMDS Ordination Plot Showing Unit 21 Community Composition Changes Between 2010 and 2018. Dashed lines represent masticated transects (*n*=6) while solid lines represent burned transects (*n*=9).

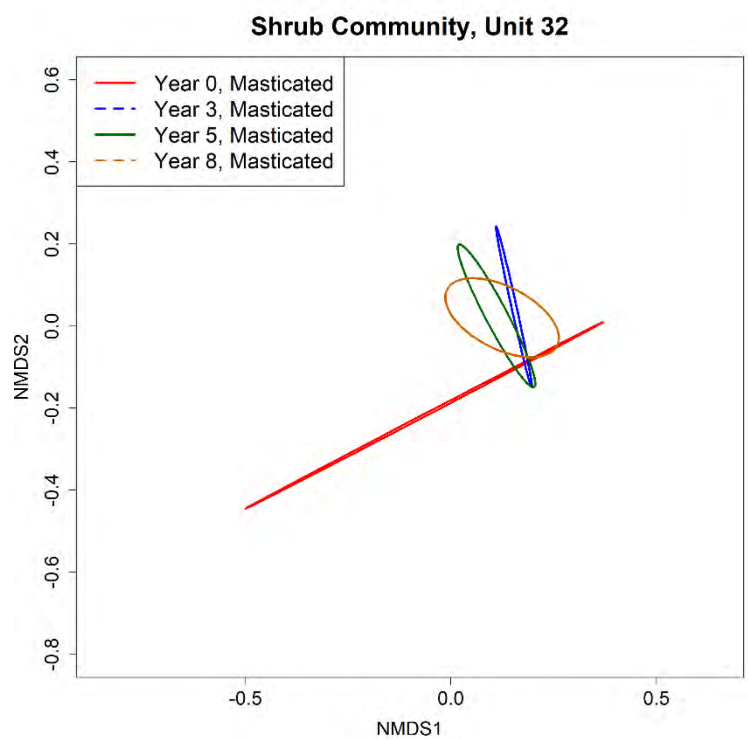

Figure 7-20. NMDS Ordination Plot Showing Unit 32 Community Composition Changes Between 2010 and 2018. Three masticated transects and one mixed transect were surveyed in Unit 32. However, since sample sizes of one cannot be visualized with the *vegan* package, only the masticated transects were plotted.

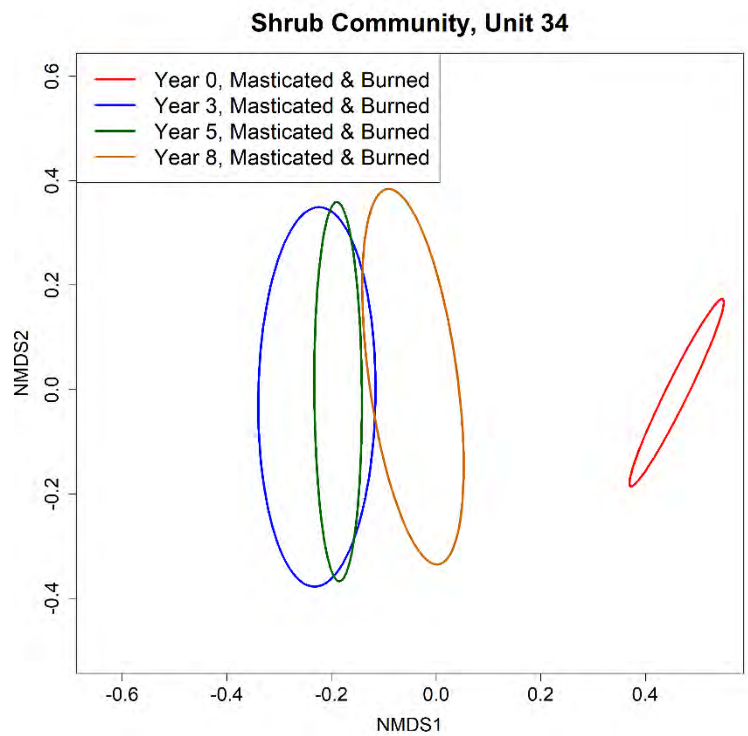

Figure 7-21. NMDS Ordination Plot Showing Unit 34 Community Composition Changes Between 2010 and 2018. Four masticated and burned transects were analyzed in Unit 34.

7.4.3 Annual Grass Monitoring

Non-native annual grasses were observed and mapped within the Containment Lines and roadside fuel breaks of Units 15 and 21 (Appendix D, Figures D-10 and D-11). The areal extent of annual grasses increased between Baseline and Year 1, after mastication in the Units 15 and 19 Containment Lines. Subsequently, the total area occupied by grasses in both Units decreased incrementally between Year 1 and Year 8. The density class with the largest areal extent in the Unit 15 Containment Lines in Year 8 was density class 2 (>25% cover) and comprised an area of approximately 3.70 acres. The density class with the largest areal extent in the Unit 21 Containment Lines in Year 8 was density class 3 (>25% cover) and comprised an area of approximately 3.00 acres. Estimated areas occupied by each density class are summarized in Tables 7-27 and 7-28.

Table 7-27. Estimated Area Occupied (Acres) by Annual Grasses Between Baseline and Year 8 in Unit 15.

Cover Class	2010, Baseline	2011, Year 1 (acres)	2013, Year 3 (acres)	2015, Year 5 (acres)	2018, Year 8 (acres)
1 (Low) 1 – 5% Cover	0.34	57.86	42.30	20.04	2.93
2 (Medium) 6 – 25% Cover	3.20	14.17	14.10	7.64	1.51
3 (High) = > 25% Cover	3.79	4.42	12.70	7.71	3.70
Total Acreage	**7.33**	**76.45**	**69.10**	**35.39**	**8.14**

Table 7-28. Estimated Area Occupied (Acres) by Annual Grasses Between Baseline and Year 8 in Unit 21.

Cover Class	2010, Baseline (acres)	2011, Year 1 (acres)	2013, Year 3 (acres)	2015, Year 5 (acres)	2018, Year 8 (acres)
Density Class 1 (Low) 1 – 5% Cover	1.25	33.42	18.7	8.58	1.28
Density Class 2 (Medium) 6 – 25% Cover	2.17	6.53	7.5	4.97	0.42
Density Class 3 (High) = > 25% Cover	2.40	6.45	5.7	3.96	3.00
Total Acreage	**5.82**	**46.40**	**31.90**	**17.51**	**4.70**

7.4.4 Invasive and Non-Native Species Monitoring

Of the target invasive species, only iceplant was observed in Units 21 and 34, while French broom and pampas grass were not observed (Appendix E, Figures E-11 and E-12). One large patch of iceplant was estimated using aerial imagery. The patch straddled the border between Units 21 and 34 and was 7.71 acres in size with 4.91 acres in Unit 21 and 2.80 acres in Unit 34. Additionally, there were minor occurrences of non-native herbaceous cover observed during transect monitoring in Unit 34 (Appendix G, Table G-9).

8 MACROPLOT ANALYSES

8.1 Introduction

Macroplot surveys were first proposed in the *Revised Protocol for Conducting Vegetation Monitoring* and additional guidance provided in *Addendum to Revisions of Survey Protocol for HMP Annual Plants: Implementation of Macroplot Sampling at Former Fort Ord* (Tetra Tech and EcoSystems West, 2015b and 2016). Macroplot surveys were included as a requirement of the *Programmatic Biological Opinion for Cleanup and Property Transfer Actions Conducted at the Former Fort Ord* (PBO) issued by the United States Fish and Wildlife Service (USFWS, 2017). The objective of the macroplot sampling is to assess changes in the distribution of HMP annual species in response to treatment.

It was hypothesized that the HMP annual species would expand outward from the quantitatively sampled grid at the center of a macroplot once mastication or fire had removed the shrub cover that shaded the HMP annuals. This expansion in distribution could be detected by noting the presence or absence of the species in the surrounding grids within a macroplot.

Burleson analyzed macroplot survey data using two approaches. The first approach is referred to as the *macroplot-level analysis* and examines changes in distribution within macroplots between the Baseline year and 2018. This approach determines if the distributions of the HMP annual species change after treatment.

The second approach is referred to as *single-season occupancy analysis* and examines three factors that may affect the distribution of the HMP annual species. This analysis examines only 2018 macroplot survey results. Using this approach, Burleson examined the extent that Age, Treatment, or density of the species in the central macroplot grid affect the distribution of HMP annual species.

8.2 Methods

8.2.1 Macroplot Selection

Macroplots consisted of nine standard 100 x 100-ft sampling grids, arranged in a 3 by 3 square, and centered on a grid that was sampled for HMP density. The presence or absence of each of the three HMP annual plants (sand gilia, seaside bird's beak, and Monterey spineflower) was determined in each of the grids within a macroplot.

Macroplots were selected based on the following rules:

- Macroplot center points were randomly selected from the grids selected for quantitative density sampling for HMPs.
- Initial detection frequencies (number of grids out of 9 grids within the macroplot that were occupied) for all possible macroplots within a unit were estimated based on the results of the meandering transects. This provides the Baseline (Year 0) estimate of detection frequency.
- Macroplots were selected from those potential macroplot locations which had a baseline detection frequency of 5/9 or less.
- Macroplots may not overlap.

- For macroplots that were established along boundaries (either unit or treatment), the position/shape of the macroplot was adjusted to ensure that it remains within the subject area.
- Macroplot size was maintained at nine grids.
- There was no stratification by Treatment (i.e., mastication or burning) within a unit when selecting macroplots.
- There was no stratification by HMP annual species.

A total of 37 macroplot locations were surveyed in 2018 (see Table 8-1 and Figure 8-1). Year 1 macroplots were randomly selected and reviewed for suitability. Macroplots that were in unsuitable areas (e.g., steep slopes) were replaced with other randomly selected locations. Year 3 and Year 5 macroplots were previously surveyed in 2016 (Burleson, 2017). Maps showing macroplot survey locations are provided in Appendix H.

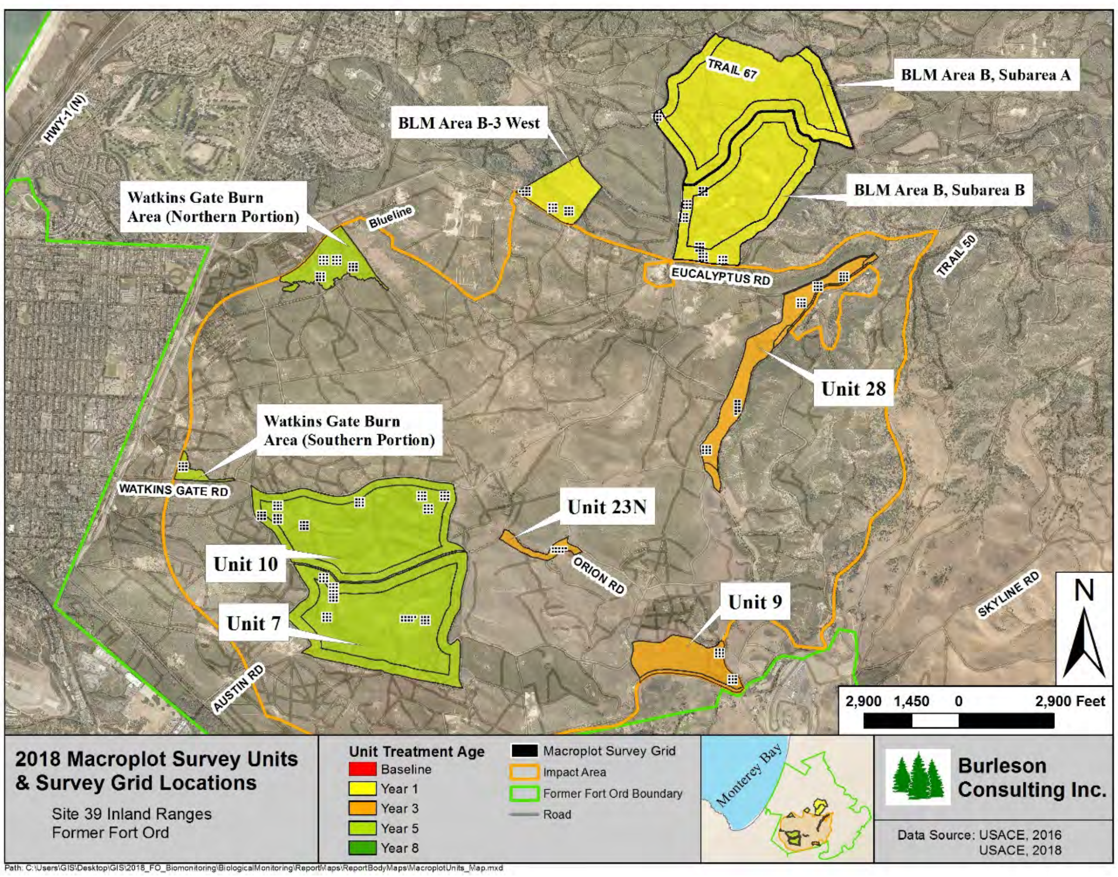

Figure 8-1. Map of Macroplots Surveyed in 2018

Table 8-1. Survey Years and Treatment Years for Each Macroplot

MacroplotID	Unit	Age	2011	2012	2013	2014	2015	2016	2017	2018
C3D4F2	BLM Area B, Subarea A	1					Y0		M	Y1
B3J5C6	BLM Area B, Subarea B	1					Y0		M&B	Y1
B3J6B2	BLM Area B, Subarea B	1					Y0		Mix	Y1
C3A4E0	BLM Area B, Subarea B	1					Y0		M	Y1
C3A5I1	BLM Area B, Subarea B	1					Y0		Mix	Y1
C3B5C6	BLM Area B, Subarea B	1					Y0		M&B	Y1
B3J5F5	BLM Area B, Subarea B	1					Y0		Mix	Y1
C2A0H0	BLM Area B-3 West	1					Y0		M	Y1
C2B0C2	BLM Area B-3 West	1					Y0		M	Y1
C3A1G5	BLM Area B-3 West	1					Y0		M	Y1
A3G6D5	9	3	Y0				M	Y1		Y3
A3H6B1	9	3	Y0				M	Y1		Y3
B3A1C2	23 North	3	Y0				M	Y1		Y3
B3D5D7	28	3	Y0				M	Y1		Y3
B3E6H6	28	3	Y0				M	Y1		Y3
B3H8I6	28	3	Y0				M	Y1		Y3
B3I9D1	28	3	Y0				M	Y1		Y3
B3I9G9	28	3	Y0				M	Y1		Y3
A2I4C1	7	5			Y0, B			Y3		Y5
A2I4I3	7	5			Y0, B			Y3		Y5
A2I6B6	7	5			Y0, B			Y3		Y5
A2I7B1	7	5			Y0, B			Y3		Y5
A2J3E0	7	5			Y0, Mix			Y3		Y5
A2J4B3	7	5			Y0, Mix			Y3		Y5
B2B2C6	10	5		Y0	B			Y3		Y5
B2B2D1	10	5		Y0	M&B			Y3		Y5
B2B2G6	10	5		Y0	B			Y3		Y5
B2B3A4	10	5		Y0	B			Y3		Y5
B2B5H1	10	5		Y0	B			Y3		Y5
B2B6J0	10	5		Y0	B			Y3		Y5
B2B7F2	10	5		Y0	B			Y3		Y5
B2B7J7	10	5		Y0	Mix			Y3		Y5
B1C9I7	Watkins Gate Burn Area	5	Y0		M			Y3		Y5
B2I3G9	Watkins Gate Burn Area	5	Y0		M			Y3		Y5
B2I4J9	Watkins Gate Burn Area	5	Y0		M			Y3		Y5
B2J3B0	Watkins Gate Burn Area	5	Y0		M			Y3		Y5
B2J4B4	Watkins Gate Burn Area	5	Y0		M			Y3		Y5

When possible, the effects due to treatment type (burned, masticated, or mixed) were evaluated. Treatment types were allocated by examining shapefiles of the HMP annual monitoring grids against the

FODIS shapefiles “flora_pres_burn_area” and “flora_fire_area” using ArcGIS (ESRI, 2017; USACE, 2018). Treatment types were allocated based on the following rules:

- Masticated – Greater than 90% of the macroplot was only masticated.
- Burned – Greater than 90% of the macroplot was only burned.
- Mixed – A portion of the macroplot was masticated and burned and a portion was only burned. Neither the masticated and burned or burned portions comprised greater than 90%.
- Masticated and Burned – Greater than 90% of the macroplot was masticated and then subsequently burned.

8.2.2 Statistical Approach

Changes in distribution of HMP annual species are characterized by changes in the number of individual grids in which the species is present within a macroplot. These changes were examined with the *macroplot-level analyses* and the *single-season occupancy analysis*.

8.2.2.1 Macroplot Level Analysis

The *macroplot-level analyses* were used to evaluate the changes in distribution of HMP annual species between Baseline and 2018. Data were summarized by calculating frequency of occurrence for different groups of macroplots based on Age and Treatment. Analysis of variance (ANOVA) was used to assess differences in frequency of occurrence between Age and Treatment. When ANOVA test assumptions were not met, permutational ANOVA (PERMANOVA) was used to assess differences between these groups. PERMANOVA was used on matrices of binary data, taking the form of *Macroplot* x *Replicate* and using Jaccard distances (McCune *et al*., 2002; Choi *et al*., 2010). Replicates represent the individual grids within the macroplot, and the data within the matrix are binary presence/absence data, where 1 is present and 0 is absent. In some cases, the HMP species were not detected in all or many of the macroplot grids. This created a scenario referred to as zero-inflation for some combinations of species and Age. In these cases, descriptive statistics were utilized to describe the observed data.

Baseline data were not collected for any macroplot. To rectify this data gap, Baseline data were estimated using Baseline meandering transects which occurred for all Units. During meandering transects the presence of all HMP annual individuals are documented and mapped. These locations were overlaid on top of the macroplot locations using ArcMap, and presence/absence derived (Esri, 2017). From these presence/absence values, frequency of occurrence was determined, and binary matrices developed for use in the *macroplot-level analyses*.

8.2.2.2 Single-season Occupancy Analysis

Single-season occupancy analysis was used to determine what factors affect the detectability of HMP annuals in macroplots during the 2018 survey season. This analysis included fitting models to observed macroplot data, utilizing Akaike Information Criterion (AIC) model selection techniques and evidence ratio (ER) calculations to determine the best fitting model, and computing $\log_{10}$ evidence ratios (LER) to evaluate support for covariates affecting detection probability (MacKenzie *et al.* 2006; Akaike, 1974; Burnham and Anderson, 2002; Burnham *et al.*, 2011; Watson, 2014). This was conducted for Monterey spineflower, sand gilia, and seaside bird’s beak separately, with one analysis per species.

Single-season occupancy analysis employs multivariate models to analyze two response variables:

1. Probability of occupancy – the probability of observing the HMP annual species in a macroplot. This value is equal to the proportion of macroplots occupied by the species.
2. Probability of detection – the probability of detecting an HMP annual species given that the macroplot is occupied. Each grid within the macroplot is treated as an independent observation of the presence of the species. Hence the number of grids supporting the HMP species is an indication of the detectability.

The first models examined were the null models. These models did not contain any covariates for either occupancy or detectability and were examined separately for each HMP annual species. The null models yielded an occupancy estimate (number of macroplots occupied divided by the total number of macroplots surveyed) and the probability of detection across all macroplots (the number of grids occupied divided by the total number of grids in macroplots that were occupied). These models provided information about the occupancy and probability of detection during the 2018 surveys. When qualitatively assessing occupancy and detectability rates from 2018 survey data, Burleson classified >0.75 as high, 0.25–0.75 as moderate, and <0.25 as low.

Burleson fit various models to estimate detectability using combinations of covariates including macroplot age (i.e., time since treatment) (Age), treatment type (Treatment), and density class in the central grid (Density). Models included single covariates as well as combinations of covariates. These models were subsequently evaluated using AIC model selection and evidence ratios (ERs) to determine which model best fit the observed data (Burnham and Anderson, 2002; Burnham *et al.*, 2011). Each covariate was evaluated using LERs to evaluate support for its effect on detectability (Watson, 2014). Following Kass and Raftery (1995), it was decided *a priori* to use the terms 'equivocal', 'substantial', 'strong', and 'decisive' to correspond approximately to LERs of less than 0.5, and greater than 0.5, 1, and 2 respectively.

Since the probability of detection represents the number of grids occupied by HMP species in an occupied macroplot, evaluating detectability provided information about the expansion of the species within a macroplot after treatment. Due to this, Burleson prioritized the probability of detection as the modeled response over the probability of occupancy.

Single-season occupancy analysis was conducted using the package *unmarked* in R statistical software (Fiske *et al.*, 2017; R Core Team, 2017). Initial analyses were also conducted in the PRESENCE software developed by the United States Geological Survey to validate results in R (Hines, 2006).

8.3 RESULTS

Thirty-seven macroplots were surveyed in 2018. Monterey spineflower was observed in 36 of the 37 macroplots, sand gilia observed in 12, and seaside bird's beak observed in two (see Appendix H). Frequency of occurrence within macroplots where the HMP species were observed varied by species and macroplot.

The most influential factors affecting the detectability of Monterey spineflower were treatment type and the density of the central grid in Baseline. The most influential factors affecting sand gilia were the density of the species in the central grid in Baseline and the Age of the macroplot.

8.3.1 Macroplot Level Analysis

Macroplot level analyses were conducted for each age group and HMP annual species, resulting in nine total analyses.

8.3.1.1 Monterey spineflower

Monterey spineflower frequency of occurrence within macroplots increased between treatment and the first post-treatment survey year for all age classes and treatments, except for one masticated and burned macroplot in Unit 10 where the frequency remained static between survey years. However, Monterey spineflower frequency of occurrence in this macroplot increased between Year 3 and Year 5 from 0.22 to 0.78. Treatment effects on Monterey spineflower were not significant for any age class.

Two-way ANOVA suggests that macroplot frequency of occurrence of Monterey spineflower was significantly different through time and was not significantly different between treatments in the Year 1 macroplots (Table 8-2; Figure 8-2). Frequency of occurrence for the species increased for all treatments between Baseline and Year 1. Year 1 macroplots are located in BLM Area B-3 West, BLM Area B Subarea B Containment Line, and BLM Area B Subarea A Containment Line.

Table 8-2. Two-way ANOVA results for Monterey spineflower frequency of occurrence in Year 1 macroplots. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	4.95	0.043*
Treat	0.924	0.420
Treat*Age	1.16	0.342

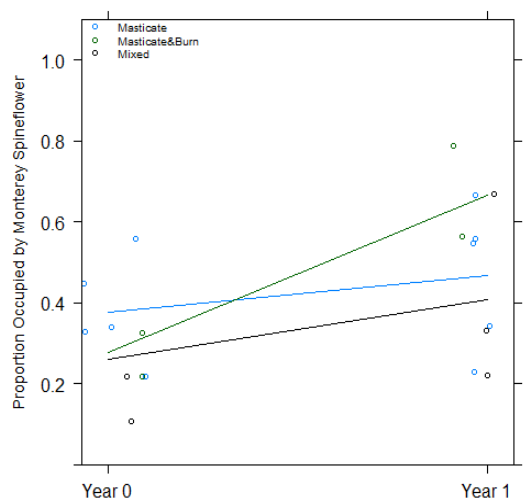

Figure 8-2. Monterey Spineflower Frequency of Occurrence in Year 1 Macroplots

One-way ANOVA suggests that macroplot frequency of occurrence of Monterey spineflower was not significantly different through time in the Year 3 macroplots (Table 8-3; Figure 8-3). However, frequency of occurrence of the species increased between Baseline and Year 1 (0.11) and decreased between Year 1 and Year 3 (-0.04). Year 3 macroplots are located in Unit 9, Unit 23, and Unit 28.

Table 8-3. One-way ANOVA results for Monterey spineflower frequency of occurrence in Year 3 macroplots. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	0.330	0.722

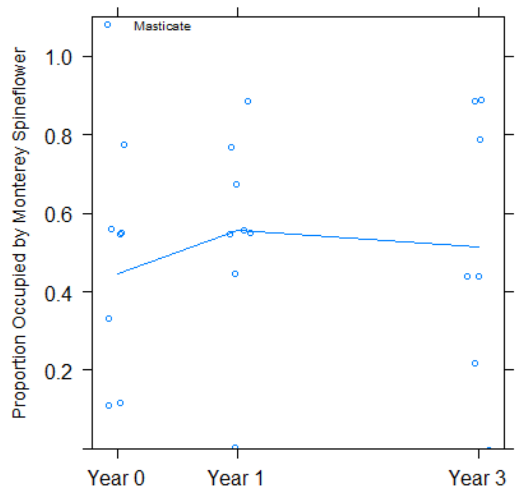

Figure 8-3. Monterey Spineflower Frequency of Occurrence in Year 3 Macroplots

Two-way PERMANOVA suggests that macroplot frequency of occurrence of Monterey spineflower was significantly different through time and not significantly different between treatments in the Year 5 macroplots (Table 8-4; Figure 8-4). Frequency of occurrence of the species in masticated macroplots increased between Baseline and Year 3 (0.29) and decreased between Year 3 and Year 5 (-0.04). Frequency of occurrence of the species in burned macroplots increased between Baseline and Year 3 (0.22) and again between Year 3 and Year 5 (0.14). Frequency of occurrence of the species in masticated and burned macroplots remained the same between Baseline and Year 3 and increased between Year 3 and Year 5 (0.56). Frequency of occurrence of the species in mixed macroplots increased between Baseline and Year 3 (0.30) and decreased between Year 3 and Year 5 (-0.07). Year 5 macroplots are located in Unit 7, Unit 10, and WGBA.

Table 8-4. Two-way PERMANOVA results for Monterey spineflower in Year 5 macroplots, based on Jaccard distance matrices. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	8.82	5.87e-04*
Treat	0.806	0.497
Treat*Age	0.584	0.741

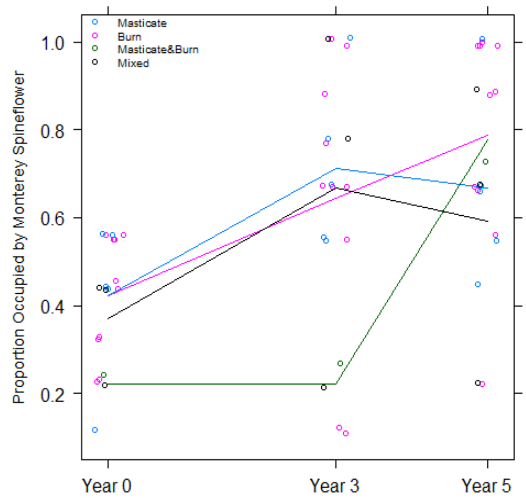

Figure 8-4. Monterey Spineflower Frequency of Occurrence in Year 5 Macroplots

8.3.1.2 Sand Gilia

Sand gilia frequency of occurrence within macroplots either increased or slightly decreased (mixed Year 5 macroplots) by the first survey year after treatment for all age classes and treatments. Decreases were observed after the initial responses in all Year 3 and Year 5 Units. Differences in sand gilia frequency of occurrence in macroplots between Treatments were graphically evident in Years 3 and 5; however, these differences were not confirmed by statistical testing due to limitations of these data (Figure 8-7).

Sand gilia was only observed in the Year 1 macroplots which were either burned and masticated or received mixed treatment. Frequency of occurrence for sand gilia increased (0.39) in burned and masticated macroplots, and increased in mixed macroplots (0.15), in Year 1 Units between Baseline and Year 1 (Figure 8-5). Year 1 macroplots were in BLM Area B-3 West, BLM Area B Subarea B Containment Line, and BLM Area B Subarea A Containment Line. These sand gilia data did not meet assumptions to conduct ANOVA. PERMANOVA could not be conducted due to zero-inflation of the dataset.

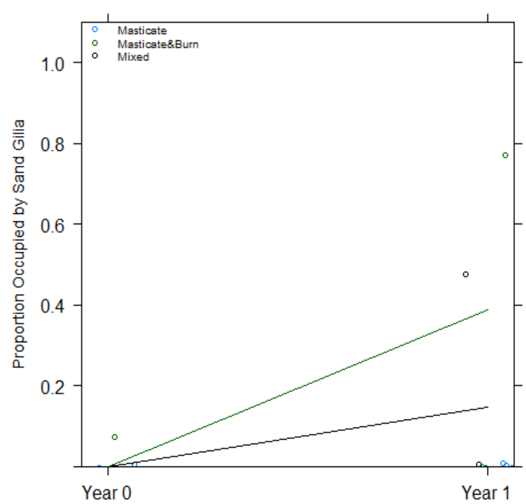

Figure 8-5. Sand Gilia Frequency of Occurrence in Year 1 Macroplots

One-way ANOVA suggests that macroplot frequency of occurrence of sand gilia was not significantly different through time in the Year 3 macroplots (Table 8-5; Figure 8-6). However, frequency of occurrence of the species increased between Baseline and Year 1 (0.26) and decreased between Year 1 and Year 3 (-0.13). Year 3 macroplots are located in Unit 9, Unit 23, and Unit 28.

Table 8-5. One-way ANOVA results for sand gilia frequency of occurrence in Year 3 macroplots. Significance is denoted using an asterisk (*), and is defined by *p*-values below 0.05 coupled with an *F*-statistic of greater than one.

Factor	*F*	*p*
Age	1.45	0.257

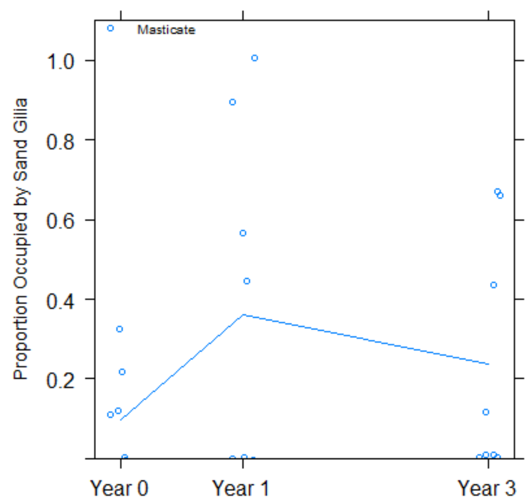

Figure 8-6. Sand Gilia Frequency of Occurrence in Year 3 Macroplots

Frequency of occurrence of the species in burned macroplots increased between Baseline and Year 3 (0.30) and decreased between Year 3 and Year 5 (-0.36) (Figure 8-7). Frequency of occurrence of the species in masticated macroplots increased between Baseline and Year 3 (0.04) and decreased between Year 3 and Year 5 (-0.04). In these masticated macroplots, no sand gilia were observed in Baseline or Year 5. Frequency of occurrence of the species in masticated and burned macroplots increased from 0.00 to 0.22 between Baseline and Year 3 and subsequently decreased from 0.22 to 0.11 between Year 3 and Year 5. Frequency of occurrence of the species in mixed macroplots decreased from 0.30 to 0.26 between Baseline and Year 3 and dropped to 0.0 by Year 5. Year 5 macroplots are located in Unit 7, Unit 10, and WGBA. These sand gilia data did not meet assumptions to conduct ANOVA. PERMANOVA could not be conducted due to zero-inflation of the dataset.

While differences between Treatments are graphically evident in Figure 8-7, these differences are likely due to differences that existed prior to Treatment. In Baseline, sand gilia was only observed in areas which were later burned or received mixed treatment.

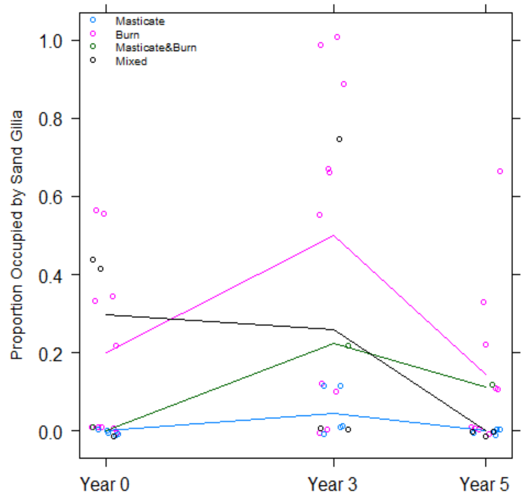

Figure 8-7. Sand Gilia Frequency of Occurrence in Year 5 Macroplots

8.3.1.3 Seaside Bird's Beak

Seaside bird's beak frequency of occurrence within macroplots was predominantly zero for all age classes and treatments, with a few exceptions.

Seaside bird's beak was not observed in the 2018 Year 1 macroplots in any survey year. The species was only observed in one 2018 Year 3 macroplot in 2018 in one grid cell and not in any other survey year (Figure 8-8). This occurrence was in macroplot B3A1C2 in Unit 23 North which was masticated (Figure 8-1). Seaside bird's beak was observed in one burned 2018 Year 5 macroplot (A2I4I3 in Unit 7) in Year 3 (2016) and again in Year 5 (2018) with a frequency of occurrence of 0.56 (Figure 8-9). The species was also observed in macroplot B2B6J0, a burned 2018 Year 5 macroplot in Unit 10, when it was in Year 3 in 2016 with the frequency of occurrence of 0.11 and not observed in any other survey year in this macroplot. None of the seaside bird's beak datasets met assumptions to conduct ANOVA. PERMANOVA could not be conducted due to zero-inflation of these datasets.

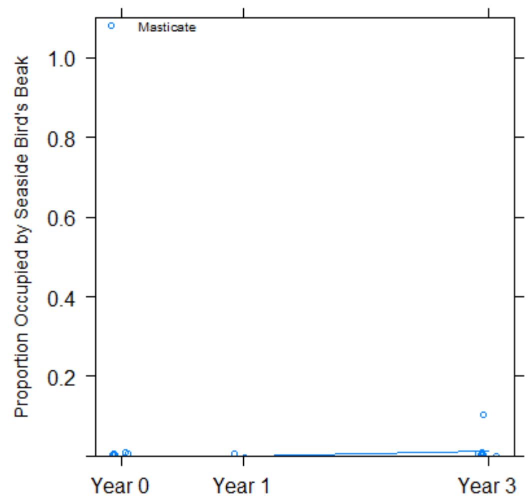

Figure 8-8. Seaside Bird's Beak Frequency of Occurrence in Year 3 Macroplots

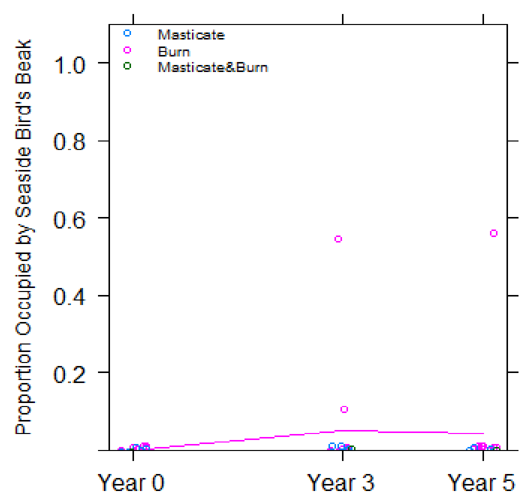

Figure 8-9. Seaside Bird's Beak Frequency of Occurrence in Year 5 Macroplots

8.3.2 Occupancy Analysis

Single-season occupancy analyses were conducted for each HMP annual species, resulting in three total analyses.

8.3.2.1 Monterey Spineflower

Monterey spineflower occupancy of macroplots was high (0.974) and detection probability was moderate (0.632) during the 2018 surveys. These values were derived from the null model where both occupancy and detectability were held constant.

The winning AIC model was model *dc6*, which included Density and Treatment as covariates for detection probability of Monterey spineflower (Table 8-6). Evidence ratios of all models compared against the winning model suggest that the winning model performs approximately three times better than the next model (*dc4*). The treatment coefficients of model *dc6* suggest that the macroplots which received mastication or mixed treatment had significantly less grids occupied per macroplot than the macroplots which were burned (Masticate = -1.1 grids, Mixed = -1.3 grids). Density coefficients suggest that density of the central grid in Baseline had a significant positive quadratic effect (0.94), where an increase in density results in a quadratic increase in grids occupied. The coefficients for each covariate were evaluated independent of the other covariate, and the design is not balanced across either treatments or density classes.

The LER results yielded strong evidence that treatment type affected Monterey spineflower detection probability, substantial evidence for density of the species in the central grid prior to treatment, and equivocal evidence for time since treatment (Table 8-7).

These findings suggest that the burned macroplots which were occupied by Monterey spineflower in 2018 had more grids where the species was detected than macroplots which received other treatments. The density of the central grid also played a significant role, where higher Baseline densities in the central grid resulted in higher detection probabilities. Time since treatment did not play a major role.

Table 8-6. AIC comparison of models representing various combinations of covariates on Monterey spineflower detection probability. The best models have the lowest ΔAIC_C, and AIC_W is interpreted as the probability that the corresponding model is the best of the compared models.

Model Name	Covariates	AIC	AIC_C	ΔAIC_C	AIC_W	ER
dc6	Density + Treatment	415	420	0.00	6.27e-01	1.00
dc4	Treatment	421	422	2.43	1.86e-01	3.37
dc8	Density + Age + Treatment	417	423	3.36	1.17e-01	5.36
dc7	Treatment + Age	422	425	5.28	4.47e-02	14.0
dc2	Density	426	427	7.46	1.51e-02	41.5
dc5	Density + Age	425	428	8.18	1.05e-02	59.7
nullchp	null	439	440	19.6	3.50e-05	17,900
dc3	Age	446	447	26.9	9.02e-07	695,000

Table 8-7. Log_{10} evidence ratio comparison assessing evidence in support for each covariate.

Monterey Spineflower Detection Probability Covariate	LER	Evidence
Age	-0.682	Equivocal
Treatment	1.59	Strong
Density	0.524	Substantial

8.3.2.2 Sand Gilia

Sand gilia occupancy of macroplots was moderate (0.329) and detection probability was moderate (0.384) during the 2018 surveys. These values were derived from the null model where both occupancy and detectability were held constant.

The winning AIC model was model *dg5*, which included Density and Age as covariates for detection probability of sand gilia (Table 8-8). Evidence ratios of all models compared against the winning model suggest that the winning model performs approximately six times better than the next model (*dg6*). The density coefficients of model *dg5* suggest that Density had a positive linear effect (1.0), where an increase in density resulted in a linear increase in grids occupied. Age coefficients suggest that time since treatment had a negative linear effect (-0.50), where the older macroplots had lower detection rates. The coefficients for each covariate were evaluated independent of the other covariate, and the design is not balanced across either treatments or density classes.

The LER results yielded strong evidence that density of the species in the central grid prior to treatment, substantial evidence that time since treatment, and equivocal evidence that treatment type, affected sand gilia detection probability (Table 8-9).

These findings suggest that the macroplots which had higher densities (> 100 plants per grid) of sand gilia in the central grid during Baseline had more grids occupied by sand gilia in 2018. Time since treatment played an important but lesser role, where the frequency of sand gilia peaked at Age 1, with decreases between Age 1 and Age 3 and Age 3 and Age 5. Treatment type did not play a major role.

Table 8-8. AIC comparison of models representing various combinations of covariates on sand gilia detection probability. The best models have the lowest ΔAIC_C, and AIC_W is interpreted as the probability that the corresponding model is the best of the compared models.

Model Name	Covariates	AIC	AIC_C	ΔAIC_C	AIC_W	ER
dg5	Density + Age	182	183	0.00	0.6870	1.00
dg6	Density + Treatment	183	186	3.48	0.1204	5.71
dg8	Density + Age + Treatment	183	187	3.76	0.1050	6.54
dg3	Age	188	188	5.52	0.0436	15.8
dg7	Treatment + Age	186	189	6.32	0.0292	23.5
dg2	Density	190	191	7.92	0.0131	52.4
nullgit	null	195	195	12.21	0.0015	458
dg4	Treatment	197	199	16.44	0.0002	3,440

Table 8-9. Log_{10} evidence ratio comparison assessing evidence in support for each covariate.

Sand Gilia Detection Probability Covariate	LER	Evidence
Age	0.806	Substantial
Treatment	-0.446	Equivocal
Density	1.09	Strong

8.3.2.3 Seaside Bird's Beak

Seaside bird's beak occupancy of macroplots was low (0.056) and detection probability was moderate (0.323) during the 2018 surveys. These values were derived from the null model where both occupancy and detectability were held constant.

The sample size of seaside bird's beak was too small to conduct occupancy analysis, since it was observed in only two macroplots (B3A1C2 and A2I4I3) during the 2018 surveys.

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9 CONCLUSIONS

9.1 HMP Annuals

Results of HMP annual species surveys on multiple Units over varying amounts of time since treatment have shown that these species continue to persist following vegetation clearance activities. In 2018, comparison to Baseline was conducted for all age classes. Treatment-related effects were assessed in BLM Area B Subarea B Containment Line (Year 1) and Units 7 and 10 (Year 5), but not in other areas due to utilization of only one Treatment.

There were no significant effects due to Treatment in the areas evaluated; however, there was a significant interaction between Treatment and Age for sand gilia in Units 7 and 10. This suggests that there were differences in sand gilia frequency of occupancy in some, but not all, levels of *Age*. Those differences are graphically evident in Figure 6-13 and show that the burned grids support higher frequency of occupancy of sand gilia, despite no significant difference from the statistical test. However, the burned grids supported more sand gilia prior to treatment and it is unclear if burning was the cause for higher frequency or simply that more sand gilia existed during Baseline.

In general, observed densities and frequency of occurrence of HMP annual species were consistent with historic baseline conditions. Sand gilia and Monterey spineflower vitality 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. Seaside bird's-beak densities are also variable (Watts *et al*., 2010). The cause for this variability is highly complex and can be the result of several factors including variable reproduction and germination rates, host availability, herbivory or seed predation, or competition from invasive species.

9.1.1 HMP Annuals Success Criteria

The Revised Protocol provided specific success criteria for re-establishment of HMP annual species following treatment (Tetra Tech and EcoSystems West, 2015b). Comparisons of survey data to these success criteria are provided in Table 9-1. The only criterion that could not be assessed was comparison of the percentage of bare ground relative to Baseline conditions for BLM Area B-3 West and BLM Area B Subareas A and B Containment Lines, because no transect surveys were required in Year 1 Units. However, given that bare ground continues to be present in high percentages in Year 3 and later Units, it is likely that sufficient bare ground was present in Year 1 Units to support HMP annual species.

Seventy eight percent of HMP annuals success criteria were met for the 2018 survey year (Table 8-1). The criteria not met were Monterey spineflower in BLM Area B-3 West and BLM Area B Subareas A and B Containment Lines (Year 1); Monterey spineflower in Units 9 and 28 (Year 3); sand gilia in Unit 7 (Year 5); and Monterey spineflower in Unit 7 and MOUT Buffer (Year 5).

The HMP annual success criteria is that frequency of occurrence is at least 90% of the Baseline frequency in any post-treatment year. The frequencies areas which did not meet this success criteria ranged between 60% and 89% of the respective Baseline frequency. Despite not meeting the criterion, sand gilia and Monterey spineflower were still persisting in these areas.

BLM Area B Subarea A Containment Line and the MOUT Buffer contained one less Monterey spineflower-occupied grid in 2018 than in Baseline. Unit 28 contained one less sand gilia-occupied grid in

2018 than in Baseline. Because sample size in these cases were small (*n*=2-4), the change of occupancy in one grid represents a substantial change in frequency. Previous surveys showed it is not uncommon to have a change of frequency of one grid. Such fluctuations can be expected to occur by chance, and they do not necessarily indicate a response to remediation activities.

Of the HMP annuals success criteria not met, 88% were related to Monterey spineflower. This occurred in all treatment types and does not appear to be due to treatment type. Other environmental factors may have affected these criteria for Monterey spineflower. Since Monterey spineflower vitality is strongly correlated with rainfall, it is possible that the historic California drought between 2012 and 2016 affected densities of the species in these areas (Fox et al., 2006; Fox, 2007).

Table 9-1. Evaluation of Success Criteria for HMP Annuals.

Year Class	Units	Criterion	Baseline	2018	Pass/Fail
Year 1	BLM Area B-3 West, BLM Area B Subareas A and B Containment Lines	Frequency of sand gilia > 90% of baseline frequency	$f_{B\text{-}3\ West} = 0.00$ $f_{Subarea\ A} = 0.00$ $f_{Subarea\ B} = 0.21$	$f_{B\text{-}3\ West} = 0.00$ $f_{Subarea\ A} = 0.00$ $f_{Subarea\ B} = 0.32$	Pass Pass Pass
		Frequency of seaside bird's-beak > 90% of baseline frequency	$f_{B\text{-}3\ West} = 0.00$ $f_{Subarea\ A} = 0.00$ $f_{Subarea\ B} = 0.00$	$f_{B\text{-}3\ West} = 0.00$ $f_{Subarea\ A} = 0.00$ $f_{Subarea\ B} = 0.03$	Pass Pass Pass
		Frequency of Monterey spineflower > 90% of baseline frequency	$f_{B\text{-}3\ West} = 1.00$ $f_{Subarea\ A} = 1.00$ $f_{Subarea\ B} = 1.00$	$f_{B\text{-}3\ West} = 0.89$ $f_{Subarea\ A} = 0.66$ $f_{Subarea\ B} = 0.89$	Fail Fail Fail
		Bare ground > Baseline condition	--	--	--
Year 3	9, 23, 28	Frequency of sand gilia > 90% of baseline frequency	$f_{Unit\ 9} = 0.00$ $f_{Unit\ 23} = 0.00$ $f_{Unit\ 28} = 0.35$	$f_{Unit\ 9} = 0.00$ $f_{Unit\ 23} = 0.00$ $f_{Unit\ 28} = 0.59$	Pass Pass Pass
		Frequency of seaside bird's-beak > 90% of baseline frequency	$f_{Unit\ 9} = 0.00$ $f_{Unit\ 23} = 0.00$ $f_{Unit\ 28} = 0.00$	$f_{Unit\ 9} = 0.00$ $f_{Unit\ 23} = 0.00$ $f_{Unit\ 28} = 0.00$	Pass Pass Pass
		Frequency of Monterey spineflower > 90% of baseline frequency	$f_{Unit\ 9} = 1.00$ $f_{Unit\ 23} = 1.00$ $f_{Unit\ 28} = 1.00$	$f_{Unit\ 9} = 0.70$ $f_{Unit\ 23} = 1.00$ $f_{Unit\ 28} = 0.89$	Fail Pass Fail
		Bare ground > Baseline condition	$c_{Unit\ 9} = 3.2\%$ $c_{Unit\ 23} = 24\%$* $c_{Unit\ 28} = 13\%$	$c_{Unit\ 9} = 31\%$ $c_{Unit\ 23} = 41\%$* $c_{Unit\ 28} = 34\%$	Pass Pass Pass
Year 5	7, 10, WGBA, MOUT Buffer	Frequency of sand gilia > 90% of baseline frequency	$f_{Unit\ 7} = 0.05$ $f_{Unit\ 10} = 0.29$ $f_{WGBA} = 0.03$ $f_{MOUT\ Buffer} = 0.75$	$f_{Unit\ 7} = 0.03$ $f_{Unit\ 10} = 0.49$ $f_{WGBA} = 0.05$ $f_{MOUT\ Buffer} = 0.75$	Fail Pass Pass Pass
		Frequency of seaside bird's-beak > 90% of baseline frequency	$f_{Unit\ 7} = 0.00$ $f_{Unit\ 10} = 0.00$ $f_{WGBA} = 0.00$ $f_{MOUT\ Buffer} = 0.00$	$f_{Unit\ 7} = 0.08$ $f_{Unit\ 10} = 0.00$ $f_{WGBA} = 0.03$ $f_{MOUT\ Buffer} = 0.00$	Pass Pass Pass Pass
		Frequency of Monterey spineflower > 90% of baseline frequency	$f_{Unit\ 7} = 0.97$ $f_{Unit\ 10} = 1.00$ $f_{WGBA} = 1.00$ $f_{MOUT\ Buffer} = 1.00$	$f_{Unit\ 7} = 0.84$ $f_{Unit\ 10} = 0.91$ $f_{WGBA} = 0.92$ $f_{MOUT\ Buffer} = 0.75$	Fail Pass Pass Fail
		Bare ground > Baseline condition	$c_{Unit\ 7} = 10\%$ $c_{Unit\ 10} = 13\%$ $c_{WGBA} = 16\%$ $c_{MOUT\ Buffer} = 16\%$	$c_{Unit\ 7} = 20\%$ $c_{Unit\ 10} = 22\%$ $c_{WGBA} = 35\%$ $c_{MOUT\ Buffer} = 19\%$	Pass Pass Pass Pass

* These values were derived from transects which are located in Unit 23N where HMP annuals were monitored and transects in the rest of Unit 23 were not included.

9.2 Macroplot Surveys

9.2.1 Macroplot Level Analyses

The *macroplot-level analyses* were used to evaluate the changes in the distribution of HMP annual species after treatment. Data were summarized by calculating frequency of occurrence for different groups of macroplots based on Age and Treatment. Seaside bird's beak was only observed in two of thirty-seven macroplots in 2018 and could not be evaluated due to small sample size.

The distribution of Monterey spineflower and sand gilia generally increased following treatment with subsequent declines in frequency by Years 3 and 5 (Figures 8-2 through 8-4). This is consistent with the observations of the 2016 macroplot survey results (Burleson, 2017a). However, since each year class had a different baseline survey year and consisted of different units, temporal patterns of grid occupancy across year classes should take these differences into consideration.

Treatment did not significantly affect the frequency of occurrence of Monterey spineflower or sand gilia (Tables 8-2 through 8-4).

9.2.2 Single-Season Occupancy Analyses

The *single-season occupancy analyses* were used to determine what factors affect the detectability of HMP annuals in macroplots during the 2018 survey season. Since the probability of detection represents the number of grids occupied by HMP species in an occupied macroplot, evaluating detectability provided information about the expansion of the species within a macroplot after treatment.

The Monterey spineflower analyses suggest that burned macroplots had approximately one more grid occupied with the species in 2018 than macroplots which were masticated or mixed. Macroplots which had higher Baseline densities in their central grid had more macroplot grids occupied in 2018 (Tables 8-6 and 8-7).

The sand gilia analyses suggest that macroplots which had higher Baseline densities in their central grid had more grids occupied by the species in 2018. Macroplots which were Age 3 or Age 5 had less grids occupied by sand gilia when compared to Age 1 macroplots (Tables 8-8 and 8-9).

It should be noted that these occupancy analyses have unbalanced designs (e.g. burned macroplots are only Age 5, number of grids between treatments are not equal), and that interactions between covariates were not evaluated.

9.3 Shrub Community

Results of shrub community structure analyses reaffirm results of previous surveys. Years 5 and 8 showed a progressive change in community structure and composition, returning towards the Baseline assemblage in the ordination plots. This pattern has been observed in every monitoring year since 2010 and reflects predictable successional changes in the shrub community (Tetra Tech and EcoSystems West, 2011 – 2015a; Burleson, 2016 – 2018).

Differential response to treatment was assessed in Units where multiple treatments were applied. This occurred in Year 5 Units 7 and 10, and Year 8 Units 15 and 21. Different species and community metrics can be promoted by burning, while others can be promoted by mastication.

Mastication yielded significantly lower total cover and higher bare ground and herbaceous cover in Unit 7 (Figures 6-18 and 6-24). Various community metrics were significantly different between treatments in Unit 10 including species evenness, herbaceous cover, community composition, and cover of Monterey ceanothus and sandmat manzanita, two HMP shrubs (Figure 6-19, 6-25, 6-31, 6-37, 6-43; Table 6-12). Burning promoted Monterey ceanothus in Unit 10, while mastication promoted sandmat manzanita. Several community metrics were significantly different between treatments in Unit 15 including total cover, bare ground and herbaceous cover, community composition, and Monterey ceanothus cover (Figures 7-2, 7-6, 7-10, 7-14, 7-18; Tables 7-18 and 7-15). Monterey ceanothus was promoted by burning in Unit 15. Unit 21 community composition was significantly different between treatments (Table 7-9; Figures 7-11 and 7-19).

9.3.1 Shrub Community Success Criteria

The Revised Protocol identified success criteria for recovery of the shrub community in Years 3 and 5. All Year 3 and Year 5 criteria were achieved except the native sub-shrub criteria (Table 9-2).

The native sub-shrub (peak rush-rose, deerweed, and golden yarrow) criterion was not met for any Year 3 Unit. The cover of these species comprised 9.1% (0.0%, Year 0), 7.2% (0.0%, Year 0), 12% (0.1%, Year 0), and 14% (2.1%, Year 0), on average, for Units 5A, 9, 23, and 28, respectively. Since the criterion requires 20% cover of these species, none of these Units were near compliance. The 20% criterion was derived from observations of previous surveys and generally aligns with the expected successional response to treatment; however, some variation of this response can be expected (Tetra Tech and EcoSystem West, 2015b).

Values similar to, and dissimilar to, the 2018 sub-shrub cover values in Units 5A, 9, 23, and 28 have been observed previously in other Year 3 Units despite similar Baseline values in all cases. Values recorded in 2014 at the Year 3 Units 4 (7.7%, Year 3; 0.1%, Year 0), 11 (2.1%, Year 3; 0.1%, Year 0), and 12 (2.5%, Year 3; 1.0%, Year 0) were similar to 2018 Year 3 Units (Tetra Tech and EcoSystems West, 2015a). Values recorded in 2012 at the Year 3 Units 14 (40%, Year 3; 0.2% Year 0) and 19 (36%, Year 3; 1.7%, Year 0) were dissimilar to 2018 Year 3 Units (Tetra Tech and EcoSystems West, 2013). It is not clear why these sub-shrub cover differences exist; however, soil composition differences or treatment type are possible contributing factors.

Field observations indicate that soil composition in Units 5A, 9, 23, and 28 and Units 4, 11, and 12 are composed of finer, hard-packed sands with reddish pebbles. The soils in Units 14 and 19 on the other hand are composed of relatively coarse, loose sand. It is possible that these soil differences have affected the sub-shrub response to treatment.

The dissimilar sub-shrub responses (Units 14 and 19 vs. Units 4, 5A, 9, 11, 12, 23, 28) occurred in areas which were treated differently. The areas with low sub-shrub cover by Year 3 were masticated (Units 5A, 9, 23, 28, 4, 11, 12), while some areas with high sub-shrub cover by Year 3 were burned (Units 14 and 19). Brennan and Keeley (2017) found no significant differences between sub-shrub cover response to mastication compared to burning in Southern California chaparral (typically chamise-dominated), however, they did not examine deerweed, peak rush-rose, or golden yarrow individually.

Other Year 3 criteria and Year 5 criteria were met. Bare ground cover was higher in Year 3 than Baseline and invasive plants comprised less than 10% cover for all Year 3 Units. The community composition in

Year 5 Units showed a progression towards the Baseline condition (Figures 6-40 through 6-45). The only recommendation is to closely watch Year 3 Units in future monitoring years.

Table 9-2. Evaluation of Success Criteria for Shrub Communities in Year 3 and Year 5.

Year Class	Units	Criterion	Rationale	Pass/Fail
Year 3	5A 9 23 28	Native sub-shrubs > 20% cover	$c_{Unit\ 5A}$ = 9.1% $c_{Unit\ 9}$ = 7.2% $c_{Unit\ 23}$ = 11% $c_{Unit\ 28}$ = 14%	Fail Fail Fail Fail
		Bare ground > baseline conditions	Figures 5-10 – 5-12	Pass
		Invasive plants < 10% cover	$c_{Unit\ 5A}$ = 0.10% $c_{Unit\ 9}$ = 0.64% $c_{Unit\ 23}$ = 0.52% $c_{Unit\ 28}$ = 3.1%	Pass
Year 5	1 East 6 7 10 Watkins Gate Unburned Area MOUT Buffer	Observation of community recovery	Figure 6-12 and Figure 6-17	Pass

As part of the Revised Protocol development, a series of three major shrub associations were identified based on dominant species present in the baseline survey. Recovery was predicted to differ among these associations (Tetra Tech and EcoSystems West, 2015b). Therefore, more detailed success criteria for each of the associations, as well as criteria for the amount of bare ground and cover of invasive species were developed for the Year 8 survey. These criteria are evaluated in Table 8-3.

All but three specified criteria were met in Year 8:

1) the shaggy-barked manzanita dominated (Shrub Association A) Baseline transects in Unit 34 were comprised less than 30% of the mean Baseline shaggy-barked manzanita cover by Year 8 (19%),
2) the shaggy-barked manzanita dominated Baseline transects in Unit 32 were observed as having less than 70% of the Baseline frequency of Monterey ceanothus by Year 8 (50%),
3) the sandmat manzanita dominated (Shrub Association C/D) Baseline transects in Unit 21 were observed as having less than 70% of the Baseline frequency of Monterey ceanothus by Year 8 (0%).

Shaggy-barked manzanita Year 8 cover did not meet the required criterion for Unit 34 Shrub Association A transects. The Baseline cover was 79%, which required a Year 8 cover value of 24% (30% of Baseline cover). The observed shaggy-barked manzanita cover in Year 8 was 15%. This was likely because dwarf ceanothus cover was promoted by treatment, which allowed it to outcompete shaggy-barked manzanita and become the dominant species in 2018 (Figure 7-13). Despite not meeting this criterion, all HMP shrubs in Unit 34 which were present in Baseline were present by Year 8 and have recovered well. This includes sandmat manzanita, Hooker's manzanita, Toro manzanita, and Monterey ceanothus (Figures 7-

13 and Figure 7-17). Monterey ceanothus was promoted by the treatment and has increased from 0.05% cover in Baseline to 19.1% cover by Year 8.

Monterey ceanothus Year 8 frequency was less than the required 70% of the Baseline frequency on Unit 32 Shrub Association A transects. While this is the case, the species was still present on half of those transects and had an overall cover of 2.8% in Unit 32, indicating it persists in the Unit. In addition, all four HMP shrubs present in Baseline were recovering well by Year 8 in Unit 32: Monterey ceanothus, Eastwood's goldenbush, Hooker's manzanita, and Toro manzanita (Figures 7-12 and 7-16)

Monterey ceanothus Year 8 frequency was less than the required 70% of Baseline frequency on Unit 21 Shrub Association C/D transects. Despite this, the species is still doing well in the Unit, where it is ranked as the second-most and third-most dominant species on the burned transects and the masticated transects, respectively (Figure 7-11). Monterey ceanothus has recovered well on masticated transects where its cover by Year 8 (10.9%) was more than double the Baseline cover (4.23%). Similarly, it has recovered well on the burned transects where its cover by Year 8 (14.3%) was approximately triple its Baseline cover (4.33%).

Despite these few criteria not being met, overall community compositions in the Year 8 Units have continued to move towards their Baseline conditions (see Figures 7-18 and 7-21). Per the Revised Protocol, Year 8 is the final year required for monitoring, and given the overall positive response of vegetation to the prescribed burns and mastication in Units 15, 21, 32, and 34, they will be removed from the monitoring schedule.

Table 9-3. Evaluation of Success Criteria for Dominant Chaparral Shrub Associations on Fort Ord in Year 8 Units Monitored in 2018 (Units 15, 21, 32, and 34).

Plant Association	Criterion	Unit	Baseline value	Year 8 value	P/F
A – ARTO dominated	Average cover of ARTO > 30% of baseline cover	15	67%	26%	Pass
		21	72%	34%	Pass
		32	53%	50%	Pass
		34	79%	15%	Fail
	Frequency of dwarf ceanothus > 70% baseline frequency	15	0.13	0.93	Pass
		21	0.20	1.0	Pass
		32	0.00	1.0	Pass
		34	0.00	1.0	Pass
	Frequency of Monterey ceanothus >70% baseline frequency	15	1.0	1.0	Pass
		21	0.70	1.0	Pass
		32	1.0	0.50	Fail
		34	0.33	1.0	Pass
B – ADFA dominated	Average cover of ADFA > 30% of baseline cover	15	52%	46%	Pass
		21	55%	48%	Pass
		32	NA	NA	NA
		34	NA	NA	NA
	Frequency of dwarf ceanothus > 70% baseline frequency	15	0.00	1.0	Pass
		21	0.00	0.50	Pass
		32	NA	NA	NA
		34	NA	NA	NA
	Frequency of Monterey ceanothus >70% baseline frequency	15	1.0	1.0	Pass
		21	1.0	1.0	Pass
		32	NA	NA	NA
		34	NA	NA	NA
C/D – ARPU dominated	Frequency of ARPU > 70% of baseline frequency	15	1.0	1.0	Pass
		21	1.0	1.0	Pass
		32	NA	NA	NA
		34	1.0	1.0	Pass
	Frequency of dwarf ceanothus > 70% baseline frequency	15	0.00	0.00	Pass
		21	0.00	0.00	Pass
		32	NA	NA	NA
		34	0.00	0.00	Pass
	Frequency of Monterey ceanothus >70% baseline frequency	15	0.50	0.50	Pass
		21	0.33	0.00	Fail
		32	NA	NA	NA
		34	0.00	1.0	Pass
Bare Ground	Bare ground > 90% of baseline cover	15	11%	26%	Pass
		21	11%	27%	Pass
		32	14%	19%	Pass
		34	6.1%	25%	Pass
Invasive plants	Invasive plants <10% cover per transect	15	0.00%	0.55%	Pass
		21	0.53%	2.1%	Pass
		32	0.00%	0.30%	Pass
		34	0.00%	0.00%	Pass

9.4 Annual Grasses

Annual grasses were generally present along the edges of roads, masticated areas, other disturbed areas, and occasionally extended into the interior of the Units. High annual grass density was present in some cleared fuel break areas; however, it overall does not appear that colonization by annual grasses is a major concern along fuel breaks.

Response of annual grasses varied between year classes and Units. The cover of annual grasses increased in all Year 1 Units since Baseline, except the Containment lines of BLM Area B Subarea A. Year 3 Units were not surveyed for annual grasses in 2018. All Year 5 Units decreased in annual grass cover by 2018 compared to the prior post-treatment years. All Year 8 Units decreased in annual grass cover by 2018 compared to the prior post-treatment years.

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10 REFERENCES

Anderson MJ. 2001. A New Method for Non-Parametric Multivariate Analysis of Variance. Austral Ecology 26:32-46.

Baldwin BG, Goldman DH, Keil DJ, Patterson R, Rosatti TJ, Wilken DH (eds.). 2012. The Jepson Manual – Higher Plants of California. 2nd ed. University of California Press, Berkeley, CA. pp. 1566.

Brennan TJ, Keeley JE. 2017. Impacts of Mastication Fuel Treatments on California, USA, Chaparral Vegetation Structure and Composition. Fire Ecology 13(3):120-138.

Burleson Consulting, Inc. 2009a. Protocol for Conducting Vegetation Monitoring in Compliance With the Installation-Wide Multispecies Habitat Management Plan at Former Fort Ord. Prepared for the U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW-2454A

Burleson Consulting, Inc. 2009b. 2009 Biological Monitoring Report for Burn Units 14, 18, 19, 22 and MRS-16, Former Fort Ord. Prepared for the U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW-2521.

Burleson Consulting, Inc. 2016. 2015 Annual Monitoring Report for BLM Area B, Subareas A, B, B-3 East, B-3 West, and C, and Units 05, 13, and 20; Units 01 West, 02 West, and 03 West; Units 02 East and 03 East; Units 15, 21, 32, and 34. Prepared for U.S. Army Corps of Engineers, Sacramento, CA.

Burleson Consulting, Inc. 2017a. 2016 Annual Report: Biological monitoring for Units 09, 23N, and 28, and Units 11 and 12 Containment Lines; Units 01 East, 06, 07, 10, Watkins Gate Burned Area, and MOUT Buffer; Unit 04 and Units 11 and 12 Interior; Units 18 and 22. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW-2824.

Burleson Consulting, Inc. 2017b. 2016 Annual Report: Former Fort Ord Site 39 Habitat Restoration. Prepared for U.S. Army Corps of Engineers, Sacramento, CA.

Burleson Consulting, Inc. 2018. 2017 Annual Report: Biological Monitoring for Units 17; Unit 25 and Units 13, 20, and 31 Containment Lines; Units 1 West, 2 West, and 3 West; Units 2 East and 3 East; and Units 14 and 19. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW 2845.

Burnham KP, Anderson DR. 2002. Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach. 2nd edition. New York, NY. Springer-Verlag.

Burnham KP, Anderson DR, Huyvaert KP. 2011. AIC Model Selection and Multimodel Inference in Behavioral Ecology: Some Background, Observations, and Comparisons. Behav Ecol Sociobiol 65:23-35.

Calow PP. 1999. Encyclopedia of Ecology and Environmental Management. Osney Mead, Oxford; Malden, Massachusetts. Blackwell Science.

Choi SS, Cha SH, Tappert CC. 2010. A Survey of Binary Similarity and Distance Measures. Systemics, Cybernetics and Informatics 8(1):43-48.

Detka J. 2007. Effects of Fire on Rare *Ericameria fasciculata* (Asteraceae). Master's Theses. 3645. http://scholarworks.sjsu.edu/etd_theses/3645

Dufrene M, Legendre P. 1997. Species Assemblages and Indicator Species: The Need for a Flexible Asymmetrical Approach. Ecological Monograph 67(3):345-366.

Esri. 2017. ArcGIS Version 10.6.

Fox LR. 2007. Climatic and Biotic Stochasticity: Disparate Causes of Convergent Demographies in Rare, Sympatric Plants. Conservation Biology 23:1556–1561.

Fox LR, Steel HN, Holl KD, Fusari MH. 2006. Contrasting demographies and persistence of rare annual plants in highly variable environments. Plant Ecology 183:157–170.

Fox LR, Steel HN, Holl KD, Fusari MH. 2006. Contrasting Demographies and Persistence of Rare Annual Plants in Highly Variable Environments. Plant Ecology 183:157–170.

Gotelli NJ, Ellison AM. 2004. A Primer of Ecological Statistics. Sinauer Associates, Inc. Sunderland, MA.

[HLA] Harding Lawson Associates. 1997. 1997 Annual Habitat Monitoring Report, Former Fort Ord, Monterey, California. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #OE-0211.

[HLA] Harding Lawson Associates. 2001. 2000 Annual Habitat Monitoring Report: Biological Baseline Studies and Follow-up Monitoring, Former Fort Ord, Monterey, CA. Prepared for U.S. Department of the Army, Sacramento, CA. Administrative Record #BW-2235.

He M, Russo M, Anderson M. 2017. Hydroclimatic Characteristics of the 2012–2015 California Drought from an Operational Perspective. Climate 5(1):5.

Kass RE, Raftery AE. 1995. Bayes factors. Journal of the American Statistical Association Vol. 90, No. 430, pp. 773-795.

Kindt R. 2017. BiodiversityR: Package for Community Ecology and Suitability Analysis. R Package Version 2.8-4. URL https://cran.r-project.org/web/packages/BiodiversityR/index.html

Legendre P, Legendre L. 1998. Numerical Ecology. Second edition. Amsterdam, The Netherlands. Elsevier Science B.V.

[MACTEC] MACTEC Engineering and Consulting, Inc. 2004. 2003 Annual Monitoring Report Biological Baseline Studies and Follow-up Monitoring Former Fort Ord, Monterey, California. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW-2278.

[MACTEC] MACTEC Engineering and Consulting, Inc. 2005 Report Baseline Biological Monitoring South Boundary Road (SBR) Vegetation Clearance Project Former Fort Ord, Monterey, California. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW-2603.

McArdle BH, Anderson MJ. 2001. Fitting Multivariate Models to Community Data: A Comment on Distance-Based Redundancy Analysis. Ecology 82(1):290-297.

McCune B, Grace JB, Urban DL. 2002. Analysis of Ecological Communities. Mjm Software Design. Gleneden Beach, OR. Chapter 6, pp 45-57.

Molles MC. 2010. Ecology: Concepts and Applications - 6th ed. McGraw-Hill. New York, NY. pp 352-355.

Moore D, Notz WI, Fligner MA. 2013. Essential Statistics – 2nd ed. W.H. Freeman and Company. New York, NY.

National Climatic Data Center of the National Oceanic and Atmospheric Administration. 2016. 30-Year Normal Precipitation Data for the NWSFO Monterey Airport Meteorological Tower. [Internet]. Accessed on July 27, 2016. Available at: https://www.ncdc.noaa.gov/cdo-web/datasets/normal_mly/stations/GHCND:USC00045802/detail

Naval Postgraduate School Department of Meteorology. 2018. Monthly Precipitation Summaries for the Monterey Region. [Internet]. Accessed August 15, 2018. Available at: http://met.nps.edu/~ldm/renard_wx/

Oksanen J. 2014. metaMDS in vegan: zero stress. Reply on discussion board for R users with author of Vegan package. URL http://r.789695.n4.nabble.com/metaMDS-in-vegan-zero-stress-td4689983.html

Oksanen J, Blanchet FG, Friendly M, Kindt R, Legendre P, McGlinn D, Minchin PR, O'Hara RB, Simpson GL, Solymos P, Henry M, Stevens H, Szoecs E, Wagner H. 2017. Vegan: Community Ecology Package. R Package Version 2.4-4. URL http://CRAN.R-project.org/package=vegan

Pielou EC. 1974. Population and Community Ecology: Principles and Methods. Gordon and Breach, New York, NY.

Pierce L, Harlan I, Inman J, Casanova M. 2016. The Parker Flats Prescribed Burn: 10th Year Post-fire Vegetation Recovery in 2015. Division of Science & Environmental Policy, California State University Monterey Bay, Seaside, CA.

R Core Team. 2017. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

Roberts DW. 2016. Ordination and Multivariate Analysis for Ecology. Software Package for R Statistical Software Version 1.8-0.

[Shaw] Shaw Environmental, Inc. 2008. 2007 Annual Biological Monitoring Report, Former Fort Ord, California. Prepared for U.S. Army Corps of Engineers, Sacramento, CA.

Smith RL, Smith TM. 2001. Ecology and Field Biology. 6th ed. Benjamin Cummings, USA.

Tetra Tech, Inc., and EcoSystems West Consulting Group. 2011. 2010 Biological Monitoring Report for Burn Units 15, 21, 32, and 34; Burn Units 14 and 19; and Ranges 43-48, Former Fort Ord. Prepared for U.S. Army Corps of Engineers, Sacramento, CA.

Tetra Tech, Inc., and EcoSystems West Consulting Group. 2012. 2011 Biological Monitoring Report for Units 11, 12, MOUT, 28, 9, 4, 5a; a portion of Unit 23 and Watkins Gate Burn Area; Units 15, 21, 32, and 34; South Boundary Road Unit; Units 18 and 22; and MRS 16 Former Fort Ord. Prepared for U.S. Army Corps of Engineers, Sacramento, CA.

Tetra Tech, Inc., and EcoSystems West Consulting Group. 2013. 2012 Biological Monitoring Report for Units 2, 3, 6, 10; Units 11, 12, 4, and 23; and Units 14 and 19, former Fort Ord. Prepared for the U.S. USACE Corps of Engineers, Sacramento, CA.

Tetra Tech, Inc., and EcoSystems West Consulting Group. 2014. 2013 Biological Monitoring Report for Units 7, 5E and 23E; Units 15, 21, 32, and 34; Units 18 and 22; and Ranges 43–48 Former Fort Ord. Prepared for the U.S. USACE Corps of Engineers, Sacramento, CA.

Tetra Tech, Inc., and EcoSystems West Consulting Group. 2015a. 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 the U.S. Army Corps of Engineers, Sacramento, CA.

Tetra Tech, Inc., and EcoSystems West Consulting Group. 2015b. Revisions of Protocol for Conducting Vegetation Monitoring for Compliance with the Installation-Wide Multispecies Habitat Management Plan, Former Fort Ord, Monterey, California. Prepared for the U.S. USACE Corps of Engineers, Sacramento, CA.

[USACE] United States Army Corps of Engineers, Sacramento District. 1997. Installation-Wide Multi-Species Habitat Management Plan for Former Fort Ord, California. April. Sacramento, CA.

[USACE] United States Army Corps of Engineers. 2013. Biological Assessment of Army Actions Which May Affect Listed Species at Former Fort Ord, California. Prepared by Base Realignment and Closure Fort Ord Field Office, Monterey, CA.

[USACE] United States Army Corps of Engineers. 2018. “flora_fire_area” shapefile. Accessed from Fort Ord Data Integration System.

[USACE] United States Army Corps of Engineers. 2018. “flora_pres_burn_area” shapefile. Accessed from Fort Ord Data Integration System.

[USDA] U.S. Department of Agriculture, Natural Resources Conservation Service. 2017. Soil Survey Spatial and Tabular Data (SSURGO 2.2). URL https://datagateway.nrcs.usda.gov/

[USDA] U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. The PLANTS Database. URL: http://plants.usda.gov

[USFWS] U.S. Fish and Wildlife Service. 20136. Fuel Break and Vegetation Clearance for Preparation of 2013 Prescribed Burns on Former Fort Ord, Monterey County, California (#AR OE-0764C.2). URL: http://fodis.net/fortorddocs/public/downloadpdf.aspx?arno=OE-0764C.2/

[USFWS] U.S. Fish and Wildlife Service. 2017. Reinitiation of Formal Consultation for Cleanup and Property Transfer Actions Conducted at the Former Fort Ord, Monterey County, California (#BW-2747A). (Original Consultation #8-8-09-F-74). URL: http://docs.fortordcleanup.com/ar_pdfs/AR-BW-2747A/

Van Dyke E, Holl KD, Griffin JR. 2001. Maritime chaparral community transition in the absence of fire. Madrono 2001:221-229.

Watson F. 2014. Lecture on log evidence ratios and AIC model comparison. Personal collection of F. Watson, California State University, Monterey Bay. Seaside, CA.

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APPENDIX A

SPECIES ACRONYMS

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Table A-1. Species Acronyms, Former Fort Ord

Acronym	Scientific Name	Common Name	Life Form
ACGL	*Acmispon glaber (Lotus scoparius)*	deerweed	subshrub
ACHEO	*Acmispon heermannii* var. *orbicularis*	round-leaved Heermann's lotus	perennial herb
ACME	*Acacia melanoxylon*	blackwood acacia	tree
ACMI	*Achillea millefolium*	common yarrow	perennial herb
ACST	*Acmispon strigosus (Lotus strigosus)*	strigose lotus	annual herb
ADFA	*Adenostoma fasciculatum*	chamise	shrub
AGXX	*Agoseris* sp.		
AICA	*Aira caryophyllea*	silvery hair grass	annual grass
AMME	*Amsinckia menziesii*	Menzies' fiddleneck	annual herb
ARCA	*Artemisia californica*	California sagebrush	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
AVBA	*Avena barbata*	slender wild oat	annual or perennial grass
BAPI	*Baccharis pilularis*	coyote brush	shrub
BEPI	*Berberis pinnata*	California barberry	shrub
BRDI	*Bromus diandrus*	ripgut brome	annual grass
BRHO	*Bromus hordeaceus*	soft chess	annual grass
BRMA	*Briza maxima*	rattlesnake grass	annual grass
BRMAR	*Bromus madritensis* ssp. *rubens*	red brome	annual grass
BRMI	*Briza minor*	small quaking grass	annual grass
CAAF	*Castilleja affinis*	Indian paintbrush	perennial herb
CAAL	*Calochortus albus*	white globe lily	perennial herb
CABR	*Carex brevicaulis*	short-stemmed sedge	perennial grass
CACO	*Camissonia contorta*	contorted suncup	annual herb
CAED	*Carpobrotus edulis*	iceplant	perennial succulent herb
CAEX	*Castilleja exserta*	purple owl's-clover	annual herb
CAGL	*Carex globosa*	round fruit sedge	perennial herb
CAKO	*Calamagrostis koelerioides*	fire reedgrass	perennial grass
CAMI	*Camissoniopsis micrantha*	Spencer primrose	annual herb
CARA	*Cardionema ramosissimum*	sand mat	perennial herb
CARU	*Calamagrostis rubescens*	pinegrass	perennial grass
CASU	*Calystegia subacaulis*	hill morning glory	perennial herb
CAXX1	*Carex* sp.	sedge	perennial herb
CAXX2	*Castilleja* sp.		
CEDE	*Ceanothus dentatus*	dwarf ceanothus	shrub
CEME	*Centaurea melitensis*	tocalote	annual herb

Table A-1. Species Acronyms, Former Fort Ord

Acronym	Scientific Name	Common Name	Life Form
CERI	*Ceanothus rigidus (Ceanothus cuneatus* var. *rigidus)*	Monterey ceanothus	shrub
CETH	*Ceanothus thyrsiflorus*	blue blossom	shrub
CHDI	*Chorizanthe diffusa*	diffuse spineflower	annual herb
CHDO	*Chorizanthe douglasii*	Douglas' spineflower	annual herb
CHPO	*Chlorogalum pomeridianum*	wavyleaf soap plant	perennial herb
CHPUP	*Chorizanthe pungens* var. *pungens*	Monterey spineflower	HMP annual
CIBR	*Cirsium brevistylum*	clustered thistle	perennial herb
CIOC	*Cirsium occidentale*	cobwebby thistle	perennial herb
COFI	*Corethrogyne (Lessingia) filaginifolia*	common sandaster	perennial herb
COJU	*Cortaderia jubata*	jubata grass	large perennial grass
CORIL	*Cordylanthus rigidus* ssp. *littoralis*	seaside bird's beak	HMP annual
COXX	*Cortaderia* sp. *(C. jubata* or *C. selloana)*	pampas grass	large perennial grass
CRCA	*Croton californicus*	California croton	perennial herb
CRSC	*Crocanthemum (Helianthemum) scoparium*	peak rush-rose	subshrub
CRXX	*Cryptantha* sp.		annual herb
DAPU	*Daucus pusillus*	American wild carrot	annual herb
DECO	*Deinandra corymbosa*	coastal tarweed	annual herb
DIAU	*Diplacus aurantiacus*	sticky monkeyflower	shrub
DICA	*Dichelostemma capitatum*	blue dicks	perennial herb
DRGL	*Drymocallis (Potentilla) glandulosa*	sticky cinquefoil	perennial herb
ELGL	*Elymus glaucus*	blue wild rye	perennial grass
ERBI	*Erodium brachycarpum*	foothill filaree	annual herb
ERBO	*Erodium botrys*	long-beaked filaree	annual herb
ERCA20*	*Erigeron canadensis*	horseweed	annual herb
ERCA6*	*Eriodictyon californicum*	yerba santa	shrub
ERCI	*Erodium cicutarium*	red-stemmed filaree	annual herb
ERCO	*Eriophyllum confertiflorum*	golden yarrow	subshrub
ERER	*Ericameria ericoides*	mock heather	shrub
ERFA	*Ericameria fasciculata*	Eastwood's goldenbush	shrub
ERNUA	*Eriogonum nudum* var. *auriculatum*	ear-shaped wild buckwheat	shrub
ERVI	*Eriastrum virgatum*	virgate eriastrum	annual herb
EURA	*Eurybia radulina*	roughleaf aster	perennial herb
FEBR	*Festuca (Vulpia) bromoides*	brome fescue	annual grass
FEMY	*Festuca (Vulpia) myuros*	rattail sixweeks grass	annual grass
FEOC	*Festuca (Vulpia) octoflora*	sixweeks grass	annual grass
FRAF	*Fritillaria affinis*	checker lily	perennial herb
FRCA	*Frangula (Rhamnus) californica*	California coffeeberry	shrub
GAAP	*Galium aparine*	goose grass	annual herb

Table A-1. Species Acronyms, Former Fort Ord

Acronym	Scientific Name	Common Name	Life Form
GACA	*Galium californicum*	California bedstraw	perennial herb
GAEL	*Garrya elliptica*	coast silk tassel	shrub
GAPH	*Gastridium phleoides*	nit grass	annual grass
GAPO	*Galium porrigens*	climbing bedstraw	vine
GAUS	*Gamochaeta ustulata*	purple cudweed	perennial herb
GEMO	*Genista monspessulana*	French broom	shrub
GITEA	*Gilia tenuiflora* ssp. *arenaria*	sand gilia	HMP annual
HEAR	*Heteromeles arbutifolia*	toyon	shrub
HEGR	*Heterotheca grandiflora*	telegraph weed	annual herb
HEXX	*Hemizonia* sp.		annual herb
HOCU	*Horkelia cuneata*	wedge-leaved horkelia	perennial herb
HYGL	*Hypochaeris glabra*	smooth cat's-ear	annual herb
HYRA	*Hypochaeris radicata*	rough cat's-ear	perennial herb
IRDO	*Iris douglasiana*	Douglas iris	perennial herb
JUPH	*Juncus phaeocephalus*	brown-headed rush	perennial grass
JUXX	*Juncus* sp.	rush	
KOMA	*Koeleria macrantha*	June grass	perennial herb
LAPL	*Layia platyglossa*	coastal tidytips	annual herb
LECA	*Lepechinia calycina*	pitcher sage	shrub
LEPE	*Lessingia pectinata* (var. *pectinata?*)	common lessingia	annual herb
LOGA	*Logfia (Filago) gallica*	daggerleaf cottonrose	annual herb
LOMA	*Lomatium* sp.		perennial herb
LOPA	*Lomatium parvifolium*	small-leaved lomatium	perennial herb
LUAL	*Lupinus albifrons* (var. *albifrons?)*	silver bush lupine	shrub
LUAR	*Lupinus arboreus*	yellow bush lupine	shrub
LUBI	*Lupinus bicolor*	miniature lupine	annual herb
LUCH	*Lupinus chamissonis*	silver beach lupine	shrub
LUCO	*Lupinus concinnus*	bajada lupine	annual herb
LUNA	*Lupinus nanus*	sky lupine	annual herb
LUTR	*Lupinus truncatus*	Nuttall's annual lupine	annual herb
LUXX	*Lupinus* sp.	lupine	
LYAR	*Lysimachia arvensis*	scarlet pimpernel	annual herb
MAEX	*Madia exigua*	small tarweed	annual herb
MAGR	*Madia gracilis*	gumweed (slender tarweed)	annual herb
MASA	*Madia sativa*	coast tarweed	annual herb
MICA	*Micropus californicus*	cotton top	annual herb
MOUN	*Monardella undulata*	curly-leaved monardella	annual herb
NAAT	*Navarretia atractyloides*	holly leaf navarretia	annual herb
NAHA	*Navarretia hamata*	hooked navarretia	annual herb
NAXX	*Navarretia* sp.		annual herb

Table A-1. Species Acronyms, Former Fort Ord

Acronym	Scientific Name	Common Name	Life Form
PEDE	*Pedicularis densiflora*	Indian warrior	perennial herb
PEDU	*Petrorhagia dubia*	hairypink	annual herb
PEMUM	*Pellaea mucronata* var. *mucronata*	bird's foot fern	fern
PETR	*Pentagramma triangularis* ssp. *triangularis*	gold back fern	fern
PHDI	*Phacelia distans*	common phacelia	annual herb
PHRA	*Phacelia ramosissima*	branching phacelia	perennial herb
PIRA	*Pinus radiata*	Monterey pine	tree
PIYA	*Piperia yadonii*	Yadon's piperia	perennial herb
PLCO	*Plantago coronopus*	cut-leaved plantain	annual herb
PLER	*Plantago erecta*	California plantain	annual herb
PLXX	*Plantago* sp.	plantain	
POCA	*Polygala californica*	California milkwort	perennial herb
POSE	*Poa secunda*	pine bluegrass	perennial grass
POUN	*Poa unilateralis*	San Francisco bluegrass	perennial grass
POXX	*Poa* sp.		
PSBE	*Pseudognaphalium beneolens*	fragrant everlasting	perennial herb
PSCA	*Pseudognaphalium californicum*	lady's tobacco	annual herb
PSRA	*Pseudognaphalium ramosissimum*	pink everlasting	biennial herb
PSST	*Pseudognaphalium stramineum*	cottonbatting plant	perennial herb
PSXX	*Pseudognaphalium* sp.		
PTAQP	*Pteridium aquilinum* var. *pubescens*	western bracken fern	fern
QUAG	*Quercus agrifolia*	coast live oak	tree
QUPAS	*Quercus parvula* var. *shrevei*	Shreve oak	tree
QUWIF	*Quercus wislizeni* var. *frutescens*	chaparral oak	tree
RISA	*Ribes sanguineum*	red flowering currant	shrub
RISP	*Ribes speciosum*	fuchsia-flowered gooseberry	shrub
ROCA	*Rosa californica*	California wild rose	shrub
ROGY	*Rosa gymnocarpa*	wood rose	shrub
RUAC	*Rumex acetosella*	sheep sorrel	perennial herb
RUUR	*Rubus ursinus*	California blackberry	woody vine
SABI	*Sanicula bipinnatifida*	purple sanicle	perennial herb
SALA	*Salix lasiolepsis*	arroyo willow	shrub
SAME	*Salvia mellifera*	black sage	shrub
SEGL	*Senecio glomeratus*	cutleaf burnweed	annual or perennial herb
SESY	*Senecio sylvaticus*	woodland ragwort	annual herb
SIBE	*Sisyrinchium bellum*	western blue-eyed grass	perennial herb
SIGA	*Silene gallica*	small flower catchfly	annual herb
SOAS	*Sonchus asper*	prickly sow thistle	annual herb
SOOL	*Sonchus oleraceus*	common sow thistle	annual herb
SOUM	*Solanum umbelliferum*	blue witch	shrub

Table A-1. Species Acronyms, Former Fort Ord

Acronym	Scientific Name	Common Name	Life Form
SOXX	*Solidago* sp.	goldenrod	perennial herb
STPU	*Stipa pulchra*	purple needle grass	perennial grass
STVI	*Stephanomeria virgata*	tall stephanomeria	annual herb
SYMO	*Symphoricarpos mollis*	creeping snowberry	subshrub
TODI	*Toxicodendron diversilobum*	poison oak	shrub
TOMI	*Toxicoscordion micranthum*	small flowered star lily	perennial herb
TRBI	*Trifolium bifidum*	notch leaf clover	annual herb
TRFR	*Trifolium fragiferum*	strawberry clover	perennial herb
TRIX	*Triteleia ixioides*	coast pretty face	perennial herb
TRMI	*Trifolium microcephalum*	small head clover	annual herb
TRVA	*Trifolium variegatum*	variegated clover	annual herb
URLI	*Uropappus lindleyi*	silver puffs	annual herb
VAOV	*Vaccinium ovatum*	huckleberry	shrub
ZEDA	*Zeltnera davyi*	Davy's centuary	annual herb
ZEMU	*Zeltnera muehlenbergii*	Muehlenberg's centaury	annual herb

*The numbered codes correspond with the species acronym codes on the USDA PLANTS Database (USDA NRCS, 2018).

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APPENDIX B

MAPS: HMP ANNUALS GRIDS

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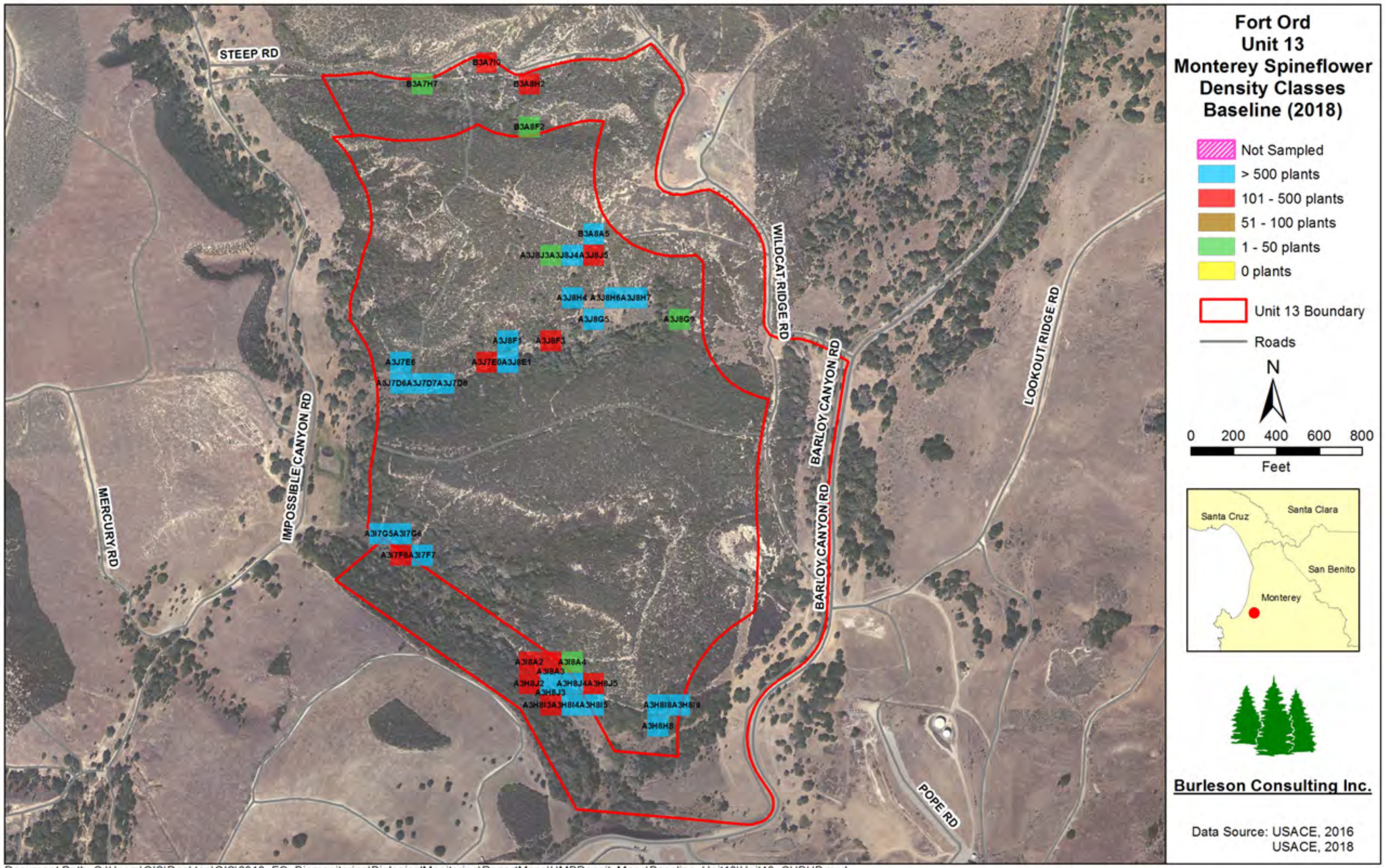

Document Path: C:\Users\GIS\Desktop\GIS\2018_FO_Biomonitoring\BiologicalMonitoring\ReportMaps\HMPDensityMaps\Baseline_Unit13\Unit13_CHPUP.mxd

Figure B-1. Map of Monterey Spineflower Density, Unit 13 (*n*=38 grids)

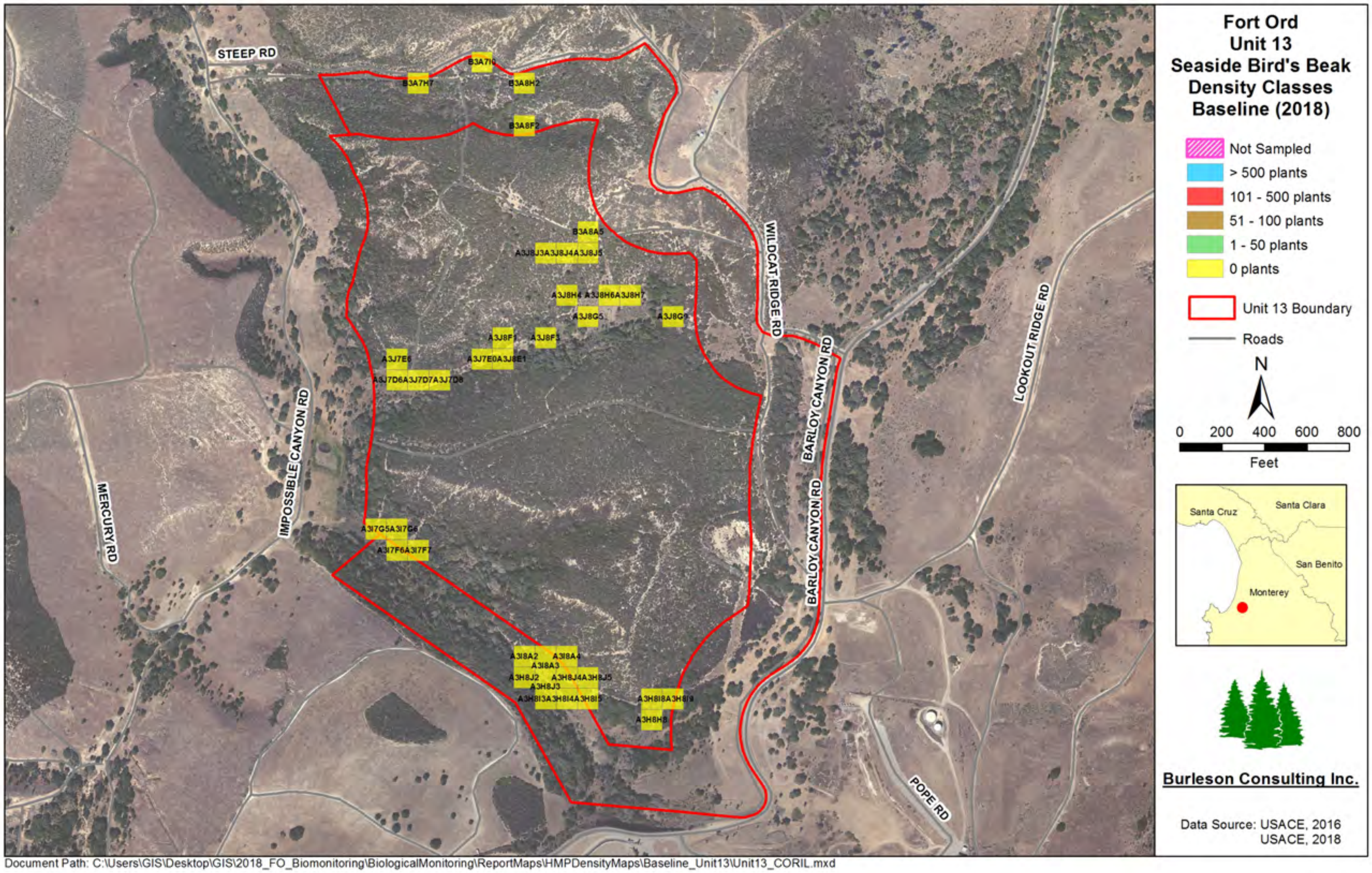

Figure B-2. Map of Seaside Bird's Beak Density, Unit 13 (*n*=38 grids)

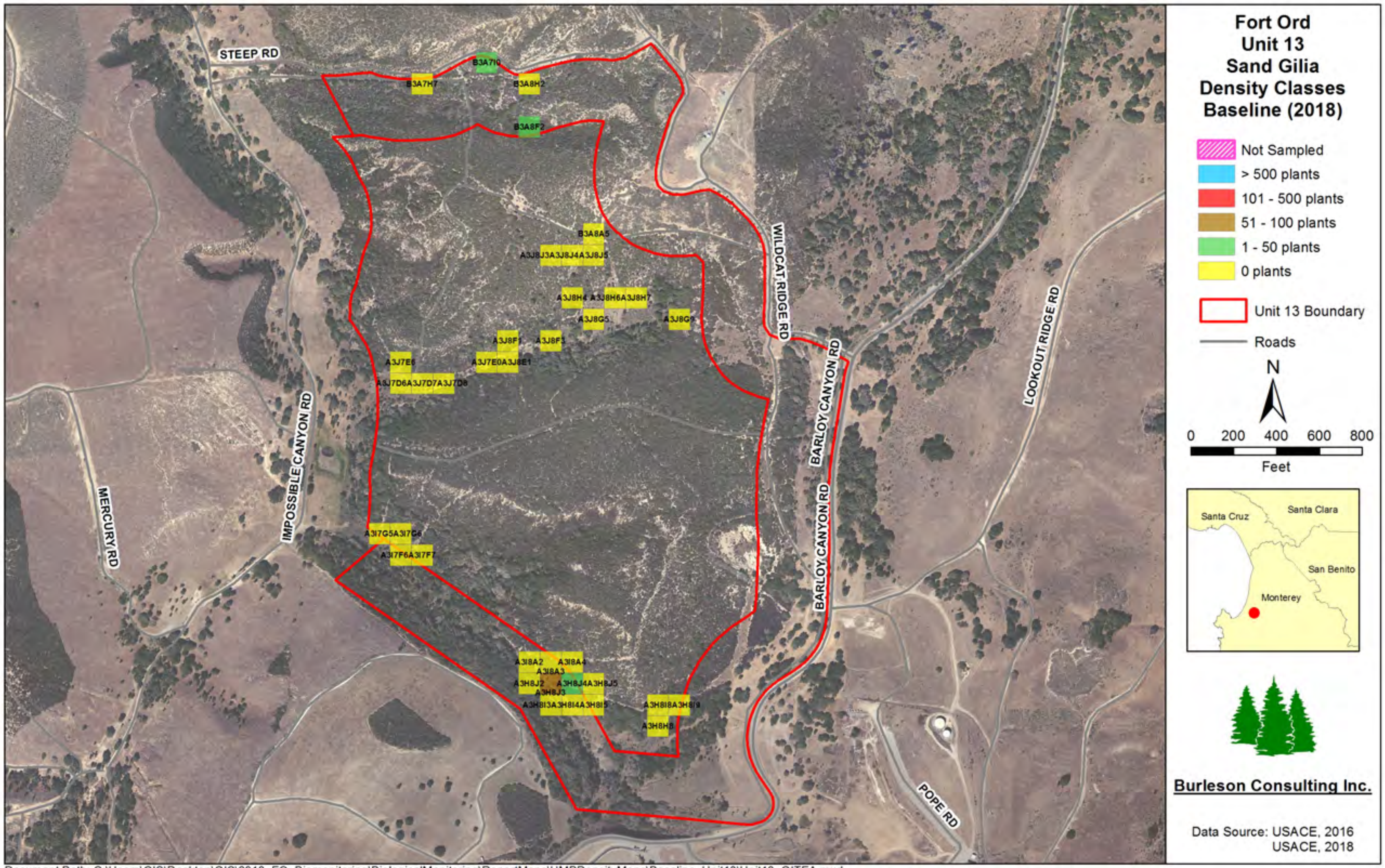

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Figure B-3. Map of Sand Gilia Density, Unit 13 (*n*=38 grids)

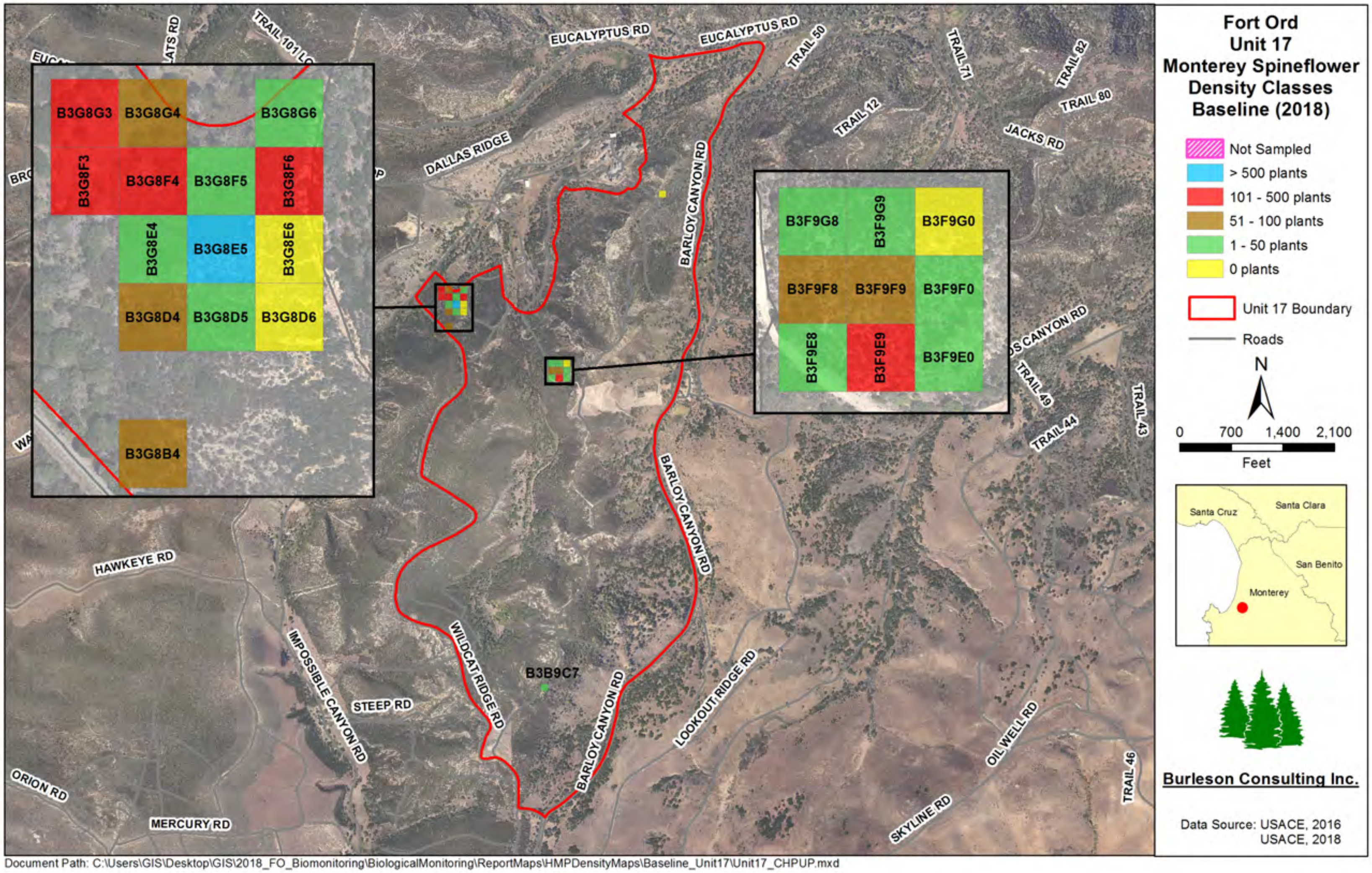

Figure B-4. Map of Monterey Spineflower Density, Unit 17 (*n*=25 grids)

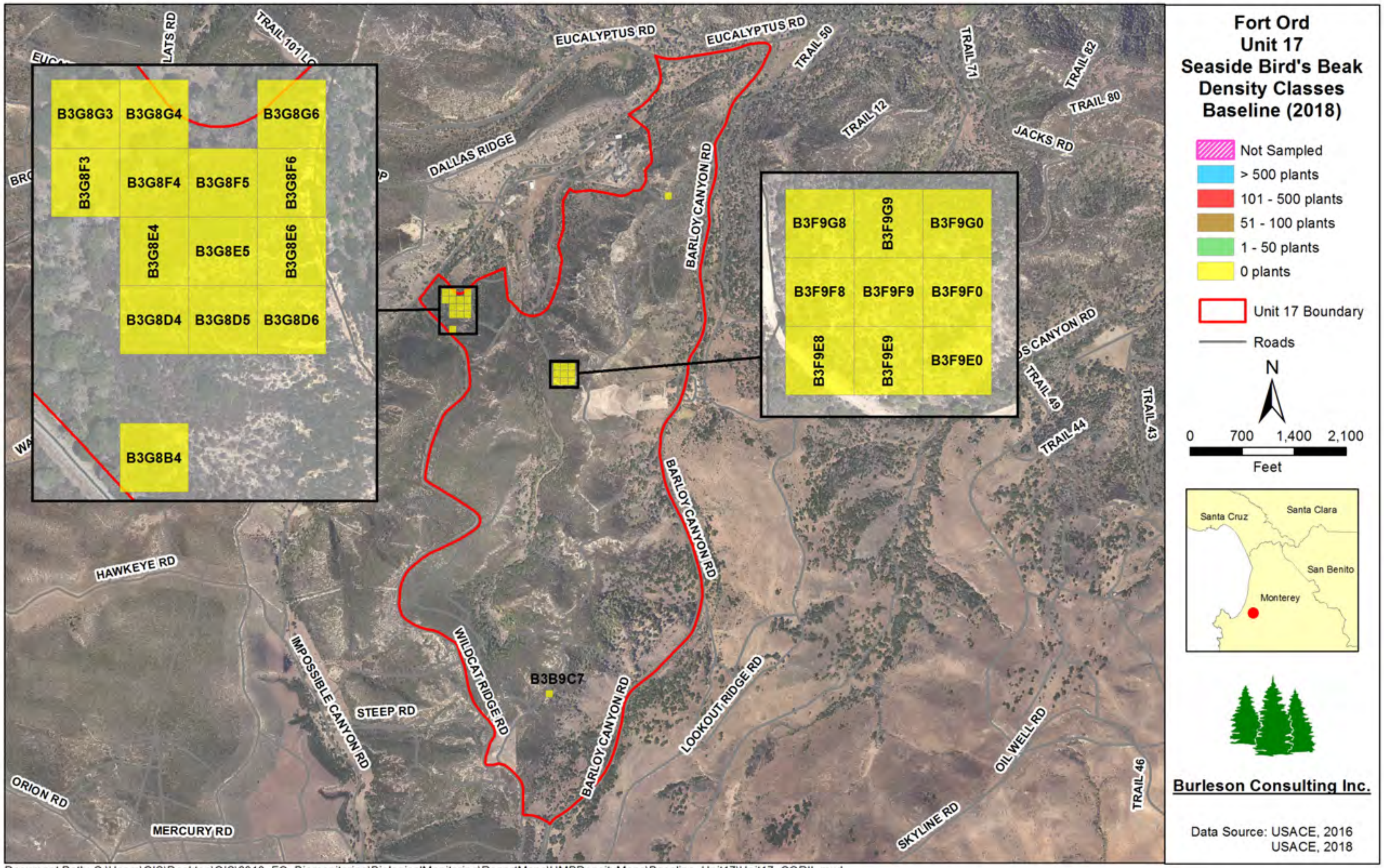

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Figure B-5. Map of Seaside Bird's Beak Density, Unit 17 (*n*=25 grids)

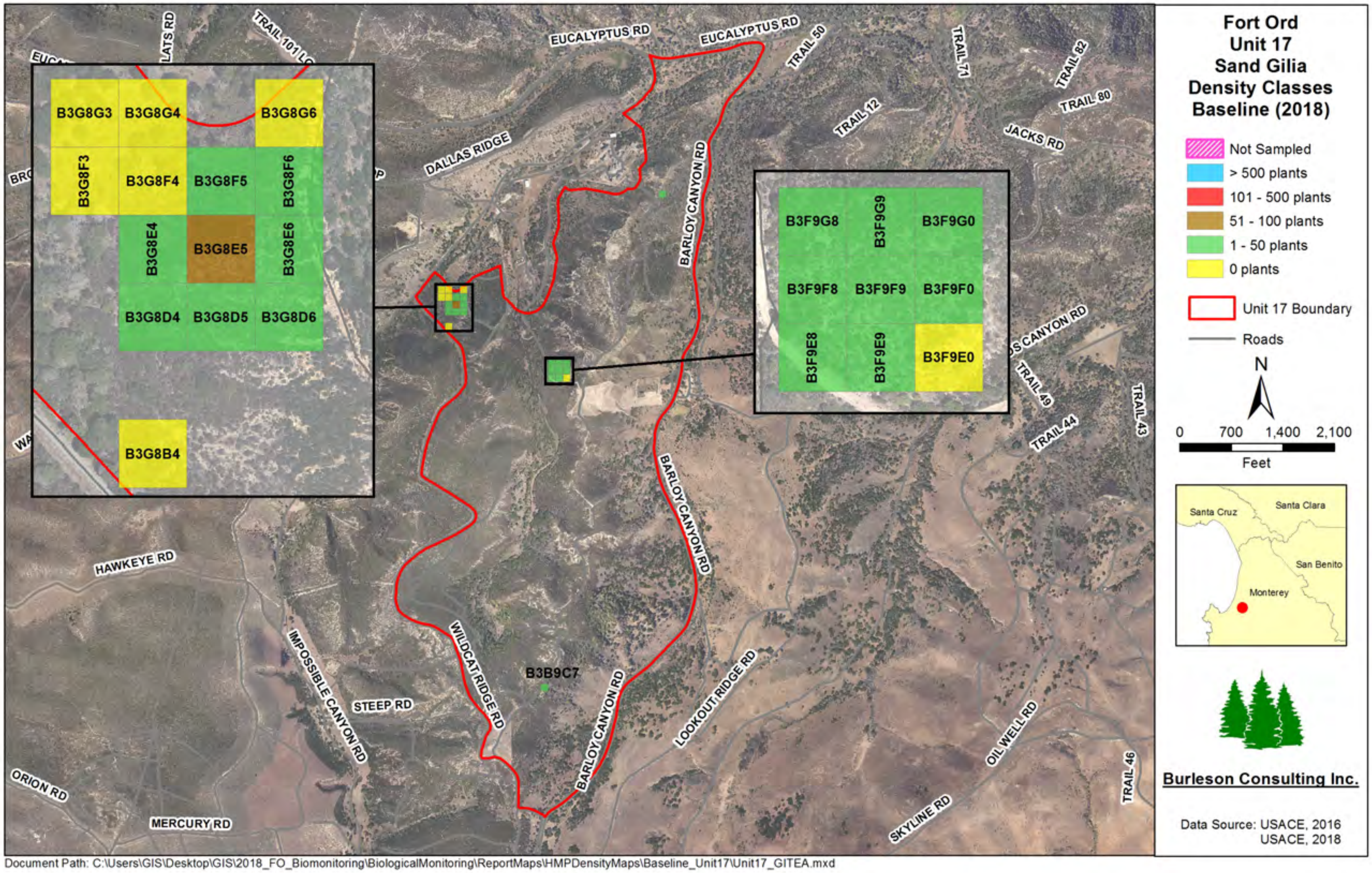

Figure B-6. Map of Sand Gilia Density, Unit 17 (*n*=25 grids)

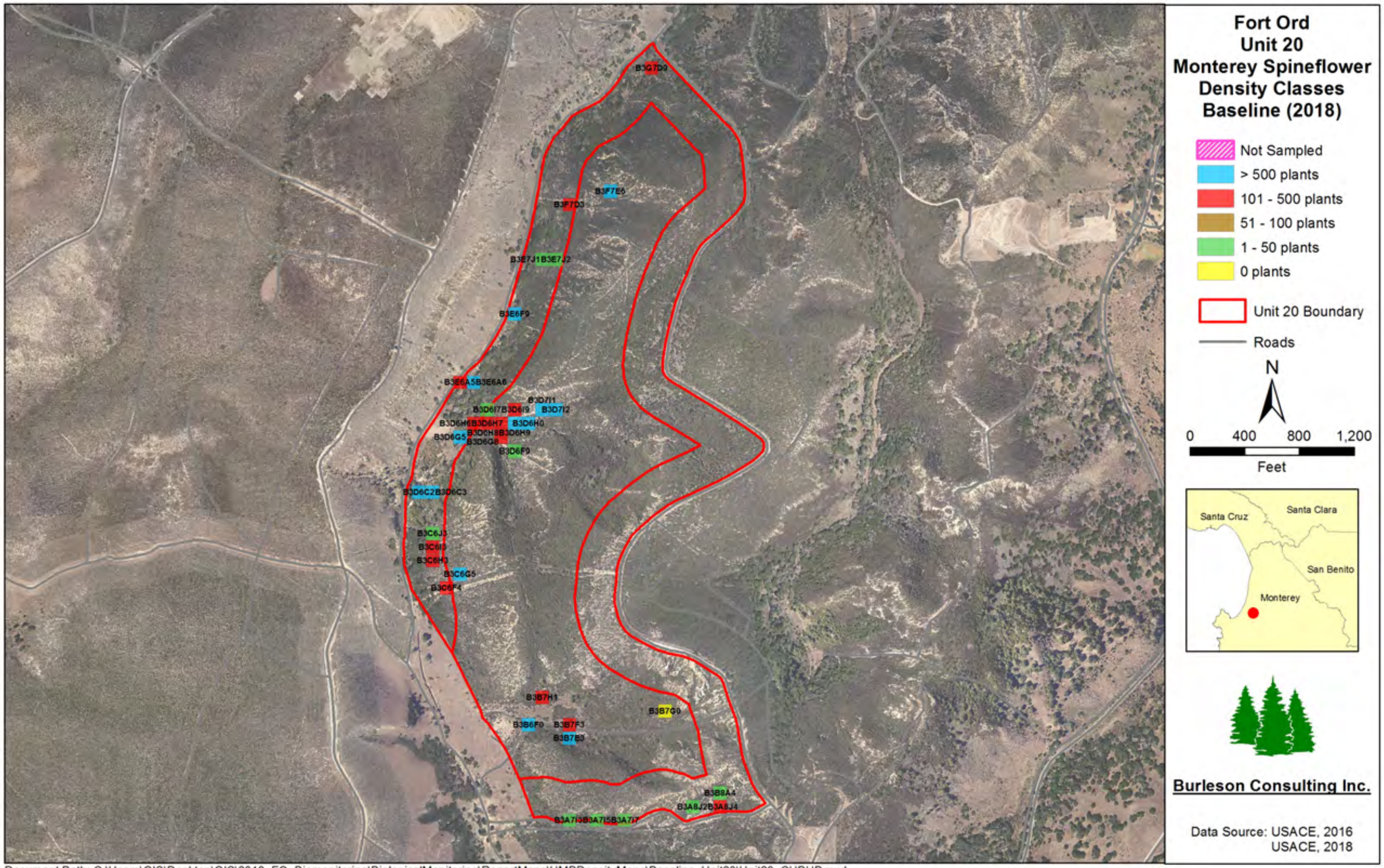

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Figure B-7. Map of Monterey Spineflower Density, Unit 20 (*n*=38 grids)

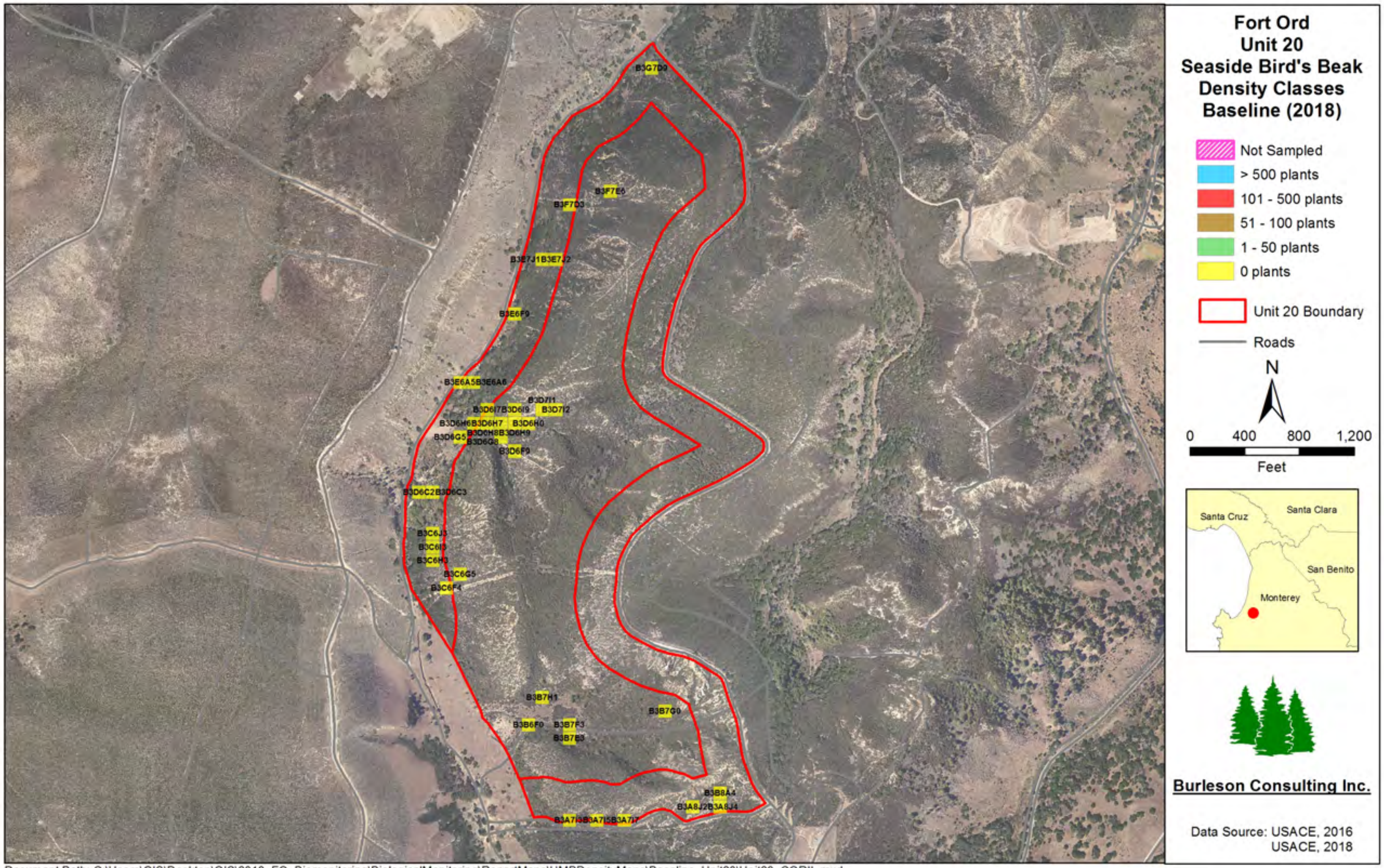

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Figure B-8. Map of Seaside Bird's Beak Density, Unit 20 (*n*=38 grids)

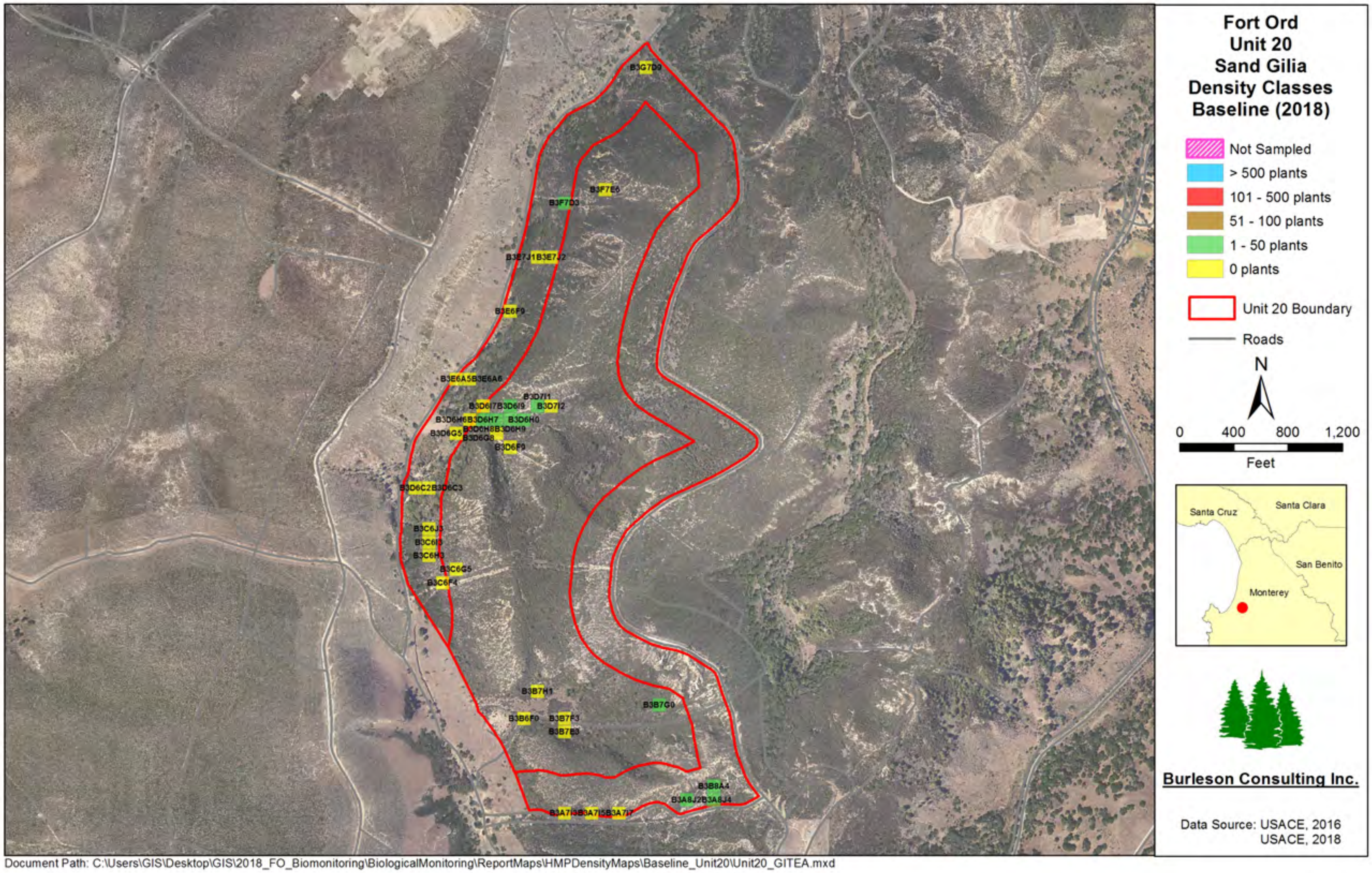

Figure B-9. Map of Sand Gilia Density, Unit 20 (*n*=38 grids)

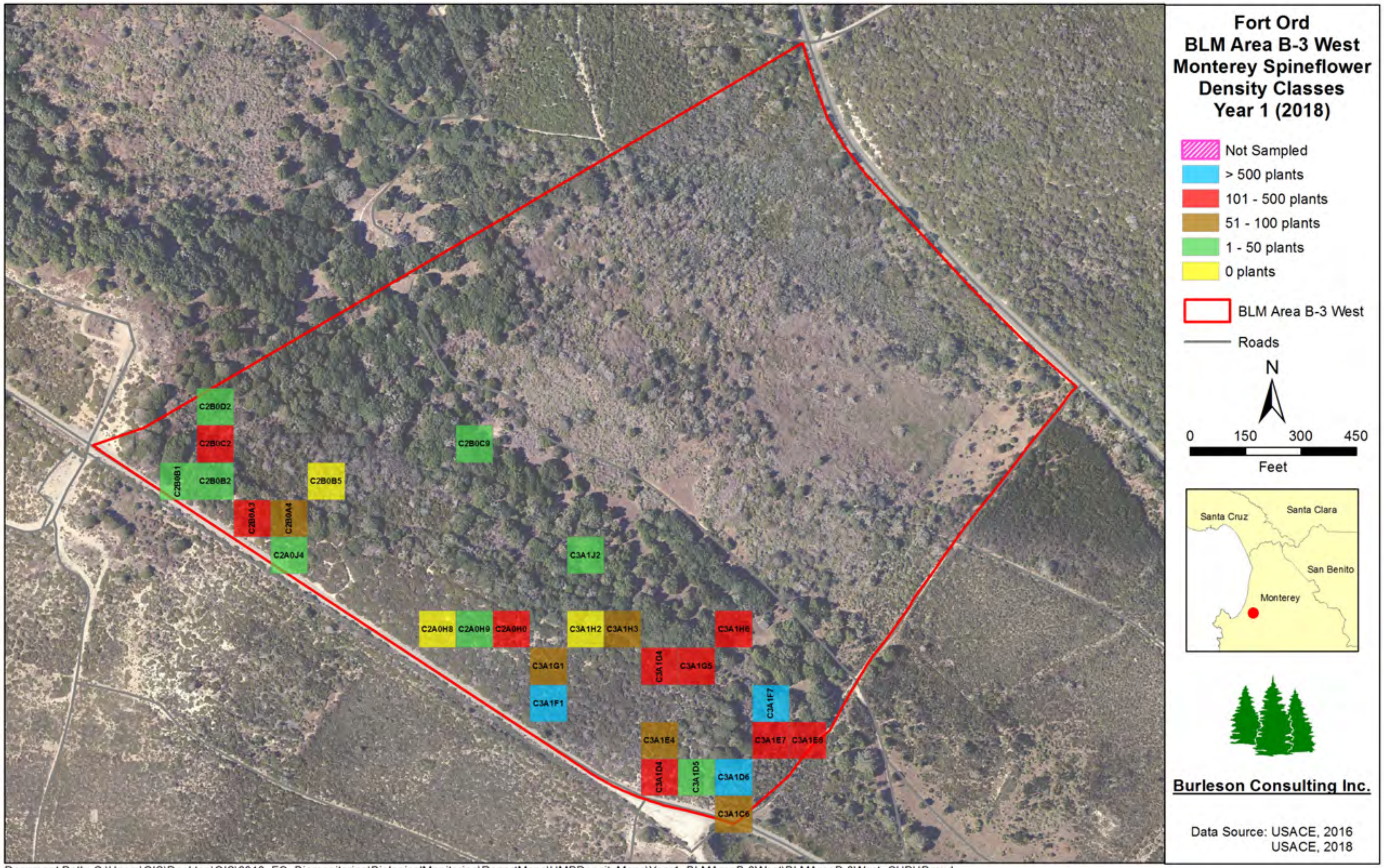

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Figure B-10. Map of Monterey Spineflower Density, BLM Area B-3 West ($n_{Masticated}$=28 grids)

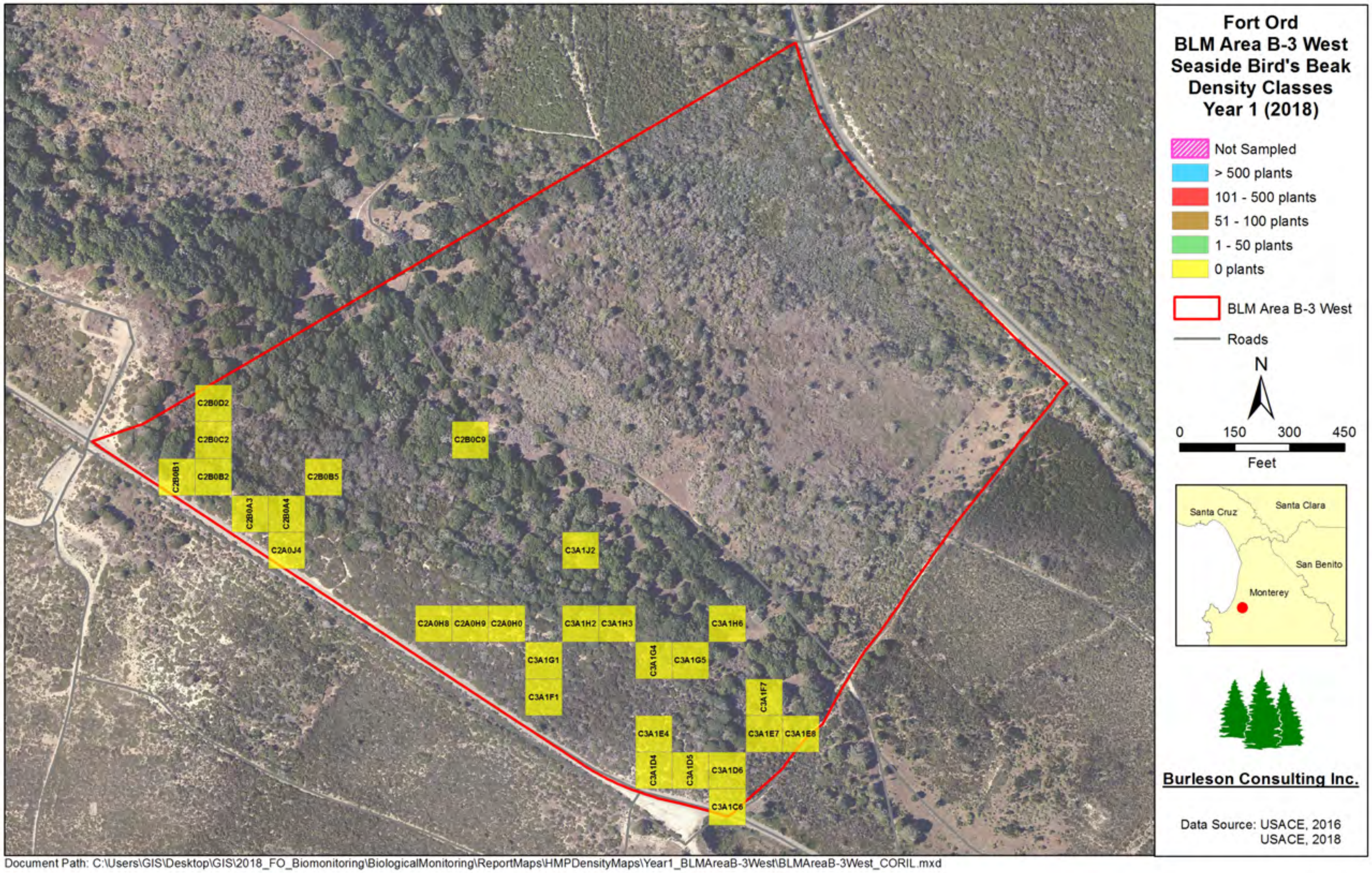
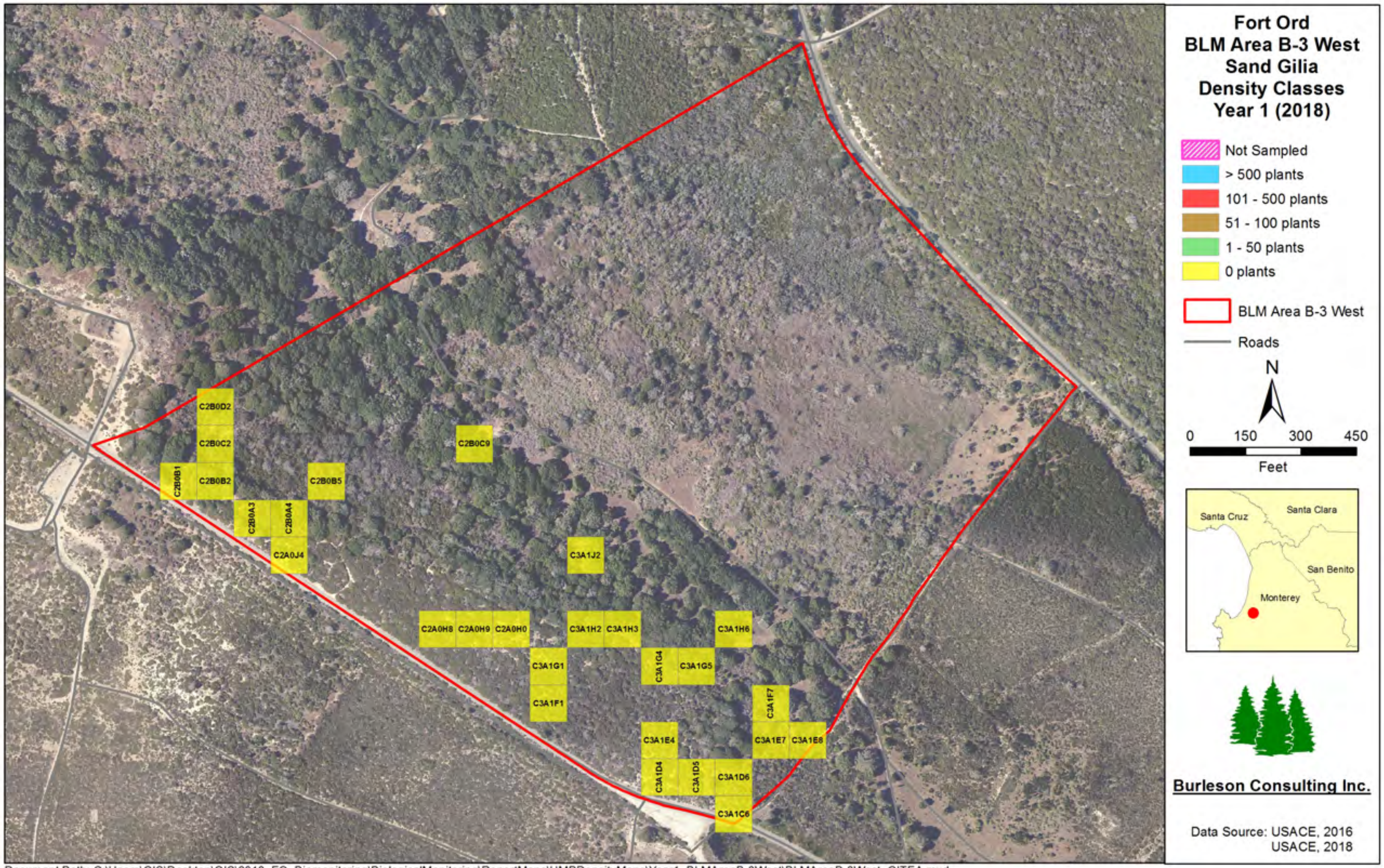


Figure B-11. Map of Seaside Bird's Beak Density, BLM Area B-3 West ($n_{Masticated}$=28 grids)



Document Path: C:\Users\GIS\Desktop\GIS\2018_FO_Biomonitoring\BiologicalMonitoring\ReportMaps\HMPDensityMaps\Year1_BLMAreaB-3West\BLMAreaB-3West_GITEA.mxd

Figure B-12. Map of Sand Gilia Density, BLM Area B-3 West ($n_{Masticated}$=28 grids)

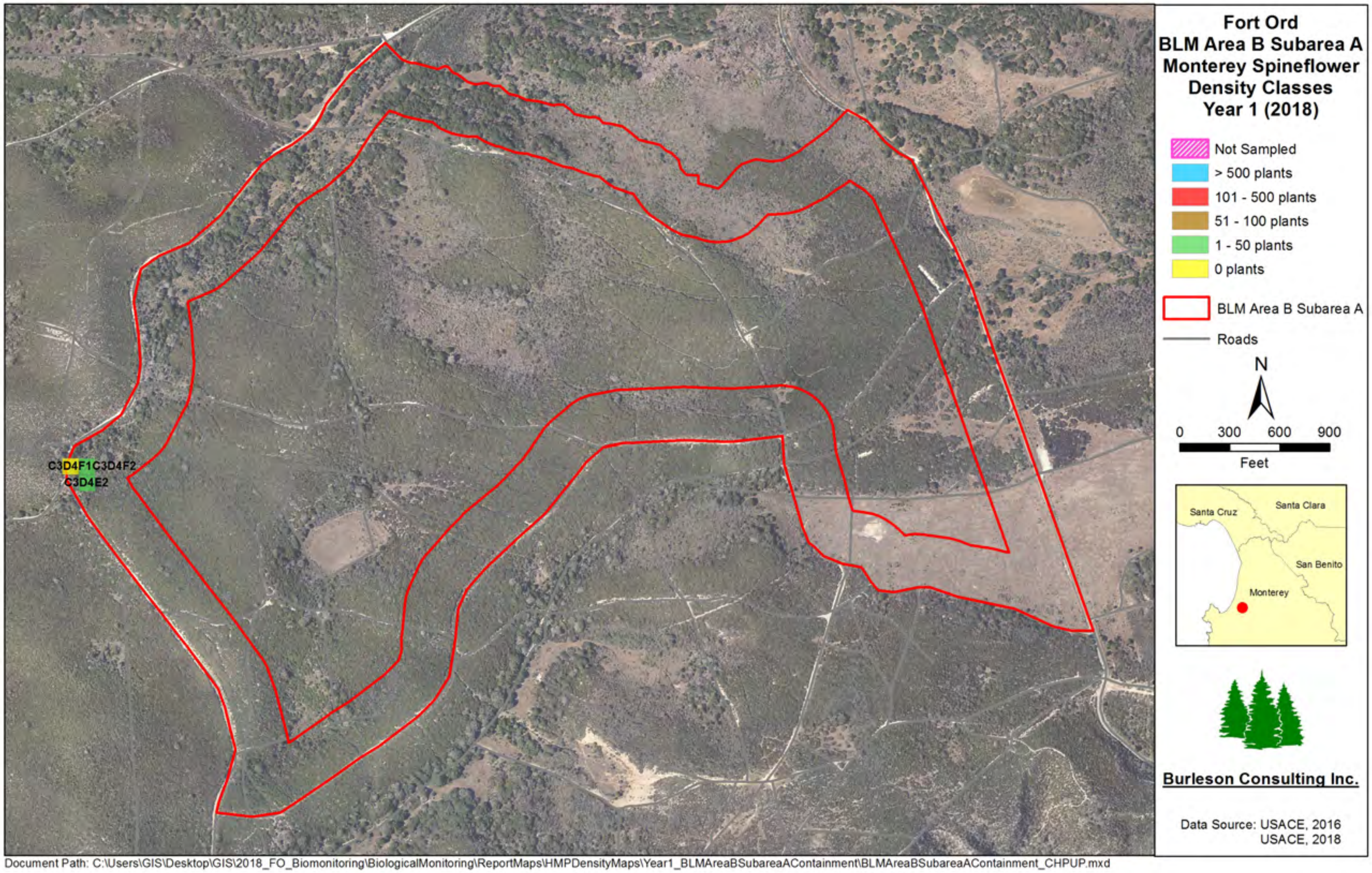


Figure B-13. Map of Monterey Spineflower Density, BLM Area B Subarea A Containment Line ($n_{Masticated}$=3 grids)

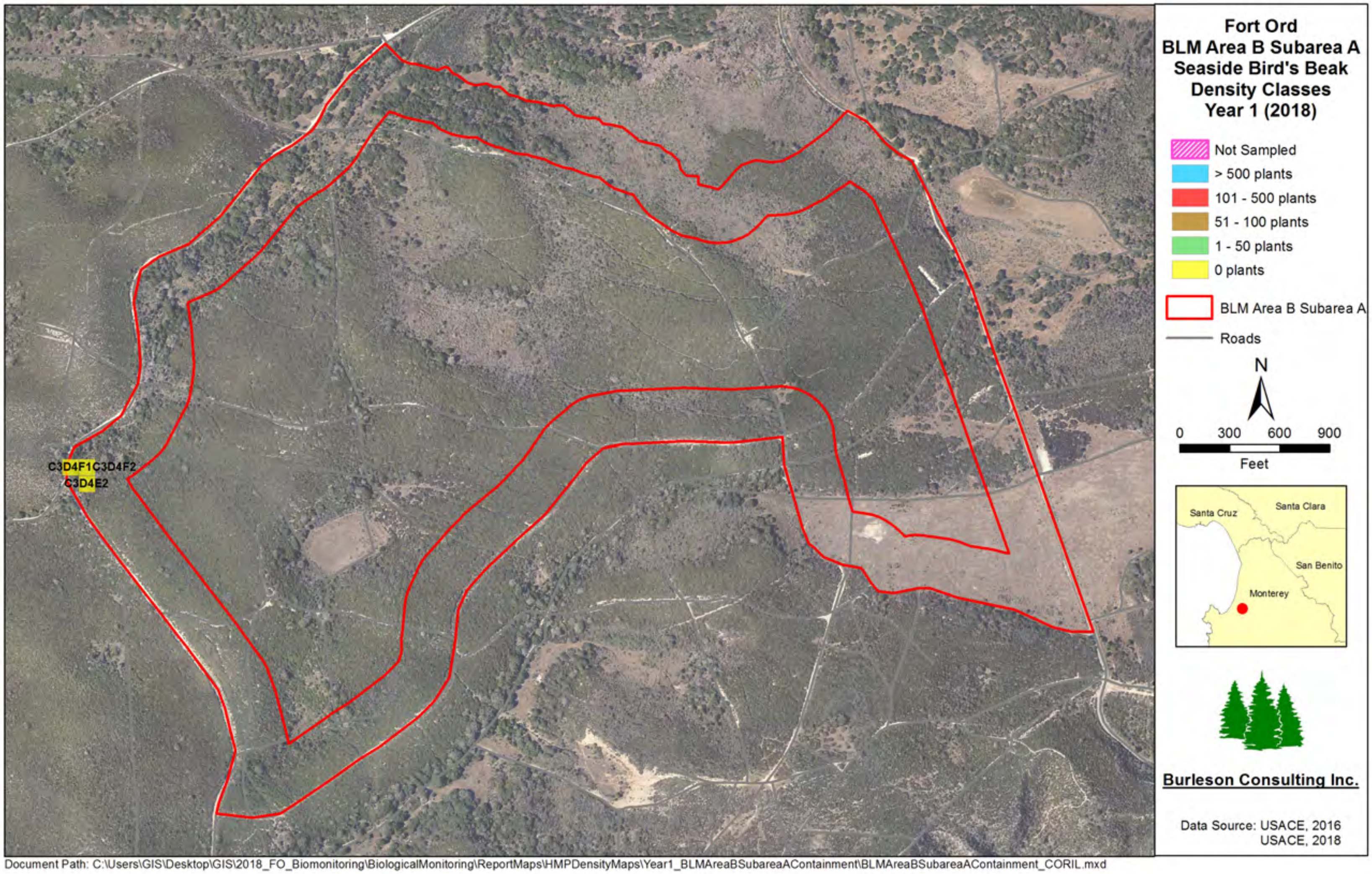


Figure B-14. Map of Seaside Bird's Beak Density, BLM Area B Subarea A Containment Line ($n_{Masticated}$=3 grids)

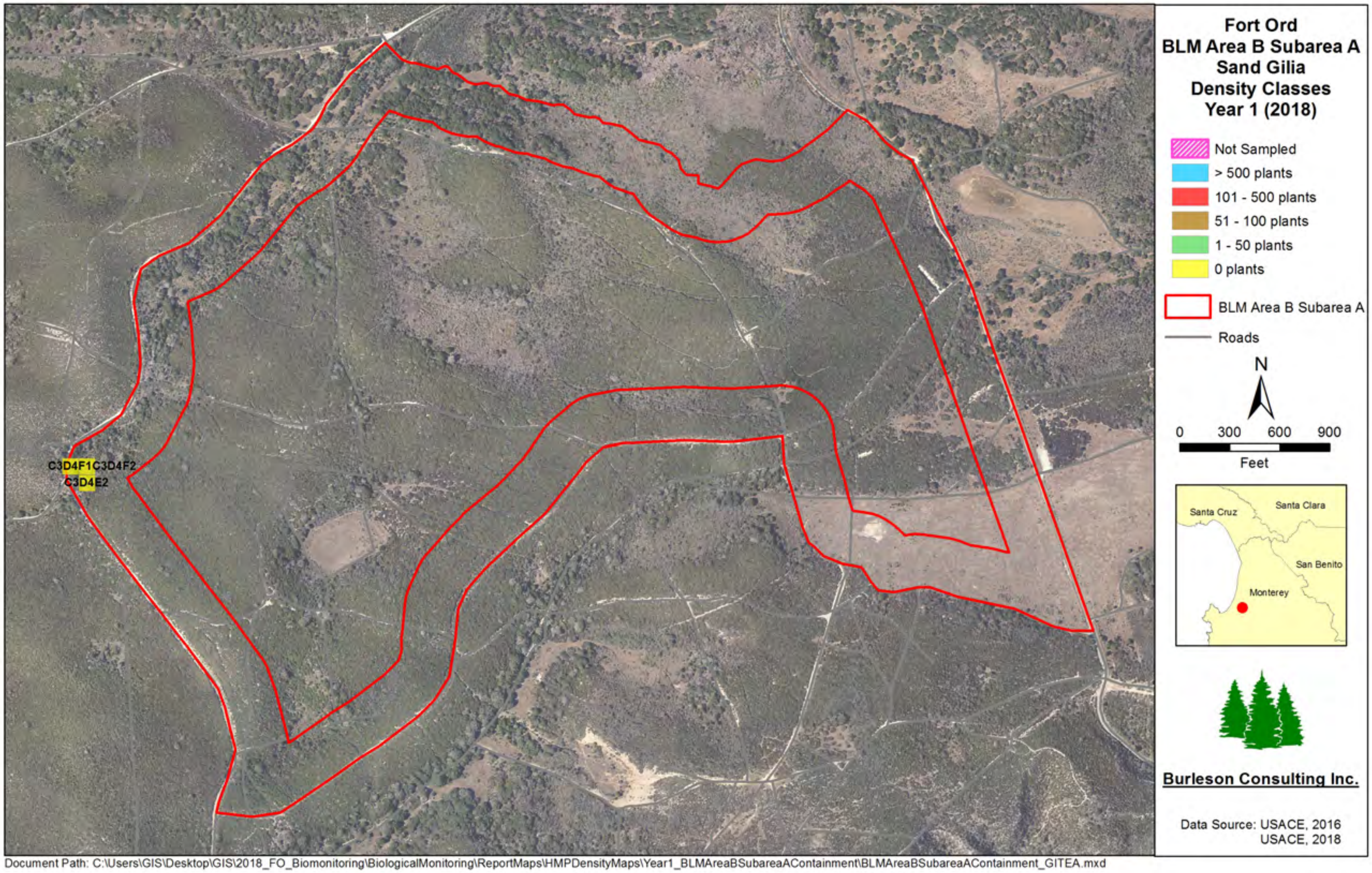


Figure B-15. Map of Sand Gilia Density, BLM Area B Subarea A Containment Line ($n_{Masticated}$=3 grids)

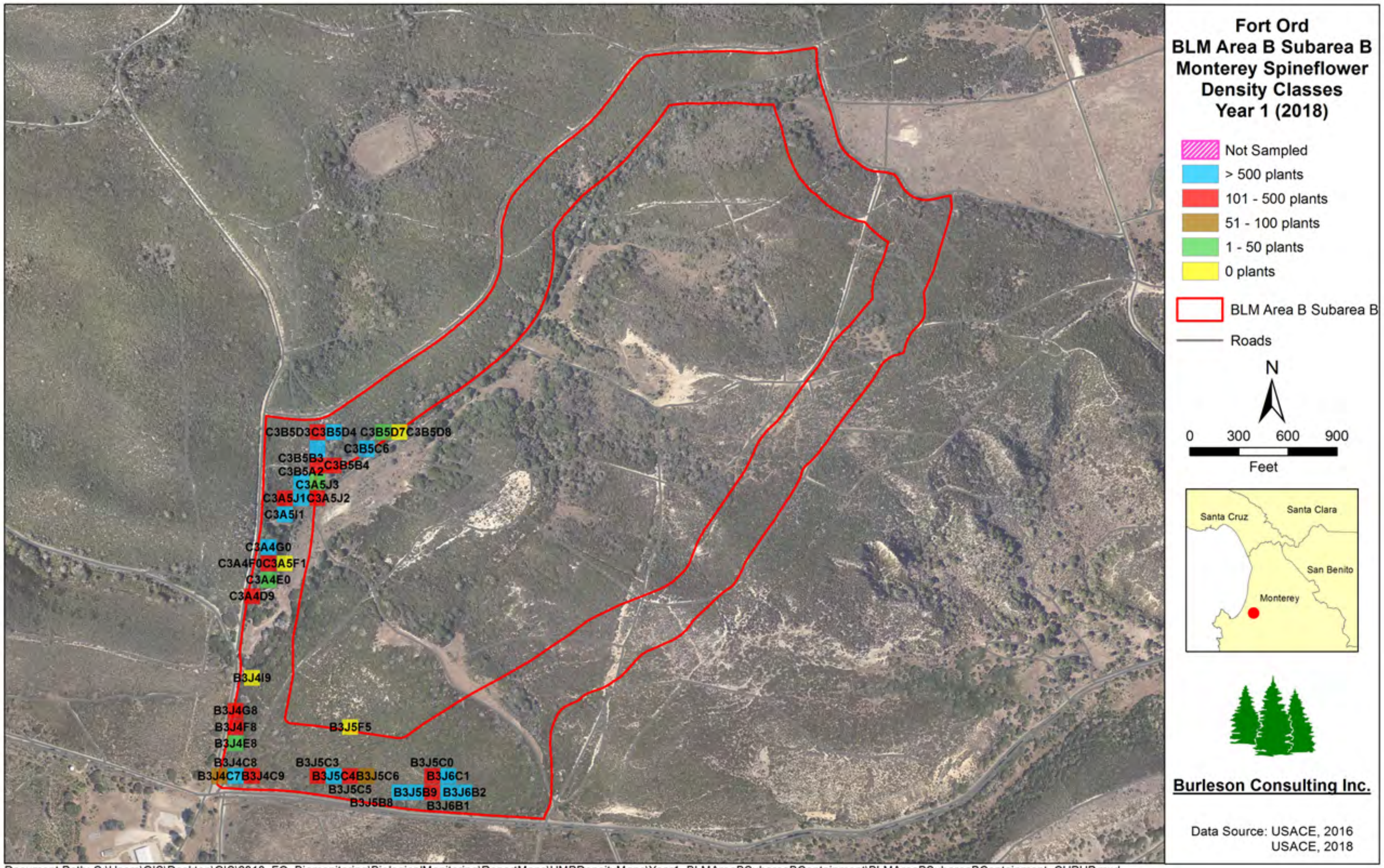


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Figure B-16. Map of Monterey Spineflower Density, BLM Area B Subarea B Containment Line ($n_{Masticated}$=15 grids; $n_{Masticated\&Burned}$=6 grids; n_{Mixed}=17 grids)

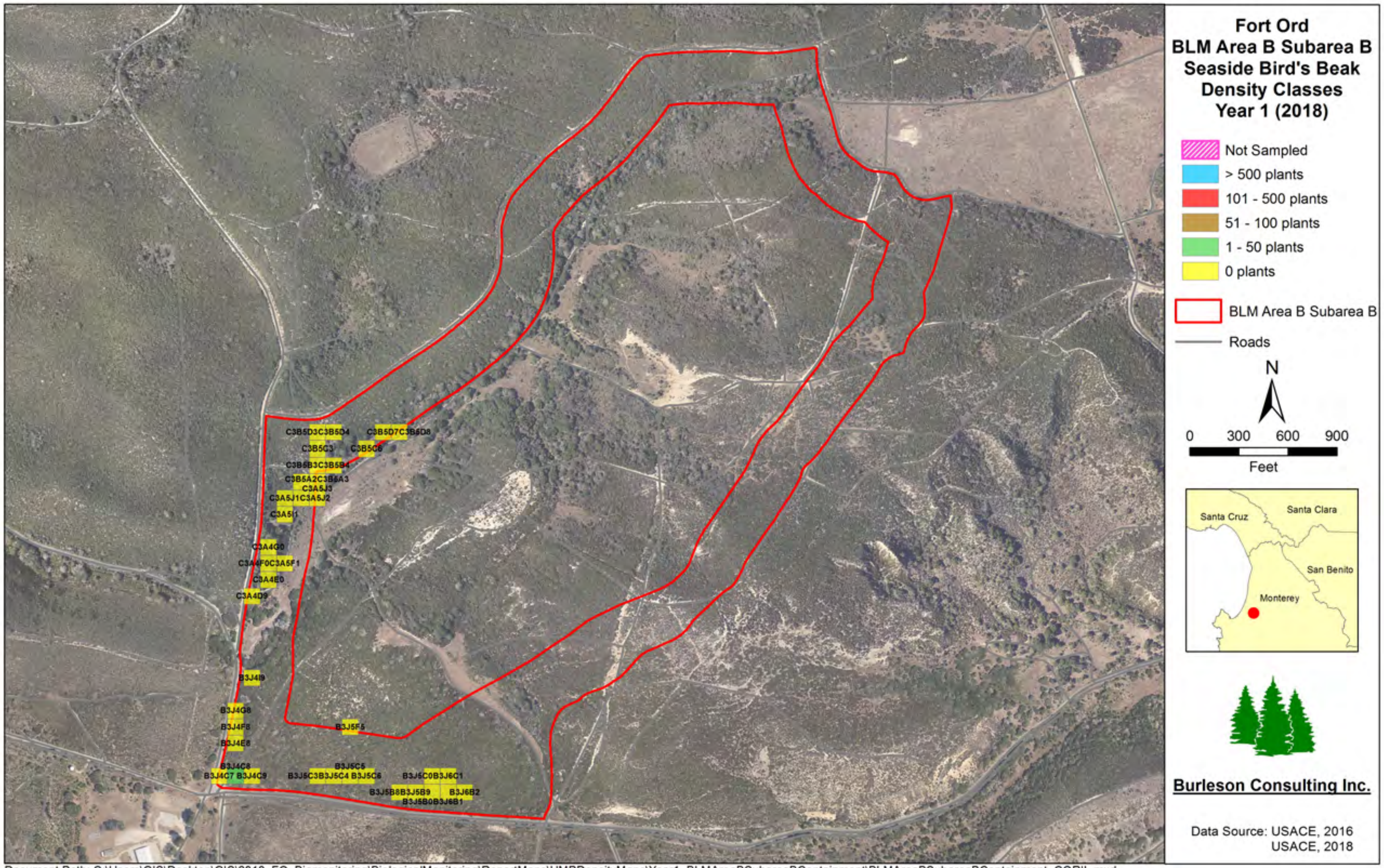

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Figure B-17. Map of Seaside Bird's Beak Density, BLM Area B Subarea B Containment Line ($n_{Masticated}$=15 grids; $n_{Masticated\&Burned}$=6 grids; n_{Mixed}=17 grids)

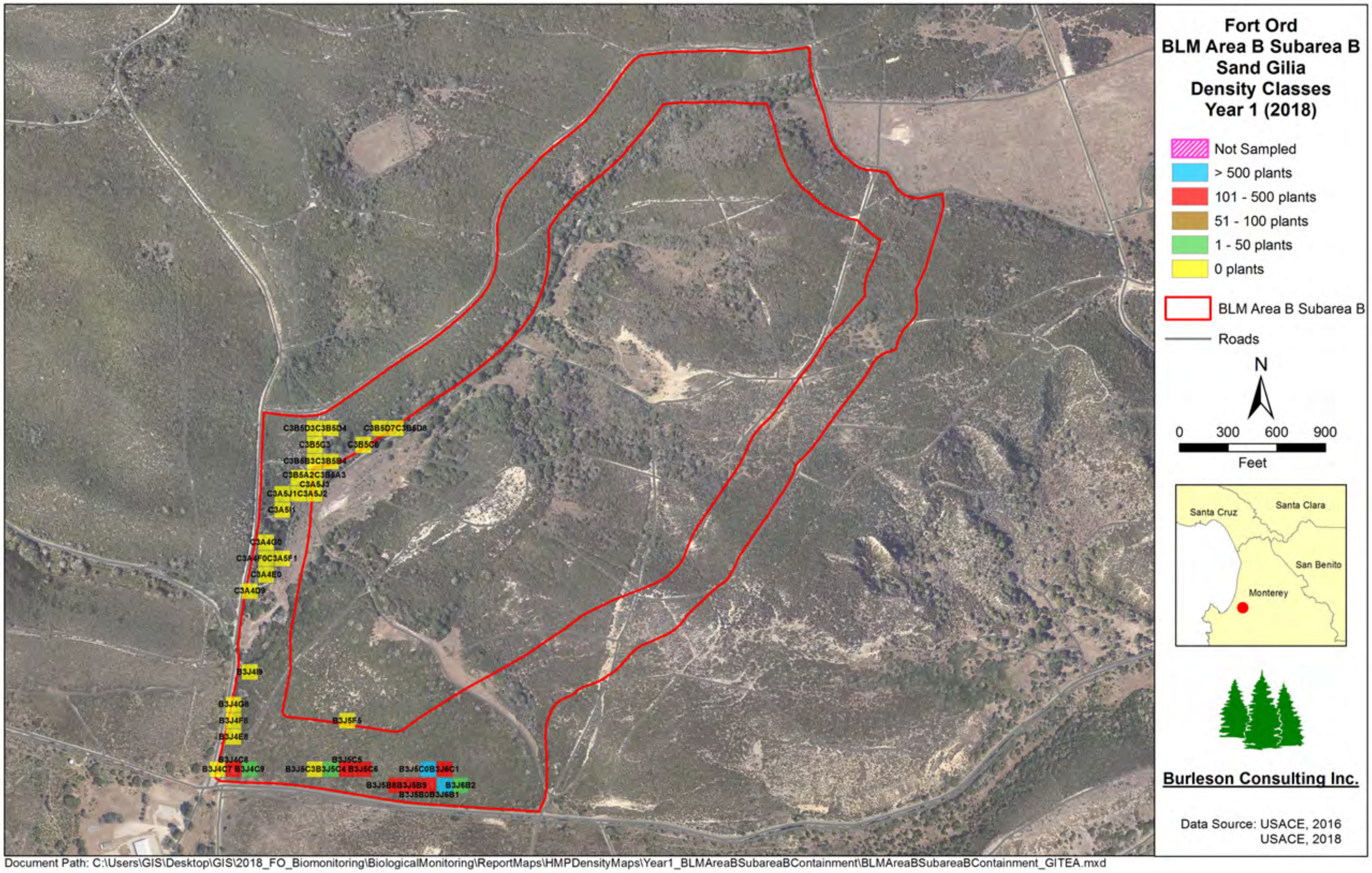

Figure B-18. Map of Sand Gilia Density, BLM Area B Subarea B Containment Line ($n_{Masticated}$=15 grids; $n_{Masticated\&Burned}$=6 grids; n_{Mixed}=17 grids)

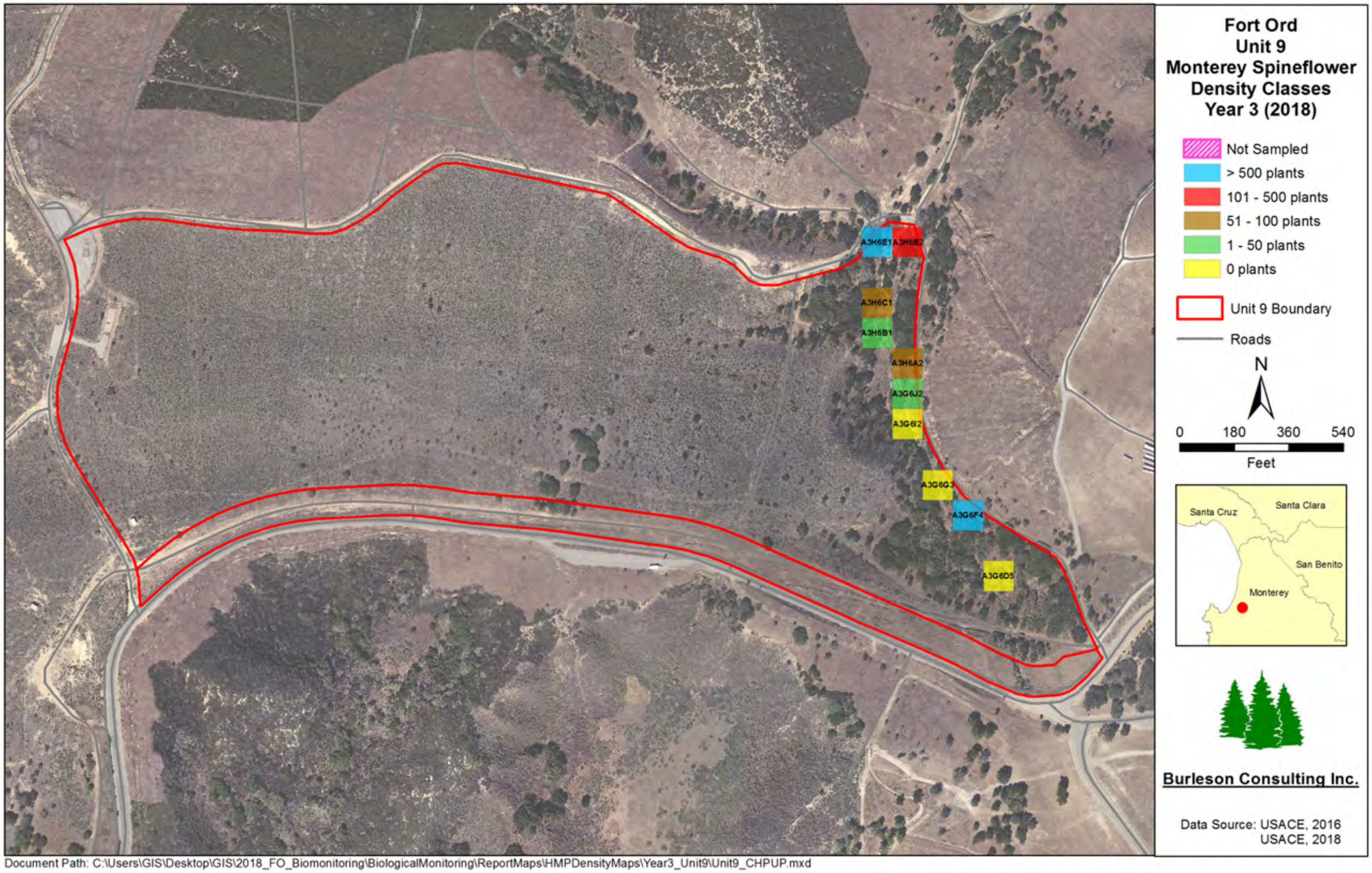

Figure B-19. Map of Monterey Spineflower Density, Unit 9 ($n_{Masticated}$=10 grids)

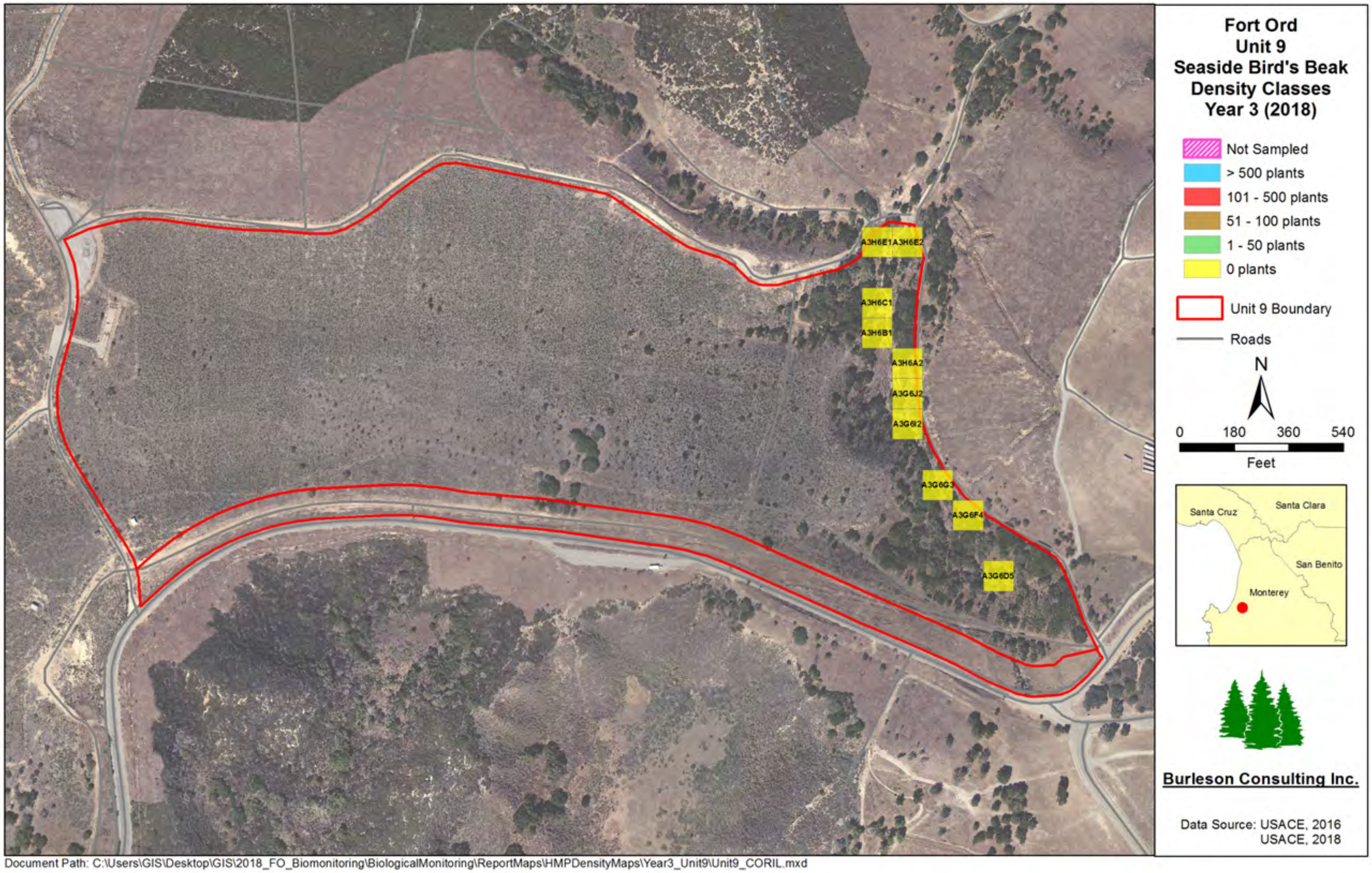

Figure B-20. Map of Seaside Bird's Beak Density, Unit 9 ($n_{Masticated}$=10 grids)

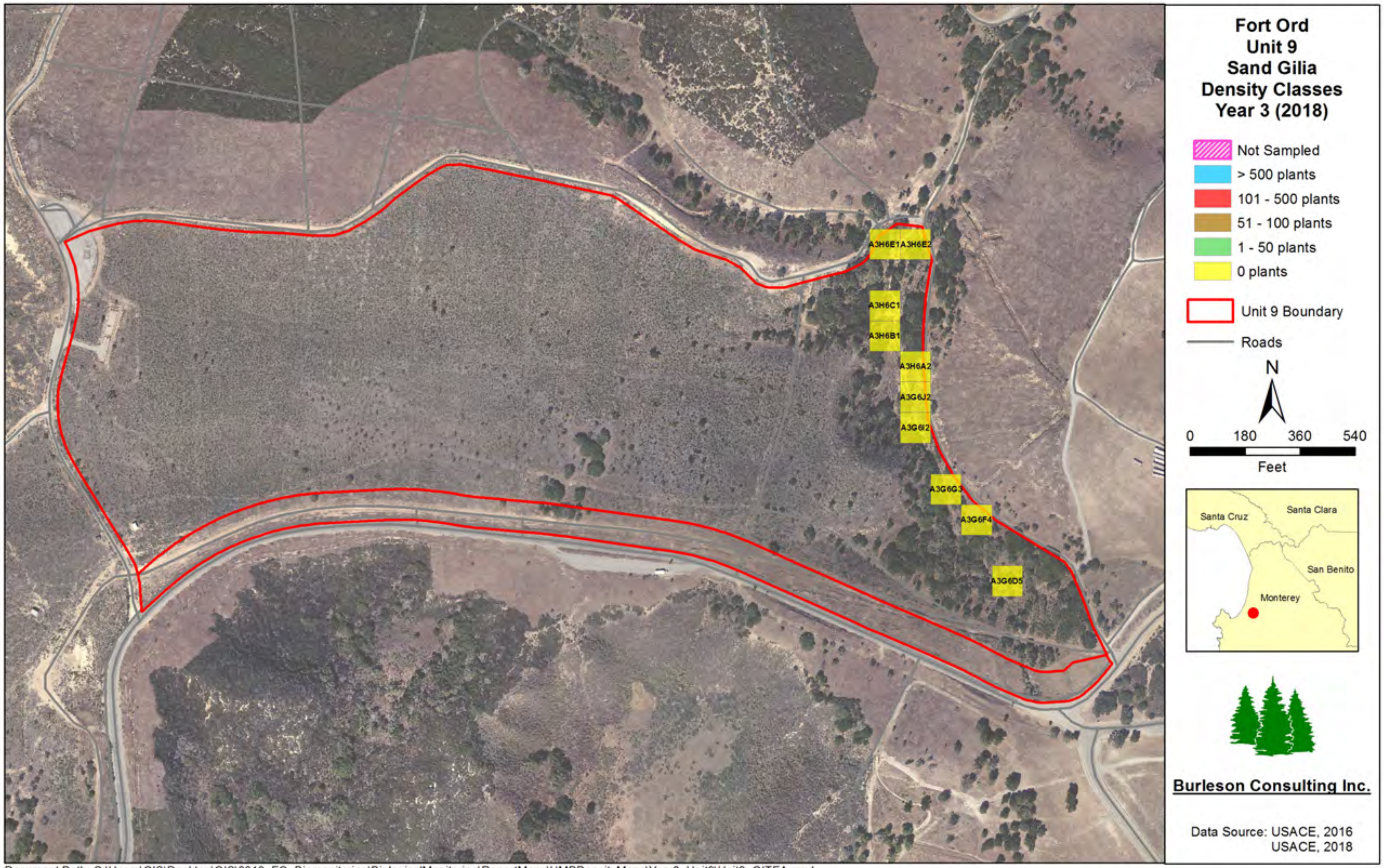

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Figure B-21. Map of Sand Gilia Density, Unit 9 ($n_{Masticated}$=10 grids)

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Figure B-22. Map of Monterey Spineflower Density, Unit 23N ($n_{Masticated}$=3 grids)

Figure B-23. Map of Seaside Bird's Beak Density, Unit 23N ($n_{Masticated}$=3 grids)

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Figure B-24. Map of Sand Gilia Density, Unit 23N ($n_{Masticated}$=3 grids)

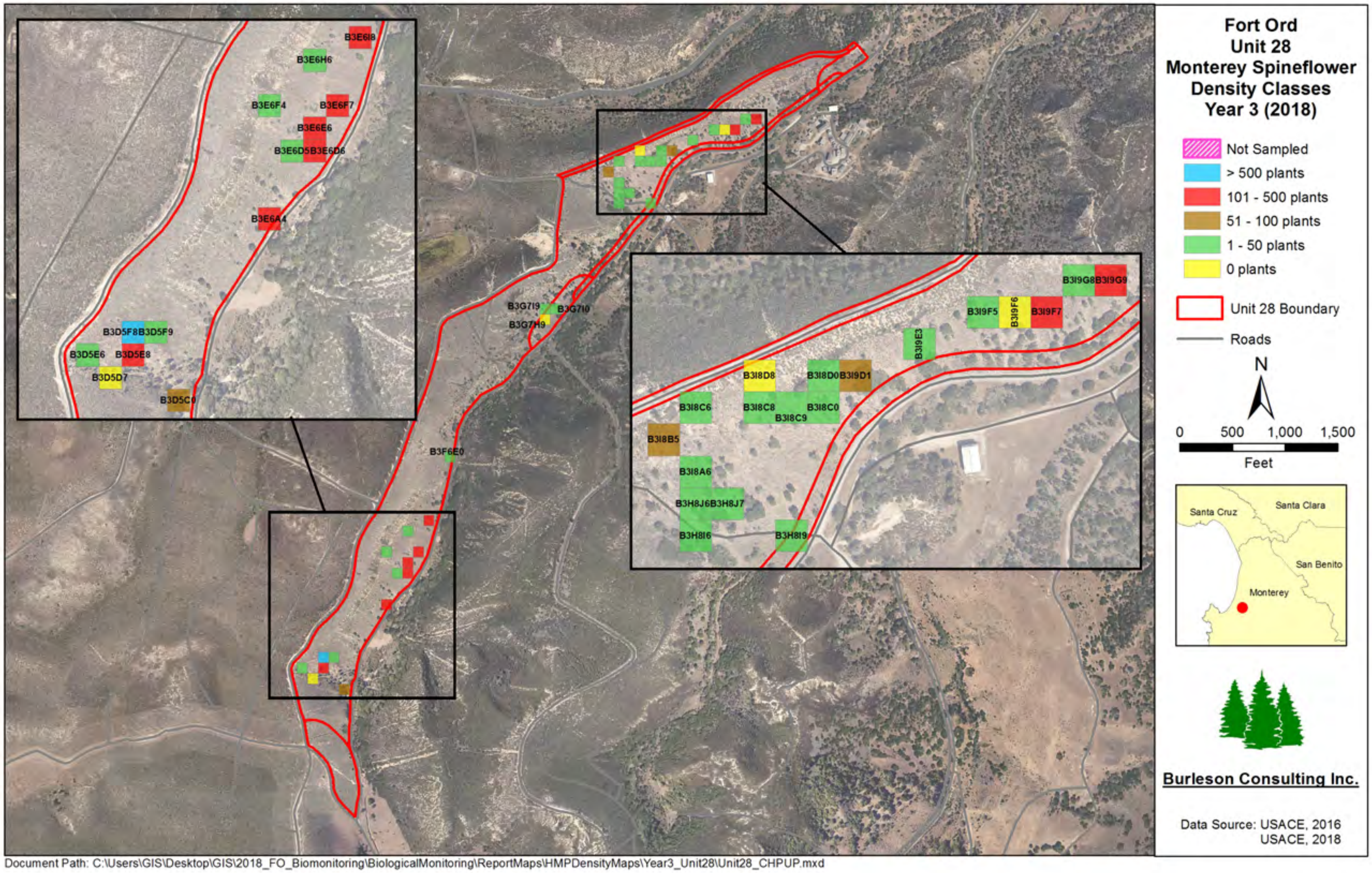

Figure B-25. Map of Monterey Spineflower Density, Unit 28 ($n_{Masticated}$=37 grids)

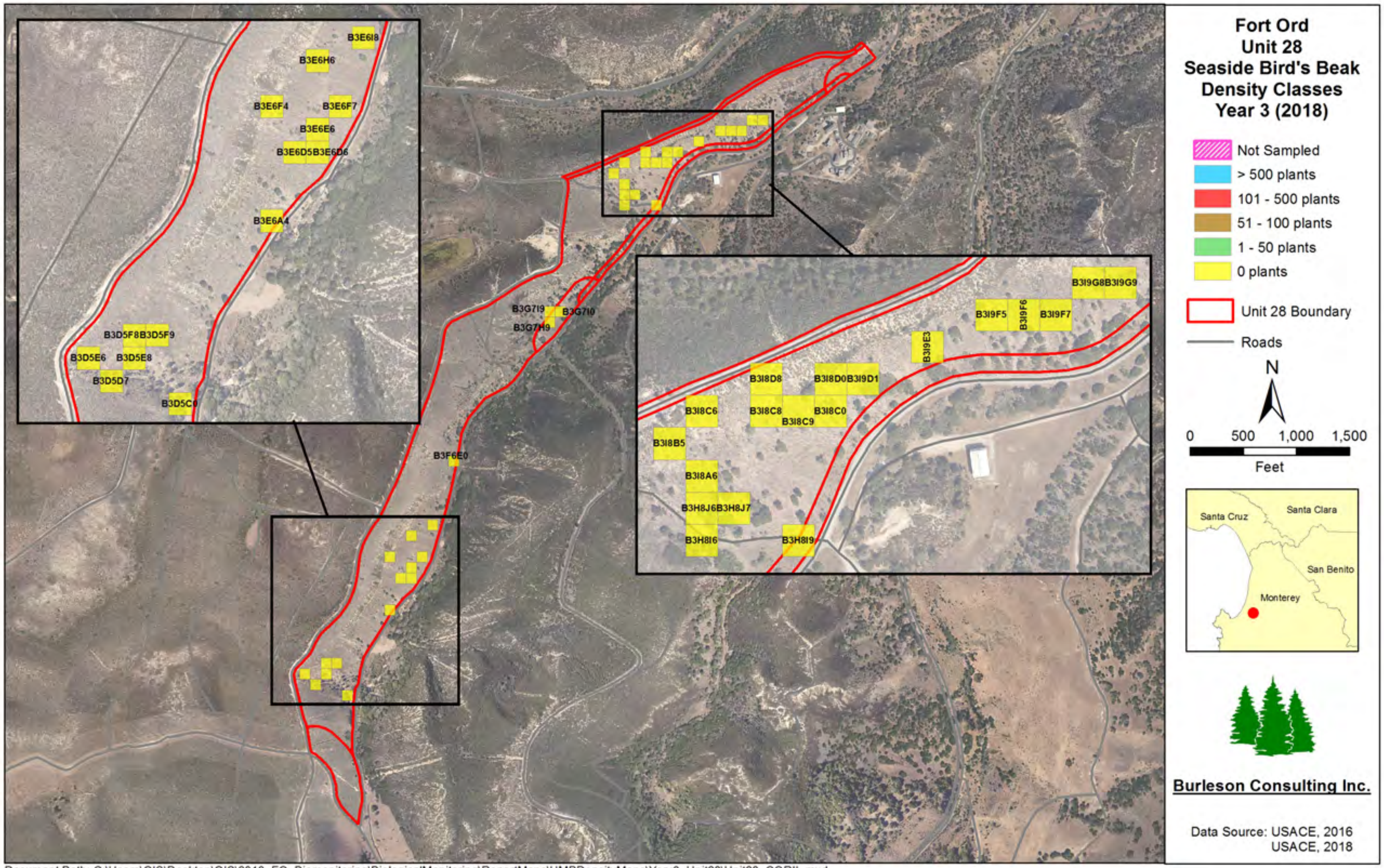

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Figure B-26. Map of Seaside Bird's Beak Density, Unit 28 ($n_{Masticated}$=37 grids)

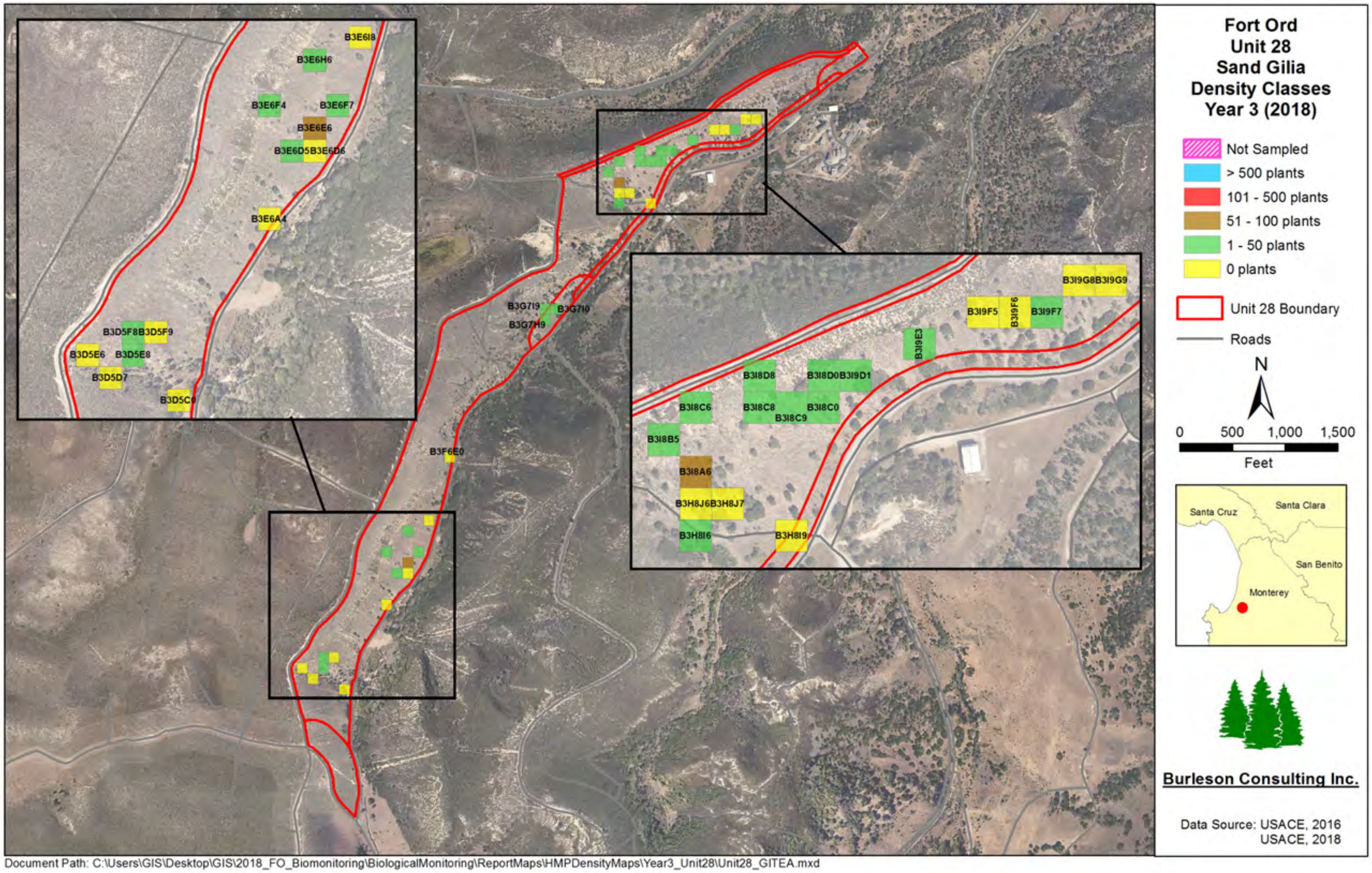

Figure B-27. Map of Sand Gilia Density, Unit 28 ($n_{Masticated}$=37 grids)

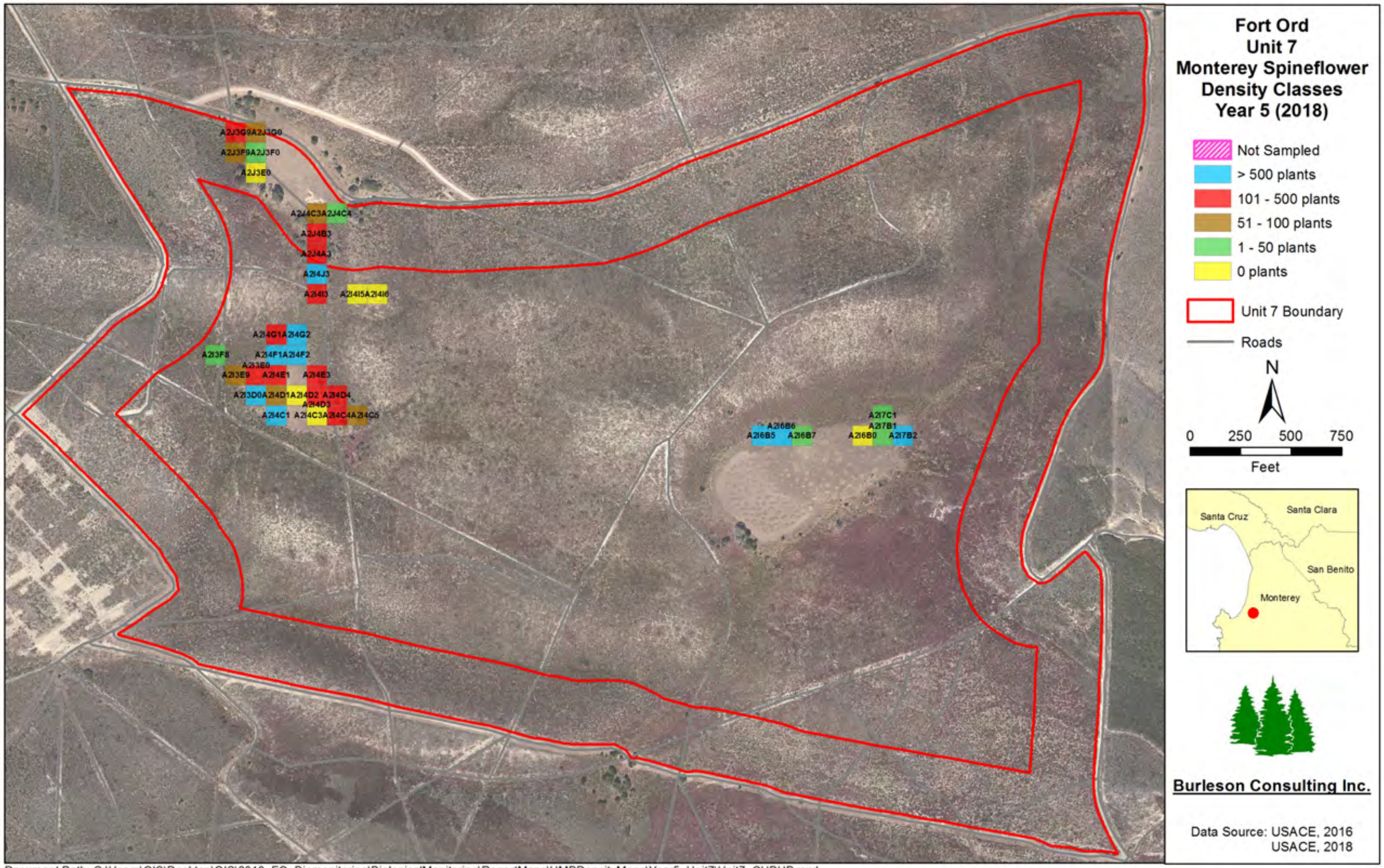

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Figure B-28. Map of Monterey Spineflower Density, Unit 7 (n_{Burned}=29 grids; $n_{Masticated}$=5 grids; $n_{Masticated\&Burned}$=2 grids; n_{Mixed}=2 grids)

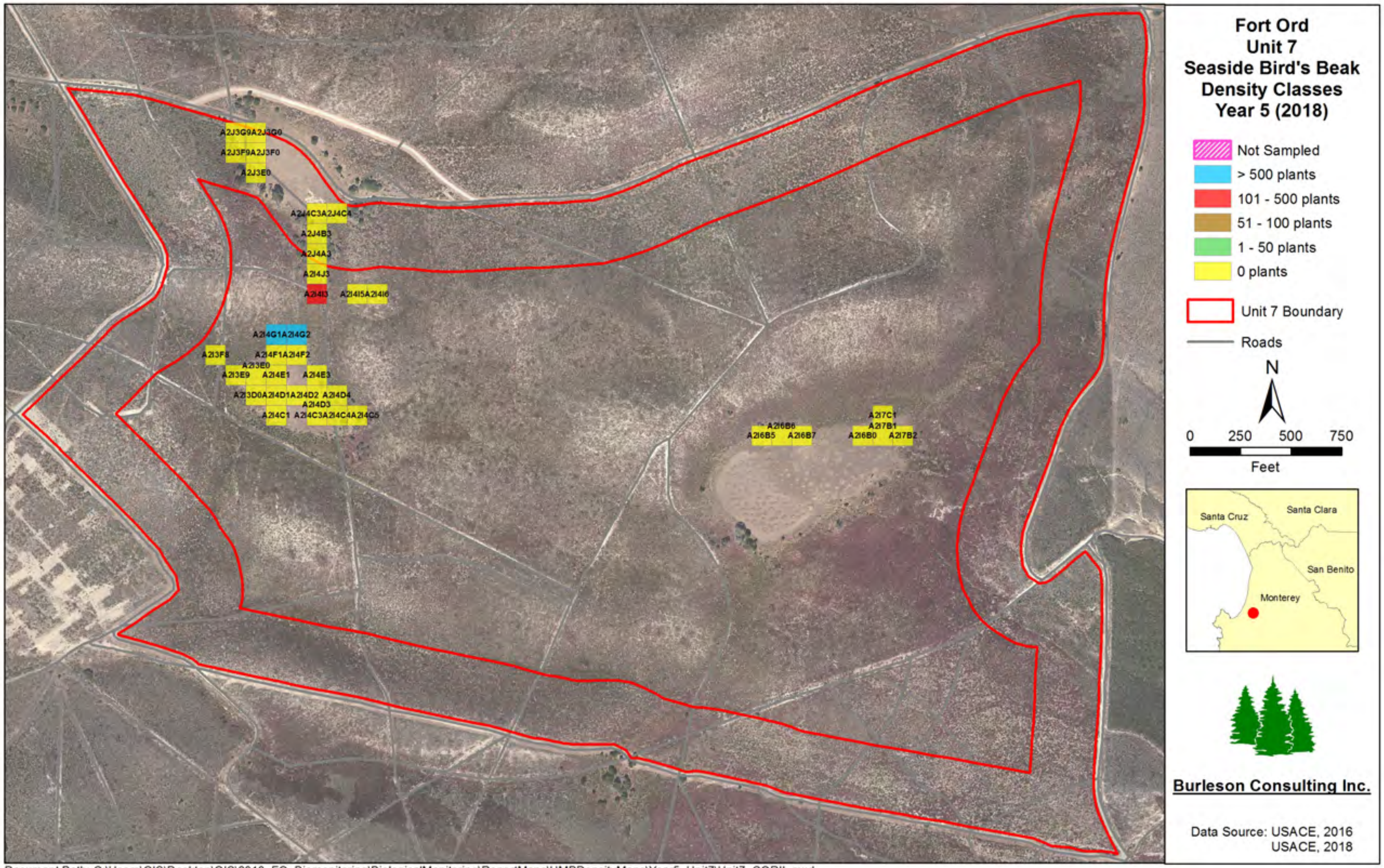

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Figure B-29. Map of Seaside Bird's Beak Density, Unit 7 (n_{Burned}=29 grids; $n_{Masticated}$=5 grids; $n_{Masticated\&Burned}$=2 grids; n_{Mixed}=2 grids)

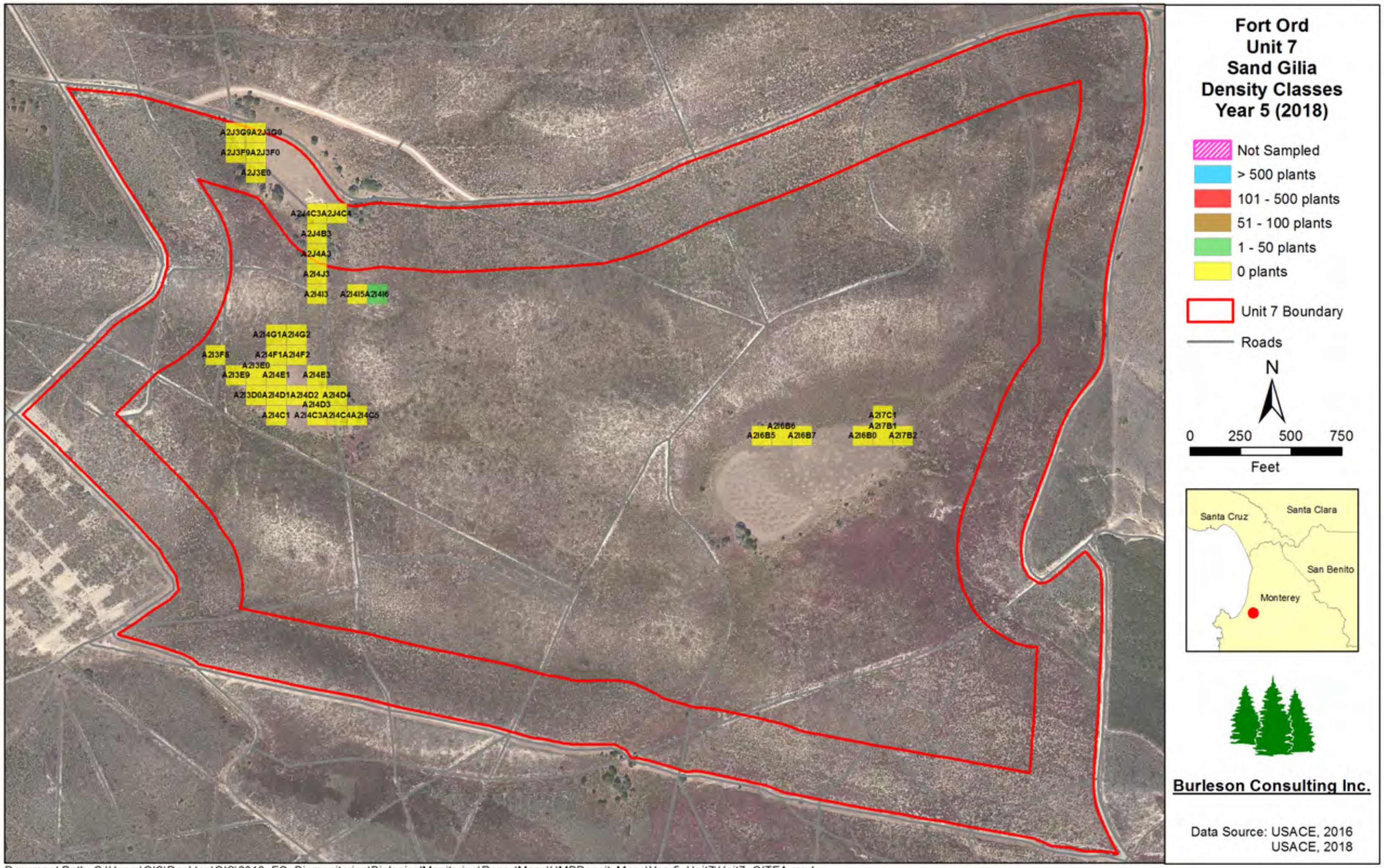

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Figure B-30. Map of Sand Gilia Density, Unit 7 (n_{Burned}=29 grids; $n_{Masticated}$=5 grids; $n_{Masticated\&Burned}$=2 grids; n_{Mixed}=2 grids)

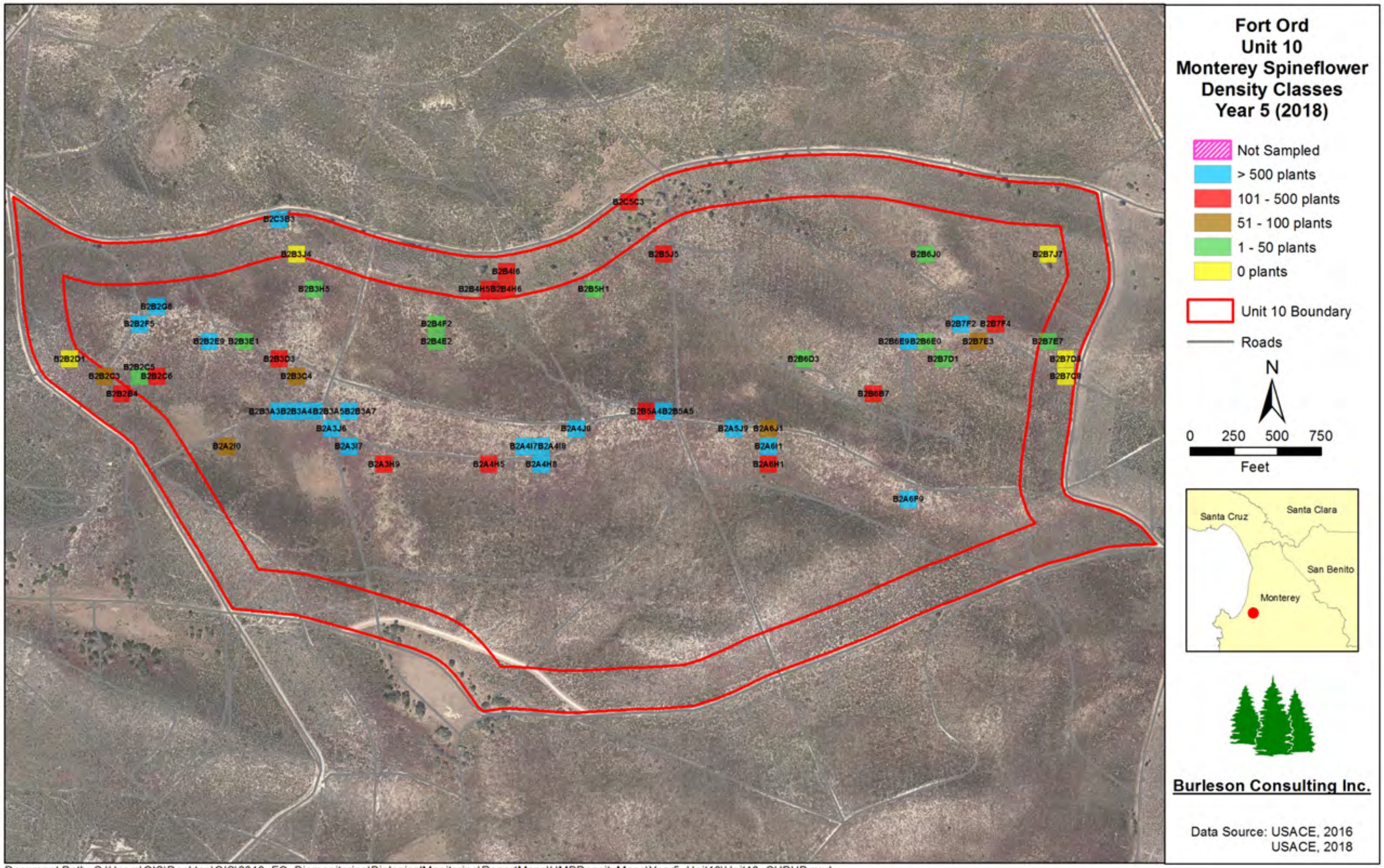

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Figure B-31. Map of Monterey Spineflower Density, Unit 10 (n_{Burned}=43 grids; $n_{Masticated}$=9 grids; $n_{Masticated\&Burned}$=3 grids)

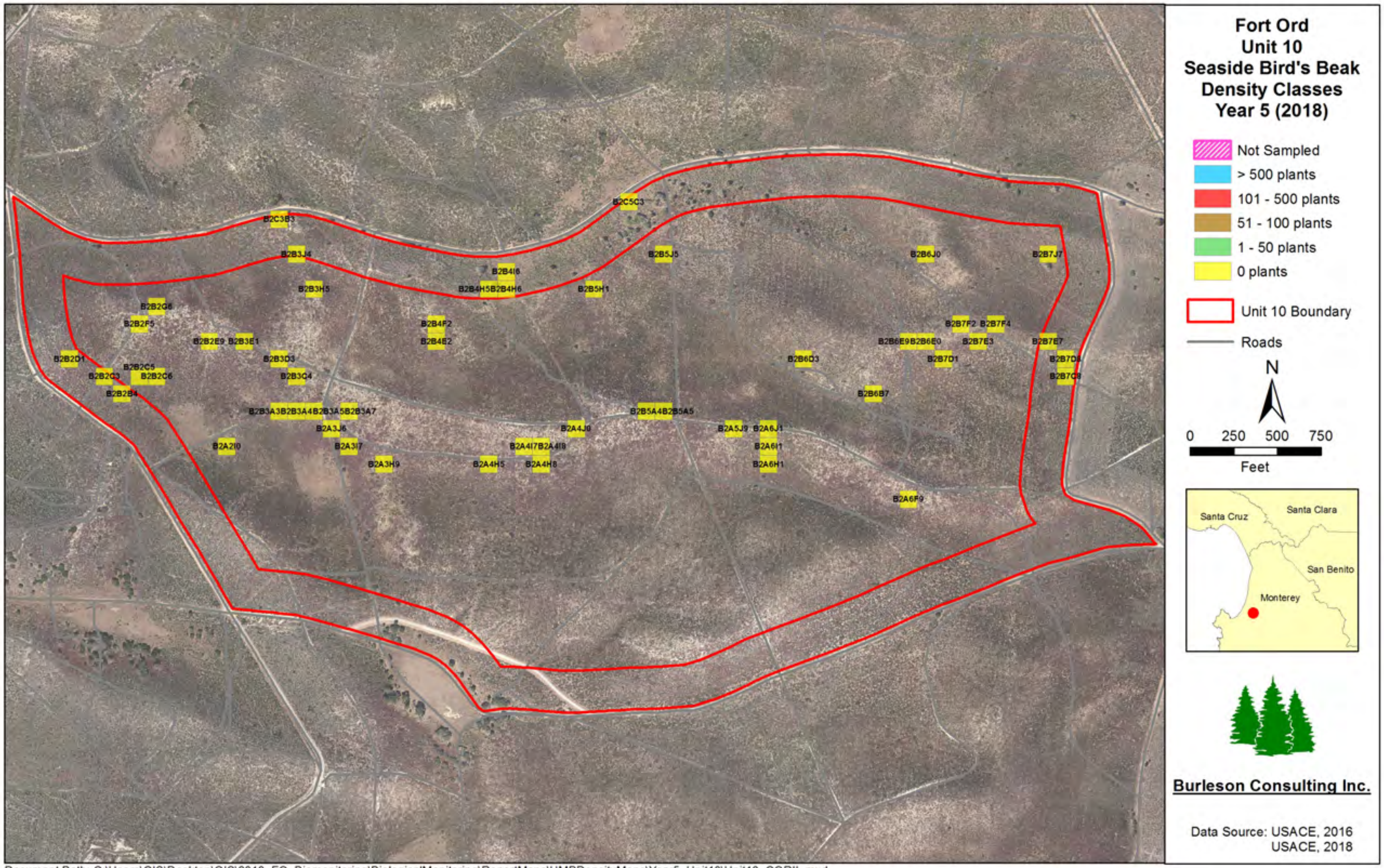

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Figure B-32. Map of Seaside Bird's Beak Density, Unit 10 (n_{Burned}=43 grids; $n_{Masticated}$=9 grids; $n_{Masticated\&Burned}$=3 grids)

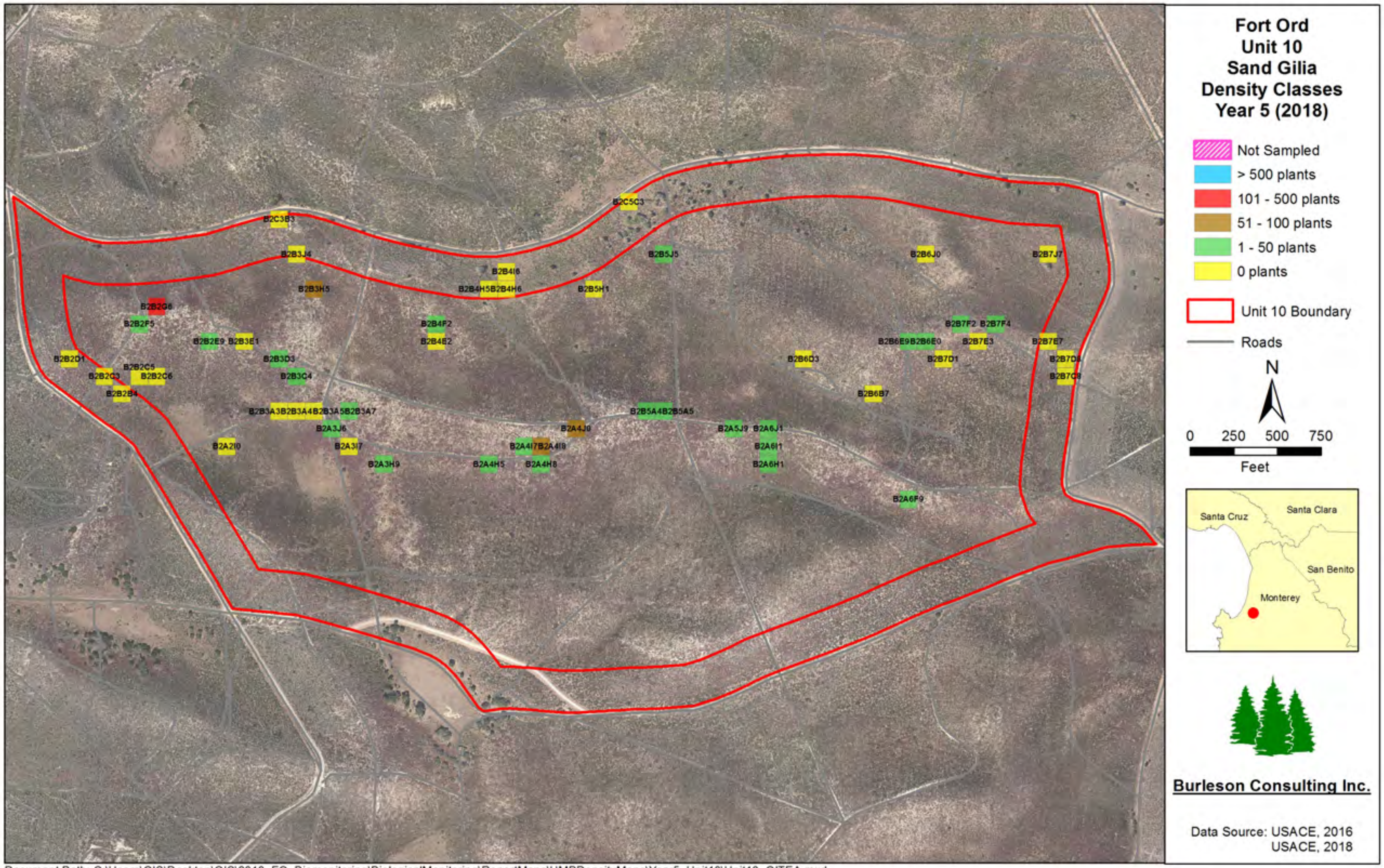

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Figure B-33. Map of Sand Gilia Density, Unit 10 (n_{Burned}=43 grids; $n_{Masticated}$=9 grids; $n_{Masticated\&Burned}$=3 grids)

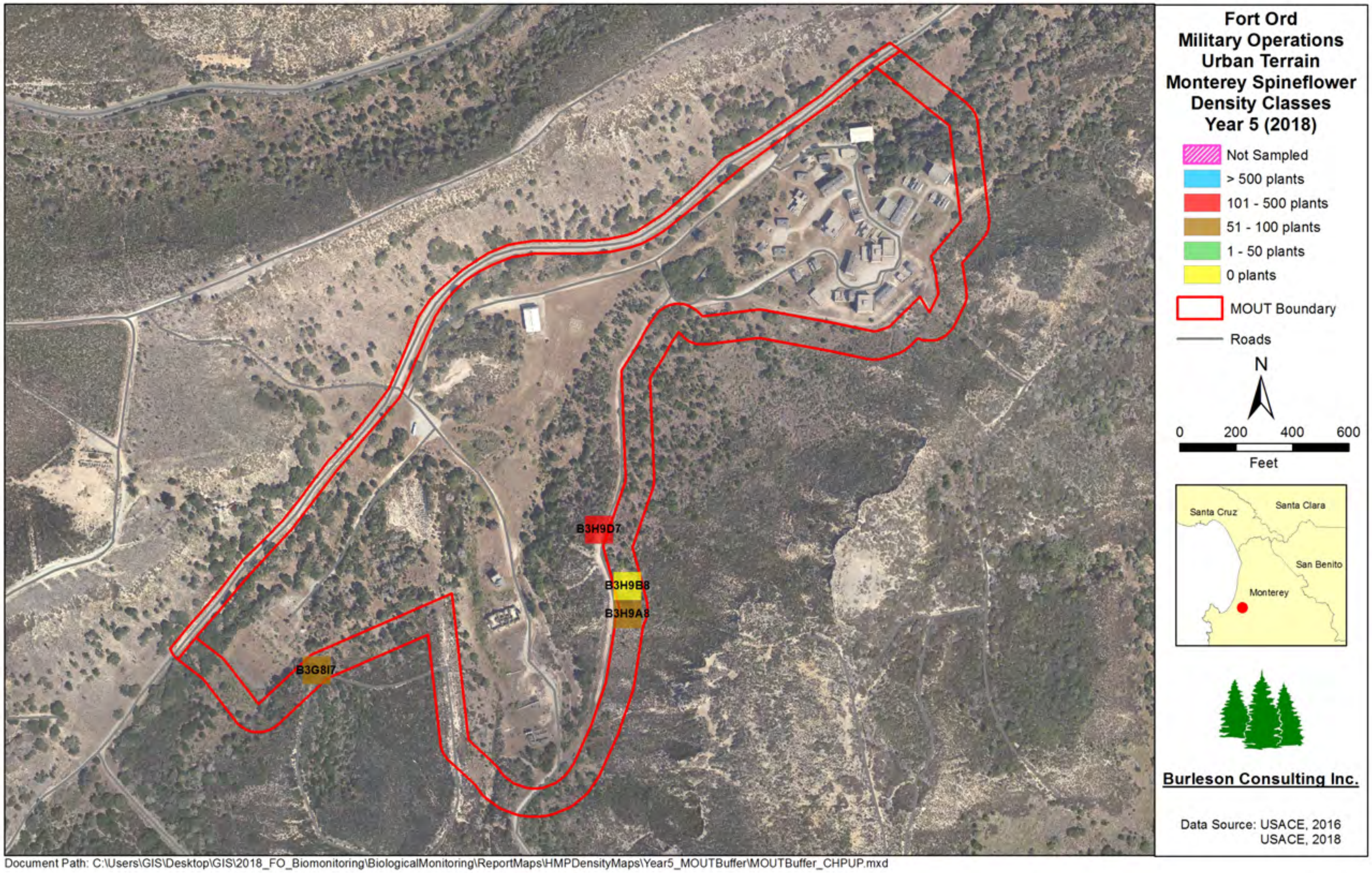

Figure B-34. Map of Monterey Spineflower Density, Military Operations Urban Terrain Buffer ($n_{Masticated}$=4 grids)

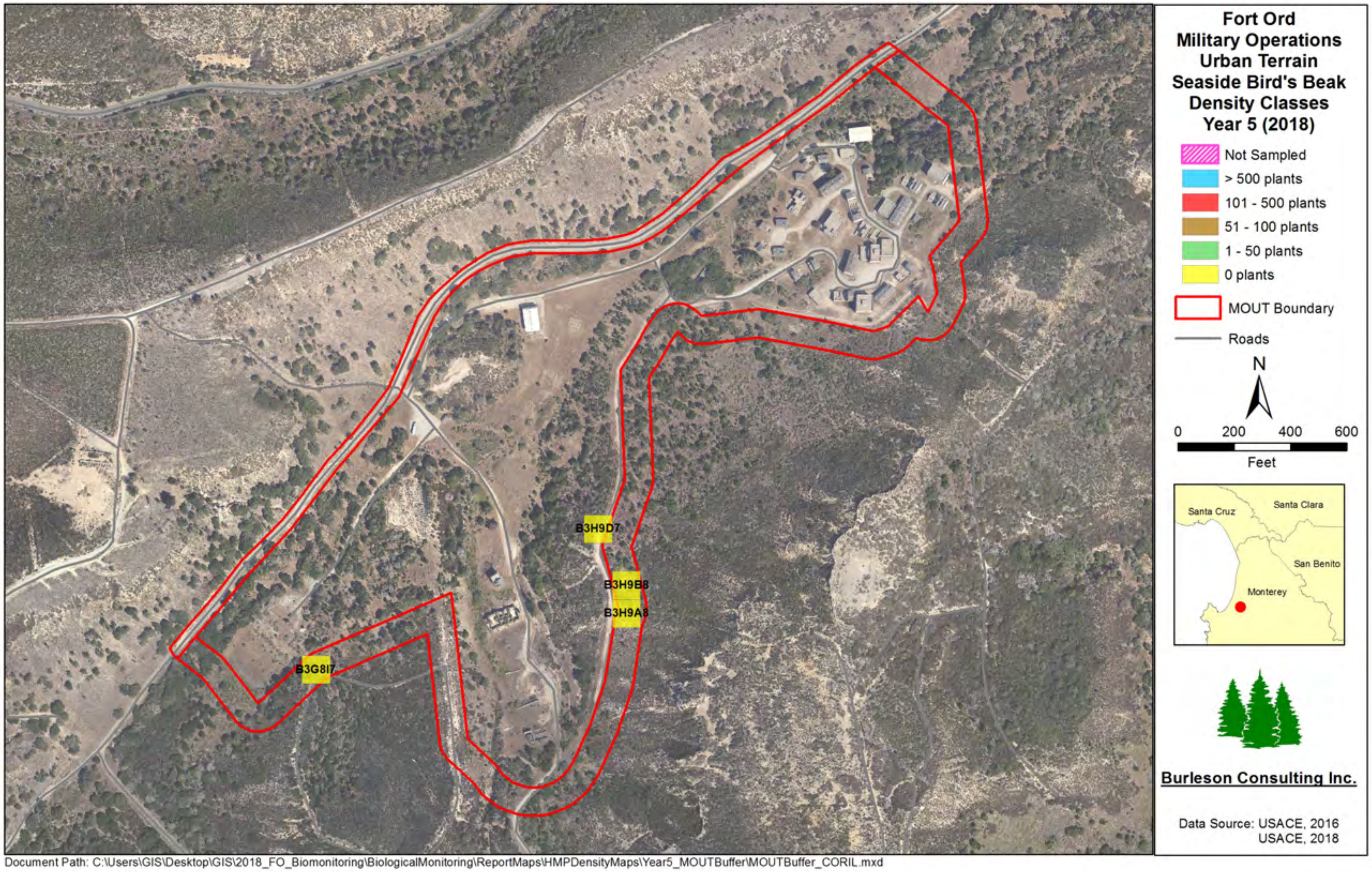

Figure B-35. Map of Seaside Bird's Beak Density, Military Operations Urban Terrain Buffer ($n_{Masticated}$=4 grids)

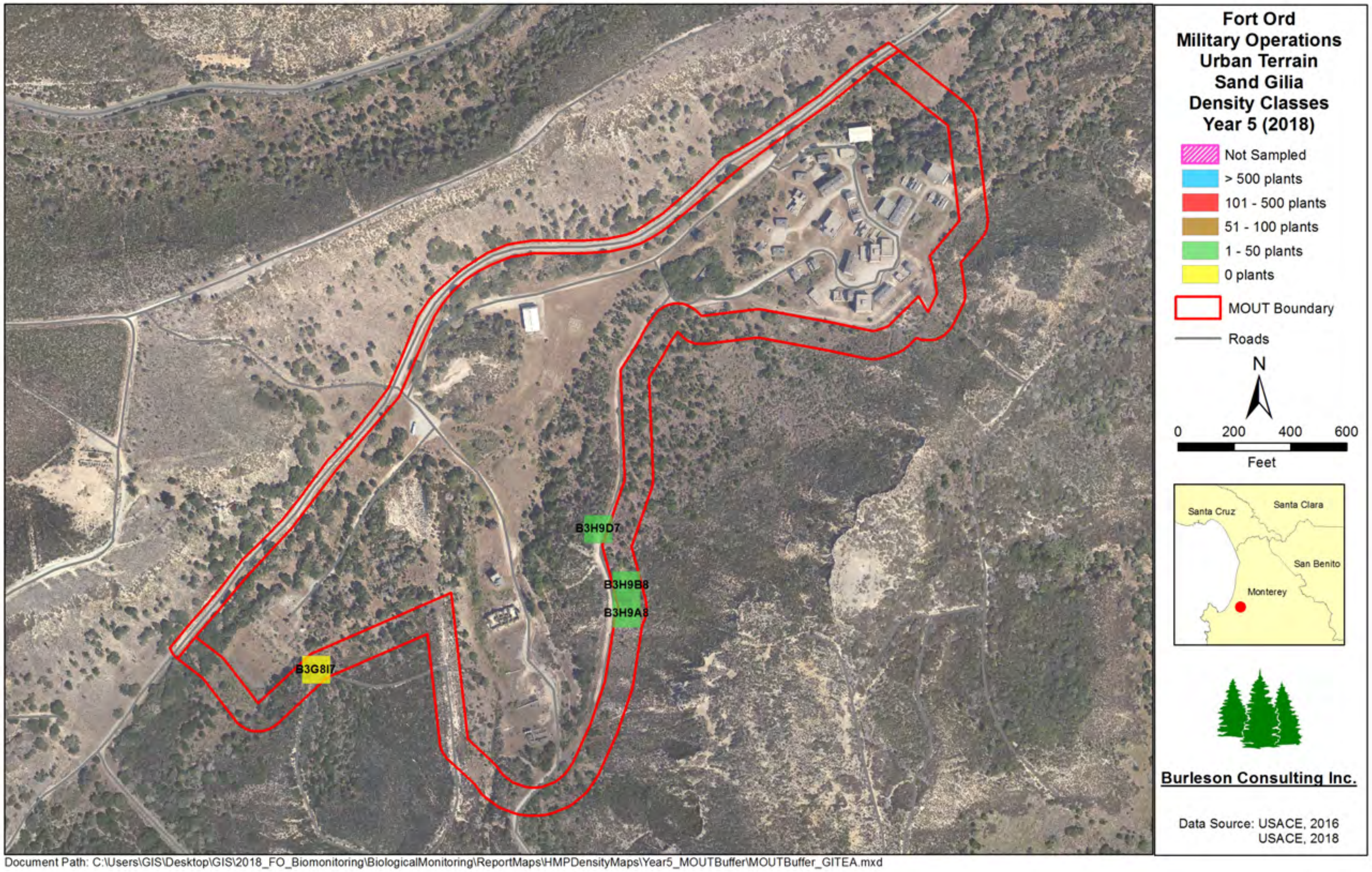

Figure B-36. Map of Sand Gilia Density, Military Operations Urban Terrain Buffer ($n_{Masticated}$=4 grids)

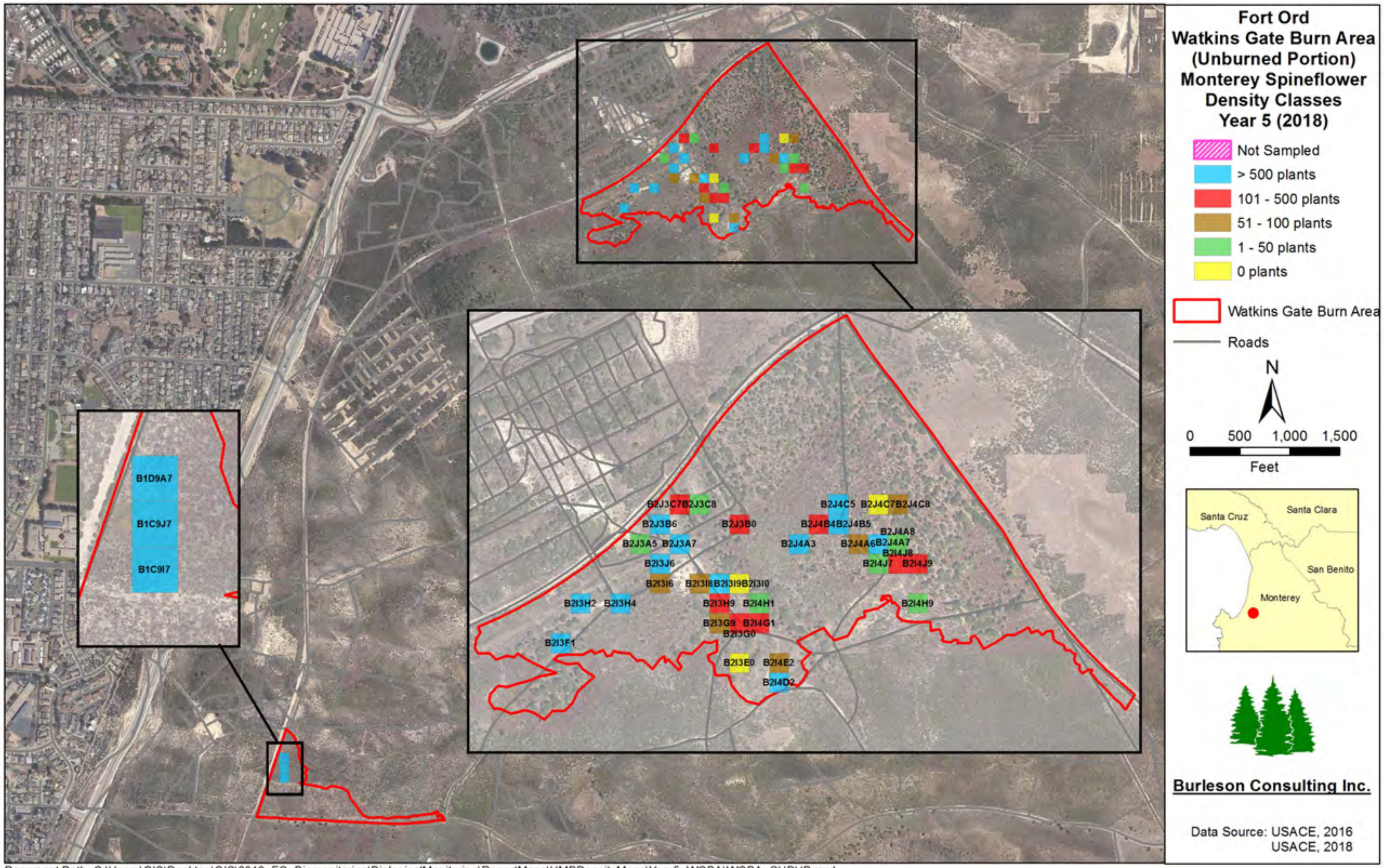

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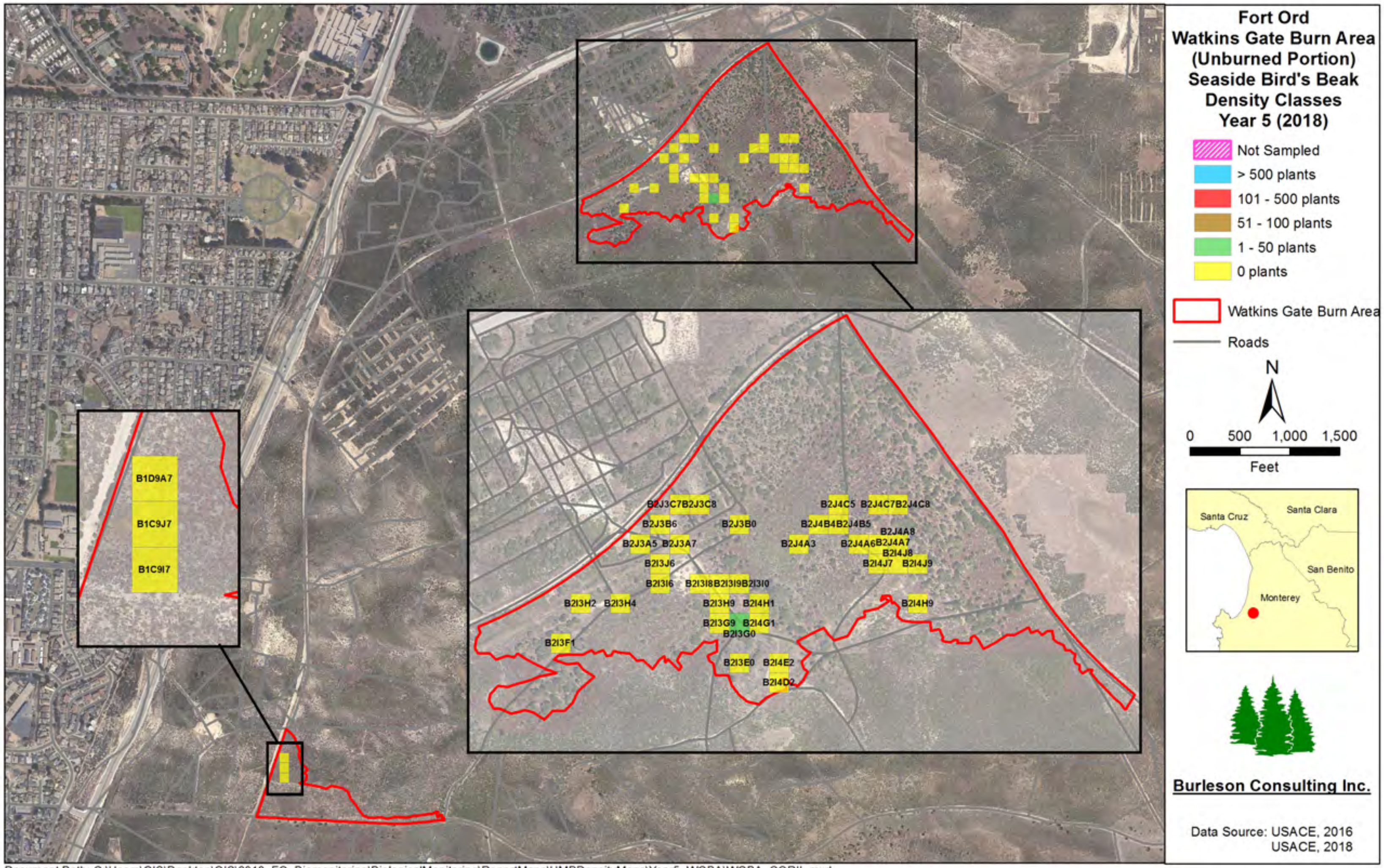
Figure B-37. Map of Monterey Spineflower Density, Unburned Portion of Watkins Gate Burn Area ($n_{Masticated}$=38 grids)



Document Path: C:\Users\GIS\Desktop\GIS\2018_FO_Biomonitoring\BiologicalMonitoring\ReportMaps\HMPDensityMaps\Year5_WGBA\WGBA_CORIL.mxd

Figure B-38. Map of Seaside Bird's Beak Density, Unburned Portion of Watkins Gate Burn Area ($n_{Masticated}$=38 grids)

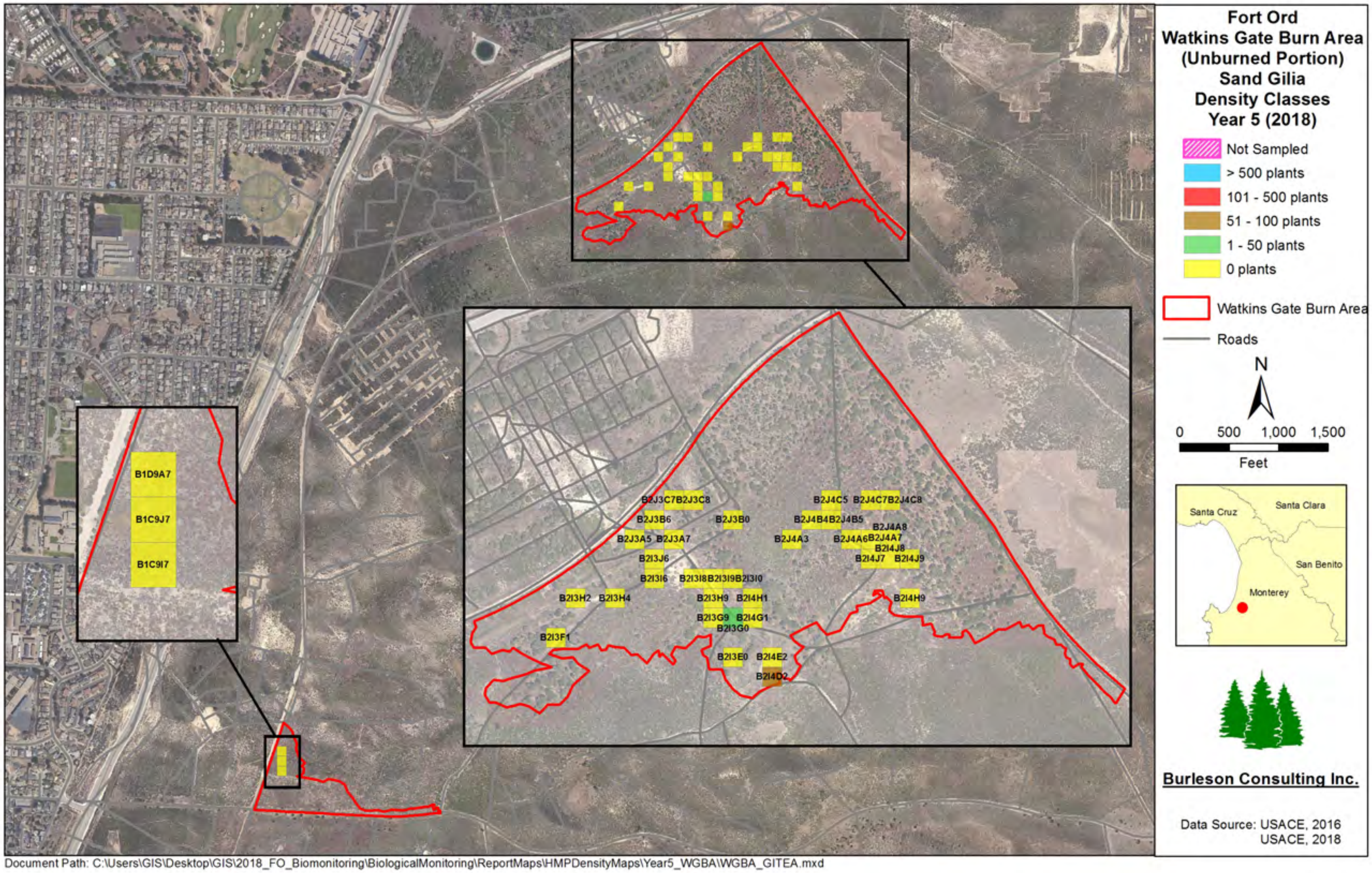


Figure B-39. Map of Sand Gilia Density, Unburned Portion of Watkins Gate Burn Area ($n_{Masticated}$=38 grids)

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APPENDIX C

MAPS: HMP SHRUB TRANSECTS

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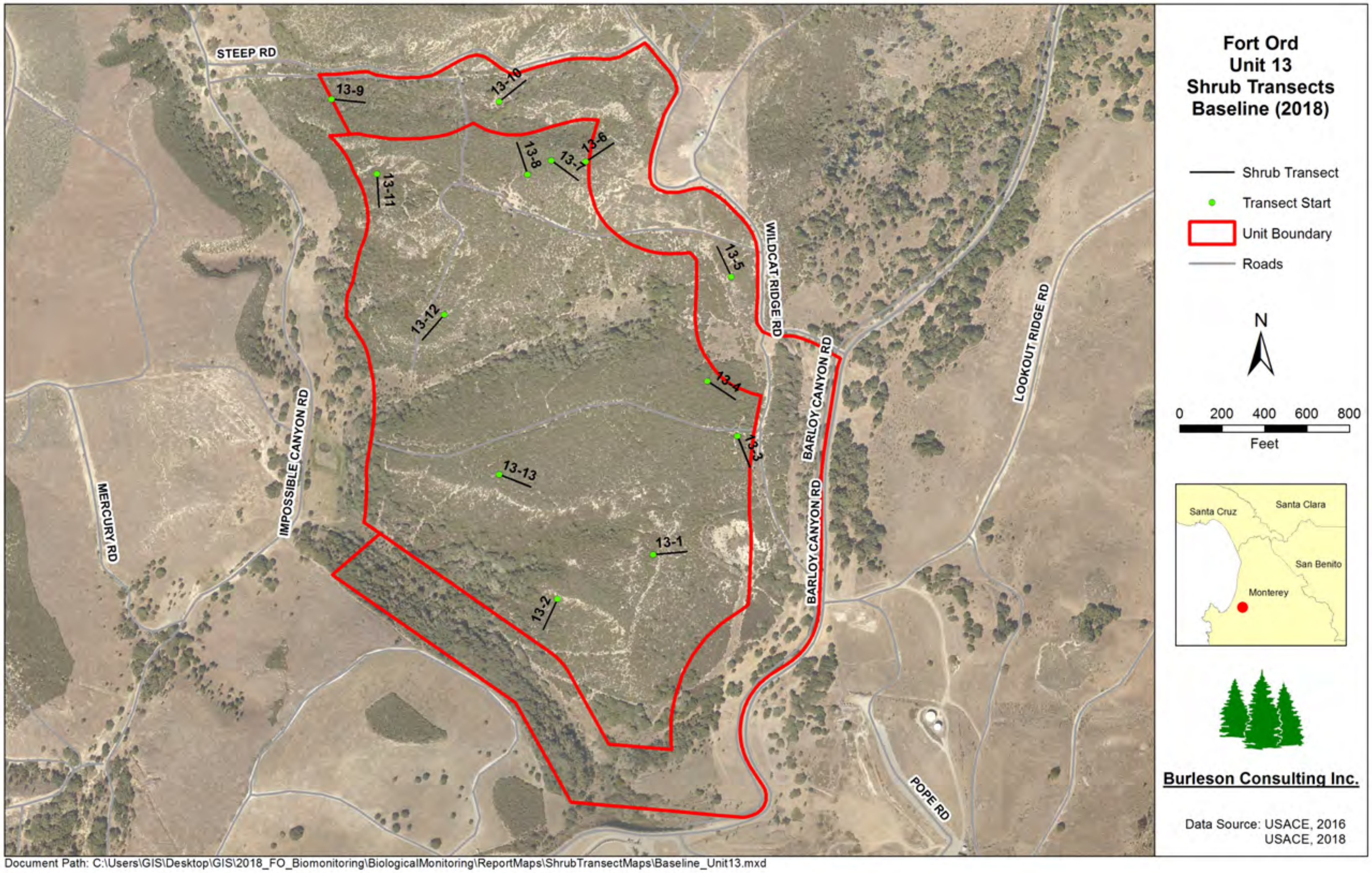
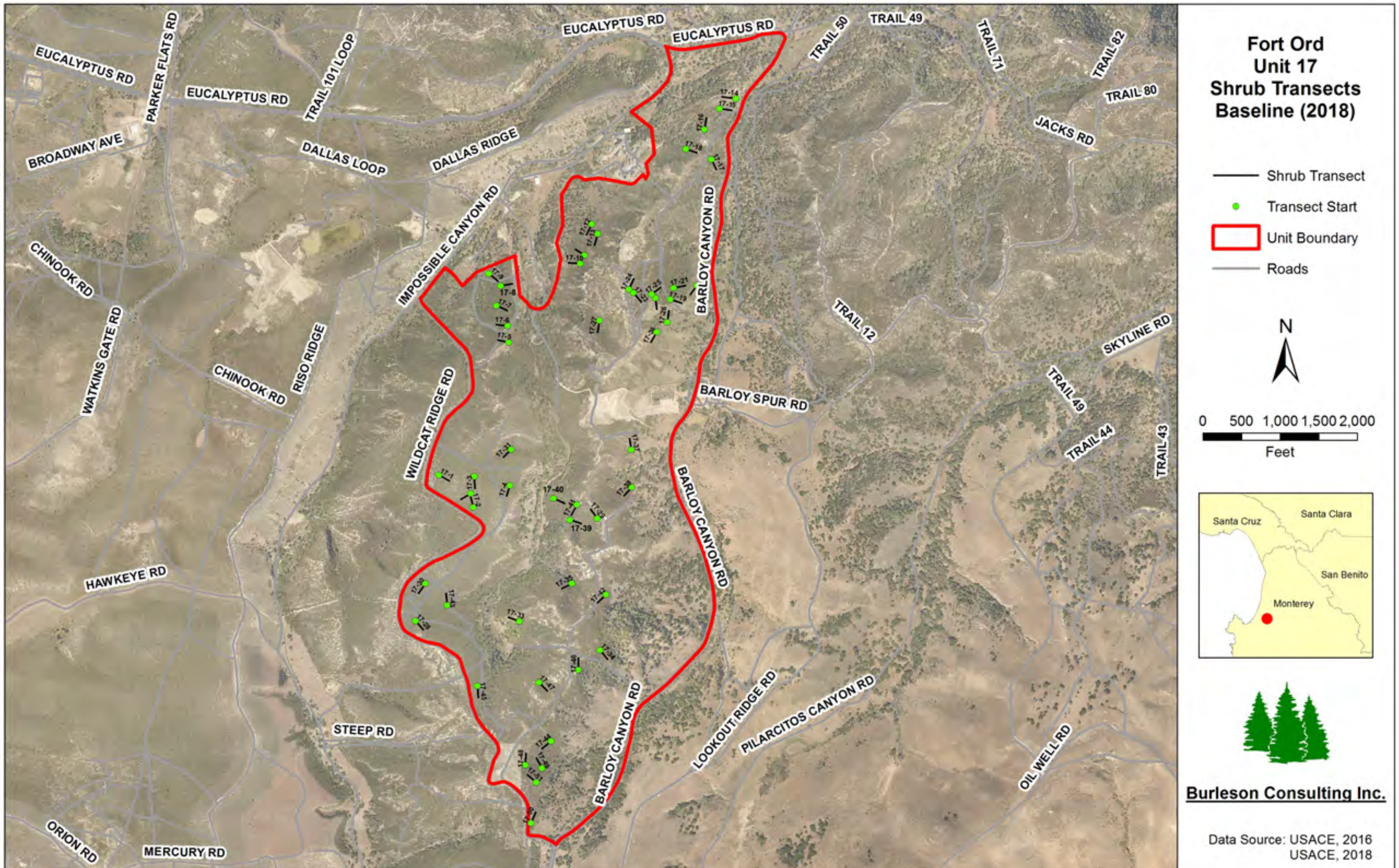


Figure C-1. Map of shrub transects, Unit 13 (*n*=13 transects)



Document Path: C:\Users\GIS\Desktop\GIS\2018_FO_Biomonitoring\BiologicalMonitoring\ReportMaps\ShrubTransectMaps\Baseline_Unit17.mxd

Figure C-2. Map of shrub transects, Unit 17 (*n*=51 transects)

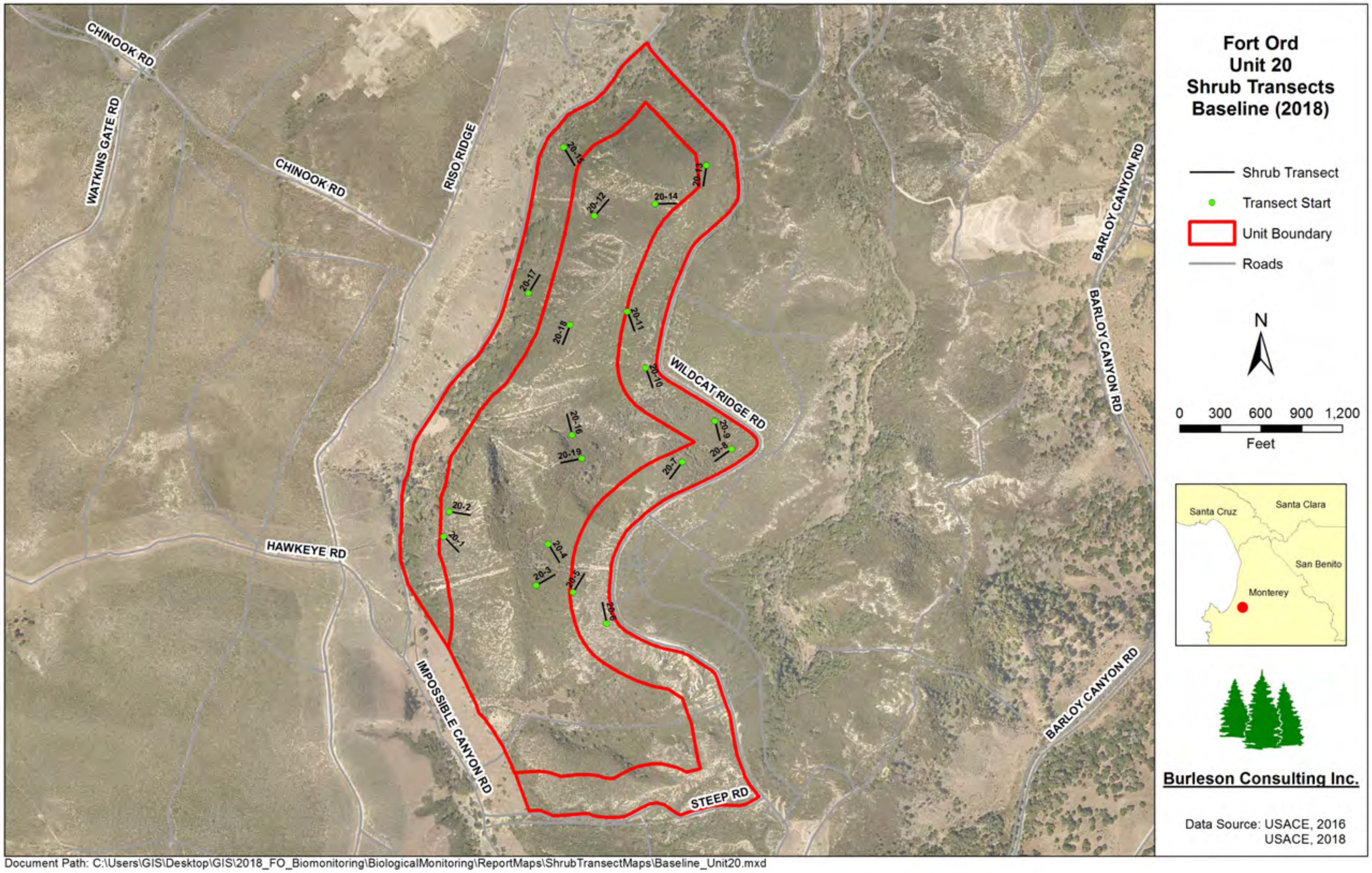


Figure C-3. Map of shrub transects, Unit 20 (*n*=19 transects)

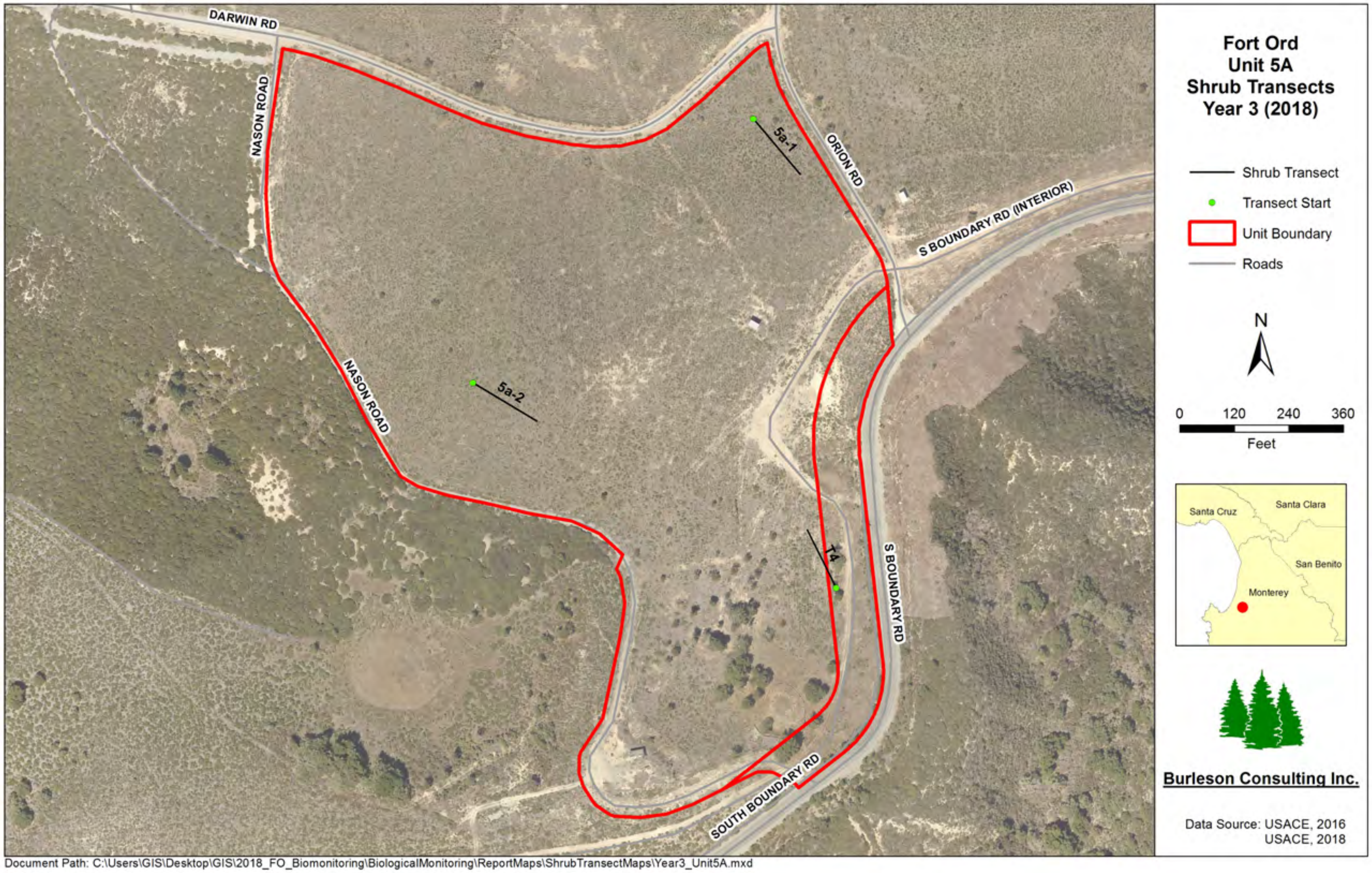


Figure C-4. Map of shrub transects, Unit 5A ($n_{Masticated}$=3 transects)

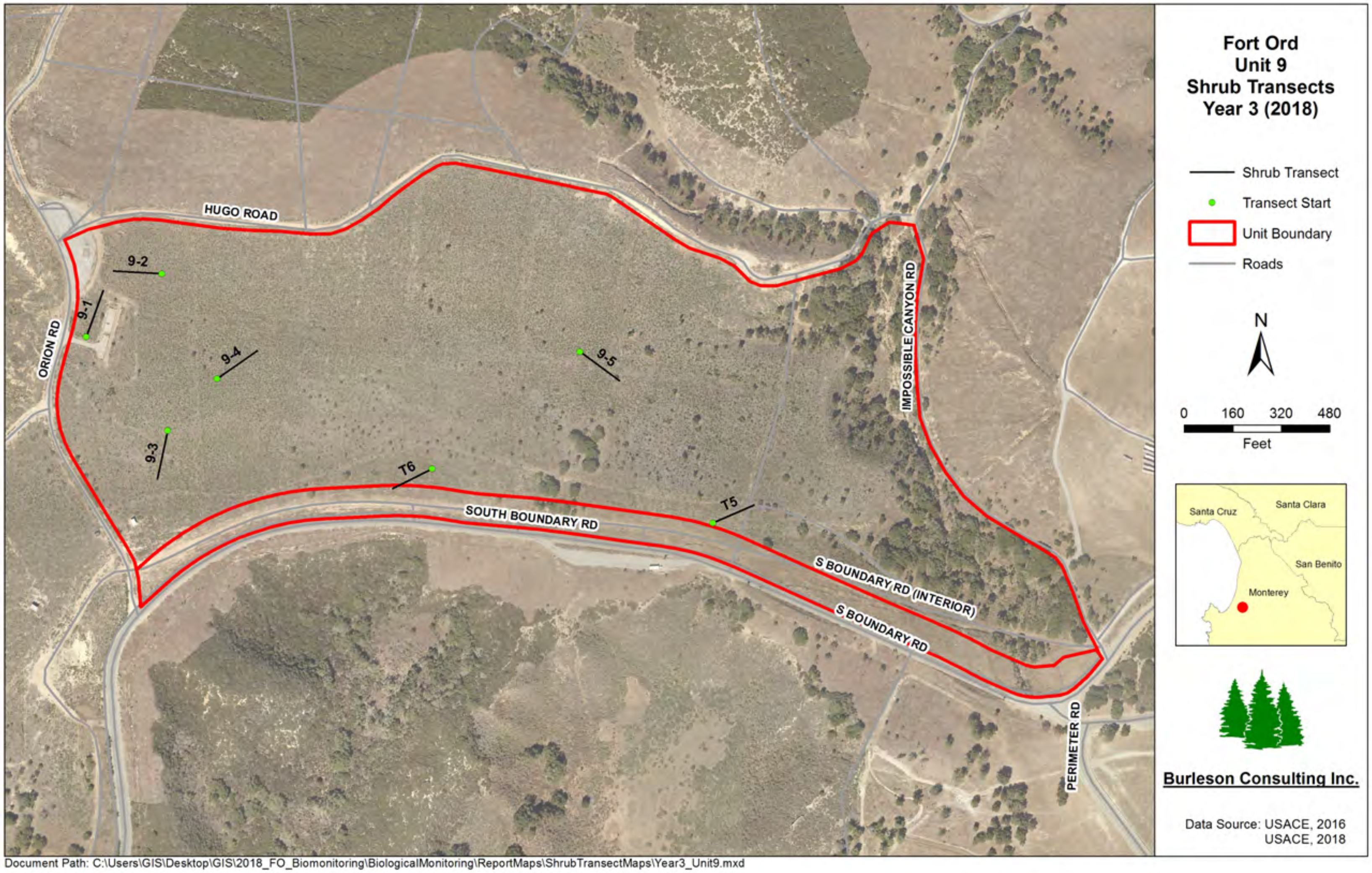


Figure C-5. Map of shrub transects, Unit 9 ($n_{Masticated}$=7 transects)

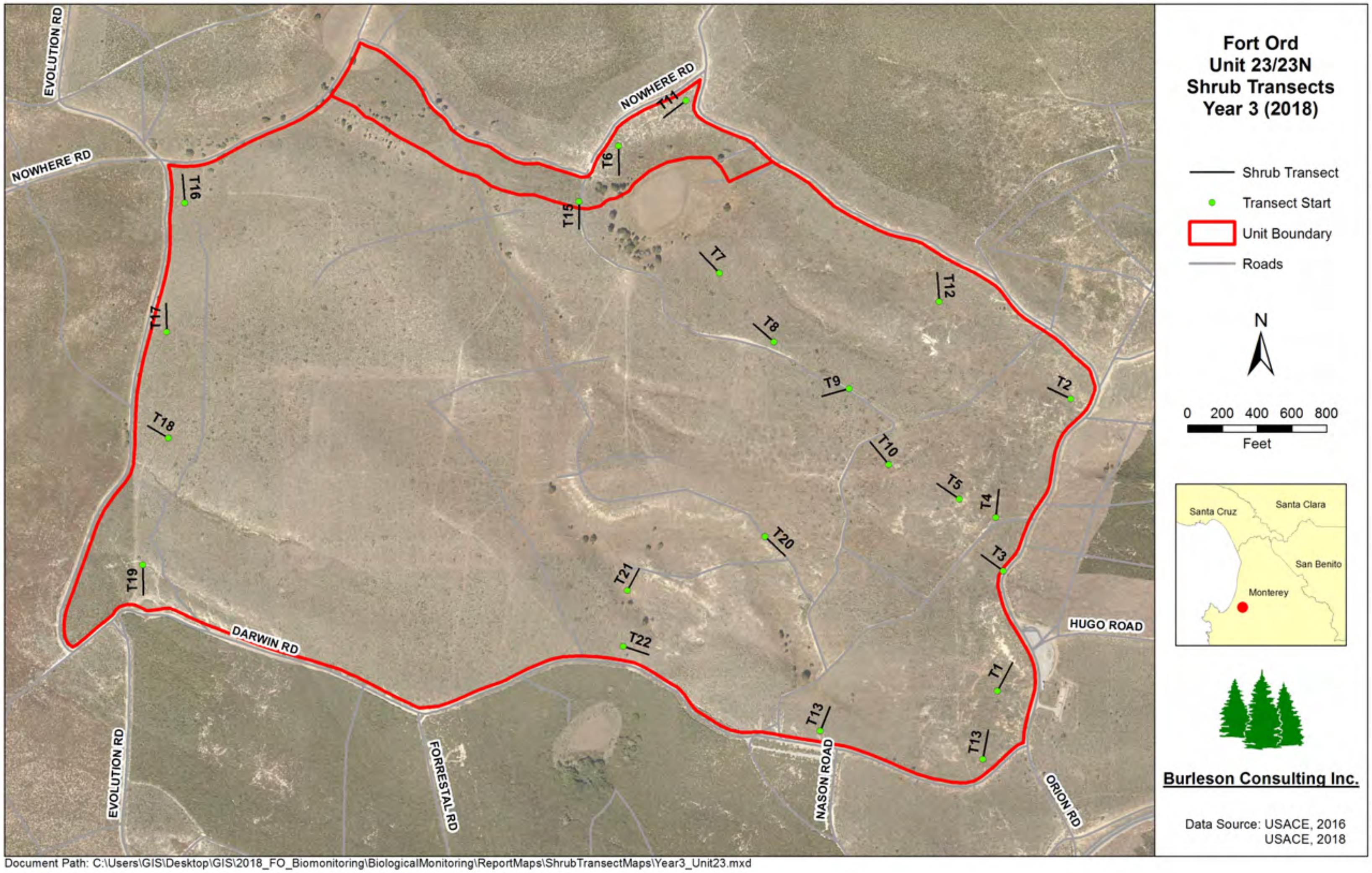


Figure C-6. Map of shrub transects, Unit 23 ($n_{Masticated}$=20 transects)

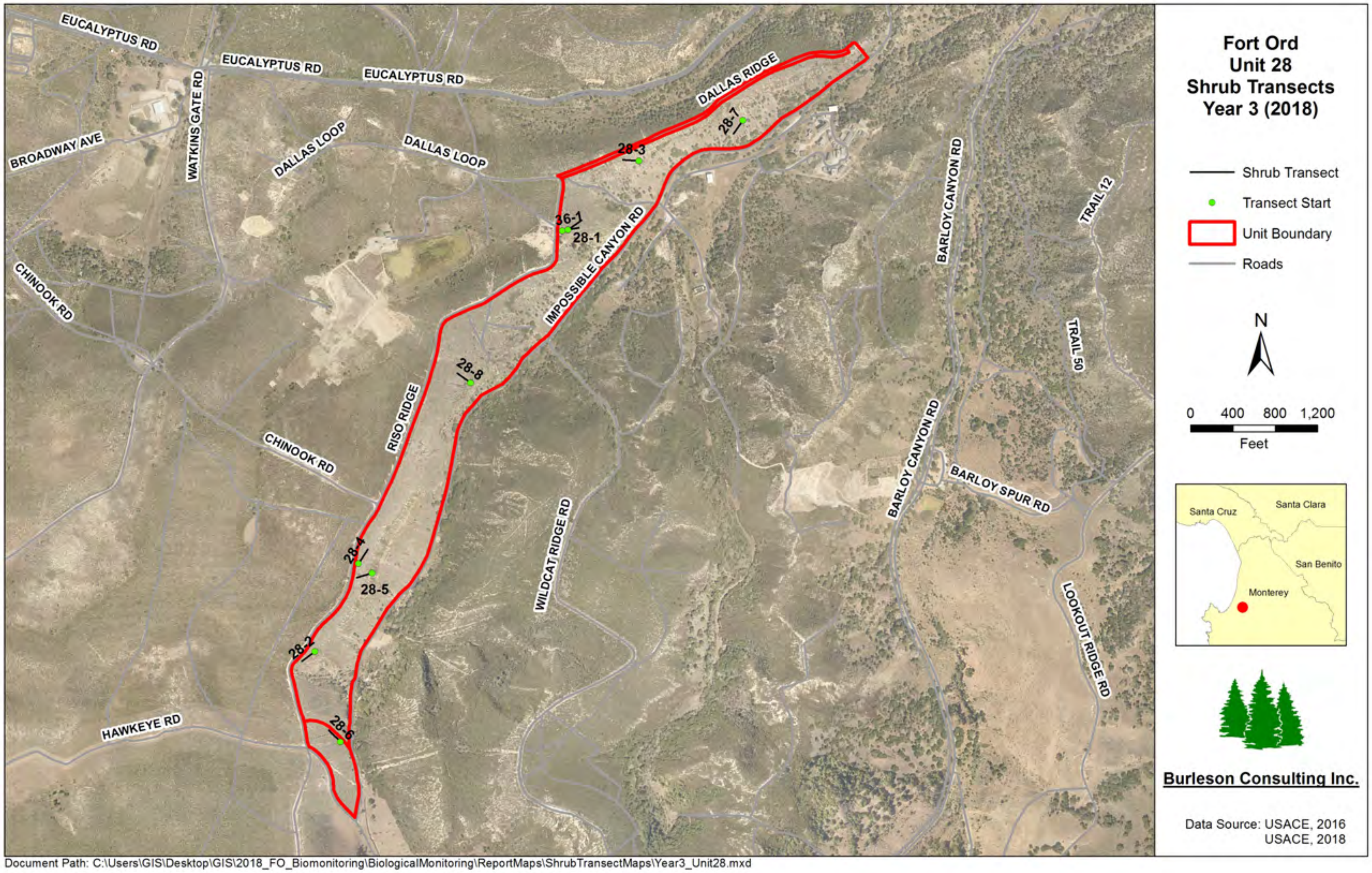


Figure C-7. Map of shrub transects, Unit 28 ($n_{Masticated}$=9 transects)

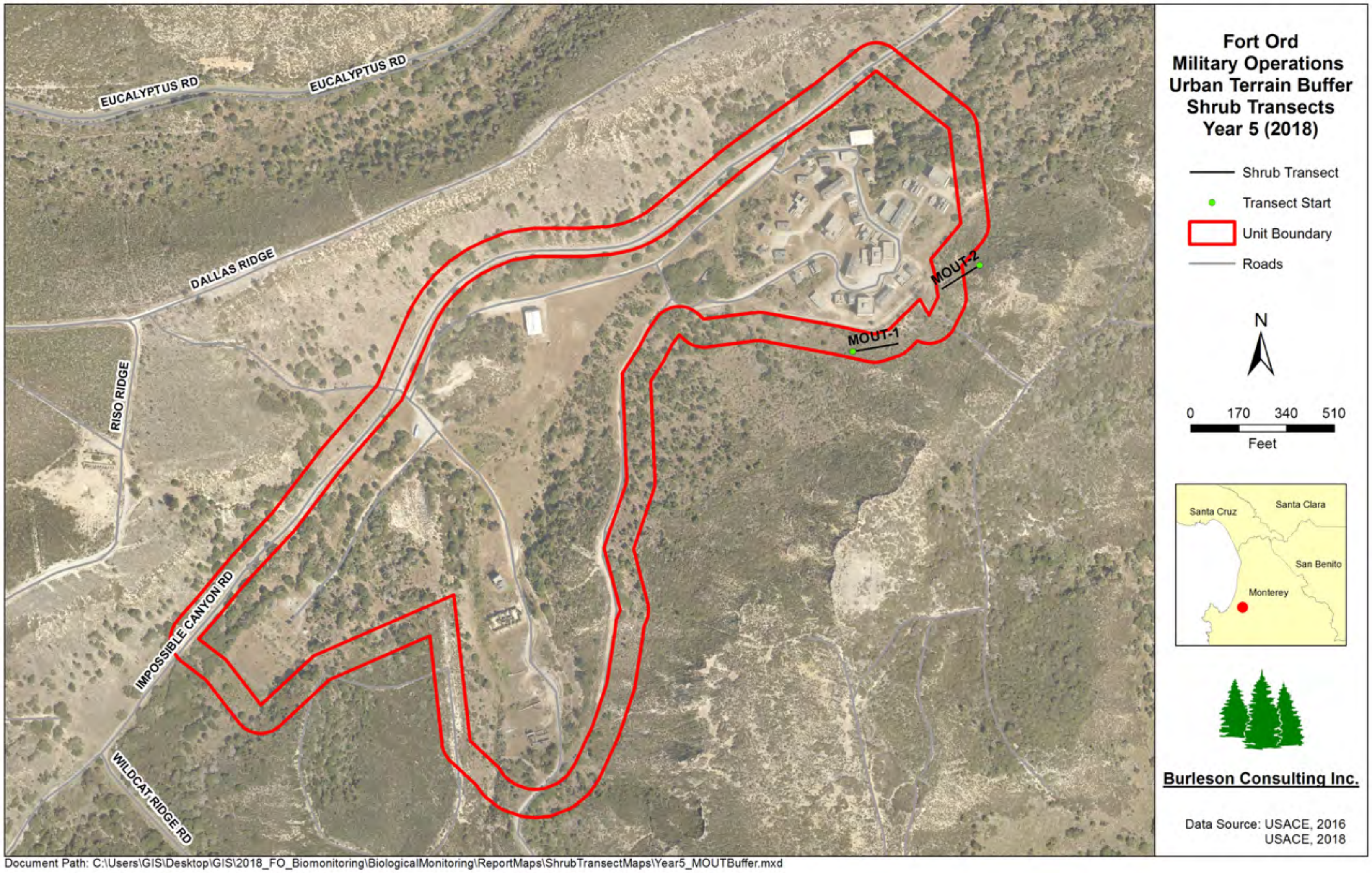


Figure C-8. Map of shrub transects, MOUT Buffer ($n_{Masticated}$=2 transects)

Figure C-9. Map of shrub transects, Unit 1 East ($n_{Masticated}$=5 transects)

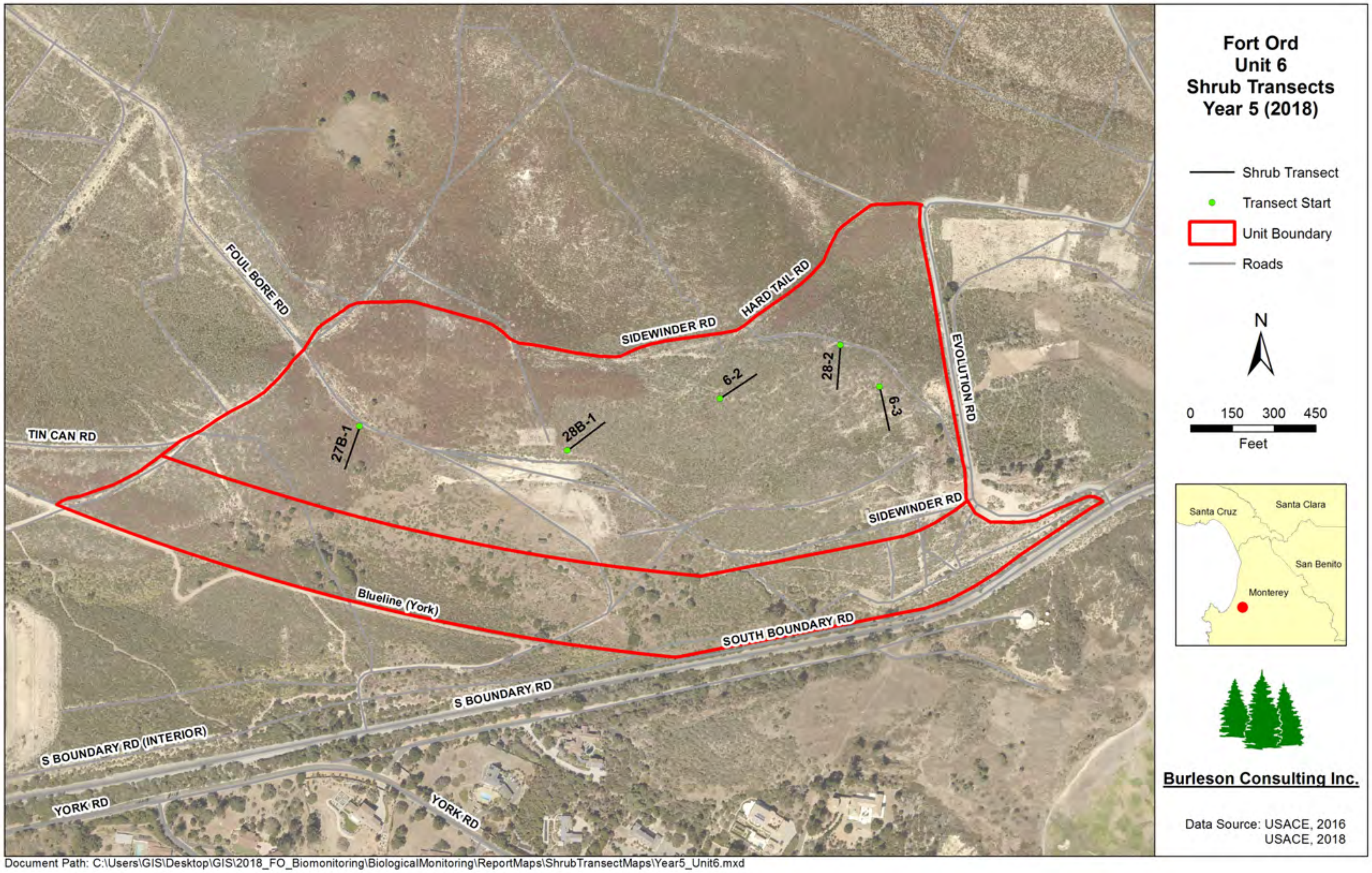


Figure C-10. Map of shrub transects, Unit 6 ($n_{Masticated}$=5 transects)

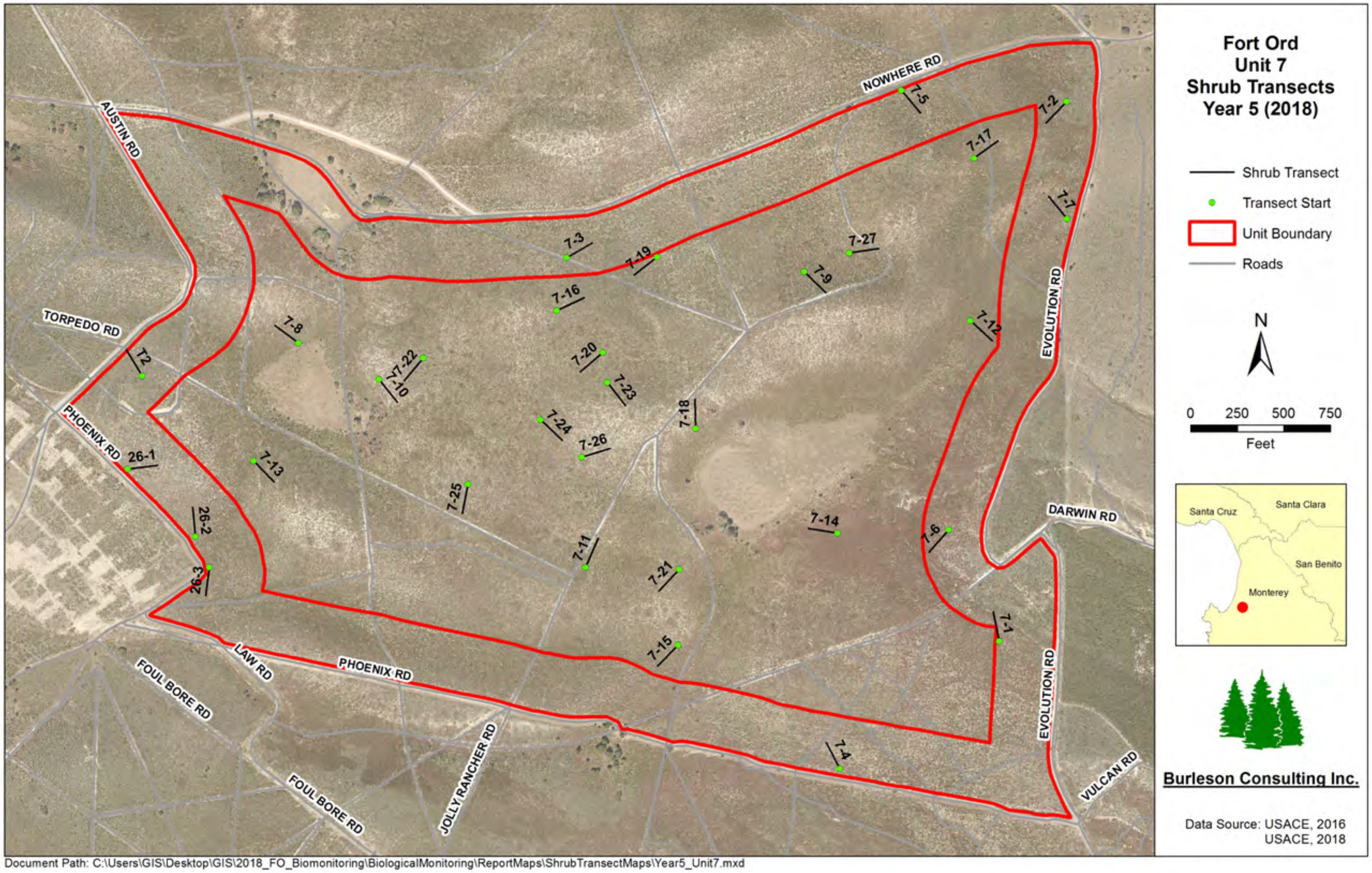
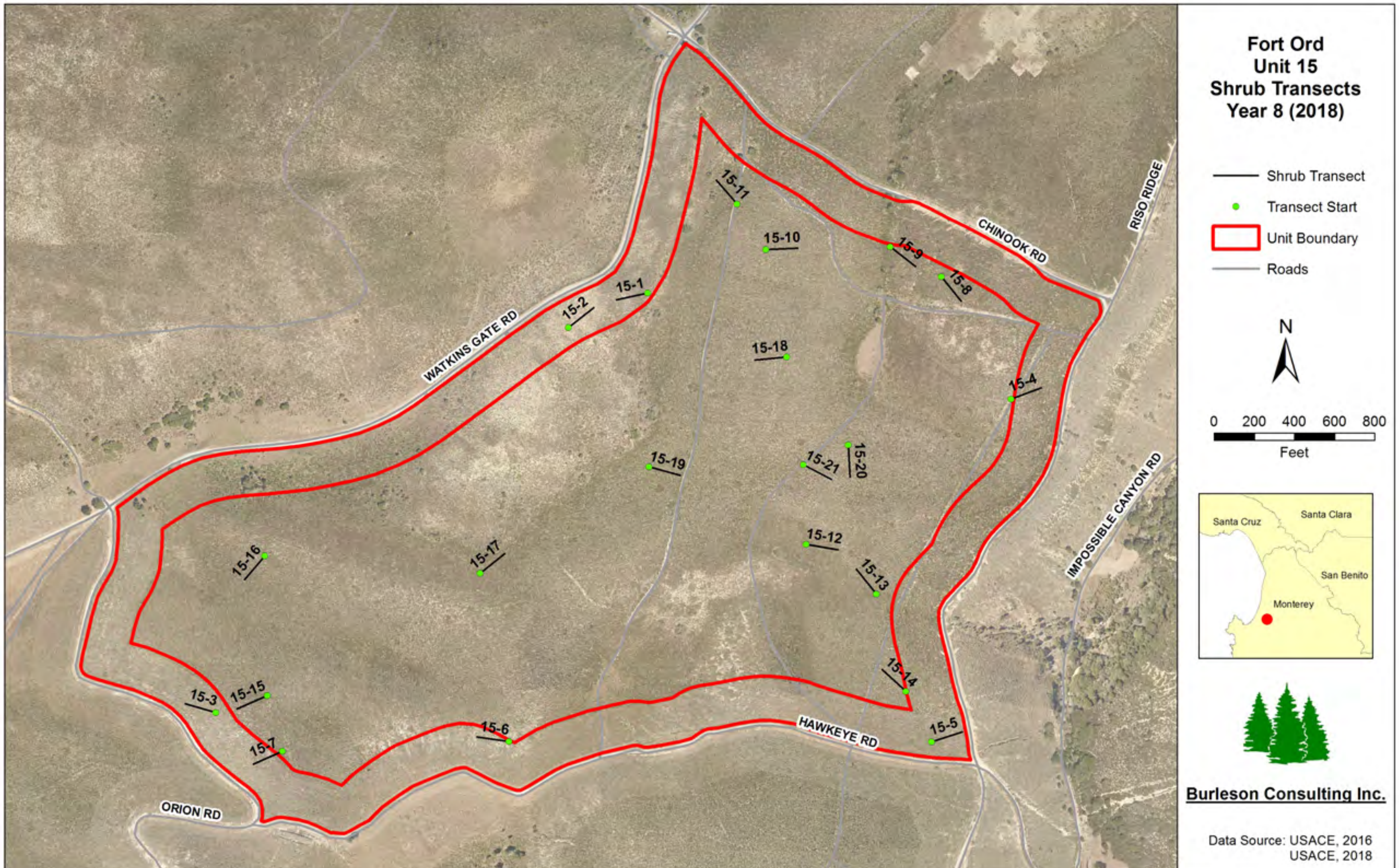


Figure C-11. Map of shrub transects, Unit 7 (n_{Burned}=20 transects; $n_{Masticated}$=2 transects; $n_{Masticated\&Burned}$=7 transects; n_{Mixed}=2 transects)

Figure C-12. Map of shrub transects, Unit 10 (n_{Burned}=22 transects; $n_{Masticated}$=2 transects; $n_{Masticated\&Burned}$=5 transects)

Document Path: C:\Users\GIS\Desktop\GIS\2018_FO_Biomonitoring\BiologicalMonitoring\ReportMaps\ShrubTransectMaps\Year5_WGBA.mxd

Figure C-13. Map of shrub transects, WGBA ($n_{Masticated}$=7 transects)



Document Path: C:\Users\GIS\Desktop\GIS\2018_FO_Biomonitoring\BiologicalMonitoring\ReportMaps\ShrubTransectMaps\Year8_Unit15.mxd

Figure C-14. Map of shrub transects, Unit 15 (n_{Burned}=14 transects; $n_{Masticated}$=7 transects)

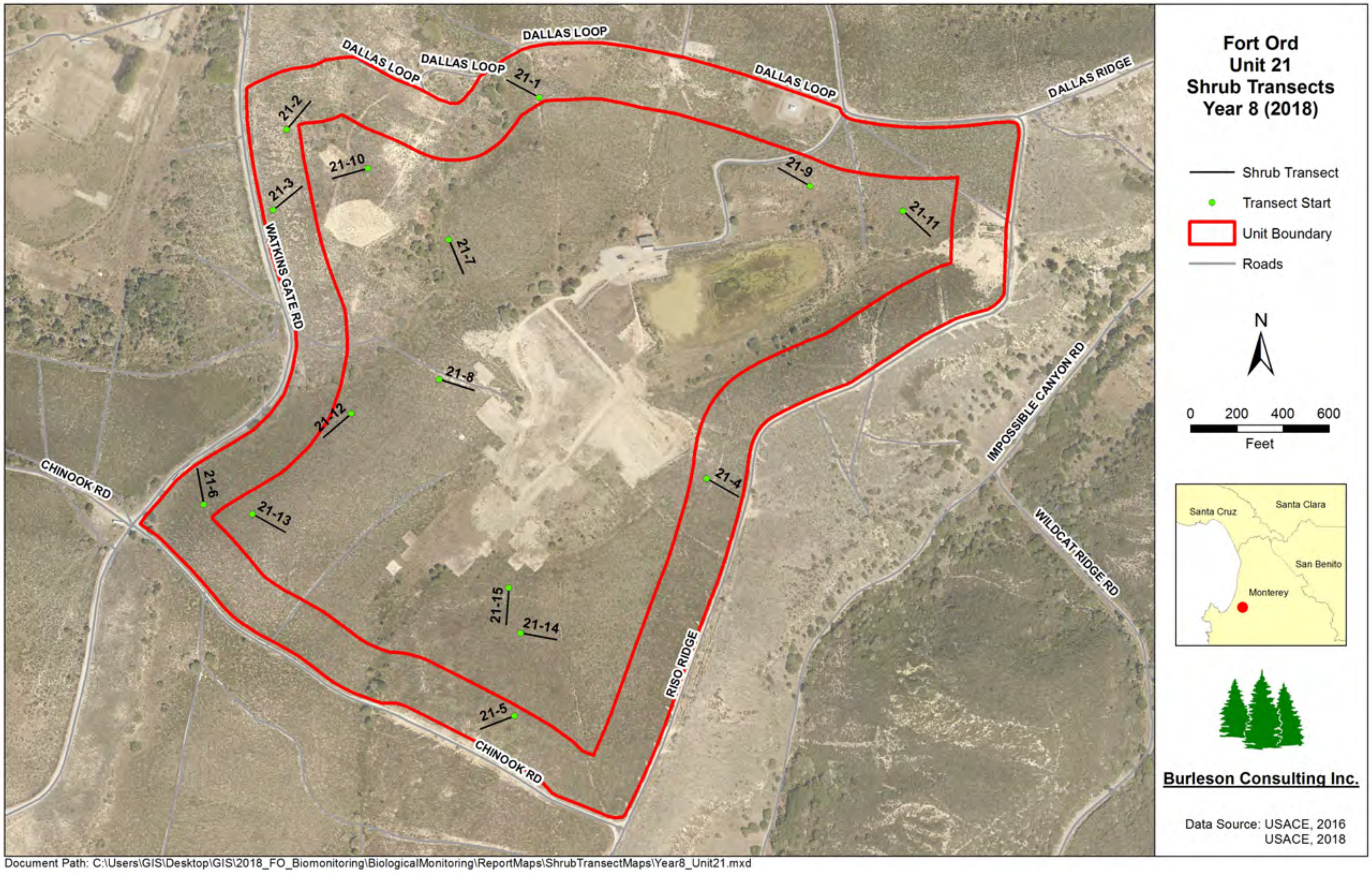


Figure C-15. Map of shrub transects, Unit 21 (n_{Burned}=9 transects; $n_{Masticated}$=6 transects)

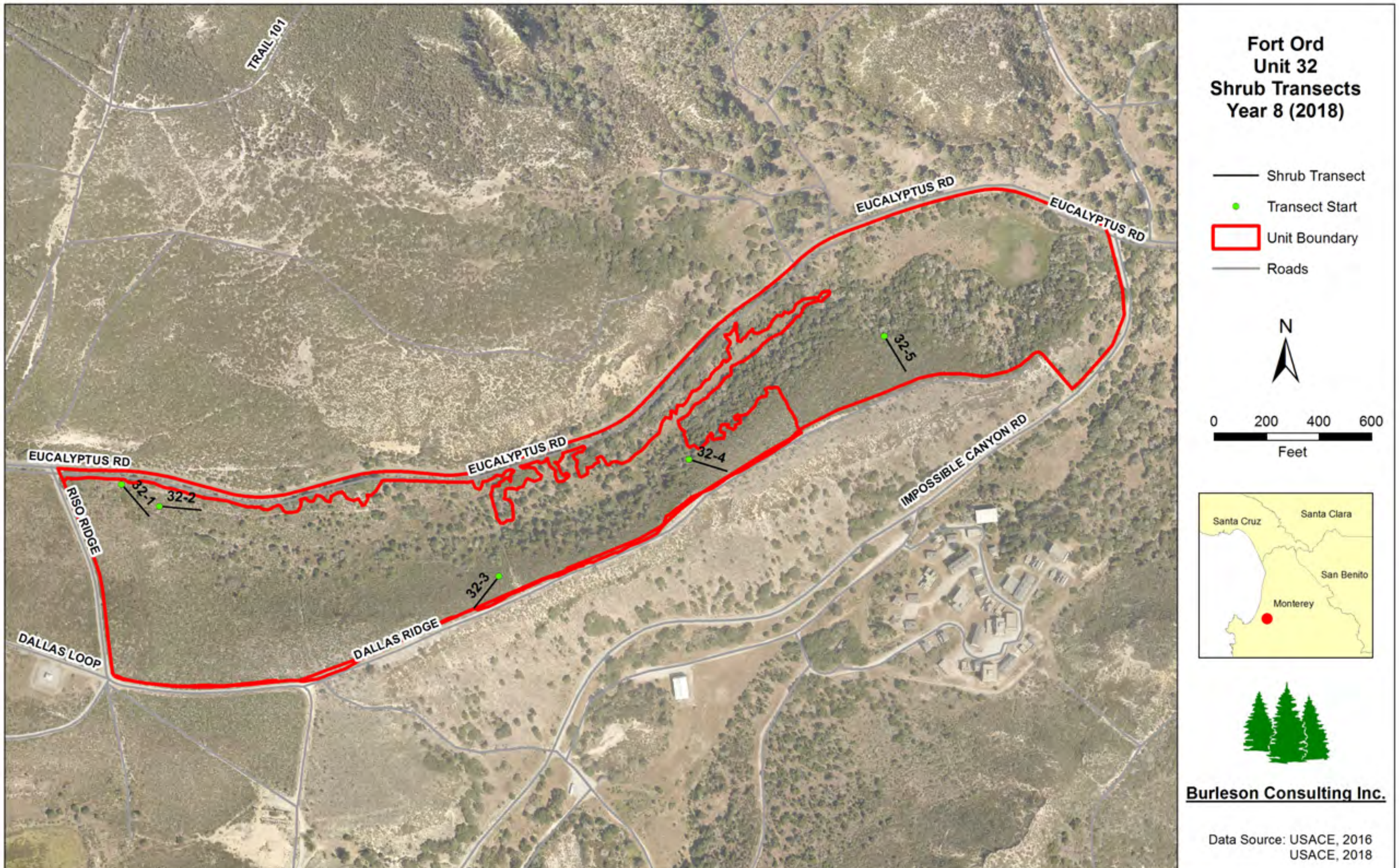


Figure C-16. Map of shrub transects, Unit 32 (n_{Mixed}=1 transect; $n_{Masticated}$=3 transects)

Figure C-17. Map of shrub transects, Unit 34 ($n_{Masticated\&Burned}$=4 transects)

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APPENDIX D

MAPS: ANNUAL GRASS DENSITY

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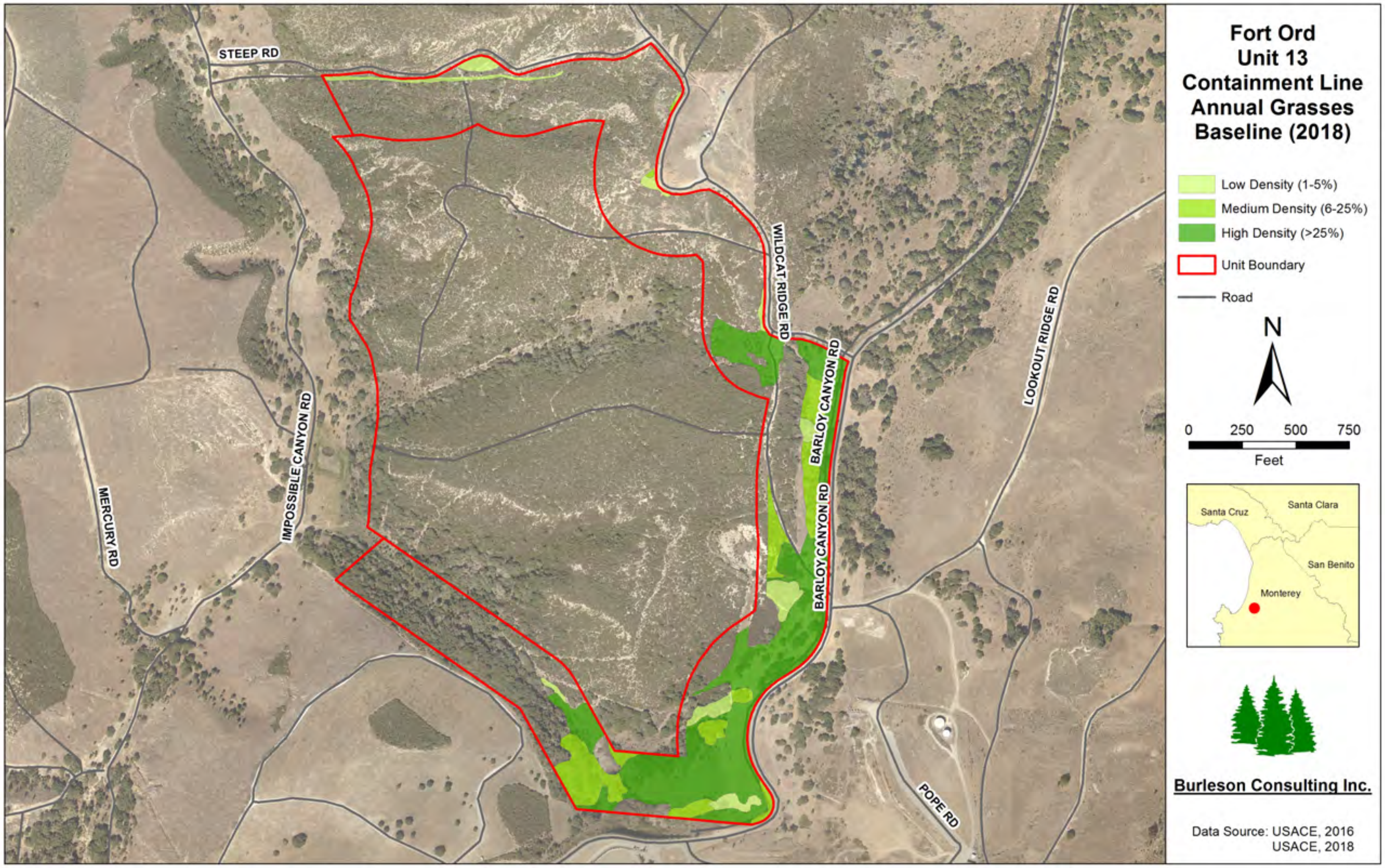

Figure D-1. Map of Annual Grass Density, Unit 13 Containment Line

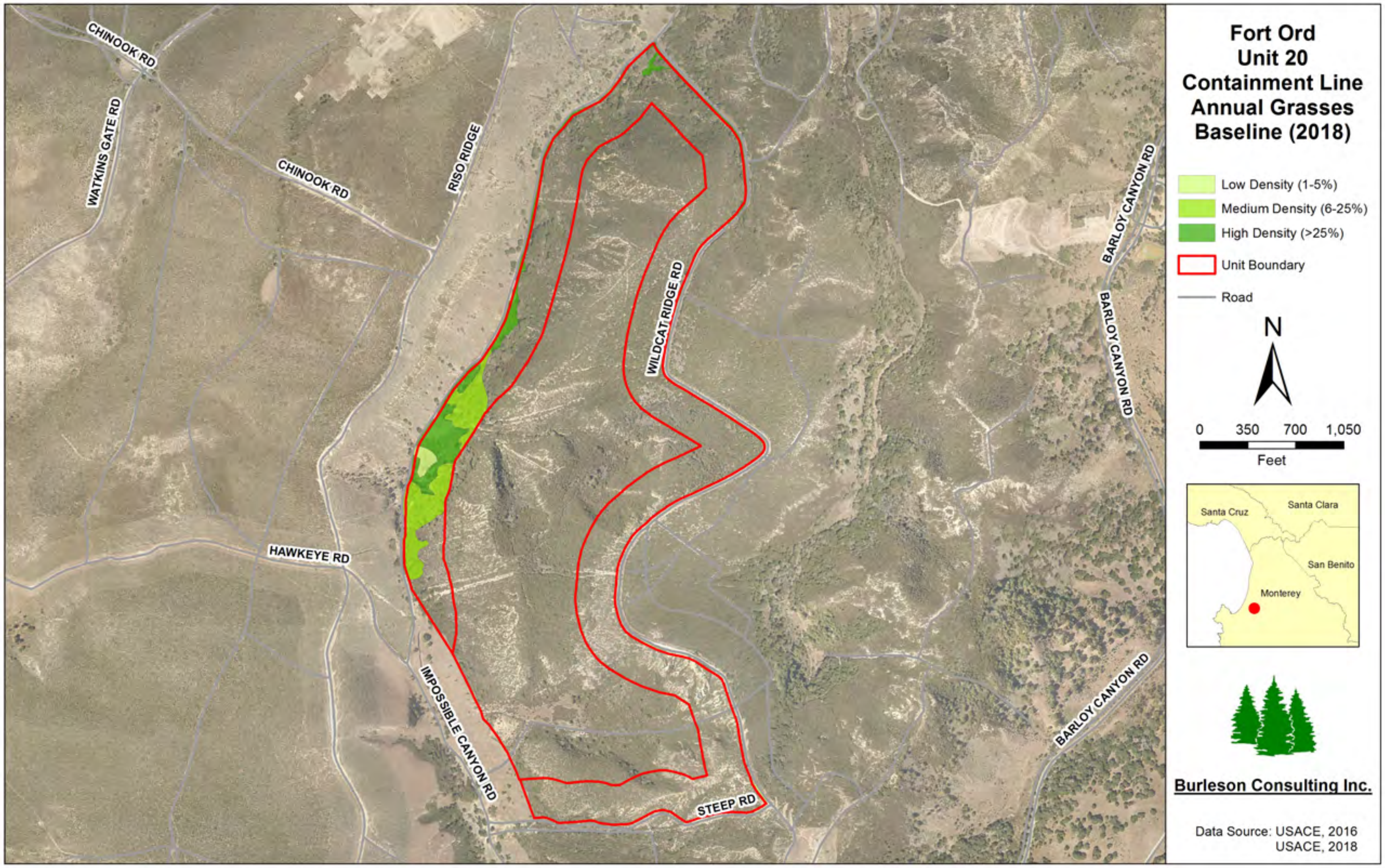

Figure D-2. Map of Annual Grass Density, Unit 20 Containment Line

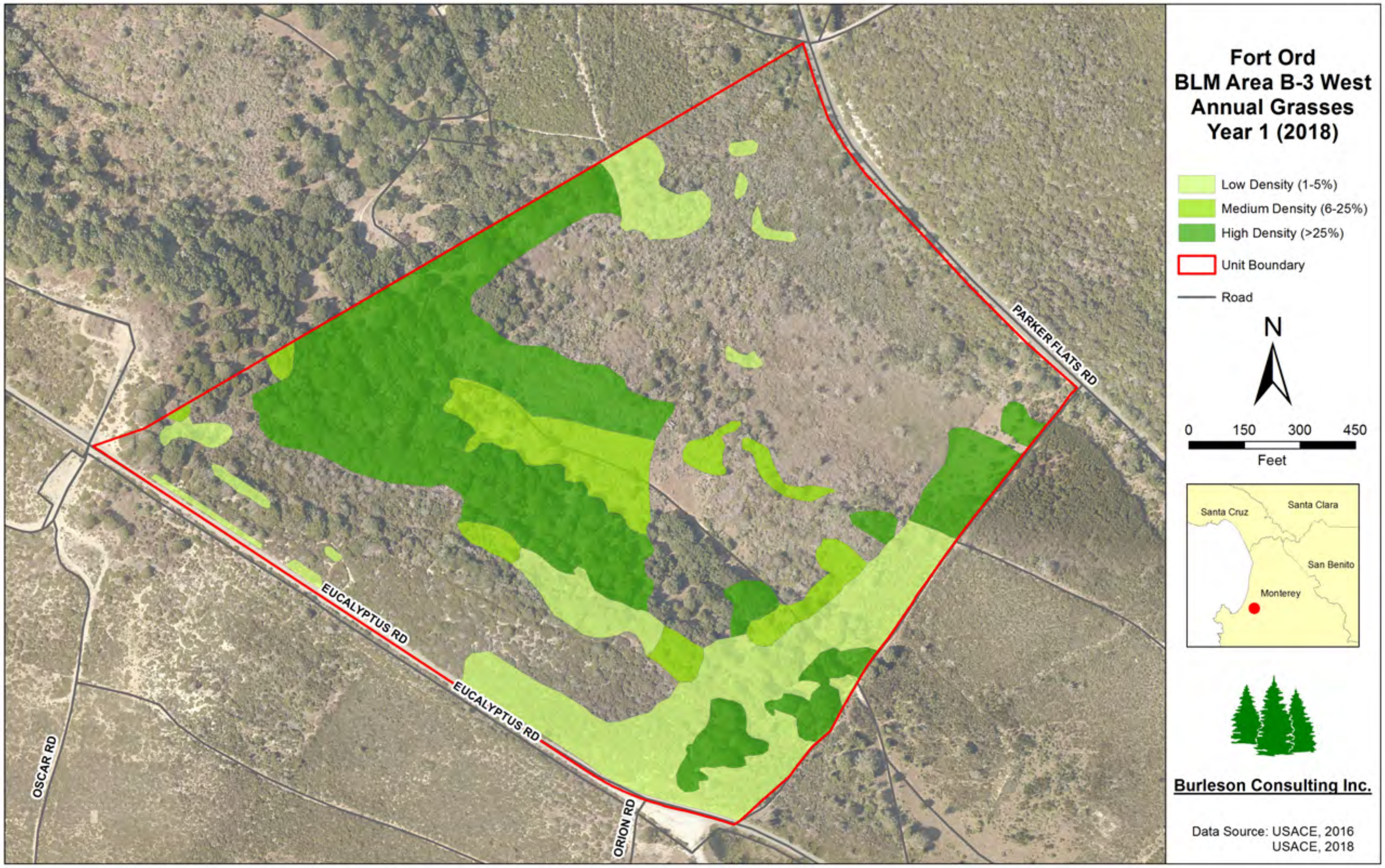

Figure D-3. Map of Annual Grass Density, BLM Area B-3 West

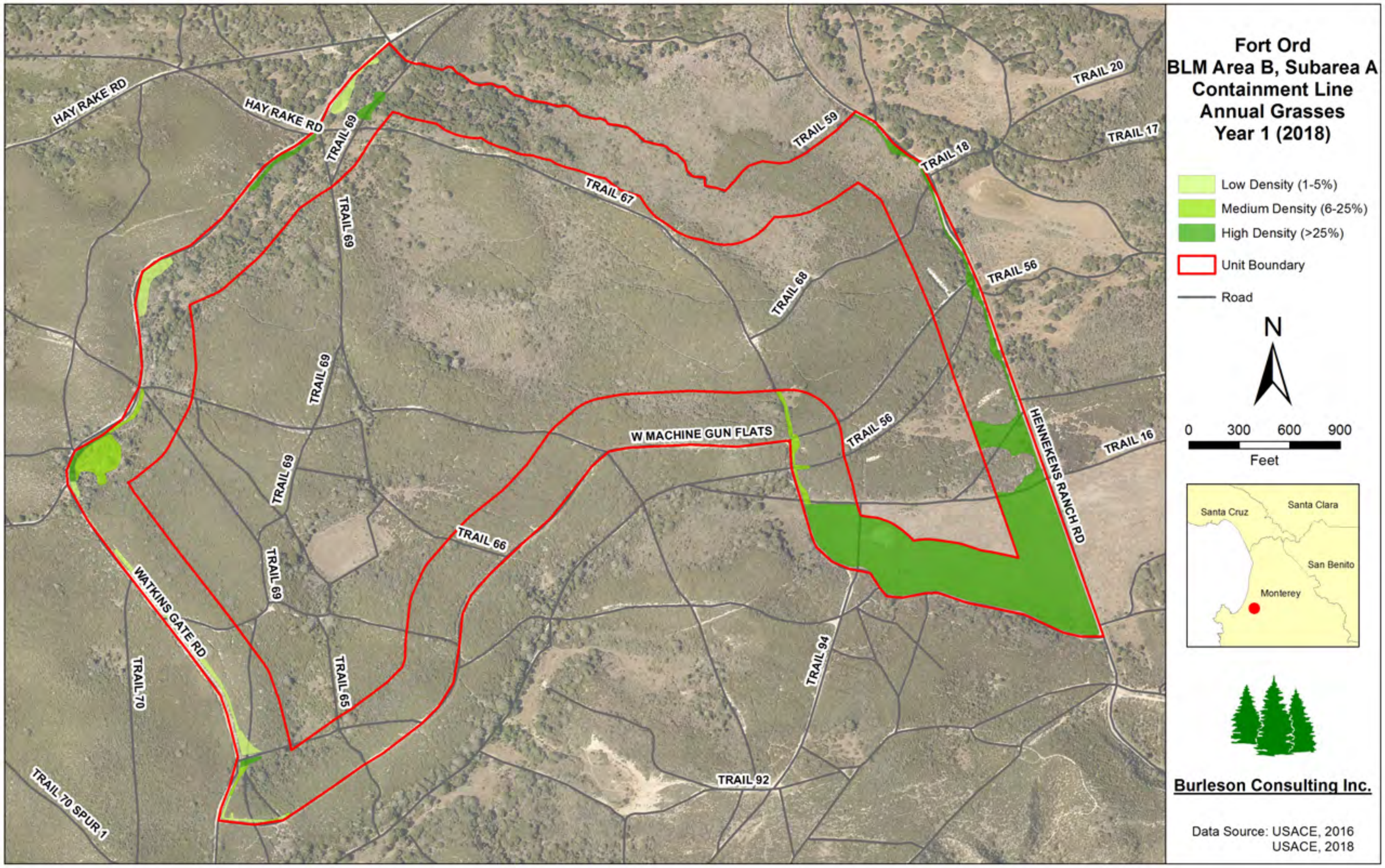

Figure D-4. Map of Annual Grass Density, BLM Area B Subarea A Containment Line

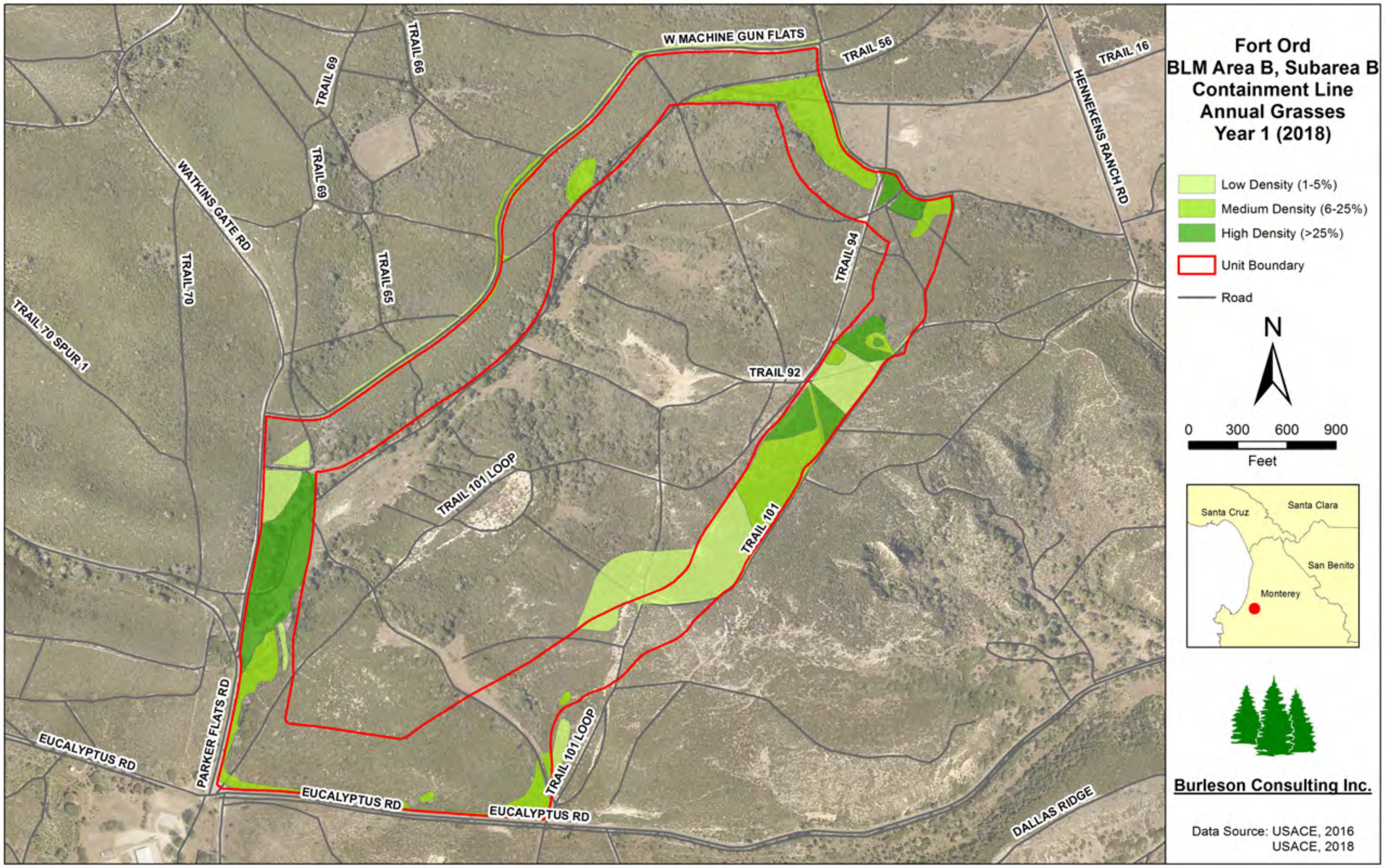

Figure D-5. Map of Annual Grass Density, BLM Area B Subarea B Containment Line

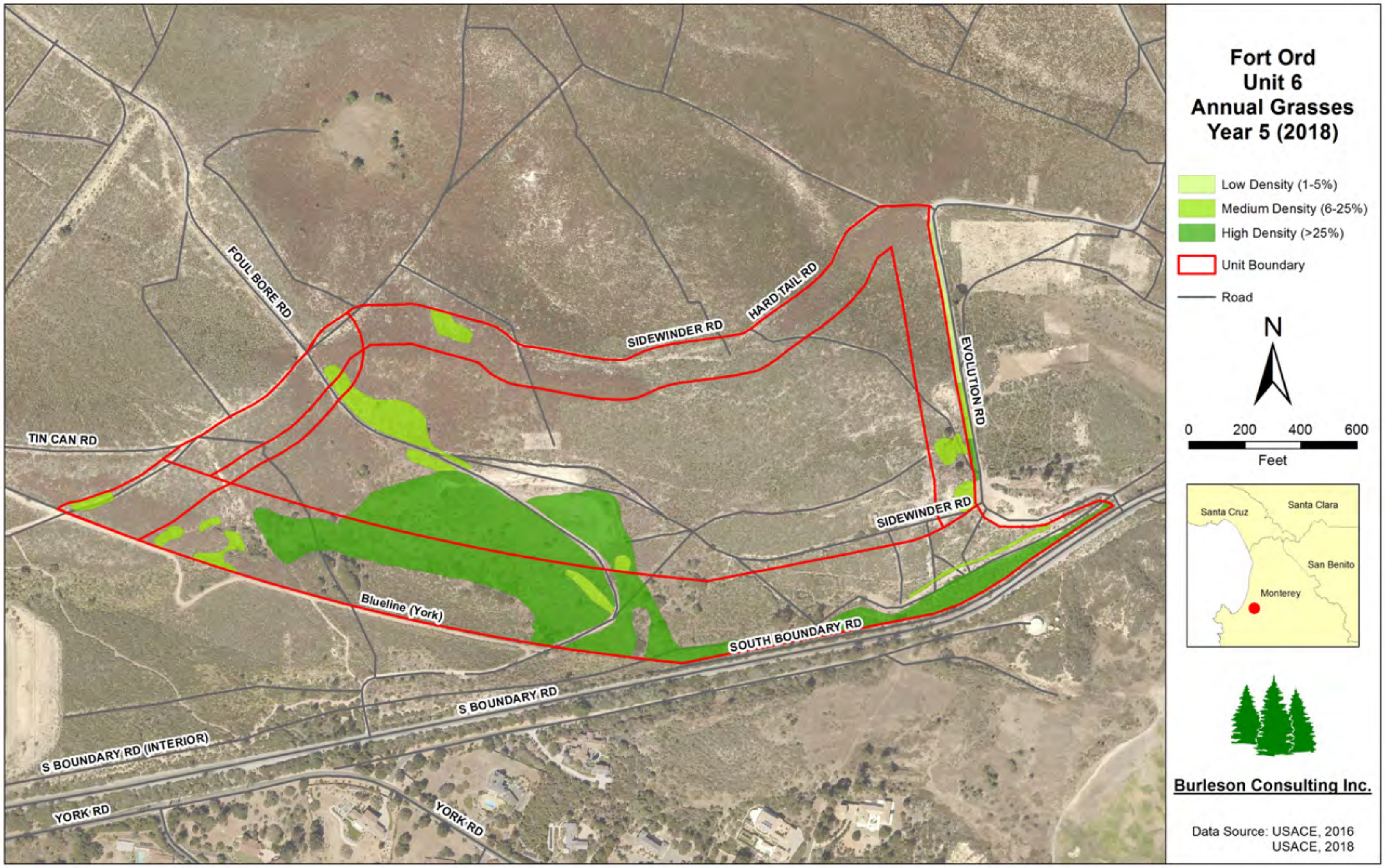

Figure D-6. Map of Annual Grass Density, Unit 6

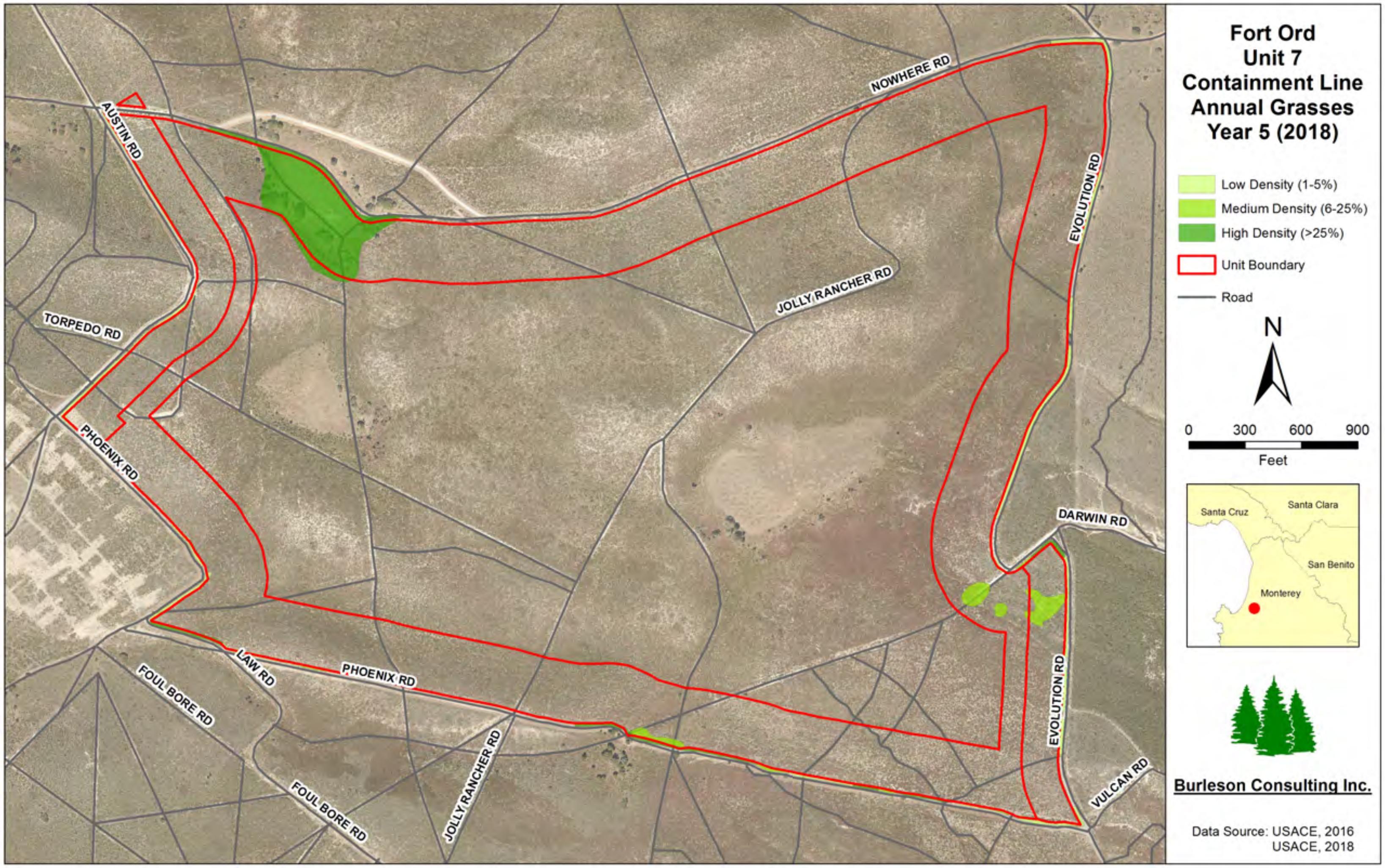

Figure D-7. Map of Annual Grass Density, Unit 7 Containment Line

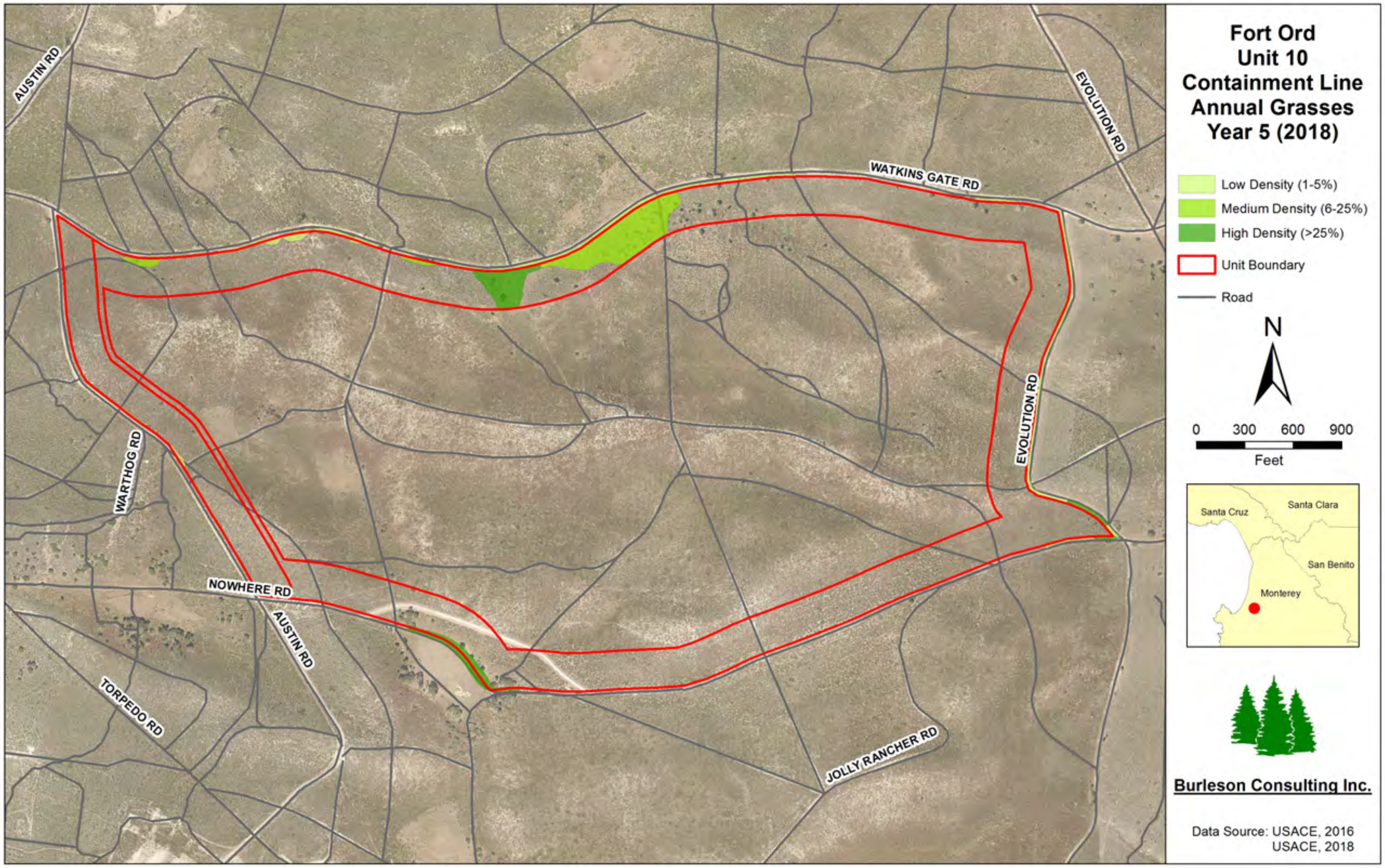

Figure D-8. Map of Annual Grass Density, Unit 10 Containment Line

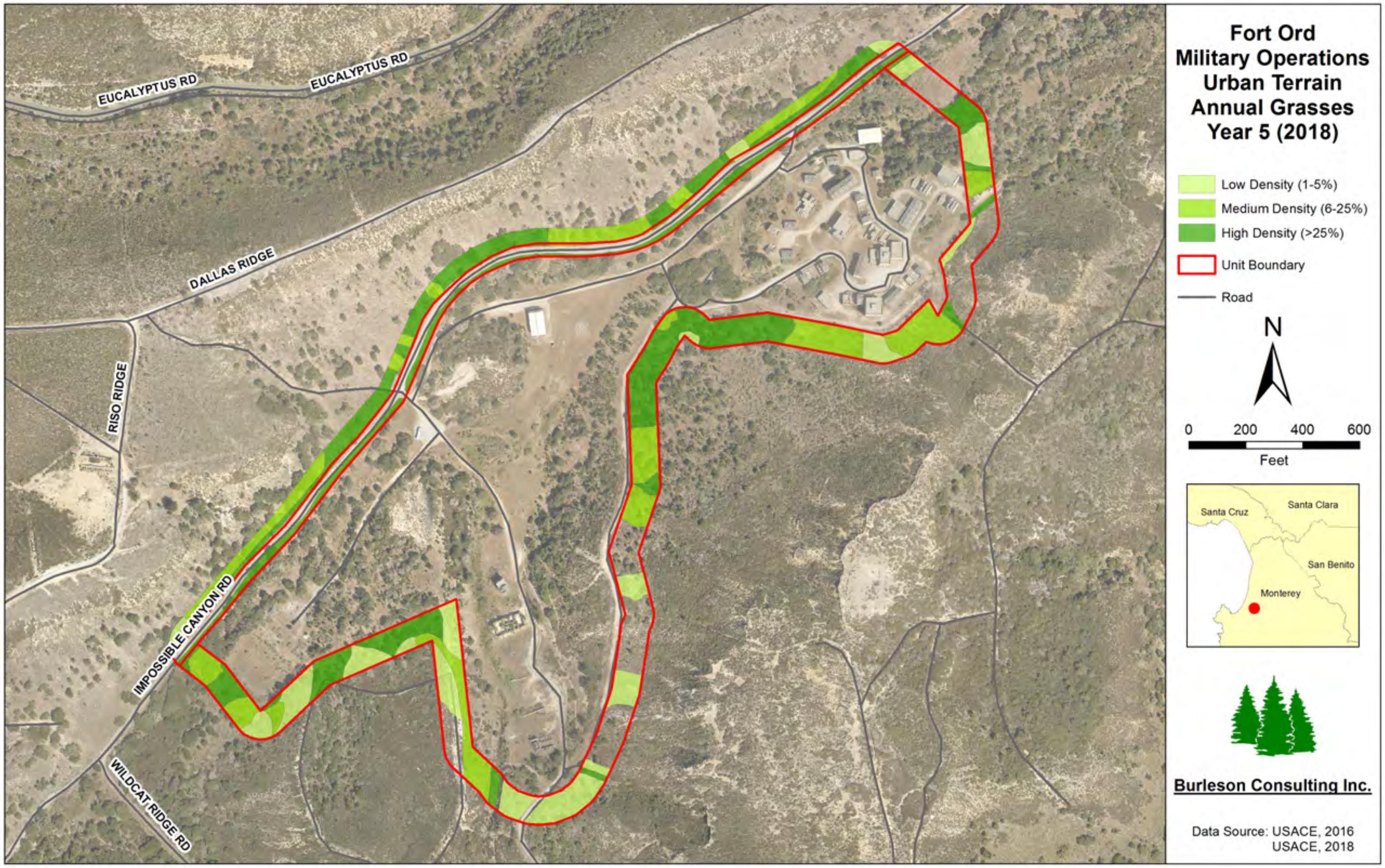

Figure D-9. Map of Annual Grass Density, MOUT Buffer Containment Line

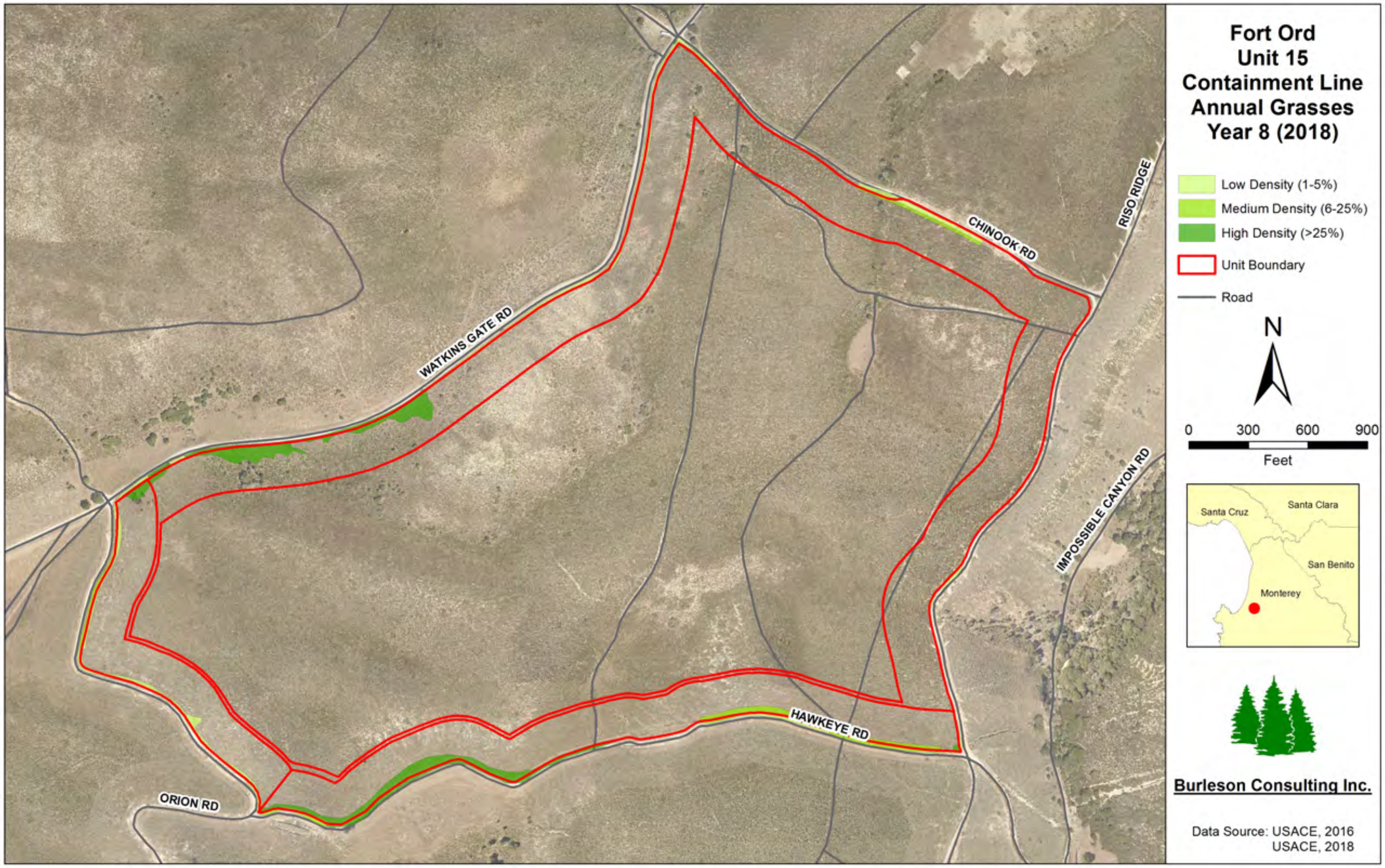

Figure D-10. Map of Annual Grass Density, Unit 15 Containment Line

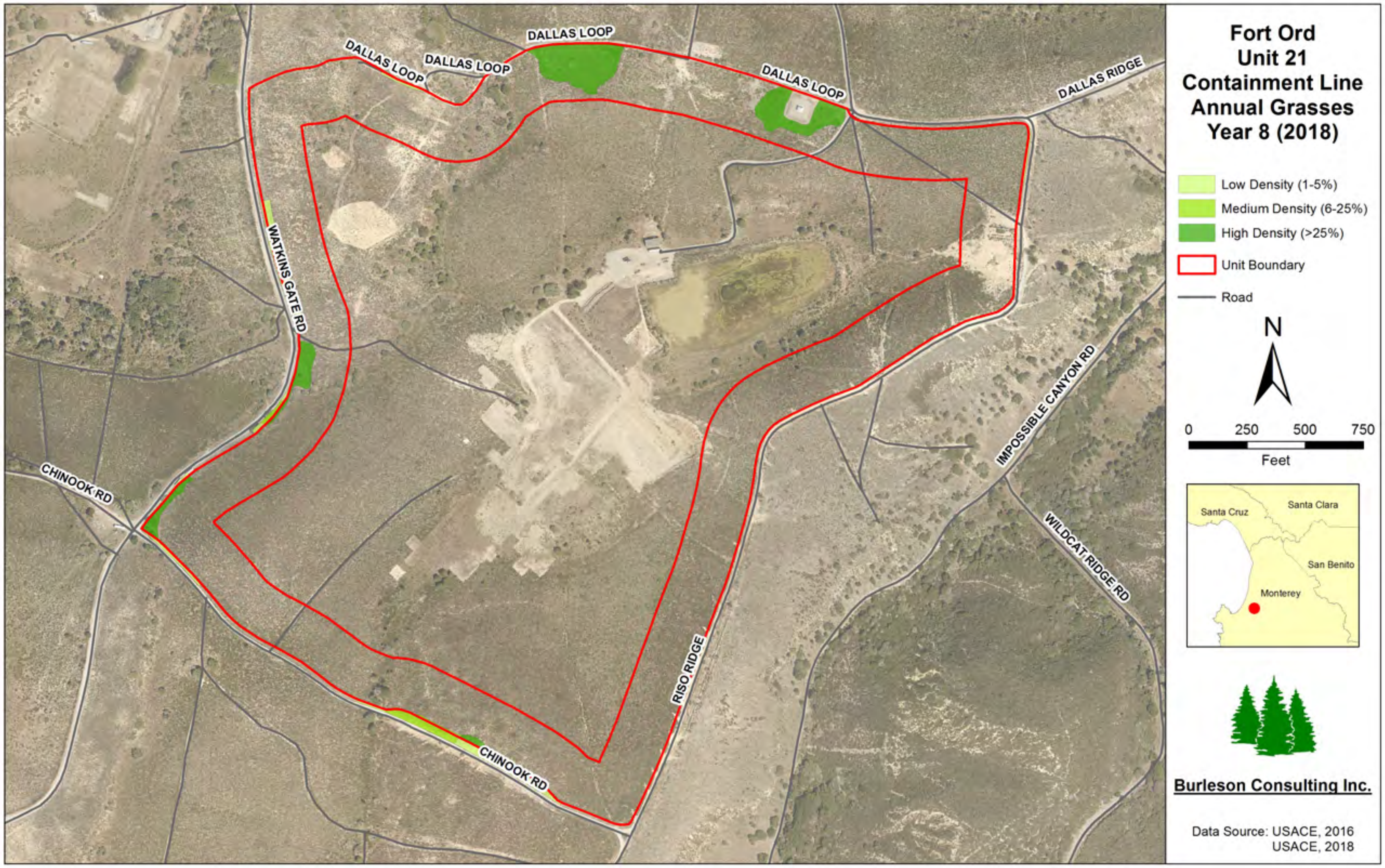

Figure D-11. Map of Annual Grass Density, Unit 21 Containment Lines

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APPENDIX E

MAPS: INVASIVE AND RARE SPECIES

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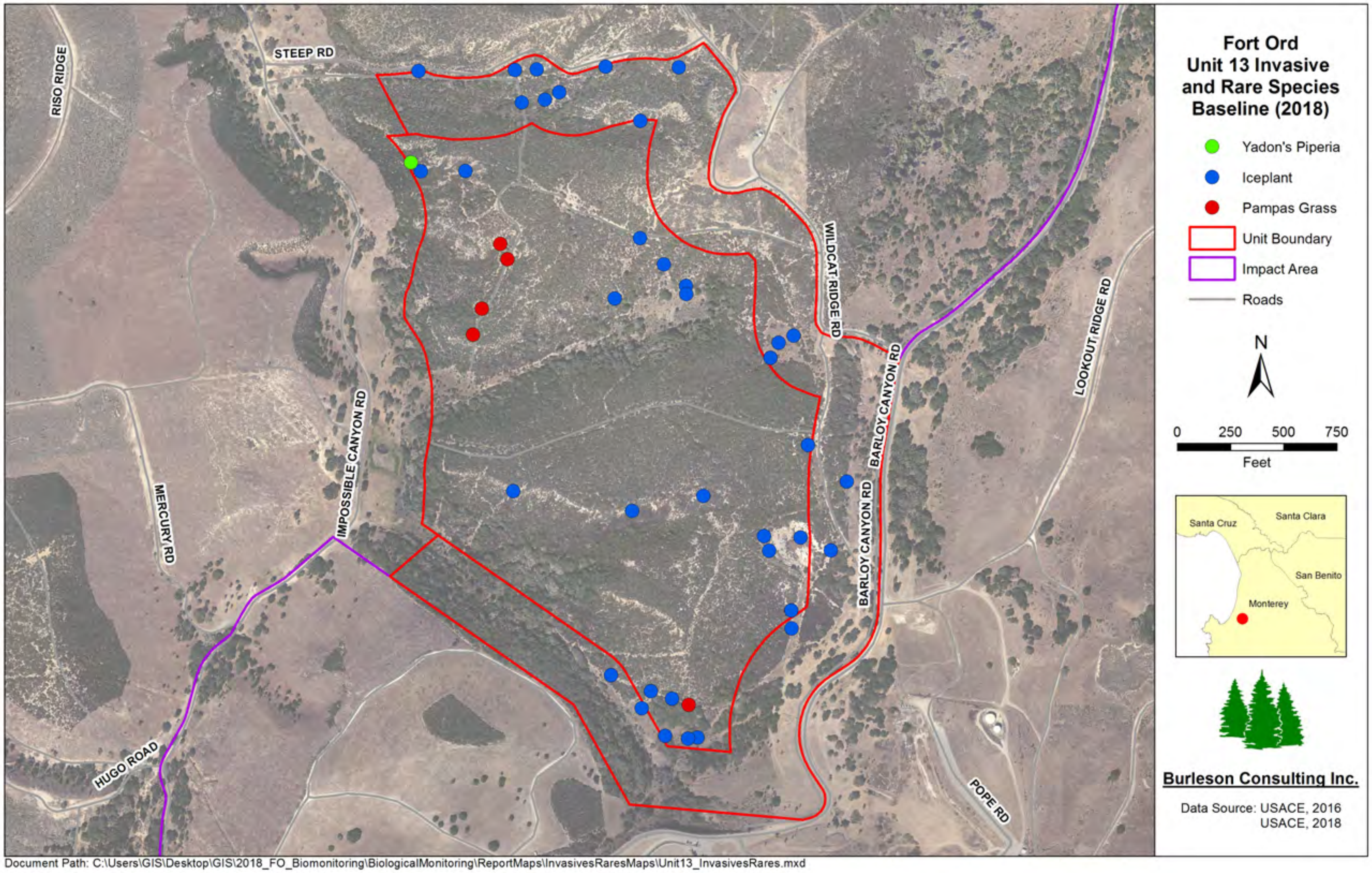

Figure E-1. Map of Invasive and Rare Species, Unit 13

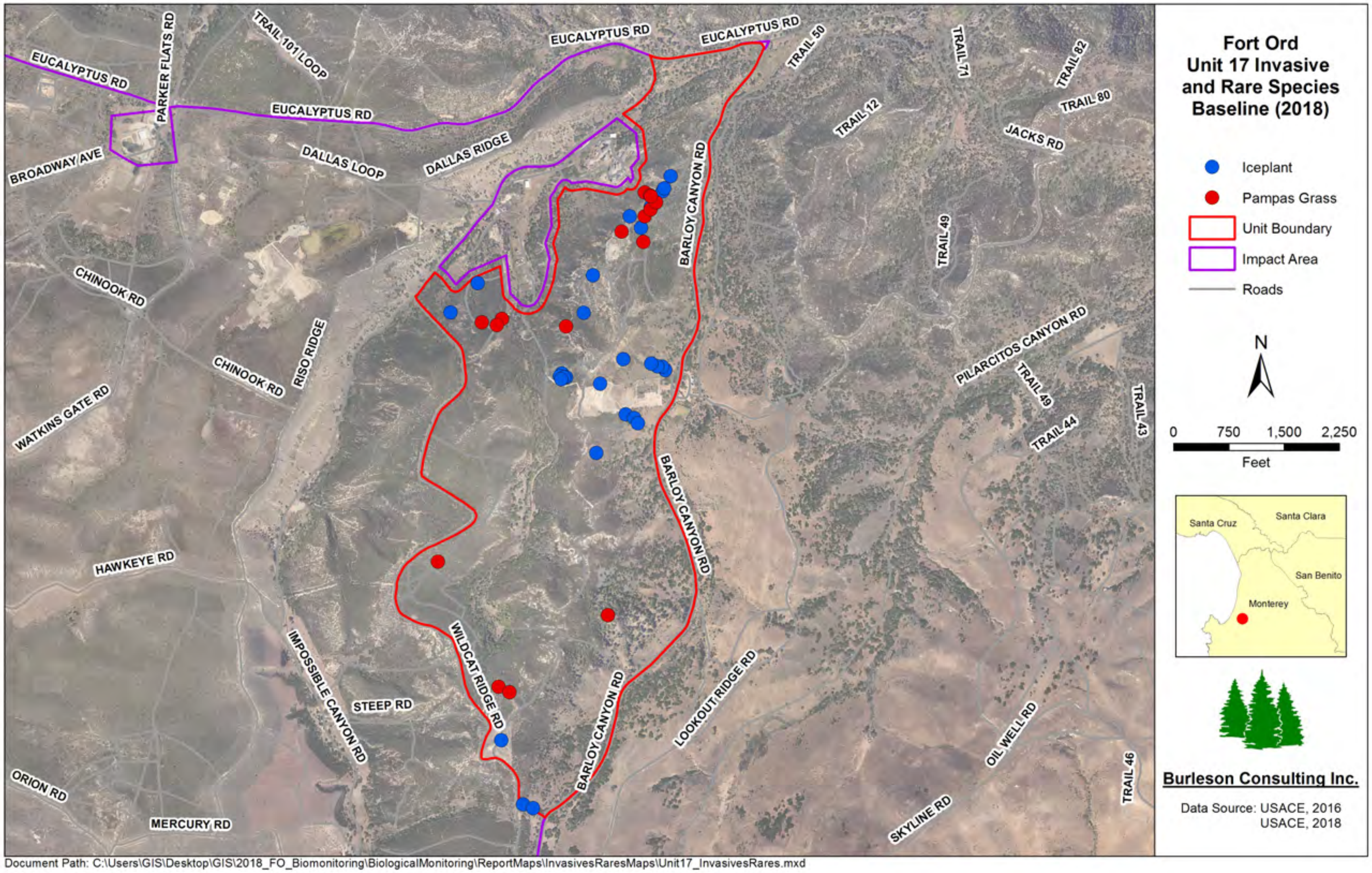

Figure E-2. Map of Invasive and Rare Species, Unit 17

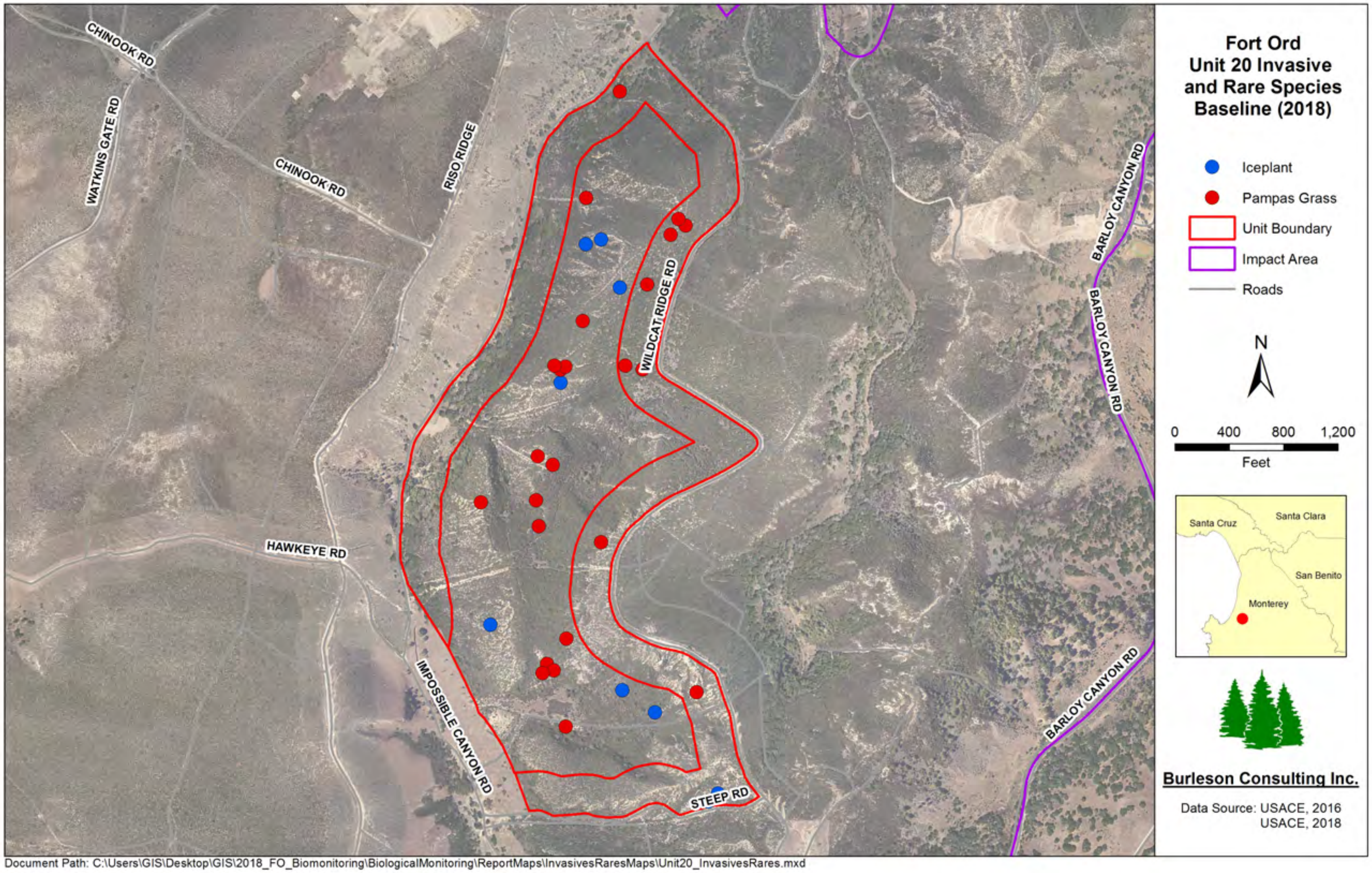

Figure E-3. Map of Invasive and Rare Species, Unit 20

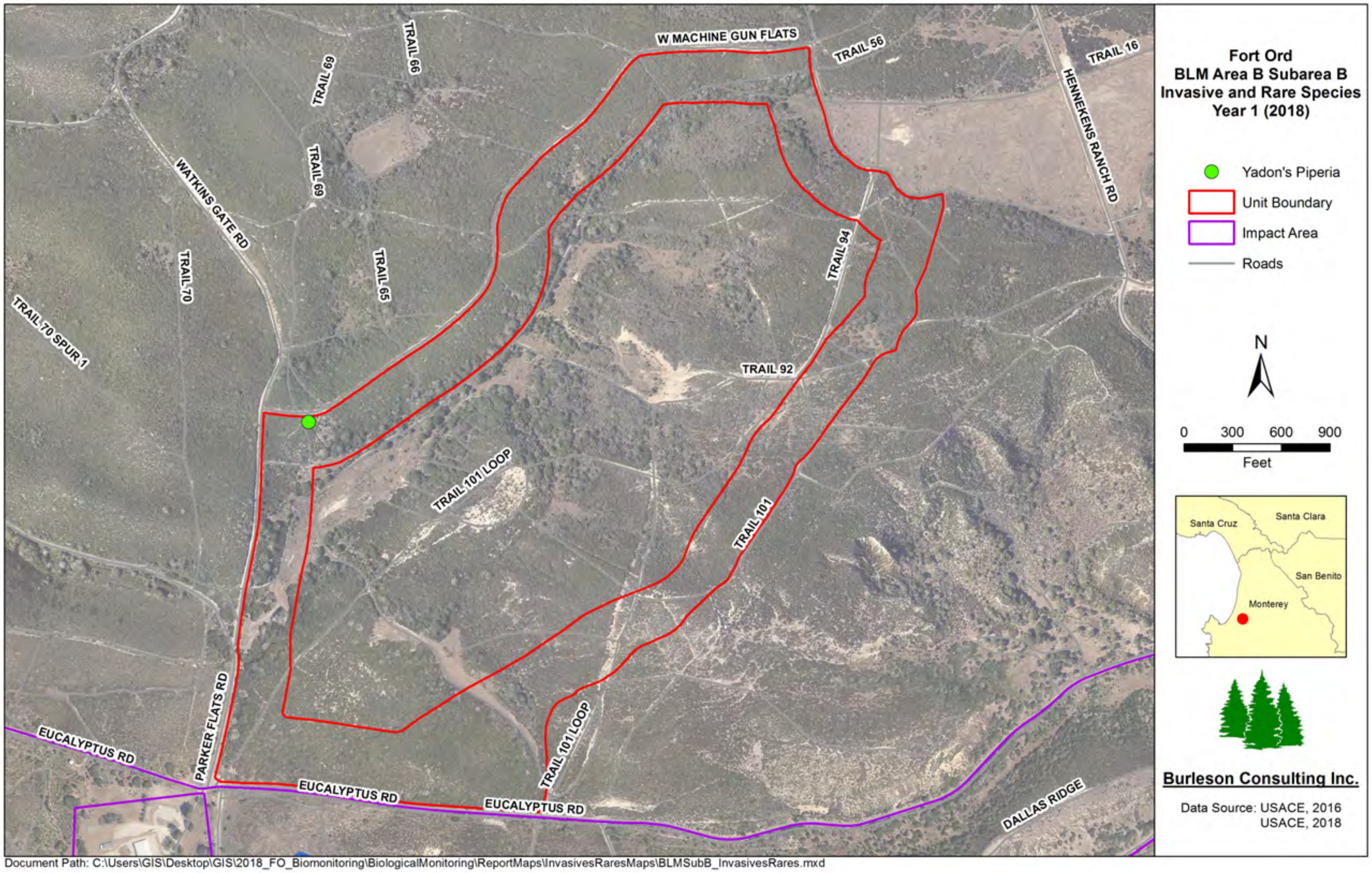

Figure E-4. Map of Invasive and Rare Species, BLM Area B Subarea B Containment Line

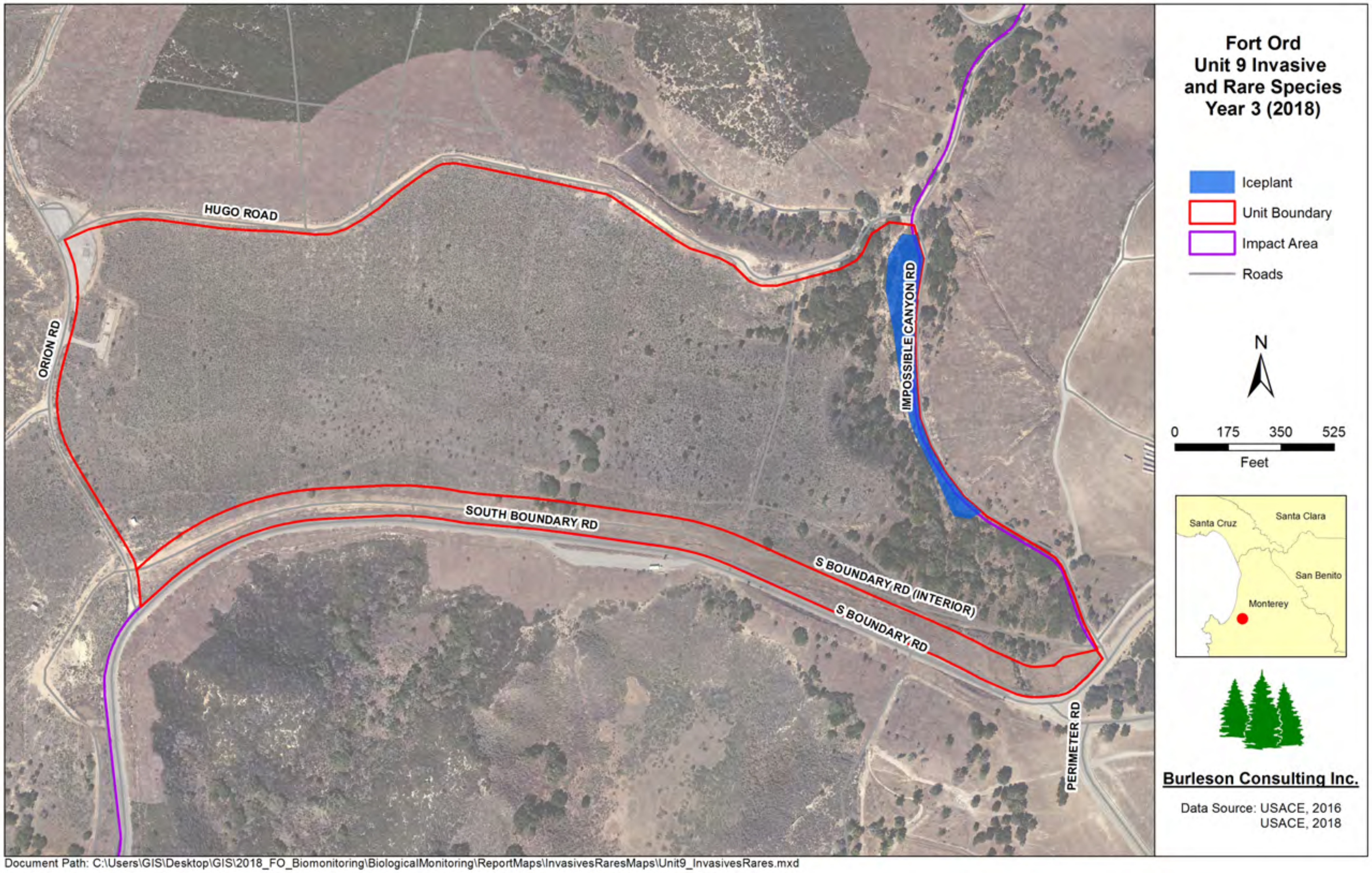

Figure E-5. Map of Invasive and Rare Species, Unit 9

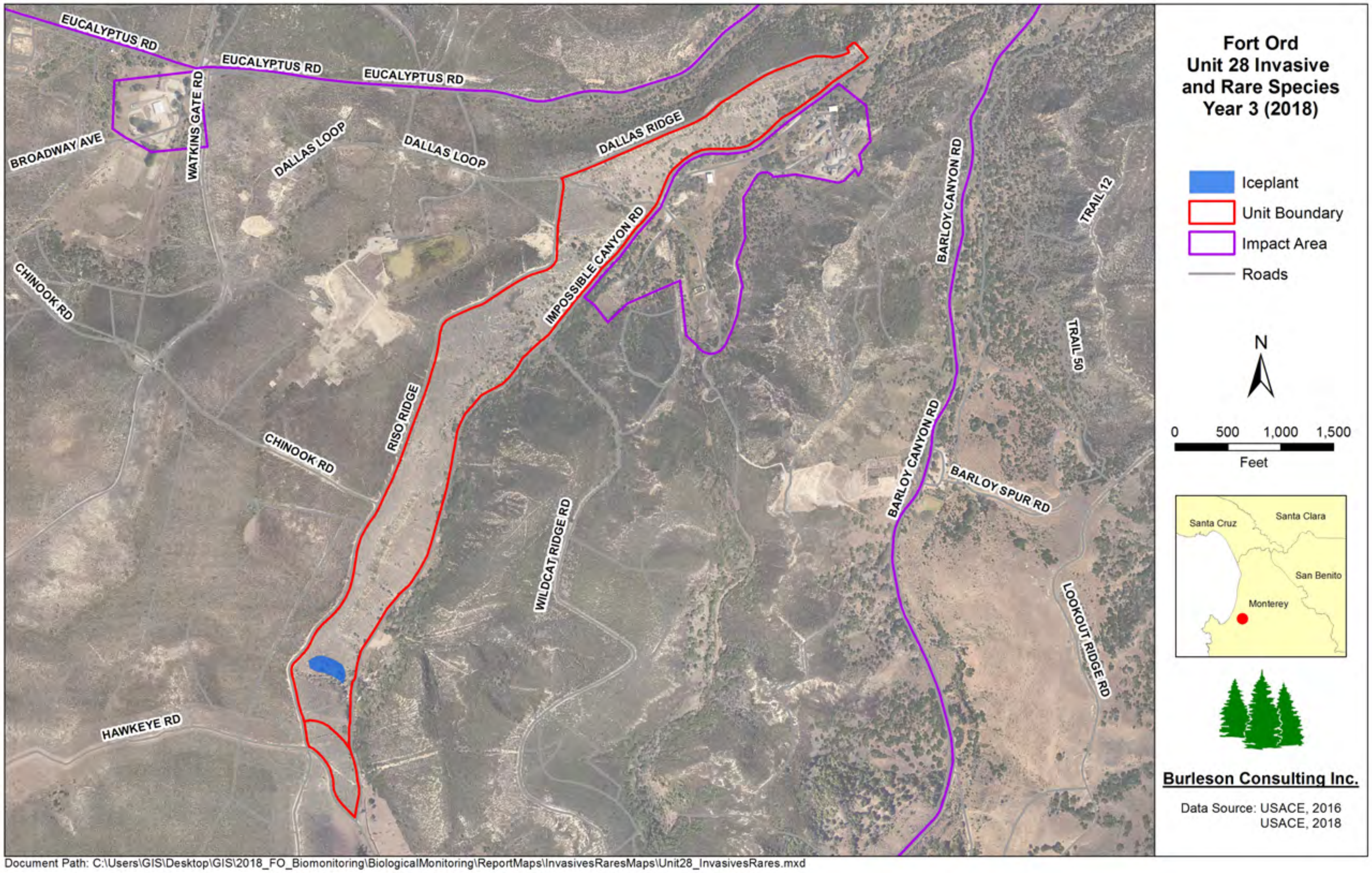

Figure E-6. Map of Invasive and Rare Species, Unit 28

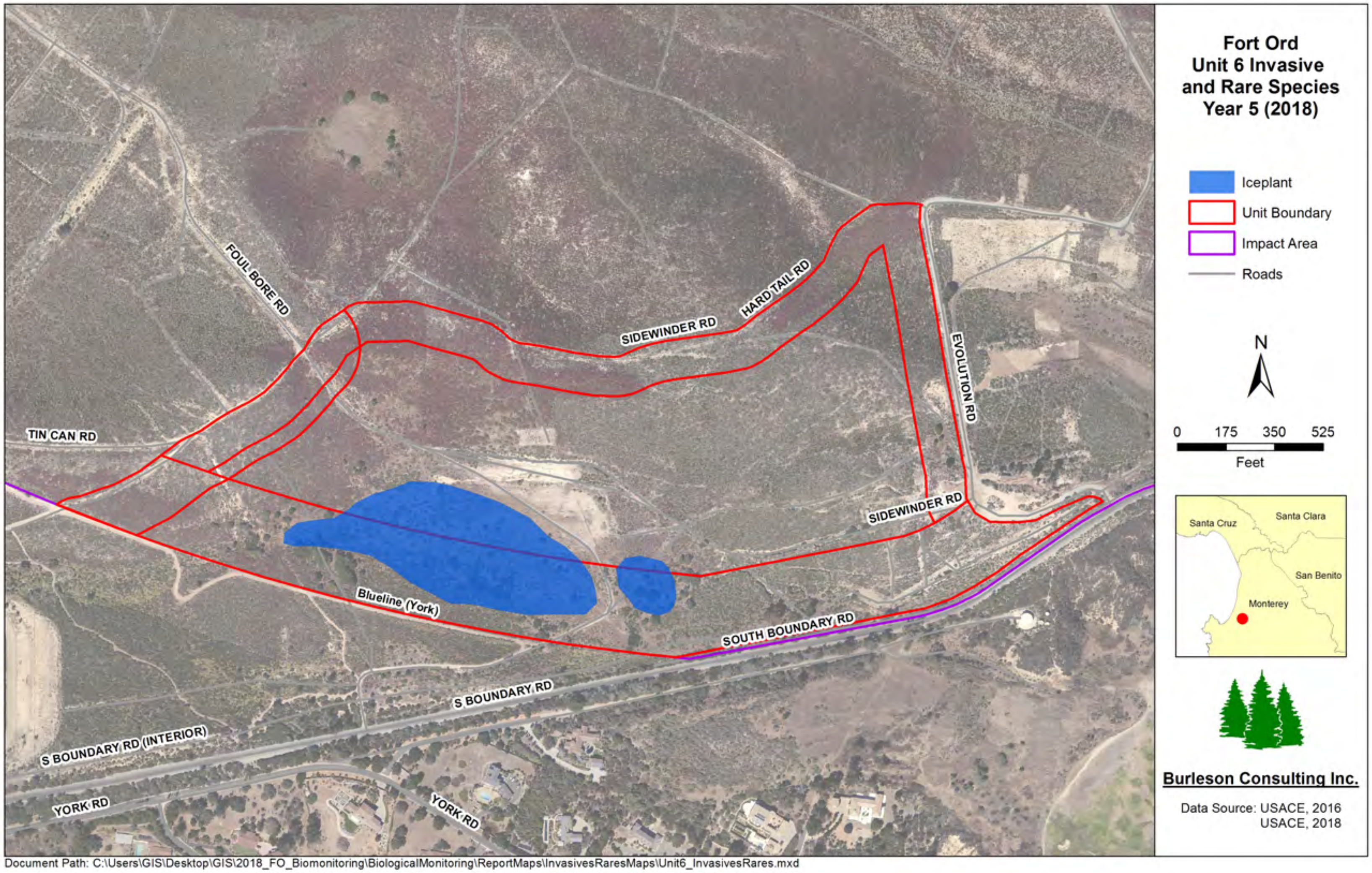

Figure E-7. Map of Invasive and Rare Species, Unit 6

Figure E-8. Map of Invasive and Rare Species, Unit 7

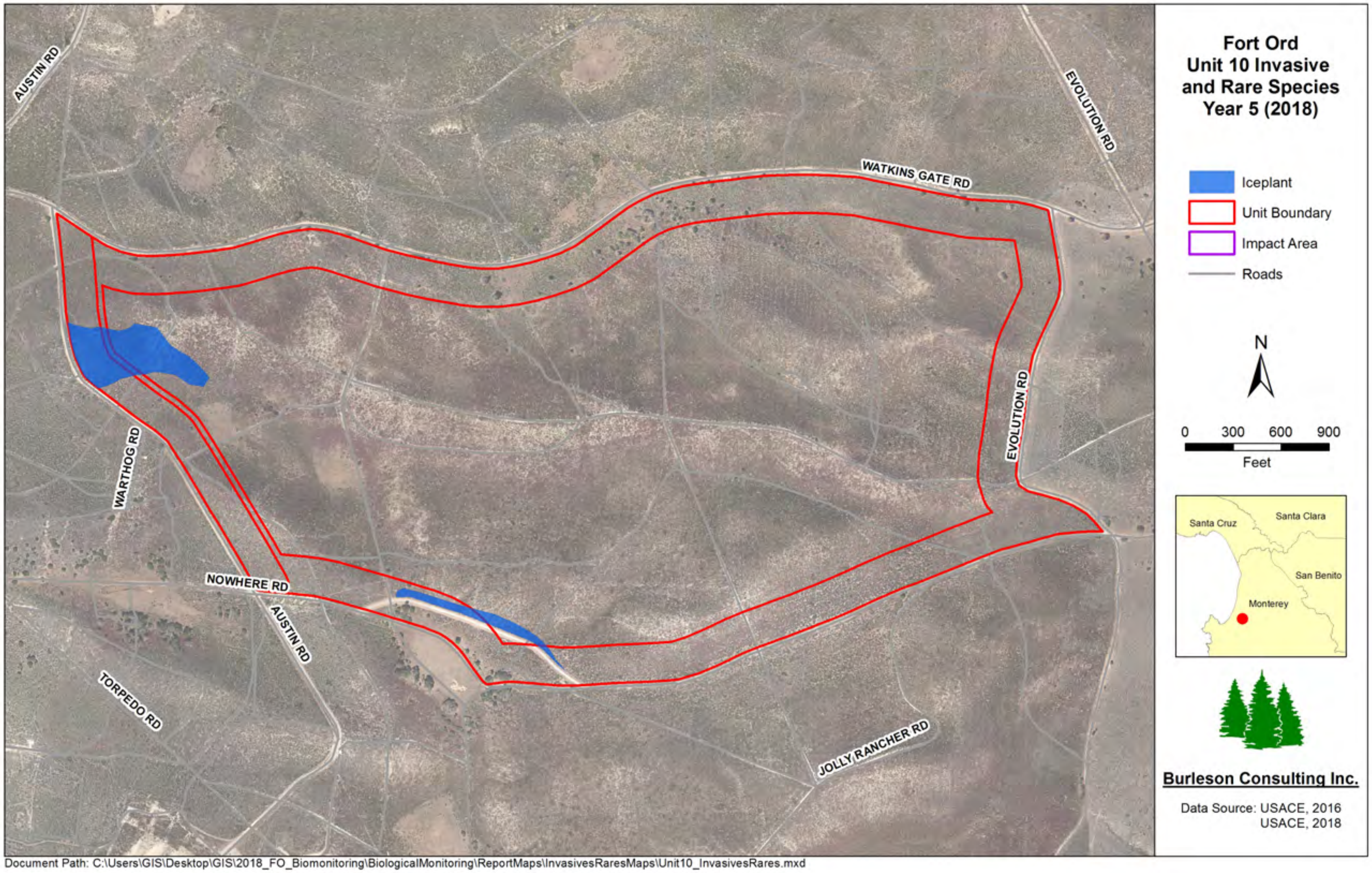

Figure E-9. Map of Invasive and Rare Species, Unit 10

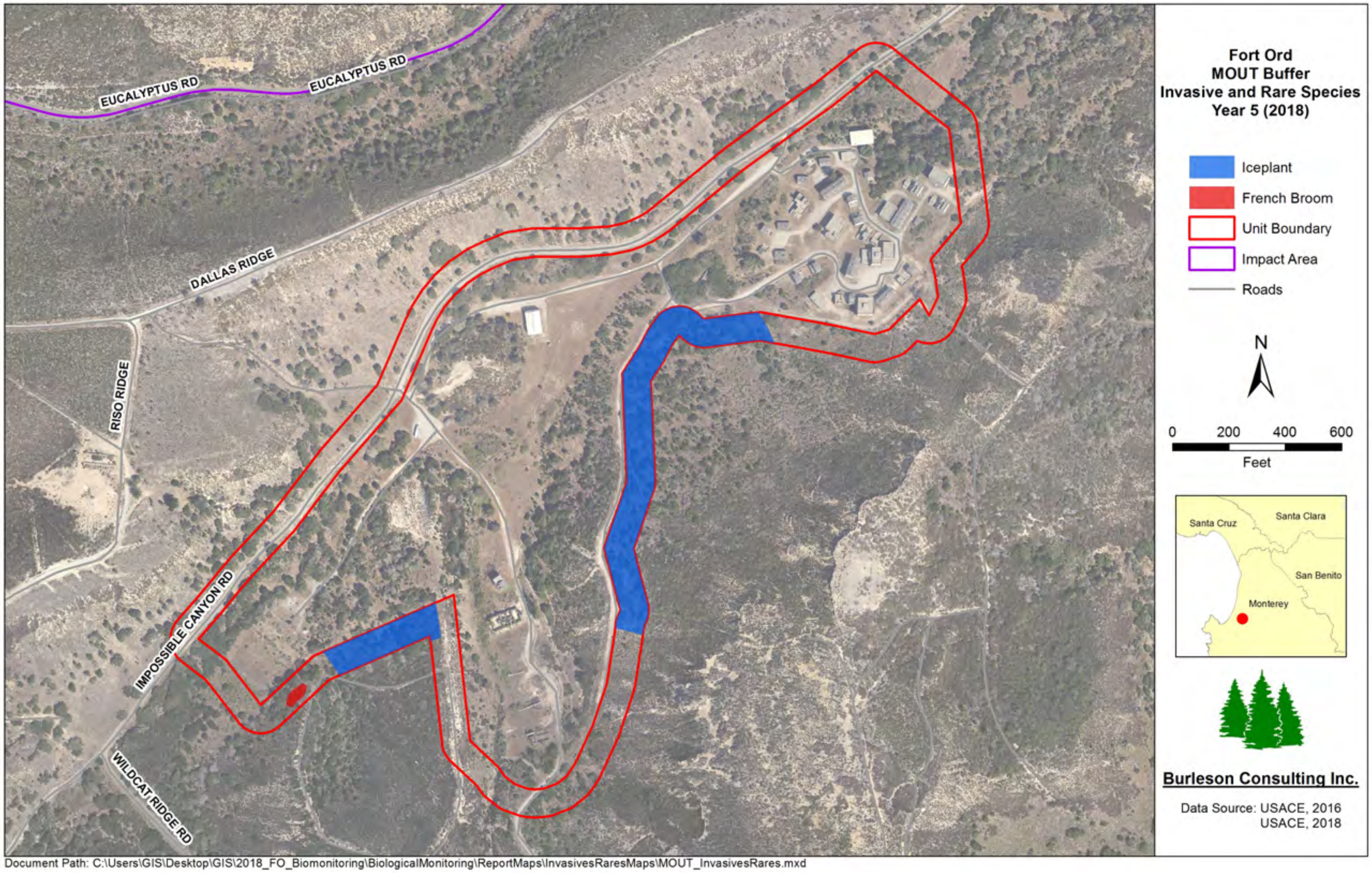

Figure E-10. Map of Invasive and Rare Species, Military Operations Urban Terrain Buffer

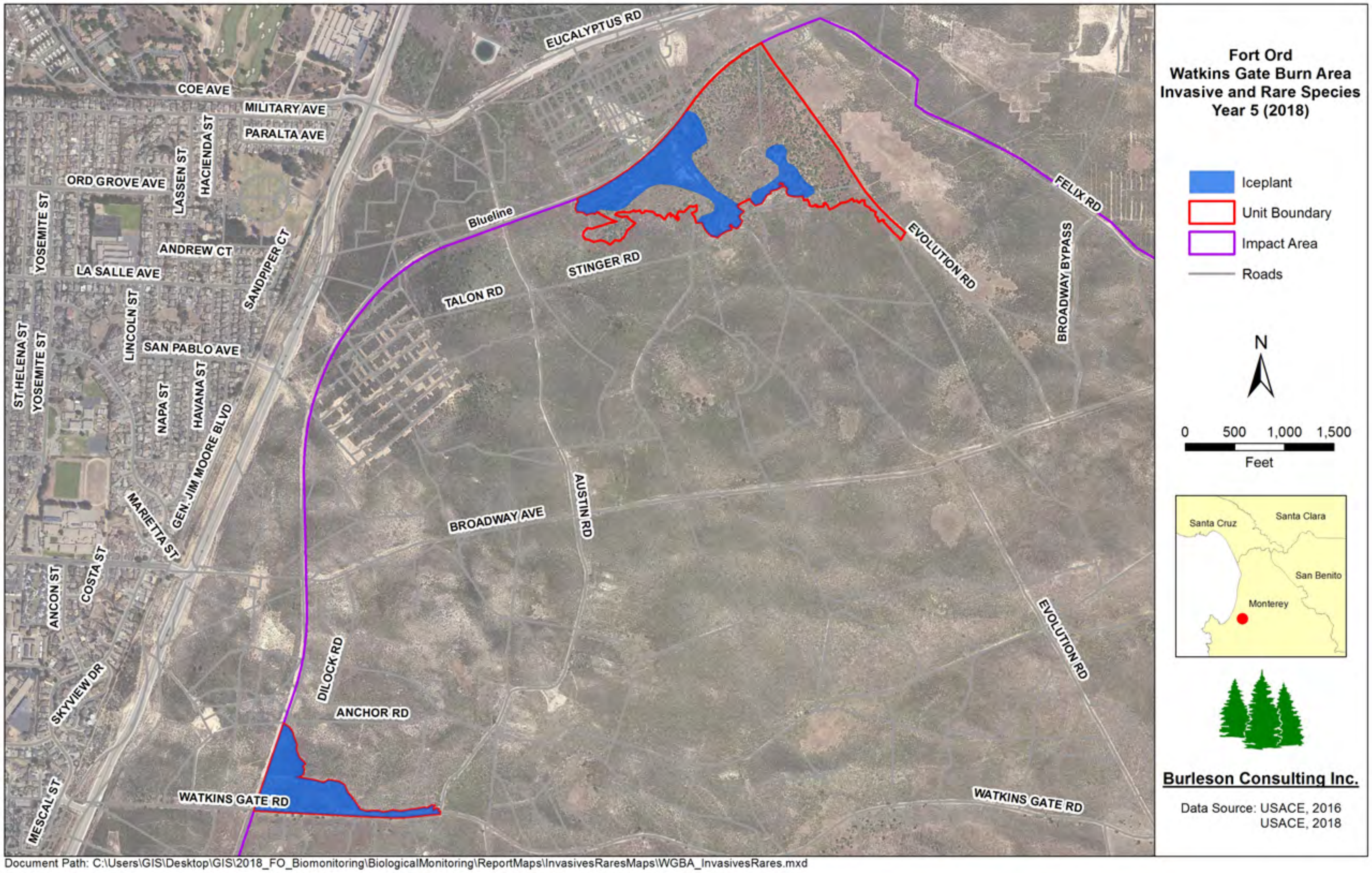

Figure E-11. Map of Invasive and Rare Species, Watkins Gate Burn Area

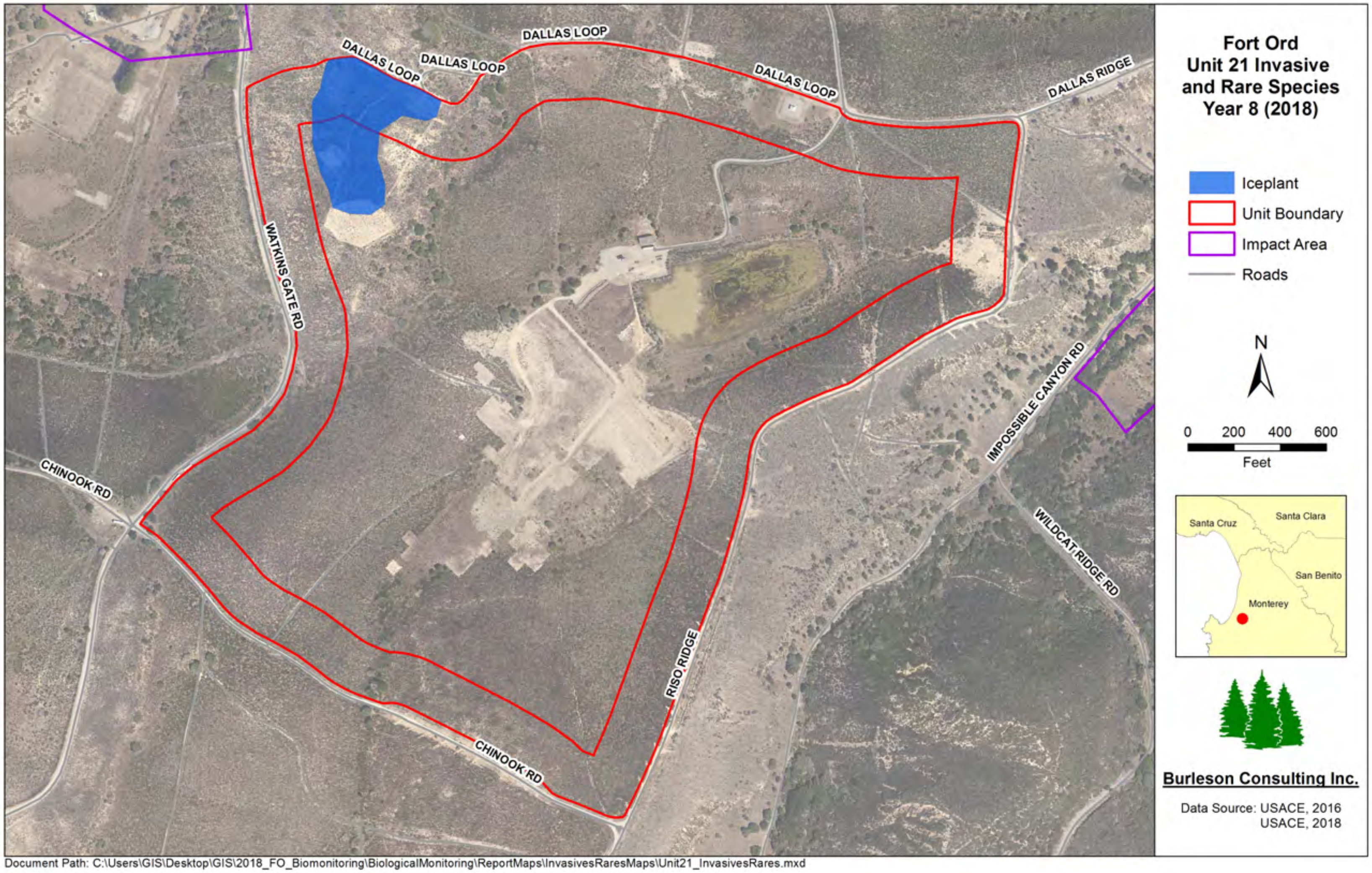

Figure E-10. Map of Invasive and Rare Species, Unit 21

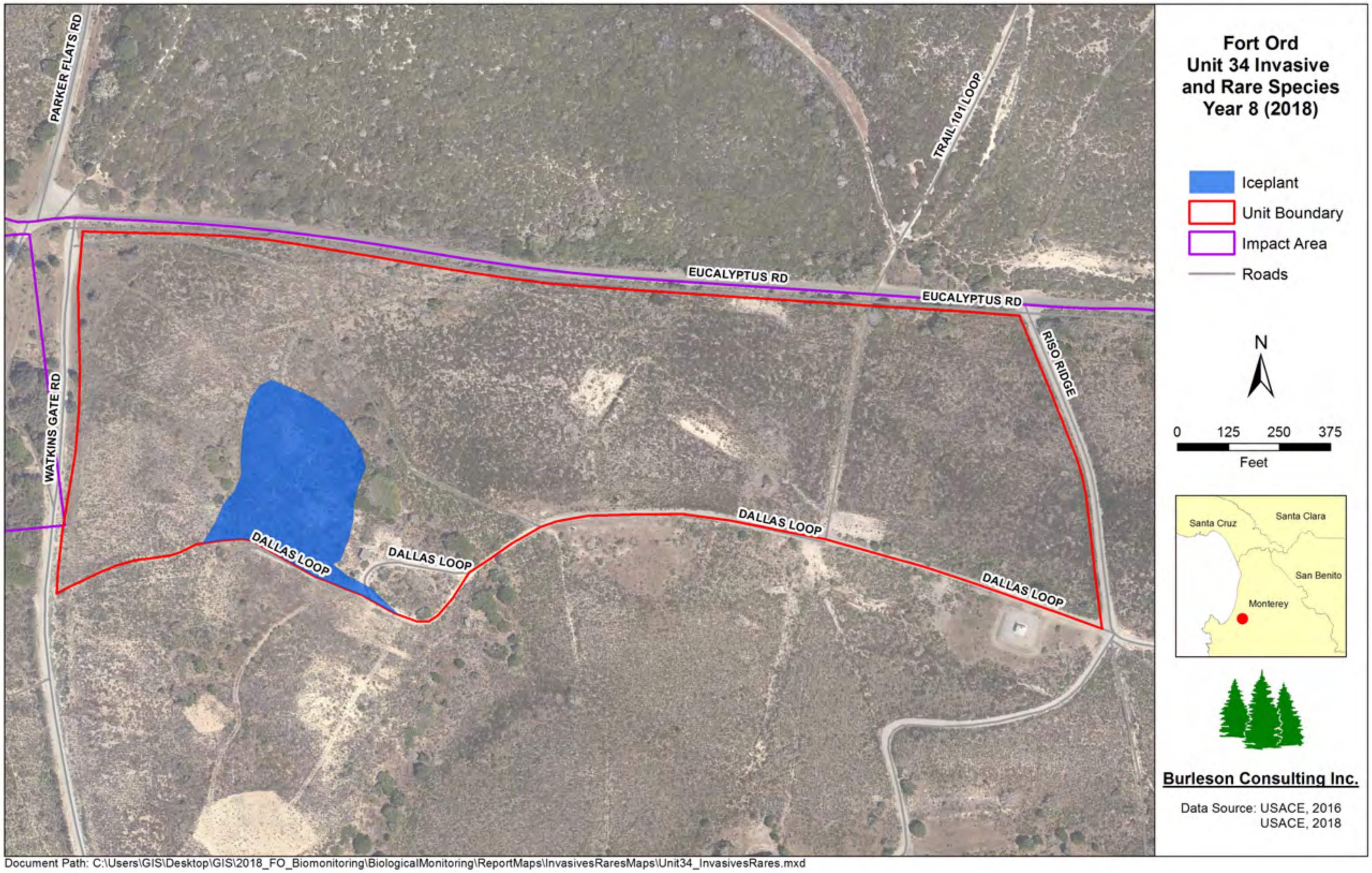

Figure E-11. Map of Invasive and Rare Species, Unit 34

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APPENDIX F

SHRUB TRANSECT COVER DATA

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Table F-1. Baseline Shrub Transects, Unit 13

		Unit 13								
Code	**Species**	**13-1**	**13-2**	**13-3**	**13-4**	**13-5**	**13-6**	**13-7**	**13-8**	**13-9**
ACGL	*Acmispon glaber*	-	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	38.4	48.4	15.4	37	50.2	32.2	18.6	27.2	45.2
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	19.4	-	-	3	22.4	3.4	-	-	-
ARMO	*Arctostaphylos montereyensis*	1	-	1	3.2	25	13.6	9.6	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	22.6	46	77.4	86	-	52.4	61	56.8	10.2
BAPI	*Baccharis pilularis*	-	-	-	-	-	-	-	1	-
CAED	*Carpobrotus edulis*	-	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	1	-	-	-	-	2.6	-
CERI	*Ceanothus rigidus*	-	-	1.4	11	-	2.2	3.2	3.2	8.2
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	-	-	-	-	-	-	-	-
DIAU	*Diplacus aurantiacus*	-	-	-	-	-	1.4	0.6	-	3.8
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	6.2
ERFA	*Ericameria fasciculata*	-	-	-	-	-	1.4	3.6	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	1.4	-	3.2	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	0.6	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	2.8
SAME	*Salvia mellifera*	11.8	7.6	12.6	13.2	0.4	-	0.4	10.4	4.6
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-	-	-	-	11.4	2
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	-
BG	Bare Ground	21	10.2	11.2	1.4	13.2	10.4	16	8.8	25.6
HERB	Herbaceous Vegetation	-	-	-	-	-	-	0.4	-	-

Table F-1. Baseline Shrub Transects, Unit 13 (continued)

		Unit 13			
Code	**Species**	**13-10**	**13-11**	**13-12**	**13-13**
ACGL	*Acmispon glaber*	-	-	-	-
ADFA	*Adenostoma fasciculata*	49.4	55.6	17.8	10.2
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	7.4
ARMO	*Arctostaphylos montereyensis*	11.6	-	-	3.4
ARPU	*Arctostaphylos pumila*	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	-	36.8	70.4	74.8
BAPI	*Baccharis pilularis*	-	-	-	-
CAED	*Carpobrotus edulis*	3.2	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	-
CERI	*Ceanothus rigidus*	9.8	3.8	-	6.4
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	-	-	-
DIAU	*Diplacus aurantiacus*	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	0.2	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-
ERFA	*Ericameria fasciculata*	0.6	-	0.6	-
FRCA	*Frangula californica*	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-
SAME	*Salvia mellifera*	11	4	5.4	8.6
SYMO	*Symphoricarpos mollis*	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	10.8	-	-
VAOV	*Vaccinium ovatum*	-	-	-	-
BG	Bare Ground	24.4	6.2	18.6	11.2
HERB	Herbaceous Vegetation	0.2	-	0.2	-

Table F-2. Baseline Shrub Transects, Unit 17

		Unit 17								
Code	**Species**	**17-1**	**17-2**	**17-3**	**17-4**	**17-5**	**17-6**	**17-7**	**17-8**	**17-9**
ACGL	*Acmispon glaber*	-	-	-	-	-	-	0.6	1	0.8
ADFA	*Adenostoma fasciculata*	15.8	25.2	4	11.8	39.6	24.4	30.6	58.6	73.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	3.6	4.8
ARMO	*Arctostaphylos montereyensis*	-	-	-	2.2	21.8	-	-	2.8	1.4
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	84.8	64	97	83.8	38.8	63.2	67	15.4	10.6
BAPI	*Baccharis pilularis*	1.4	2	-	-	4.2	0.2	-	0.8	3.8
CAED	*Carpobrotus edulis*	-	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	-	-	16.6	1.4	-	-
CERI	*Ceanothus rigidus*	-	-	-	2.8	12	10	15	17	3.4
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	-	-	-	-	-	-	-	-
DIAU	*Diplacus aurantiacus*	-	-	-	-	2.2	0.6	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	0.2	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	3.8	-	-	-
GAEL	*Garrya elliptica*	2	-	-	1.8	-	1.2	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	1.2	-	0.4	4	-	15.2	-
LECA	*Lepechinia calycina*	-	-	-	-	2.4	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	-	4	-	1.8	12.4	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	0.8
TODI	*Toxicodendron diversilobum*	-	-	-	-	-	-	-	-	-
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	-
BG	Bare Ground	6.6	17	0.2	6.6	6.2	8	8.4	10	14.6
HERB	Herbaceous Vegetation	-	-	-	-	-	3.4	-	-	-

Table F-2. Baseline Shrub Transects, Unit 17 (continued)

		Unit 17								
Code	**Species**	**17-10**	**17-11**	**17-12**	**17-13**	**17-14**	**17-15**	**17-16**	**17-17**	**17-18**
ACGL	*Acmispon glaber*	-	1.4	-	-	20.6	-	-	0.8	-
ADFA	*Adenostoma fasciculata*	34.4	54.8	43.8	30	-	67.2	19	52.2	31.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	3.6	5.8
ARMO	*Arctostaphylos montereyensis*	0.8	-	0.8	-	-	4.4	1.4	2.2	1.8
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	32.8	22	19	33.8	-	-	76.6	5.8	27.4
BAPI	*Baccharis pilularis*	-	-	0.4	0.2	-	-	-	1.4	-
CAED	*Carpobrotus edulis*	-	-	1.4	6.6	-	-	-	2	-
CEDE	*Ceanothus dentatus*	1.6	-	-	-	-	-	0.6	-	1.6
CERI	*Ceanothus rigidus*	20	27	50	29	-	-	31	14	23
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	-	-	-	-	-	-	-	-
DIAU	*Diplacus aurantiacus*	-	0.4	-	0.8	-	-	0.6	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-	-	-	0.6
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	-	0.8	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	7.2	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	0.4	5	-	-	1	1.2	8.4
QUAG	*Quercus agrifolia*	-	2.2	-	-	-	-	-	-	0.2
RUUR	*Rubus ursinus*	0.8	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	36.8	16.4	12.8	7.6	82.6	2	0.2	24.2	0.8
SYMO	*Symphoricarpos mollis*	-	-	1.2	2	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	0.4	-	-	8.2	2	-	-	-	0.6
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	-
BG	Bare Ground	4.8	4.6	7	6.4	13	27.6	3	7.2	24.2
HERB	Herbaceous Vegetation	-	-	0.8	-	-	-	1.4	-	0.6

Table F-2. Baseline Shrub Transects, Unit 17 (continued)

		Unit 17								
Code	**Species**	**17-19**	**17-20**	**17-21**	**17-22**	**17-23**	**17-24**	**17-25**	**17-26**	**17-27**
ACGL	*Acmispon glaber*	-	0.6	-	-	-	4.4	-	11.6	-
ADFA	*Adenostoma fasciculata*	37.8	66.6	34.6	30.4	5.2	5.2	49.6	50.6	30.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	3.4	3	1.4	-	-
ARMO	*Arctostaphylos montereyensis*	3.2	-	9.8	6.2	15.4	21	12.2	-	1.8
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	20.8	4.2	57.6	23.4	53	49	14.4	-	43.6
BAPI	*Baccharis pilularis*	-	-	0.6	-	-	2.2	-	-	-
CAED	*Carpobrotus edulis*	1.6	-	-	2.4	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	-	-	-	-	-	1.8
CERI	*Ceanothus rigidus*	18	7	20	15	24	2.2	13	-	11
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	-	-	-	-	-	-	-	-
DIAU	*Diplacus aurantiacus*	-	-	-	-	1	2.2	1.6	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	0.6	-	-	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	1.8	-	-	-	3.6
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	0.6	10.2	3.4	-	3.8	3.6
QUAG	*Quercus agrifolia*	5.8	-	1.8	-	-	-	3.2	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	12.2	25.2	-	1.8	-	-	18.8	31.4	15.2
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	3.6	0.2	-	19.2	4.4	4.6
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	-
BG	Bare Ground	18.6	8.8	6	30.2	10.6	20	7.6	15.6	11.8
HERB	Herbaceous Vegetation	0.8	0.2	-	3	-	-	4.6	1	-

Table F-2. Baseline Shrub Transects, Unit 17 (continued)

		Unit 17								
Code	**Species**	**17-28**	**17-29**	**17-30**	**17-31**	**17-32**	**17-33**	**17-34**	**17-35**	**17-36**
ACGL	*Acmispon glaber*	-	-	-	-	-	-	0.2	-	-
ADFA	*Adenostoma fasciculata*	10.6	50.4	17.8	7.4	25.6	97	31.4	50.2	65
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	2.2	0.4	-	-	-	-	1.2	4.4	-
ARMO	*Arctostaphylos montereyensis*	10.6	54.4	9.2	-	-	3.6	69.6	24.4	1.6
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	74.8	10.8	81	90.2	83	2	18.6	36.4	-
BAPI	*Baccharis pilularis*	-	-	-	-	4.4	-	-	0.6	-
CAED	*Carpobrotus edulis*	-	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	-	-	-	-	-	-
CERI	*Ceanothus rigidus*	0.2	3.8	-	4.4	1.2	-	-	3.8	-
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	18.4	-
CRSC	*Crocanthemum scoparium*	-	-	-	-	-	-	-	-	-
DIAU	*Diplacus aurantiacus*	-	-	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-	0.2	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	18.6	-	-	-	-	-	0.8	-	-
HEAR	*Heteromeles arbutifolia*	10.8	-	-	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	0.8	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	0.4	-
SAME	*Salvia mellifera*	-	8	-	-	2.2	6	4.2	-	12.4
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	5	-	-	-	-	-	-	15.6	-
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	-
BG	Bare Ground	0.6	4.8	1.6	5.6	1.2	2	9	0.8	23.4
HERB	Herbaceous Vegetation	-	-	-	-	-	-	-	-	-

Table F-2. Baseline Shrub Transects, Unit 17 (continued)

		Unit 17								
Code	**Species**	**17-37**	**17-38**	**17-39**	**17-40**	**17-41**	**17-42**	**17-43**	**17-44**	**17-45**
ACGL	*Acmispon glaber*	2.4	12.2	-	-	-	0.6	-	-	-
ADFA	*Adenostoma fasciculata*	83	62	34.8	65.4	57.8	45.8	28	86.8	48
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	0.6	-	-	1.4	5.4	-
ARMO	*Arctostaphylos montereyensis*	12.2	4.4	52.4	16.2	32.6	37.8	-	3.4	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	5	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	-	22	21.8	28.6	22.8	2.2	72	-	70.8
BAPI	*Baccharis pilularis*	-	0.6	-	-	-	-	4.4	-	-
CAED	*Carpobrotus edulis*	-	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	-	-	-	-	-	-
CERI	*Ceanothus rigidus*	-	14	5.6	9.8	8	-	8.2	-	4.6
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	-	-	-	-	-	-	-	-
DIAU	*Diplacus aurantiacus*	-	2.6	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-	-	2	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	-	10	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	14.6	-	9.4	0.6	4.4	6.2	-	8.8	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	2	-	-	-	-	-	-	1.8
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	-
BG	Bare Ground	4.4	8	0.2	1.8	7.2	8	5.4	5.4	2.4
HERB	Herbaceous Vegetation	-	2.4	-	-	0.4	-	-	-	-

Table F-2. Baseline Shrub Transects, Unit 17 (continued)

		Unit 17					
Code	**Species**	**17-46**	**17-47**	**17-48**	**17-49**	**17-50**	**17-51**
ACGL	*Acmispon glaber*	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	32.4	53.6	74.6	59.2	73.2	62.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	3.4	11	34.4	10.6	9.6
ARMO	*Arctostaphylos montereyensis*	50.4	18.2	28.2	10.8	18.4	13.6
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	24.2	39.2	4.8	3.6	-	2.6
BAPI	*Baccharis pilularis*	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	-	-	-
CERI	*Ceanothus rigidus*	9.2	5.4	2.6	3.4	-	-
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	-	-	-	-	-
DIAU	*Diplacus aurantiacus*	-	-	-	2.4	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	6.2	-	-	-
LECA	*Lepechinia calycina*	-	2.6	-	-	-	-
QUAG	*Quercus agrifolia*	0.4	1.4	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	9.4	-	1.4	4.4	0.8	6.4
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	3	2	-	-	-	-
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-
BG	Bare Ground	1.8	1.8	0.4	4	9.6	20.4
HERB	Herbaceous Vegetation	-	-	-	-	-	-

Table F-3. Baseline Shrub Transects, Unit 20

		Unit 20								
Code	**Species**	**20-1**	**20-2**	**20-3**	**20-4**	**20-5**	**20-6**	**20-7**	**20-8**	**20-9**
ACGL	*Acmispon glaber*	1.2	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	59.8	56.4	24.2	26	19.2	11.4	29.4	1.6	23.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	3.6	27	-	11.4	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	39.4	17	42.2	47.4
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	9.6	34	95.2	95	69.4	2	60	36.6	48.8
BAPI	*Baccharis pilularis*	-	-	-	5	-	-	1.2	6.6	4
CAED	*Carpobrotus edulis*	-	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	-	0.8	-	-	-	-
CERI	*Ceanothus rigidus*	-	-	2.4	-	0.8	-	2	3.8	1.4
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	0.6	1	-	-	-	-	-	-	-
DIAU	*Diplacus aurantiacus*	2	-	-	-	1	-	0.6	-	-
ERCO	*Eriophyllum confertiflorum*	0.6	1.2	-	-	0.4	0.2	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	3	-	-	-	0.4	-	1	-	-
FRCA	*Frangula californica*	-	-	-	-	6.8	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	0.4	-	-	-	7
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-	1	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	8.4	3.4	-	1.8	1.2	-	2.4	0.6	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	0.2	-	-	-	0.4	-	-	-	-
VAOV	*Vaccinium ovatum*	-	-	-	-	0.2	-	-	-	-
BG	Bare Ground	23.6	15.8	2	0.6	8.6	24.8	1.2	4.2	-
HERB	Herbaceous Vegetation	2.6	-	-	-	0.4	0.2	-	-	-

Table F-3. Baseline Shrub Transects, Unit 20 (continued)

		Unit 20								
Code	**Species**	**20-10**	**20-11**	**20-12**	**20-13**	**20-14**	**20-15**	**20-16**	**20-17**	**20-18**
ACGL	*Acmispon glaber*	-	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	15.8	17.4	58.6	29.2	63.8	48.4	34.4	73.8	22.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	37.6	-	7	69.4	13.2	6.4	3.4	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	28.6	70.6	14.4	25	16.8	32.8	59	32.6	63.2
BAPI	*Baccharis pilularis*	11	4.2	-	1.2	-	-	1.4	-	-
CAED	*Carpobrotus edulis*	-	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	-	-	-	-	-	-
CERI	*Ceanothus rigidus*	-	-	14	4.6	5.2	13	7.6	4	3
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	-	-	-	-	-	-	-	-
DIAU	*Diplacus aurantiacus*	0.8	-	0.4	-	-	3.4	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	0.6	-	-	-
ERFA	*Ericameria fasciculata*	-	-	0.6	-	-	-	-	-	0.6
FRCA	*Frangula californica*	-	-	-	-	-	1.2	-	-	6
GAEL	*Garrya elliptica*	-	8.2	-	2.2	-	-	-	-	1.4
HEAR	*Heteromeles arbutifolia*	18.2	-	-	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	5.2	2.6	2.4	1.2	6.6	4.2	12.4	-	1.6
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	17.2	-	-	3.8	1	-	-
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	3
BG	Bare Ground	14.8	4	14.4	3.8	12.4	9.4	7	2.2	11.2
HERB	Herbaceous Vegetation	-	-	0.2	-	0.2	-	-	-	-

Table F-3. Baseline Shrub Transects, Unit 20 (continued)

Code	Species	Unit 20 20-19
ACGL	*Acmispon glaber*	-
ADFA	*Adenostoma fasciculata*	48
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	4.6
ARMO	*Arctostaphylos montereyensis*	37.4
ARPU	*Arctostaphylos pumila*	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	38.4
BAPI	*Baccharis pilularis*	1.2
CAED	*Carpobrotus edulis*	-
CEDE	*Ceanothus dentatus*	-
CERI	*Ceanothus rigidus*	17
CETH	*Ceanothus thrysifloris* var. *griseus*	-
CRSC	*Crocanthemum scoparium*	-
DIAU	*Diplacus aurantiacus*	-
ERCO	*Eriophyllum confertiflorum*	-
ERER	*Ericameria ericoides*	-
ERFA	*Ericameria fasciculata*	-
FRCA	*Frangula californica*	-
GAEL	*Garrya elliptica*	-
HEAR	*Heteromeles arbutifolia*	-
LECA	*Lepechinia calycina*	1
QUAG	*Quercus agrifolia*	-
RUUR	*Rubus ursinus*	-
SAME	*Salvia mellifera*	2.2
SYMO	*Symphoricarpos mollis*	-
TODI	*Toxicodendron diversilobum*	-
VAOV	*Vaccinium ovatum*	-
BG	Bare Ground	0.8
HERB	Herbaceous Vegetation	-

Table F-4. Year 3 Shrub Transects, Unit 5A

		Unit 5A		
Code	**Species**	**5A-1**	**5A-2**	**T4**
ACGL	*Acmispon glaber*	-	6.4	4.25
ADFA	*Adenostoma fasciculata*	22	11.2	-
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	6.209
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	42.2	28	47.1
ARPU	*Arctostaphylos pumila*	-	2.4	3.59
BAPI	*Baccharis pilularis*	-	-	-
CAED	*Carpobrotus edulis*	-	0.2	-
CEDE	*Ceanothus dentatus*	-	5.4	-
CERI	*Ceanothus rigidus*	-	0.6	-
CRSC	*Crocanthemum scoparium*	-	10.2	7.52
DIAU	*Diplacus aurantiacus*	-	-	5.56
ERCO	*Eriophyllum confertiflorum*	1.6	-	-
ERER	*Ericameria ericoides*	-	-	-
FRCA	*Frangula californica*	-	-	-
GAEL	*Garrya elliptica*	5.8	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-
LECA	*Lepechinia calycina*	-	-	-
QUAG	*Quercus agrifolia*	-	-	-
SAME	*Salvia mellifera*	1.4	7.8	6.54
SYMO	*Symphoricarpos mollis*	1.4	-	-
TODI	*Toxicodendron diversilobum*	-	-	-
BG	Bare Ground	31.6	41.8	28.8
HERB	Herbaceous Vegetation	6.6	0.6	-

Table F-5. Year 3 Shrub Transects, Unit 9

		Unit 9						
Code	**Species**	**9-1**	**9-2**	**9-3**	**9-4**	**9-5**	**T5**	**T6**
ACGL	*Acmispon glaber*	1.4	8.2	0.6	3.6	0.6	19.4	6
ADFA	*Adenostoma fasciculata*	12.8	18	4.6	10	14.6	6.8	3.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	2	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	5.2	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	35.4	45.8	53	58.6	48	19.6	41.4
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-
BAPI	*Baccharis pilularis*	0.2	-	2	-	-	-	0.2
CAED	*Carpobrotus edulis*	3.2	-	-	-	-	-	1.8
CEDE	*Ceanothus dentatus*	0.8	2.6	-	0.8	-	-	-
CERI	*Ceanothus rigidus*	1.6	0.4	1.4	1	1.4	0.8	-
CRSC	*Crocanthemum scoparium*	6.8	2.8	2.4	-	-	4.4	1.6
DIAU	*Diplacus aurantiacus*	-	-	0.6	-	-	-	2.8
ERCO	*Eriophyllum confertiflorum*	5.6	0.8	0.2	-	3	1.6	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	3.8	-	1.4	0.2	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	2.2	-	-	-
LECA	*Lepechinia calycina*	-	0.4	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	2.2	5.6	4.8	0.4	0.6	6.4	3.2
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-	-	-	8
BG	Bare Ground	31	27	37	27	35	33.4	14
HERB	Herbaceous Vegetation	5.2	0.4	6.2	0.2	3.8	22.6	36.6

Table F-6. Year 3 Shrub Transects, Unit 23

		Unit 23								
Code	**Species**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**
ACGL	*Acmispon glaber*	0.6	1.6	2.6	0.2	0.4	7.8	9.4	3.2	7
ADFA	*Adenostoma fasciculata*	34.6	34.2	22.9	37.2	12.2	27	31.8	18.2	52.5
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	3	0.2	3.2	2	-	-	-	-	1.3
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	13.2	16.2	4.3	1	16	17.8	37.4	39.8	14.9
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
BAPI	*Baccharis pilularis*	-	-	-	-	0.2	0.4	-	-	-
CAED	*Carpobrotus edulis*	-	-	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	0.8	1.5	-	8	-	1.2	0.4	4.6
CERI	*Ceanothus rigidus*	-	0.4	1.1	0.2	-	-	-	-	0.2
CRSC	*Crocanthemum scoparium*	3.6	0.4	2.4	3.4	5.6	1.8	1.8	-	3.1
DIAU	*Diplacus aurantiacus*	-	0.8	3.5	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	15.2	13.6	10.4	3.8	7.8	-	1.8	3	3.7
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	1.6	1.6	0.4	2.8	0.4	-	-	0.4	-
HEAR	*Heteromeles arbutifolia*	4.8	-	-	-	1.4	-	-	-	5.5
LECA	*Lepechinia calycina*	0.2	1.8	-	2.4	4.4	-	0.6	-	0.4
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	0.4	2	3.5	0.4	1.2	3.2	-	1.8	9
SYMO	*Symphoricarpos mollis*	-	-	0.9	0.2	0.6	-	5.6	-	-
TODI	*Toxicodendron diversilobum*	-	3.4	1.7	-	-	-	-	16.2	5.7
BG	Bare Ground	23.4	26.4	29.9	29	44	38.4	18.4	30.8	16
HERB	Herbaceous Vegetation	27.2	23	27.9	33.4	10.6	11.6	18.8	5.4	5.7

Table F-6. Year 3 Shrub Transects, Unit 23 (continued)

		Unit 23								
Code	**Species**	**T10**	**T11**	**T12**	**T13 (East)**	**T15**	**T16**	**T17**	**T18**	**T19**
ACGL	*Acmispon glaber*	10.2	3.2	1.2	14	0.4	2.4	0.2	4.6	0.2
ADFA	*Adenostoma fasciculata*	18	13.2	21.6	49	15	24.6	58.8	46	12.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	2	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	18.8	23.2	16.2	7	36.6	32.2	8.8	20.8	49.8
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
BAPI	*Baccharis pilularis*	-	1.8	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	0.6	-	-	-	-	2.6	0.2	-	-
CEDE	*Ceanothus dentatus*	-	-	2.8	-	6.2	8.2	3	-	2
CERI	*Ceanothus rigidus*	0.4	-	-	1.2	-	2.2	2.6	0.8	0.2
CRSC	*Crocanthemum scoparium*	9.6	1.2	8.4	1	3.6	3.8	0.2	-	-
DIAU	*Diplacus aurantiacus*	5.2	-	1.2	-	-	-	-	1.4	-
ERCO	*Eriophyllum confertiflorum*	12.6	-	2.2	5.4	1	0.2	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	0.6	-	-	1.4	0.2	-	3
HEAR	*Heteromeles arbutifolia*	4.8	-	3.6	-	-	2.4	-	-	3.2
LECA	*Lepechinia calycina*	1	-	-	-	-	1.2	-	6	2.8
QUAG	*Quercus agrifolia*	-	-	-	-	-	7.6	-	-	-
SAME	*Salvia mellifera*	3.8	1.8	1.2	0.4	2	11.4	4.6	11.8	2.6
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-	3	-	-	4	-
BG	Bare Ground	17.4	43.4	23	27.8	36.6	19.6	31.8	20.4	27.2
HERB	Herbaceous Vegetation	24.8	20.6	31.2	6.2	11.4	3.8	-	-	-

Table F-6. Year 3 Shrub Transects, Unit 23 (continued)

Code	Species	Unit 23 T21	Unit 23 T22
ACGL	*Acmispon glaber*	14	9.2
ADFA	*Adenostoma fasciculata*	18.8	18
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-
ARMO	*Arctostaphylos montereyensis*	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	18.2	26
ARPU	*Arctostaphylos pumila*	-	-
BAPI	*Baccharis pilularis*	0.6	-
CAED	*Carpobrotus edulis*	3	3.4
CEDE	*Ceanothus dentatus*	4.4	4.6
CERI	*Ceanothus rigidus*	-	0.4
CRSC	*Crocanthemum scoparium*	0.8	4.2
DIAU	*Diplacus aurantiacus*	-	-
ERCO	*Eriophyllum confertiflorum*	1.6	1
ERER	*Ericameria ericoides*	-	-
FRCA	*Frangula californica*	-	0.4
GAEL	*Garrya elliptica*	-	-
HEAR	*Heteromeles arbutifolia*	-	-
LECA	*Lepechinia calycina*	2	2.8
QUAG	*Quercus agrifolia*	-	-
SAME	*Salvia mellifera*	8.2	4.6
SYMO	*Symphoricarpos mollis*	-	-
TODI	*Toxicodendron diversilobum*	28.2	2.2
BG	Bare Ground	25.8	35.6
HERB	Herbaceous Vegetation	6	5

Table F-7. Year 3 Shrub Transects, Unit 28

		Unit 28								
Code	**Species**	**28-1**	**28-2**	**28-3**	**28-4**	**28-5**	**28-6**	**28-7**	**28-8**	**36-1**
ACGL	*Acmispon glaber*	2.4	38.2	9.6	4.8	7	9.4	23.4	2.4	1.6
ADFA	*Adenostoma fasciculata*	17	26.8	19.2	7.8	17.4	22	16	1	36
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	2.4	-	4.2	-	-	-	13.6	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	41.2	17	-	43.6	14.6	30.4	-	16.2	24.4
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
BAPI	*Baccharis pilularis*	-	-	-	-	9.8	1.6	-	0.2	-
CAED	*Carpobrotus edulis*	-	-	14.4	0.4	11.4	-	-	2	-
CEDE	*Ceanothus dentatus*	1.8	-	-	0.6	0.2	0.8	-	-	1.8
CERI	*Ceanothus rigidus*	0.8	-	-	-	-	0.4	-	-	0.6
CRSC	*Crocanthemum scoparium*	1.4	0.4	-	0.6	3.8	2.4	0.6	1.8	1.6
DIAU	*Diplacus aurantiacus*	-	2	-	-	9.6	7	-	1.2	-
ERCO	*Eriophyllum confertiflorum*	5	0.6	-	0.6	0.6	1	-	-	3.2
ERER	*Ericameria ericoides*	-	-	-	-	-	-	0.6	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	0.2	-	0.2
GAEL	*Garrya elliptica*	1.2	-	-	-	-	-	-	-	2.4
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-	-	5.4	-
LECA	*Lepechinia calycina*	0.2	-	-	-	-	0.2	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	7	13.6	-
SAME	*Salvia mellifera*	-	-	10.2	0.8	9.6	4.6	3.2	2.2	3.8
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	0.4
TODI	*Toxicodendron diversilobum*	-	-	-	2.8	-	5.2	-	-	-
BG	Bare Ground	31.4	25.8	42.4	37.8	38	24.6	37.2	40	28.6
HERB	Herbaceous Vegetation	8.2	8.6	10.6	0.6	2	7	23	10.4	15.2

Table F-8. Year 5 Shrub Transects, Unit 1 East

		Unit 1 East				
Code	**Species**	**24A-1**	**26-2**	**27-3**	**T-11**	**T-12**
ACGL	*Acmispon glaber*	2.2	1.22	4.83	0.4	1.4
ACME	*Acacia melanoxylon*	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	14	20	14.7	20.8	5.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	1.2	6.4
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	48	43.8	35.5	17.4	17.6
BAPI	*Baccharis pilularis*	-	-	-	8.2	-
CAED	*Carpobrotus edulis*	-	11.2	-	0.4	-
CEDE	*Ceanothus dentatus*	9.2	3.26	11.1	23.4	1.6
CERI	*Ceanothus rigidus*	0.2	-	-	-	-
CRSC	*Crocanthemum scoparium*	3	0.41	6.76	3.2	17.4
DIAU	*Diplacus aurantiacus*	-	0.2	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	2.24	-	-	7.8
ERER	*Ericameria ericoides*	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	0.8
FRCA	*Frangula californica*	-	-	-	-	-
GAEL	*Garrya elliptica*	-	5.3	-	4.4	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-
LECA	*Lepechinia calycina*	1.8	-	9.66	1	-
LUAR	*Lupinus arboreus*	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	2.174	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-
SAME	*Salvia mellifera*	7.2	2.65	8.94	38.6	11.6
SOUM	*Solanum umbelliferum*	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	3.05	-	2.8	-
BG	Bare Ground	26.2	19.3	20.8	16.8	36
HERB	Herbaceous Vegetation	0.2	-	3.6	1.4	7.4

Table F-9. Year 5 Shrub Transects, Unit 6

		Unit 6					
Code	**Species**	**6-2**	**6-3**	**6-6**	**27B-1**	**28B-1**	**28-2**
ACGL	*Acmispon glaber*	1.6	7.8	0.4	-	13.8	1
ACME	*Acacia melanoxylon*	-	-	16.4	-	-	-
ADFA	*Adenostoma fasciculata*	5.8	13	10.4	32.8	15.8	12.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	0.2	4.6	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	42.4	35.8	55.4	22.6	28.6	33.2
BAPI	*Baccharis pilularis*	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	-	-	8	2.2	-	-
CEDE	*Ceanothus dentatus*	13.2	3.6	-	-	-	4.6
CERI	*Ceanothus rigidus*	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	7	11	3.2	-	20.4	11.6
DIAU	*Diplacus aurantiacus*	-	-	2.8	3.2	-	-
ERCO	*Eriophyllum confertiflorum*	5.2	3.2	-	-	4.8	5.6
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-	-	-
LUAR	*Lupinus arboreus*	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	0.8	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	2	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	3.4	3.6	4.6	0.6	0.4	3.8
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-	-	-
BG	Bare Ground	32	32.8	18.6	36.4	29.2	31.4
HERB	Herbaceous Vegetation	2	1.2	-	8.8	2.2	4.4

Table F-10. Year 5 Shrub Transects, Unit 7

		Unit 7								
Code	**Species**	**7-1**	**7-2**	**7-3**	**7-4**	**7-5**	**7-6**	**7-7**	**7-8**	**7-9**
ACGL	*Acmispon glaber*	0.2	-	-	1	-	-	1.6	0.6	5.8
ACME	*Acacia melanoxylon*	-	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	11.2	22.2	8	8.8	12.4	14.8	26.8	27.4	10
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	31.6	24	23.8	29.2	18.2	3	11	11.8	29
BAPI	*Baccharis pilularis*	-	-	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	0.8	1.6	-	2.4	0.6	-	6.6	4	-
CEDE	*Ceanothus dentatus*	13.8	25.8	59	19.2	52.8	13.6	4	31.8	51.2
CERI	*Ceanothus rigidus*	7.2	2.2	0.8	15	13	13	3.2	5.2	-
CRSC	*Crocanthemum scoparium*	10.2	9.2	15.4	2	0.8	30.6	0.6	17.4	6.8
DIAU	*Diplacus aurantiacus*	3	-	-	-	-	-	1.4	-	-
ERCO	*Eriophyllum confertiflorum*	-	1.8	-	-	-	0.4	-	0.4	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	0.6	-	13.6	-	-	-	2.8
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	6.2	-	-	3.2
LECA	*Lepechinia calycina*	2.2	1.4	1.4	8	0.2	4.8	-	-	3.2
LUAR	*Lupinus arboreus*	-	-	-	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	8.6	10.6	1.8	5.8	1.2	7.2	27.4	0.2	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	0.8	-	0.8	-	-	-	2
BG	Bare Ground	26.4	22.6	14.8	24.2	15	22.8	31.2	19.6	14
HERB	Herbaceous Vegetation	-	0.8	-	-	-	0.2	-	3.8	-

Table F-10. Year 5 Shrub Transects, Unit 7 (continued)

		Unit 7								
Code	**Species**	**7-10**	**7-11**	**7-12**	**7-13**	**7-14**	**7-15**	**7-16**	**7-17**	**7-18**
ACGL	*Acmispon glaber*	4.4	-	0.4	0.8	-	0.4	1	2.8	13
ACME	*Acacia melanoxylon*	-	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	20.6	11.4	55.6	20.8	39.4	31.2	12.4	5.4	35.2
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	16.8	30	0.6	25.2	2	18.4	29.8	15.6	4.4
BAPI	*Baccharis pilularis*	-	-	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	0.2	1	-	-	-	2	-	0.6	0.4
CEDE	*Ceanothus dentatus*	29	57.2	21.6	47.8	-	16.6	30	49.6	2.2
CERI	*Ceanothus rigidus*	0.8	1	21	1.6	6.8	18	1.8	0.4	1.8
CRSC	*Crocanthemum scoparium*	47.6	9.4	1.8	24	-	20.2	11.2	39.2	27.2
DIAU	*Diplacus aurantiacus*	-	-	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	2.8	-	1.6	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-	3.8	-	-
LECA	*Lepechinia calycina*	-	0.4	-	0.4	16	-	-	-	-
LUAR	*Lupinus arboreus*	-	-	-	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	1.4	4.4	-	0.8	4	8.6	2.4	4	7.6
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	1.4	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	2.4	11.8	-	0.6	-	-
BG	Bare Ground	13.6	14.6	22.8	8.2	31	14.2	22.4	19.2	26.4
HERB	Herbaceous Vegetation	1.2	-	-	-	0.4	-	-	-	-

Table F-10. Year 5 Shrub Transects, Unit 7 (continued)

		Unit 7								
Code	**Species**	**7-19**	**7-20**	**7-21**	**7-22**	**7-23**	**7-24**	**7-25**	**7-26**	**7-27**
ACGL	*Acmispon glaber*	2.2	3.2	2.6	4.2	2.4	5.2	11.2	1.4	14.4
ACME	*Acacia melanoxylon*	-	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	15.2	12.6	6	28	8.6	15.8	10.6	5.8	11.2
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	18.8	17	36.4	14.2	35.6	17.2	31.6	29	23.2
BAPI	*Baccharis pilularis*	-	-	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	-	-	0.4	-	0.2	-	-	-	-
CEDE	*Ceanothus dentatus*	33	36	27.4	28.4	40.2	37.4	46.2	29.8	54.2
CERI	*Ceanothus rigidus*	21	0.2	15	5.2	1.2	1.6	12	-	5
CRSC	*Crocanthemum scoparium*	0.4	1	39.4	8.4	21	18.8	43.2	40	6.4
DIAU	*Diplacus aurantiacus*	-	-	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	9.2	2	-	5.4	0.8	1.8	-	-	-
HEAR	*Heteromeles arbutifolia*	8.4	4.8	-	3.4	5.6	-	-	-	-
LECA	*Lepechinia calycina*	3	-	-	-	-	-	1	-	7.2
LUAR	*Lupinus arboreus*	-	-	-	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	-	3.6	0.2	2.2	-	3.2	1	1.8	8.8
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	0.8	-	-	-	0.4	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-	0.2	-	1.4	-	1.6
BG	Bare Ground	18.4	30.2	12	22.8	13.8	22.8	8.4	15.8	12.2
HERB	Herbaceous Vegetation	-	-	-	-	0.2	-	-	-	-

Table F-10. Year 5 Shrub Transects, Unit 7 (continued)

		Unit 7			
Code	**Species**	**26-1**	**26-2**	**26-3**	**T2**
ACGL	*Acmispon glaber*	0.4	-	0.2	0.6
ACME	*Acacia melanoxylon*	-	-	-	-
ADFA	*Adenostoma fasciculata*	26.2	2.8	2.6	15.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	0.2	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	19.8	16.8	20.6	42.2
BAPI	*Baccharis pilularis*	-	-	-	-
CAED	*Carpobrotus edulis*	0.8	2.2	0.6	-
CEDE	*Ceanothus dentatus*	17	52.2	57.6	8.8
CERI	*Ceanothus rigidus*	0.6	-	2.6	-
CRSC	*Crocanthemum scoparium*	9.4	27	6.2	0.8
DIAU	*Diplacus aurantiacus*	-	-	-	0.6
ERCO	*Eriophyllum confertiflorum*	-	-	-	0.2
ERER	*Ericameria ericoides*	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	1.4
HEAR	*Heteromeles arbutifolia*	-	-	-	-
LECA	*Lepechinia calycina*	0.2	0.2	1.8	1.6
LUAR	*Lupinus arboreus*	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-
SAME	*Salvia mellifera*	0.4	4.8	5	7.4
SOUM	*Solanum umbelliferum*	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-
BG	Bare Ground	33.2	19.8	21	30.4
HERB	Herbaceous Vegetation	1.4	1.4	0.4	0.4

Table F-11. Year 5 Shrub Transects, Unit 10

		Unit 10								
Code	**Species**	**10-1**	**10-2**	**10-3**	**10-5**	**10-6**	**10-7**	**10-8**	**10-9**	**10-10**
ACGL	*Acmispon glaber*	-	2.6	-	1	11	0.2	1.6	-	-
ACME	*Acacia melanoxylon*	-	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	7.6	10.2	14.6	18	6.6	4.2	-	17.8	6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	2.4	5.8	-	0.6
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	6.4	18.2	4.4	25	5.6	55.2	24.6	12.4	41.8
BAPI	*Baccharis pilularis*	0.6	-	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	7.4	-	-	-	20	-	-	3	4.4
CEDE	*Ceanothus dentatus*	34.2	29.6	62.2	15.2	4.2	4.8	1.2	42	6
CERI	*Ceanothus rigidus*	23	3.2	17	0.6	11	1.6	2.4	24	25
CRSC	*Crocanthemum scoparium*	3	6	6.2	5.4	20	3	3.6	9.2	5
DIAU	*Diplacus aurantiacus*	-	-	-	0.4	-	0.2	1.6	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	2.6	3.8	4.4	5.2	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	3.8	-	3	3.6	-	7	1.4	-	-
HEAR	*Heteromeles arbutifolia*	-	8.4	4.8	-	-	-	-	-	-
LECA	*Lepechinia calycina*	4.2	-	1.4	-	-	-	2.2	-	-
LUAR	*Lupinus arboreus*	-	-	-	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	5	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	11.4	15.2	17.2	10.4	7.2	2	0.6	16.2	6.8
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-	-	-	0.4
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	5	-	11
TODI	*Toxicodendron diversilobum*	-	-	-	-	-	14.6	35.6	-	-
BG	Bare Ground	17.8	25	12.6	30.2	34.4	18.6	24.4	16.4	19.8
HERB	Herbaceous Vegetation	-	-	-	0.6	0.4	-	9.8	-	-

Table F-11. Year 5 Shrub Transects, Unit 10 (continued)

		Unit 10								
Code	**Species**	**10-11**	**10-12**	**10-13**	**10-14**	**10-15**	**10-16**	**10-17**	**10-18**	**10-19**
ACGL	*Acmispon glaber*	11.8	-	3.4	3	9.8	1.6	0.8	-	17
ACME	*Acacia melanoxylon*	-	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	8.8	11.2	9.6	4.6	11.8	11.8	13.2	40.4	12.2
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	0.4	-	0.4	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	15.2	34.2	22.8	34.6	18.2	9.8	23.8	9.8	6
BAPI	*Baccharis pilularis*	-	-	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	0.4	-	-	-	6.8	0.6	2	2.2	7
CEDE	*Ceanothus dentatus*	5	34.4	18.8	46.6	37.8	13.4	13.6	46.6	-
CERI	*Ceanothus rigidus*	0.2	7.4	8.8	6.4	12	14	14	13	0.2
CRSC	*Crocanthemum scoparium*	30.4	7	18.8	7	16.2	9	16.4	0.8	33.4
DIAU	*Diplacus aurantiacus*	0.8	-	-	-	-	-	-	-	0.6
ERCO	*Eriophyllum confertiflorum*	1	-	-	-	3	-	-	-	0.6
ERER	*Ericameria ericoides*	-	-	-	-	-	-	2.4	-	0.4
ERFA	*Ericameria fasciculata*	-	-	-	-	0.8	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	-	0.4	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	0.8	-	-	-	12.8	-	-	-
LUAR	*Lupinus arboreus*	-	-	-	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	2.6	-	-	3.6
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	2.4	3.4	1.8	-	2.6	18.6	4	-	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	0.2	0.2	-	-
TODI	*Toxicodendron diversilobum*	-	-	5.4	2.6	5.8	-	5.4	-	2.2
BG	Bare Ground	33.6	27.8	31	17.8	12.2	29.4	23.2	11.6	30.2
HERB	Herbaceous Vegetation	0.4	-	-	-	1	-	0.2	0.2	6.8

Table F-11. Year 5 Shrub Transects, Unit 10 (continued)

		Unit 10								
Code	**Species**	**10-20**	**10-21**	**10-22**	**10-23**	**10-24**	**10-25**	**10-26**	**10-27**	**10-28**
ACGL	*Acmispon glaber*	31	-	1.4	2.6	7.2	22.6	4.2	12.4	1
ACME	*Acacia melanoxylon*	-	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	6.8	16.4	17.2	6.4	3	6.2	2.8	11.6	6.2
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	0.2	0.2	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	41	16.6	19.6	24	15	26.2	29.4	22.6	37.4
BAPI	*Baccharis pilularis*	-	-	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	9.8	-	-	-	-	3.8	2.4	-	0.2
CEDE	*Ceanothus dentatus*	1	52	34.4	32.2	27.8	11.4	40	48.4	33.2
CERI	*Ceanothus rigidus*	-	3	5.4	4.2	2	-	16	3.2	7.4
CRSC	*Crocanthemum scoparium*	28	13.2	6.8	25.6	11.2	18.8	25.6	20.2	9
DIAU	*Diplacus aurantiacus*	0.6	-	-	-	-	1.8	0.4	0.2	-
ERCO	*Eriophyllum confertiflorum*	1.4	-	-	-	-	0.6	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	0.4	-	-	-	-	-	2.2	-
HEAR	*Heteromeles arbutifolia*	-	5.6	-	-	-	0.6	-	8	-
LECA	*Lepechinia calycina*	-	3.4	0.2	-	-	-	-	-	-
LUAR	*Lupinus arboreus*	-	-	-	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	2.6	3.6	4.2	3.2	4.8	0.4	10.6	2.4	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	4	-	-	-	-	35	-	-	4.2
BG	Bare Ground	9.2	15.8	24.8	23.6	44	18.4	12.6	12	21.2
HERB	Herbaceous Vegetation	-	-	-	-	-	0.8	-	-	1.6

Table F-11. Year 5 Shrub Transects, Unit 10 (continued)

		Unit 10	
Code	**Species**	**10-29**	**10-30**
ACGL	*Acmispon glaber*	-	0.2
ACME	*Acacia melanoxylon*	-	-
ADFA	*Adenostoma fasciculata*	3	3.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-
ARMO	*Arctostaphylos montereyensis*	-	-
ARPU	*Arctostaphylos pumila*	0.6	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	22.8	39.4
BAPI	*Baccharis pilularis*	-	-
CAED	*Carpobrotus edulis*	-	11
CEDE	*Ceanothus dentatus*	45.2	8.8
CERI	*Ceanothus rigidus*	9	13
CRSC	*Crocanthemum scoparium*	4.2	3.2
DIAU	*Diplacus aurantiacus*	-	-
ERCO	*Eriophyllum confertiflorum*	-	-
ERER	*Ericameria ericoides*	-	-
ERFA	*Ericameria fasciculata*	-	-
FRCA	*Frangula californica*	-	-
GAEL	*Garrya elliptica*	6.4	1.2
HEAR	*Heteromeles arbutifolia*	-	-
LECA	*Lepechinia calycina*	-	-
LUAR	*Lupinus arboreus*	-	-
PIRA	*Pinus radiata*	-	-
QUAG	*Quercus agrifolia*	-	0.8
RUUR	*Rubus ursinus*	-	-
SAME	*Salvia mellifera*	-	3.8
SOUM	*Solanum umbelliferum*	-	-
SYMO	*Symphoricarpos mollis*	-	-
TODI	*Toxicodendron diversilobum*	4.6	-
BG	Bare Ground	20	32.2
HERB	Herbaceous Vegetation	-	1

Table F-12. Year 5 Shrub Transects, Watkins Gate Unburned Area

		Watkins Gate Unburned Area						
Code	**Species**	**12-1**	**12-3**	**13-1**	**13-3**	**14-1**	**15-1**	**9A-1**
ACGL	*Acmispon glaber*	6.4	13.6	11.8	10.8	1	0.2	19.2
ACME	*Acacia melanoxylon*	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculata*	5	3.6	-	19.6	-	-	26.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	2	-	-	-	3.2	11.2
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	18.2	37.4	41.6	25	41.2	53.4	10.2
BAPI	*Baccharis pilularis*	-	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	13.4	13.4	8	39.6	10.6	8	5.8
CEDE	*Ceanothus dentatus*	-	-	-	-	-	-	-
CERI	*Ceanothus rigidus*	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	2.4	1	1.2	-	-	-	3.6
DIAU	*Diplacus aurantiacus*	7.8	-	1.2	1.2	-	-	5.4
ERCO	*Eriophyllum confertiflorum*	0.4	-	1.8	-	0.4	-	1.4
ERER	*Ericameria ericoides*	3.2	-	0.8	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-	-	-	-
LUAR	*Lupinus arboreus*	-	-	1.2	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	7.8	2.2	5.2	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	2.4	-	1	3.2	-	-	1.4
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	0.4	-	16	-
BG	Bare Ground	47.8	35.4	27.6	26	49	28	31
HERB	Herbaceous Vegetation	2.4	-	14.4	1	1.6	0.2	0.6

Table F-13. Year 5 Shrub Transects, MOUT

		MOUT	
Code	**Species**	**MOUT-1**	**MOUT-2**
ACGL	*Acmispon glaber*	-	-
ACME	*Acacia melanoxylon*	-	-
ADFA	*Adenostoma fasciculata*	19.6	43.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	0.2
ARMO	*Arctostaphylos montereyensis*	-	-
ARPU	*Arctostaphylos pumila*	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	28.4	22.6
BAPI	*Baccharis pilularis*	2.2	-
CAED	*Carpobrotus edulis*	-	0.8
CEDE	*Ceanothus dentatus*	6.4	-
CERI	*Ceanothus rigidus*	3.4	0.4
CRSC	*Crocanthemum scoparium*	-	-
DIAU	*Diplacus aurantiacus*	1.2	0.8
ERCO	*Eriophyllum confertiflorum*	2.6	0.4
ERER	*Ericameria ericoides*	-	-
ERFA	*Ericameria fasciculata*	-	-
FRCA	*Frangula californica*	7	-
GAEL	*Garrya elliptica*	-	0.2
HEAR	*Heteromeles arbutifolia*	-	-
LECA	*Lepechinia calycina*	-	-
LUAR	*Lupinus arboreus*	-	-
PIRA	*Pinus radiata*	-	-
QUAG	*Quercus agrifolia*	3.2	-
RUUR	*Rubus ursinus*	6.2	-
SAME	*Salvia mellifera*	-	3.8
SOUM	*Solanum umbelliferum*	-	-
SYMO	*Symphoricarpos mollis*	27.8	-
TODI	*Toxicodendron diversilobum*	0.8	-
BG	Bare Ground	8	30.2
HERB	Herbaceous Vegetation	38.2	1.2

Table F-14. Year 8 Shrub Transects, Unit 15

		Unit 15								
Code	**Species**	**15-1**	**15-2**	**15-3**	**15-4**	**15-5**	**15-6**	**15-7**	**15-8**	**15-9**
ACGL	*Acmispon glaber*	15.4	2.2	8.8	2	0.6	2.8	0.8	8.8	13.2
ADFA	*Adenostoma fasciculata*	27	6.2	17	13.6	24.4	15	10.4	30.6	43.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	0.6	-	-	-	1.2	3.8
ARMO	*Arctostaphylos montereyensis*	-	-	-	4.2	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	9.4	14	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	8	-	38	17	32	27.8	18	14.8	8.6
BAPI	*Baccharis pilularis*	-	-	-	-	-	-	-	-	0.4
CAED	*Carpobrotus edulis*	-	-	-	2	-	-	-	-	2.6
CEDE	*Ceanothus dentatus*	-	-	1.8	32.8	8	7	33	14	0.6
CERI	*Ceanothus rigidus*	1.8	-	3.2	3.4	8.6	0.6	1.2	22	15
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	3.2	-	0.6	2.4	2.4	4.6	7.2	4.4	5.4
DIAU	*Diplacus aurantiacus*	3.2	-	-	0.6	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	2.2	0.4	0.4	-	0.2	-	-	0.2	0.2
ERFA	*Ericameria fasciculata*	1.6	-	-	-	-	1.8	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	2.8	-	-	-	-	3.8	-
HEAR	*Heteromeles arbutifolia*	-	-	2.8	-	-	-	-	2	-
LECA	*Lepechinia calycina*	-	-	0.4	-	2.6	-	-	1.8	7.8
LUCH	*Lupinus chamissonis*	-	10.8	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	-	-	17.8	17.6	4.6	2.8	9.2	8.6	8.2
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-	-	-	-	-	1
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	-
BG	Bare Ground	39.2	60.8	23.2	28.8	21.4	39	35.6	25.4	22.4
HERB	Herbaceous Vegetation	3.2	10.6	1.6	6.2	7.4	8.4	3.4	-	0.6

Table F-14. Year 8 Shrub Transects, Unit 15 (continued)

		Unit 15								
Code	**Species**	**15-10**	**15-11**	**15-12**	**15-13**	**15-14**	**15-15**	**15-16**	**15-17**	**15-18**
ACGL	*Acmispon glaber*	0.8	-	-	-	1	1.2	-	4.6	-
ADFA	*Adenostoma fasciculata*	2	29	50.2	60.6	32	4.6	28	30.6	8.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	0.8	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	0.2	0.43	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	39.6	27.7	13	5.6	25	45.6	14	14	35.8
BAPI	*Baccharis pilularis*	-	-	-	-	-	-	-	1	-
CAED	*Carpobrotus edulis*	0.2	-	-	-	-	-	-	-	0.4
CEDE	*Ceanothus dentatus*	26.8	1.29	1	1.2	13.8	37.6	2.2	-	20
CERI	*Ceanothus rigidus*	4.4	31	28	23	16	3	19	36	8.8
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	9.8	-	1.4	0.4	-	9.4	5.8	-	6
DIAU	*Diplacus aurantiacus*	-	1.29	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	1.6	13.3	6	-	-	3	0.6	-	-
HEAR	*Heteromeles arbutifolia*	-	-	3.8	-	-	-	-	-	-
LECA	*Lepechinia calycina*	0.2	0.86	1.4	1.4	0.2	-	4	37.4	1.2
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	8.8	4.73	4	19	18.8	6.6	22.6	6.8	14.2
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	0.86	3.4	0.6	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	0.4	1.6	-	0.2	-	8.2	1
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	-
BG	Bare Ground	24.8	17.849	15.2	16.4	19.4	13	27.4	9.6	23.8
HERB	Herbaceous Vegetation	0.6	1.29	0.2	0.8	-	2	-	-	0.4

Table F-14. Year 8 Shrub Transects, Unit 15 (continued)

		Unit 15		
Code	**Species**	**15-19**	**15-20**	**15-21**
ACGL	*Acmispon glaber*	2	3	0.8
ADFA	*Adenostoma fasciculata*	44.8	25.8	20.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	0.8	-
ARMO	*Arctostaphylos montereyensis*	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	6.4	23.2	29.4
BAPI	*Baccharis pilularis*	0.6	0.4	-
CAED	*Carpobrotus edulis*	-	6.4	-
CEDE	*Ceanothus dentatus*	4.4	0.8	9.2
CERI	*Ceanothus rigidus*	28	18	13
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-
CRSC	*Crocanthemum scoparium*	1	1.2	0.2
DIAU	*Diplacus aurantiacus*	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-
FRCA	*Frangula californica*	-	-	-
GAEL	*Garrya elliptica*	4	1.6	0.6
HEAR	*Heteromeles arbutifolia*	-	-	-
LECA	*Lepechinia calycina*	4.2	4.2	-
LUCH	*Lupinus chamissonis*	-	-	-
QUAG	*Quercus agrifolia*	-	-	-
RUUR	*Rubus ursinus*	-	-	-
SAME	*Salvia mellifera*	15.6	16.4	9.2
SOUM	*Solanum umbelliferum*	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-
VAOV	*Vaccinium ovatum*	-	-	-
BG	Bare Ground	20.6	29.2	32.6
HERB	Herbaceous Vegetation	-	-	0.8

Table F-15. Year 8 Shrub Transects, Unit 21

		Unit 21								
Code	**Species**	**21-1**	**21-2**	**21-3**	**21-4**	**21-5**	**21-6**	**21-7**	**21-8**	**21-9**
ACGL	*Acmispon glaber*	0.2	8.8	8.6	-	1.2	6.2	1.8	2.2	-
ADFA	*Adenostoma fasciculata*	21.2	17	8.4	6	32.8	62.2	3.8	11	6.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	3.6	-	-	-	5.2	-	-	1.2	1
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	1	-	-	-	-
ARPU	*Arctostaphylos pumila*	0.2	13.4	15.4	-	-	1	4	4	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	39.8	5.8	6.4	60	26	1.4	33	24	24.4
BAPI	*Baccharis pilularis*	0.4	-	-	-	0.4	1.4	-	-	2.2
CAED	*Carpobrotus edulis*	1	1	-	2.6	-	1	0.6	-	0.6
CEDE	*Ceanothus dentatus*	9	-	-	3	3.4	-	13	10.2	16.8
CERI	*Ceanothus rigidus*	6.8	-	-	4.2	3.6	51	23	2.8	21
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	2.2	7.2	4.6	-	-	-	8.2	13.6
DIAU	*Diplacus aurantiacus*	0.2	0.4	-	0.4	6.2	1.2	1.2	0.6	-
ERCO	*Eriophyllum confertiflorum*	-	0.4	0.8	-	1	-	-	0.2	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	4.8	-	-	5.6	1.6	-	3.4	-	0.8
HEAR	*Heteromeles arbutifolia*	-	-	-	-	0.4	4	-	-	-
LECA	*Lepechinia calycina*	5.4	-	-	-	5.8	7.6	11	1	0.6
LUCH	*Lupinus chamissonis*	-	2.2	0.6	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	1.6	-	-	-	-	-	1.6	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	9	3.4	2.2	-	-	-	-	7.6	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-	0.6	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	0.2	2.4	-	-	0.2	-	0.6	-	-
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-	-	-	-
BG	Bare Ground	21.4	47.4	51.2	24.6	23.8	4.2	26.6	38.6	32.2
HERB	Herbaceous Vegetation	-	3.8	3	0.6	-	-	0.2	3.2	-

Table F-15. Year 8 Shrub Transects, Unit 21 (continued)

		Unit 21					
Code	**Species**	**21-10**	**21-11**	**21-12**	**21-13**	**21-14**	**21-15**
ACGL	*Acmispon glaber*	10.2	-	-	0.4	5	1.8
ADFA	*Adenostoma fasciculata*	3	2	11	10	21.8	25.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	0.2	-	-	1.4	0.2
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	0.2	-
ARPU	*Arctostaphylos pumila*	6.8	1.2	0.4	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	8.4	42.2	47.2	30	15	24
BAPI	*Baccharis pilularis*	-	-	0.8	-	1	1
CAED	*Carpobrotus edulis*	18	6.6	-	-	-	-
CEDE	*Ceanothus dentatus*	-	2	22.2	17.4	20.8	24.6
CERI	*Ceanothus rigidus*	-	36	15	14	10	6.8
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-	-	-
CRSC	*Crocanthemum scoparium*	5.6	4.2	1.4	23.6	10.6	4.8
DIAU	*Diplacus aurantiacus*	3.4	-	0.8	0.4	1	-
ERCO	*Eriophyllum confertiflorum*	0.8	-	-	-	1.8	3.2
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula californica*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	4.2	-	2.6	3.8
HEAR	*Heteromeles arbutifolia*	-	-	-	0.8	-	-
LECA	*Lepechinia calycina*	-	-	7.8	0.8	4.2	6.4
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	17.8	2.8	3	-	3.4	-
SOUM	*Solanum umbelliferum*	-	2.2	-	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	1.6	-	1.4	3.4
TODI	*Toxicodendron diversilobum*	-	-	-	-	0.8	2.8
VAOV	*Vaccinium ovatum*	-	-	-	-	-	-
BG	Bare Ground	29.8	19.6	20.6	23.4	23.4	19.2
HERB	Herbaceous Vegetation	3.8	0.4	0.2	4.4	2.4	-

Table F-16. Year 8 Shrub Transects, Unit 32

		Unit 32			
Code	**Species**	**32-1**	**32-2**	**32-3**	**32-4**
ACGL	*Acmispon glaber*	-	-	1	-
ADFA	*Adenostoma fasciculata*	15.6	10.4	7	9
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	4.8	-	-	0.6
ARMO	*Arctostaphylos montereyensis*	11.2	1	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	35	61.8	60.2	39.2
BAPI	*Baccharis pilularis*	1.8	7	0.8	2.8
CAED	*Carpobrotus edulis*	1	0.2	-	-
CEDE	*Ceanothus dentatus*	17.4	9.2	1.6	0.6
CERI	*Ceanothus rigidus*	5	4	-	2.2
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	-
CRSC	*Crocanthemum scoparium*	-	-	-	0.8
DIAU	*Diplacus aurantiacus*	-	-	-	2.2
ERCO	*Eriophyllum confertiflorum*	-	-	3.6	0.8
ERFA	*Ericameria fasciculata*	-	-	-	2.2
FRCA	*Frangula californica*	-	-	2.8	2.8
GAEL	*Garrya elliptica*	12.2	4.4	-	2.8
HEAR	*Heteromeles arbutifolia*	2.2	1.2	-	-
LECA	*Lepechinia calycina*	-	-	-	-
LUCH	*Lupinus chamissonis*	-	-	-	-
QUAG	*Quercus agrifolia*	0.4	7.6	-	-
RUUR	*Rubus ursinus*	0.2	3	-	0.2
SAME	*Salvia mellifera*	5.8	12.8	-	-
SOUM	*Solanum umbelliferum*	-	-	-	-
SYMO	*Symphoricarpos mollis*	3.8	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-
VAOV	*Vaccinium ovatum*	-	-	1.2	-
BG	Bare Ground	16	9.2	21.2	30.4
HERB	Herbaceous Vegetation	0.4	0.2	15.2	15.6

Table F-17. Year 8 Shrub Transects, Unit 34

		Unit 34			
Code	**Species**	**34-1**	**34-2**	**34-3**	**34-4**
ACGL	*Acmispon glaber*	4	4	0.4	-
ADFA	*Adenostoma fasciculata*	6.4	2.4	2.8	5
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	7.4	1.6
ARMO	*Arctostaphylos montereyensis*	-	-	2.8	-
ARPU	*Arctostaphylos pumila*	16	20	-	2.2
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	8	15	13.6	23.8
BAPI	*Baccharis pilularis*	-	-	1.2	0.6
CAED	*Carpobrotus edulis*	-	-	-	-
CEDE	*Ceanothus dentatus*	15.6	-	56.2	62.6
CERI	*Ceanothus rigidus*	34	18	21	3.4
CETH	*Ceanothus thrysifloris* var. *griseus*	-	-	-	2
CRSC	*Crocanthemum scoparium*	3	1.8	-	1.2
DIAU	*Diplacus aurantiacus*	-	-	0.6	-
ERCO	*Eriophyllum confertiflorum*	-	0.2	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-
FRCA	*Frangula californica*	0.2	-	-	-
GAEL	*Garrya elliptica*	-	-	-	2.8
HEAR	*Heteromeles arbutifolia*	-	-	-	-
LECA	*Lepechinia calycina*	-	-	8.4	3.8
LUCH	*Lupinus chamissonis*	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-
SAME	*Salvia mellifera*	0.8	-	-	-
SOUM	*Solanum umbelliferum*	0.4	-	-	-
SYMO	*Symphoricarpos mollis*	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-
VAOV	*Vaccinium ovatum*	-	-	-	-
BG	Bare Ground	23.8	45.6	15.2	14
HERB	Herbaceous Vegetation	9.6	3	1.2	-

APPENDIX G

NON-NATIVE SPECIES

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Table G-1. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 9

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silvery hair grass	AICA
Avena barbata	slender wild oat	AVBA
Bromus diandrus	ripgut brome	BRDI
Bromus hordeaceus	soft chess	BRHO
Briza maxima	rattlesnake grass	BRMA
Erodium botrys	long-beaked filaree	ERBO
Festuca (Vulpia) myuros	rattail sixweeks grass	FEMY
Hypochaeris glabra	smooth cat's-ear	HYGL
Logfia (Filago) gallica	daggerleaf cottonrose	LOGA
Lysimachia arvensis	scarlet pimpernel	LYAR

Table G-2. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 23

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silvery hair grass	AICA
Avena barbata	slender wild oat	AVBA
Bromus diandrus	ripgut brome	BRDI
Briza minor	small quaking grass	BRMI
Festuca (Vulpia) bromoides	brome fescue	FEBR
Festuca (Vulpia) myuros	rattail sixweeks grass	FEMY
Gastridium phleoides	nit grass	GAPH
Hypochaeris glabra	smooth cat's-ear	HYGL
Hypochaeris radicata	rought cat's-ear	HYRA
Logfia (Filago) gallica	daggerleaf cottonrose	LOGA
Lysimachia arvensis	scarlet pimpernel	LYAR
Plantago coronopus	cut-leaved plantain	PLCO

Table G-3. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 1 East

Non-Native Herbaceous Species Name	Common Name	Species Code
Avena barbata	slender wild oat	AVBA
Briza minor	small quaking grass	BRMI

Table G-4. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 6

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silvery hair grass	AICA
Briza maxima	rattlesnake grass	BRMA
Festuca (Vulpia) bromoides	brome fescue	FEBR
Festuca (Vulpia) myuros	rattail sixweeks grass	FEMY
Gastridium phleoides	nit grass	GAPH
Hypochaeris glabra	smooth cat's-ear	HYGL
Senecio glomeratus	cutleaf burnweed	SEGL

Table G-5. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 7

Non-Native Herbaceous Species Name	Common Name	Species Code
Hypochaeris glabra	smooth cat's-ear	HYGL
Hypochaeris radicata	rought cat's-ear	HYRA
Lysimachia arvensis	scarlet pimpernel	LYAR
Rumex acetosella	sheep sorrel	RUAC

Table G-6. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 10

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silvery hair grass	AICA
Festuca (Vulpia) myuros	rattail sixweeks grass	FEMY
Hypochaeris radicata	rought cat's-ear	HYRA

Table G-7. Non-Native Species Observed During Line Intercept Transect Monitoring in MOUT Buffer

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silver hair grass	AICA

Table G-8. Non-Native Species Observed During Line Intercept Transect Monitoring in Watkins Gate Burn Area

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silvery hair grass	AICA
Briza maxima	rattlesnake grass	BRMA
Festuca (Vulpia) bromoides	brome fescue	FEBR
Hypochaeris glabra	smooth cat's-ear	HYGL

Table G-9. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 34

Non-Native Herbaceous Species Name	Common Name	Species Code
Senecio glomeratus	cutleaf burnweed	SEGL

APPENDIX H

MAPS: MACROPLOTS PRESENCE/ABSENCE

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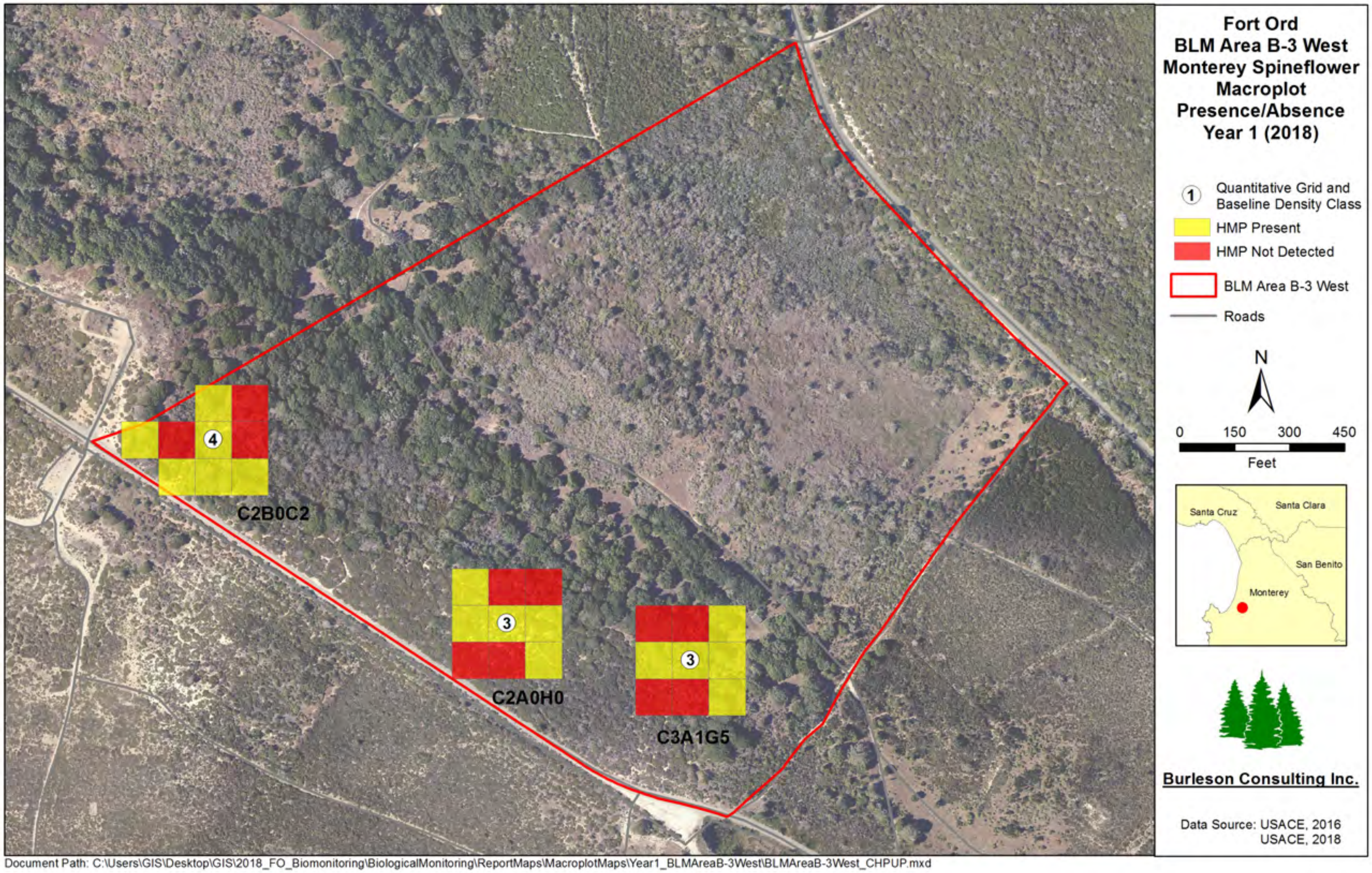

Figure H-1. Map of Monterey Spineflower Macroplot Presence/Absence, BLM Area B-3 West ($n_{Masticated}$=3 macroplots)

Figure H-2. Map of Seaside Bird's Beak Macroplot Presence/Absence, BLM Area B-3 West ($n_{Masticated}$=3 macroplots)

Figure H-3. Map of Sand Gilia Macroplot Presence/Absence, BLM Area B-3 West ($n_{Masticated}$=3 macroplots)

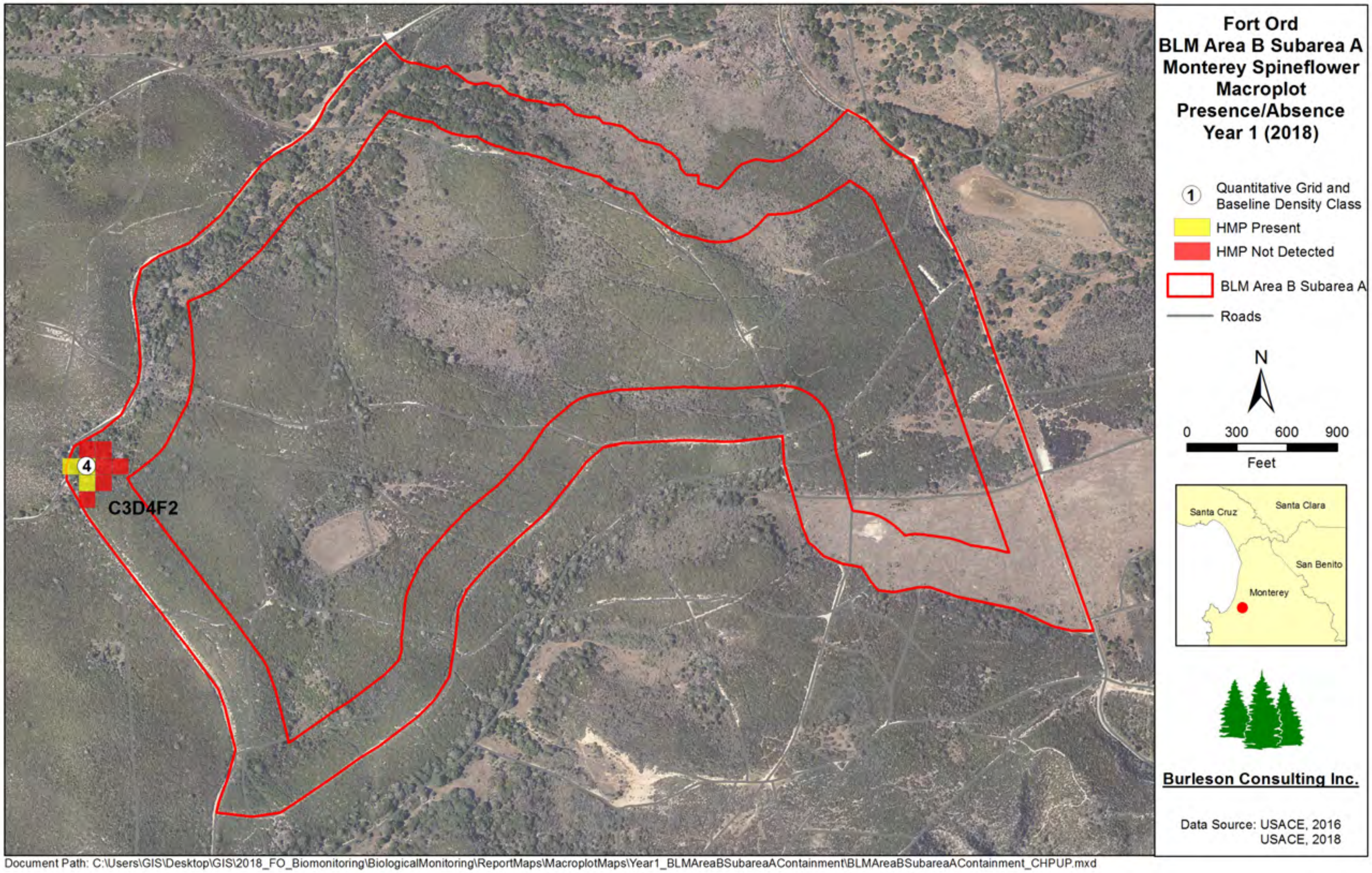

Figure H-4. Map of Monterey Spineflower Macroplot Presence/Absence, BLM Area B Subarea A Containment Line ($n_{Masticated}$=1 macroplot)

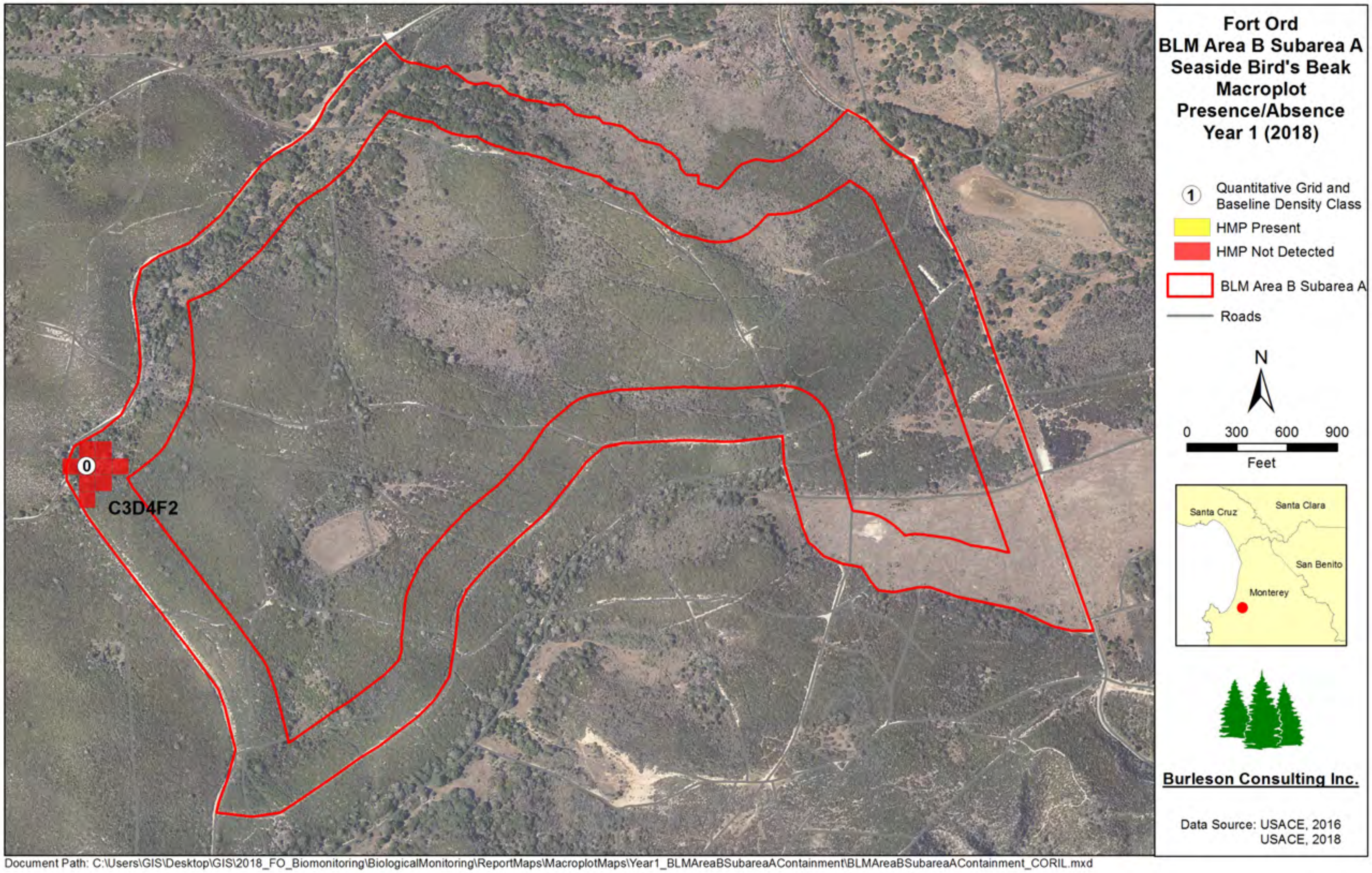

Figure H-5. Map of Seaside Bird's Beak Macroplot Presence/Absence, BLM Area B Subarea A Containment Line ($n_{Masticated}$=1 macroplot)

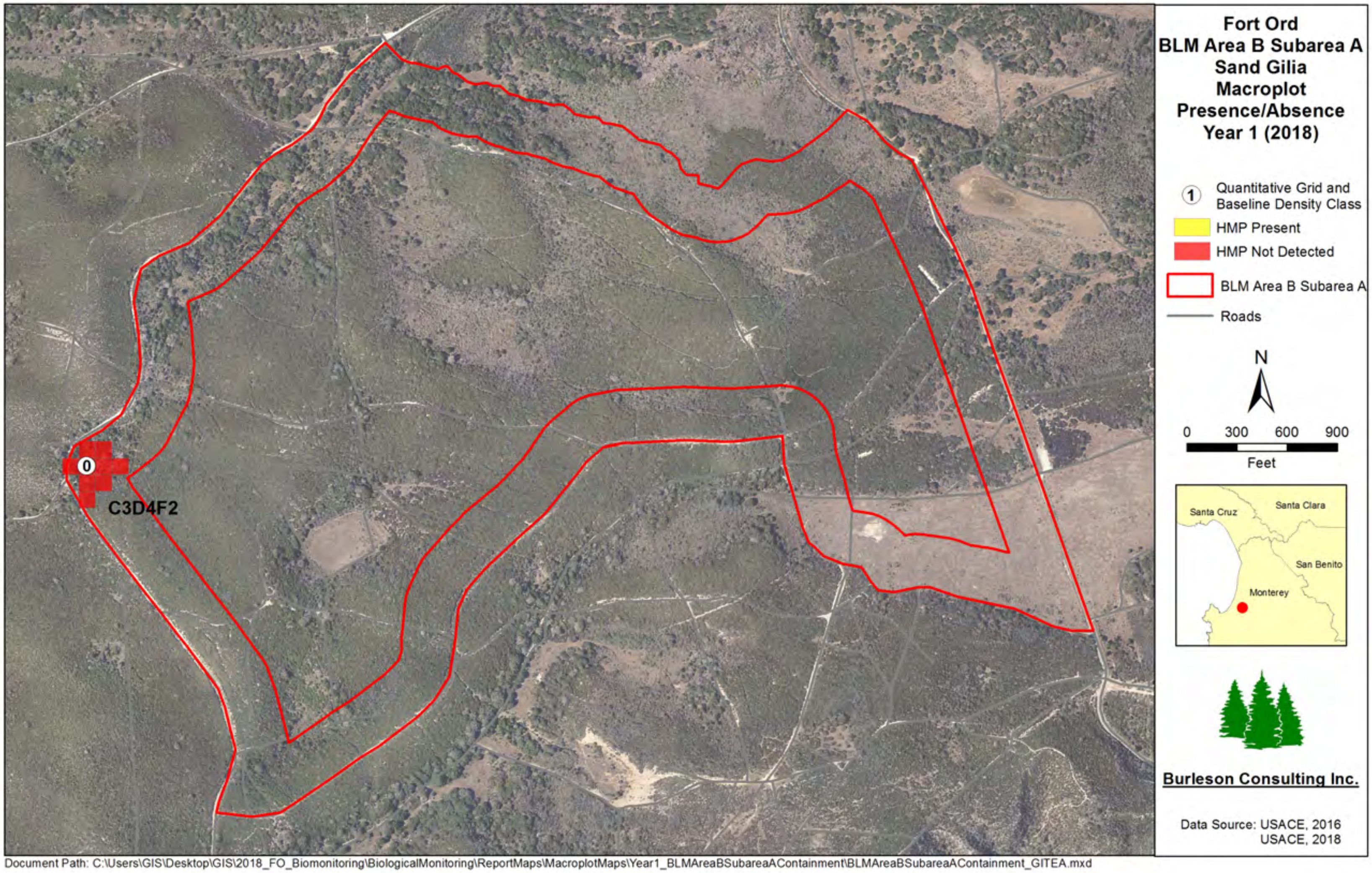

Figure H-6. Map of Sand Gilia Macroplot Presence/Absence, BLM Area B Subarea A Containment Line ($n_{Masticated}$=1 macroplot)

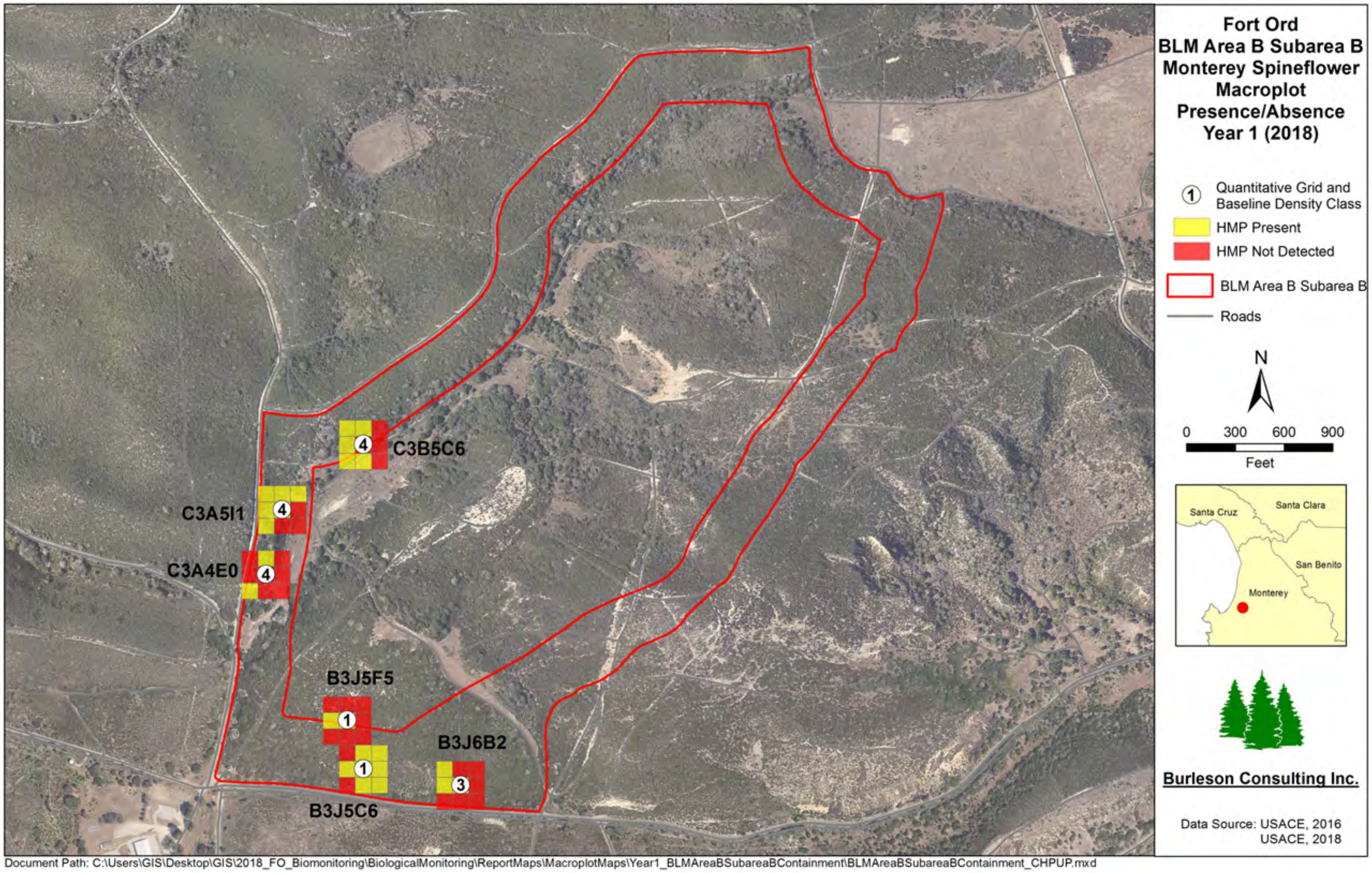

Figure H-7. Map of Monterey Spineflower Macroplot Presence/Absence, BLM Area B Subarea B Containment Line ($n_{Masticated}$=1 macroplot; $n_{Masticated\&Burned}$=3 macroplots; n_{Mixed}=2 macroplots)

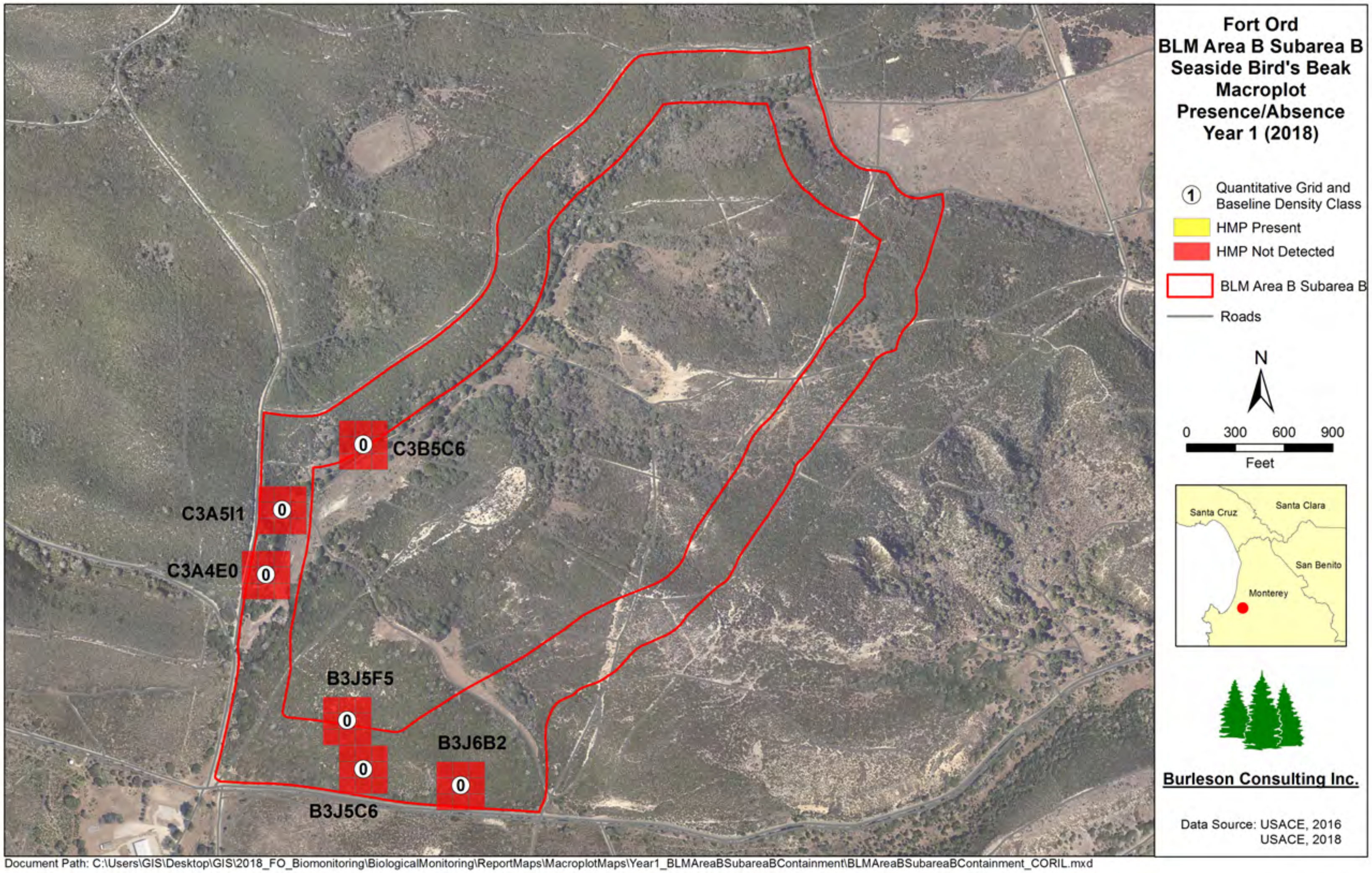

Figure H-8. Map of Seaside Bird's Beak Macroplot Presence/Absence, BLM Area B Subarea B Containment Line ($n_{Masticated}$=1 macroplot; $n_{Masticated\&Burned}$=3 macroplots; n_{Mixed}=2 macroplots)

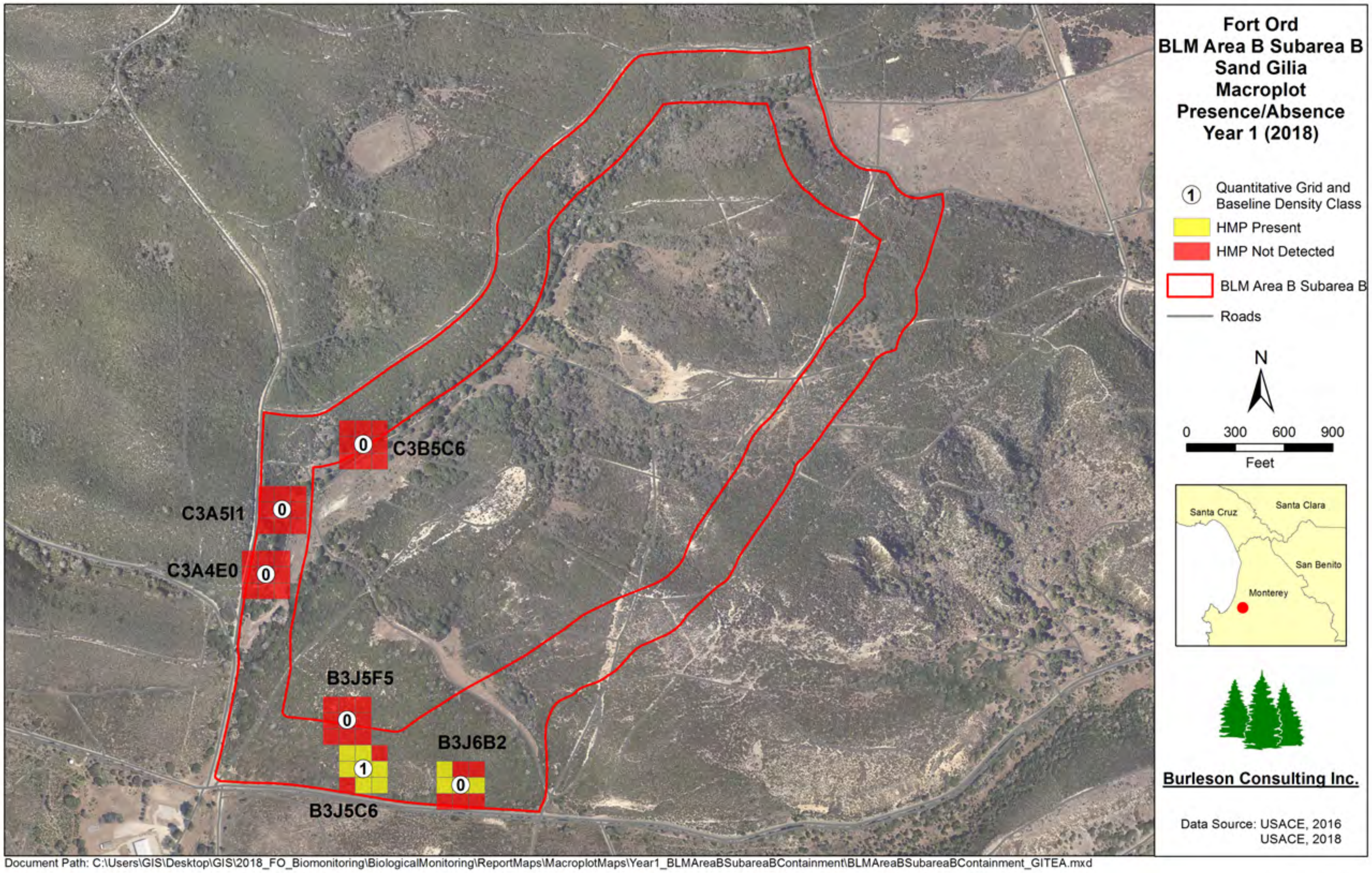

Figure H-9. Map of Sand Gilia Macroplot Presence/Absence, BLM Area B Subarea B Containment Line ($n_{Masticated}$=1 macroplot; $n_{Masticated\&Burned}$=3 macroplots; n_{Mixed}=2 macroplots)

Figure H-10. Map of Monterey Spineflower Macroplot Presence/Absence, Unit 9 ($n_{Masticated}$=2 macroplots)

Figure H-11. Map of Seaside Bird's Beak Macroplot Presence/Absence, Unit 9 ($n_{Masticated=}$2 macroplots)

Figure H-12. Map of Sand Gilia Macroplot Presence/Absence, Unit 9 ($n_{Masticated}$=2 macroplots)

Document Path: C:\Users\GIS\Desktop\GIS\2018_FO_Biomonitoring\BiologicalMonitoring\ReportMaps\MacroplotMaps\Year3_Unit23\Unit23_CHPUP.mxd

Figure H-13. Map of Monterey Spineflower Macroplot Presence/Absence, Unit 23 ($n_{Masticated}$=1 macroplot)

Figure H-14. Map of Seaside Bird's Beak Macroplot Presence/Absence, Unit 23 ($n_{Masticated}$=1 macroplot)

Figure H-15. Map of Sand Gilia Macroplot Presence/Absence, Unit 23 ($n_{Masticated}$=1 macroplot)

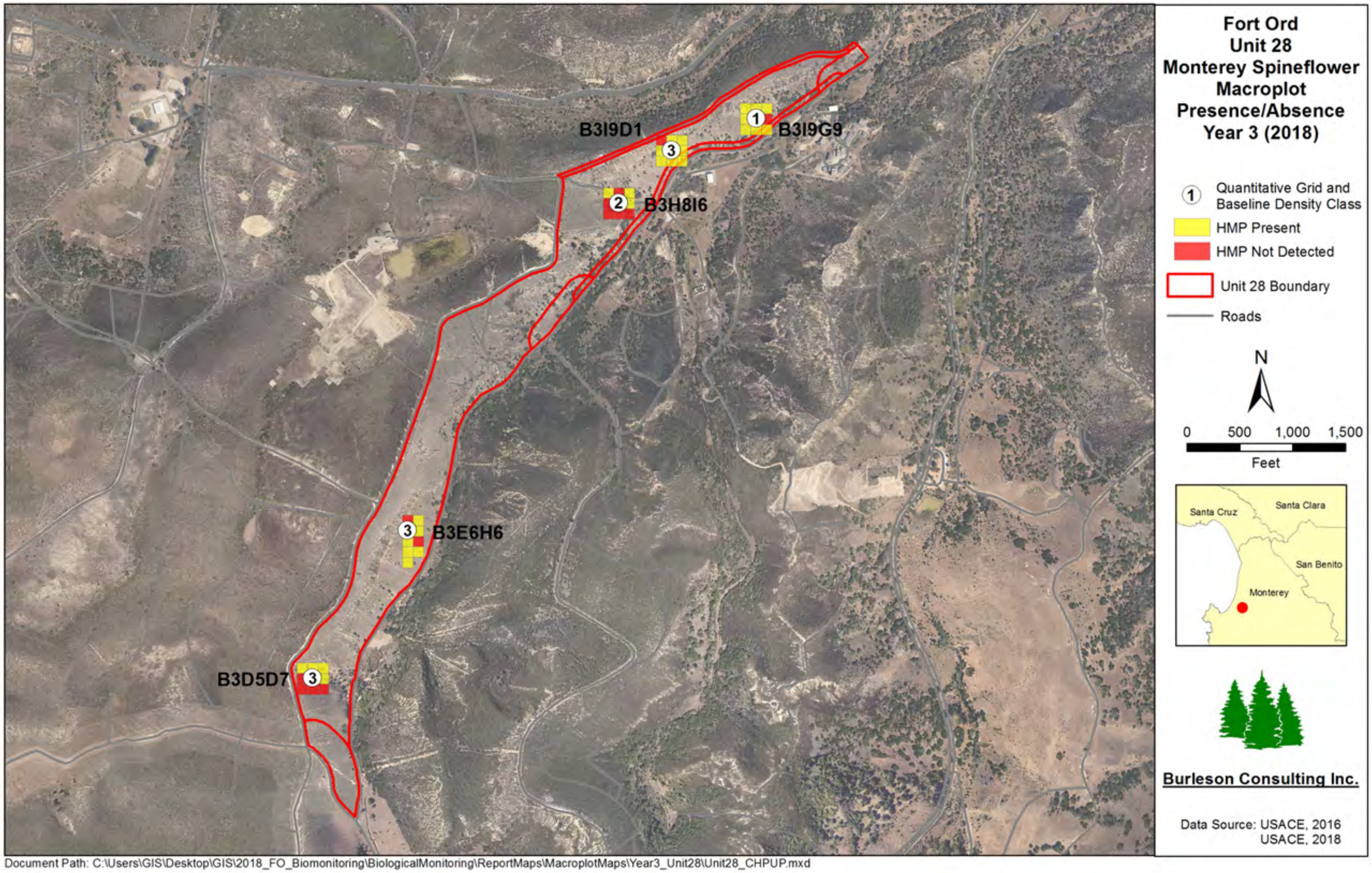

Figure H-16. Map of Monterey Spineflower Macroplot Presence/Absence, Unit 28 ($n_{Masticated}$=5 macroplots)

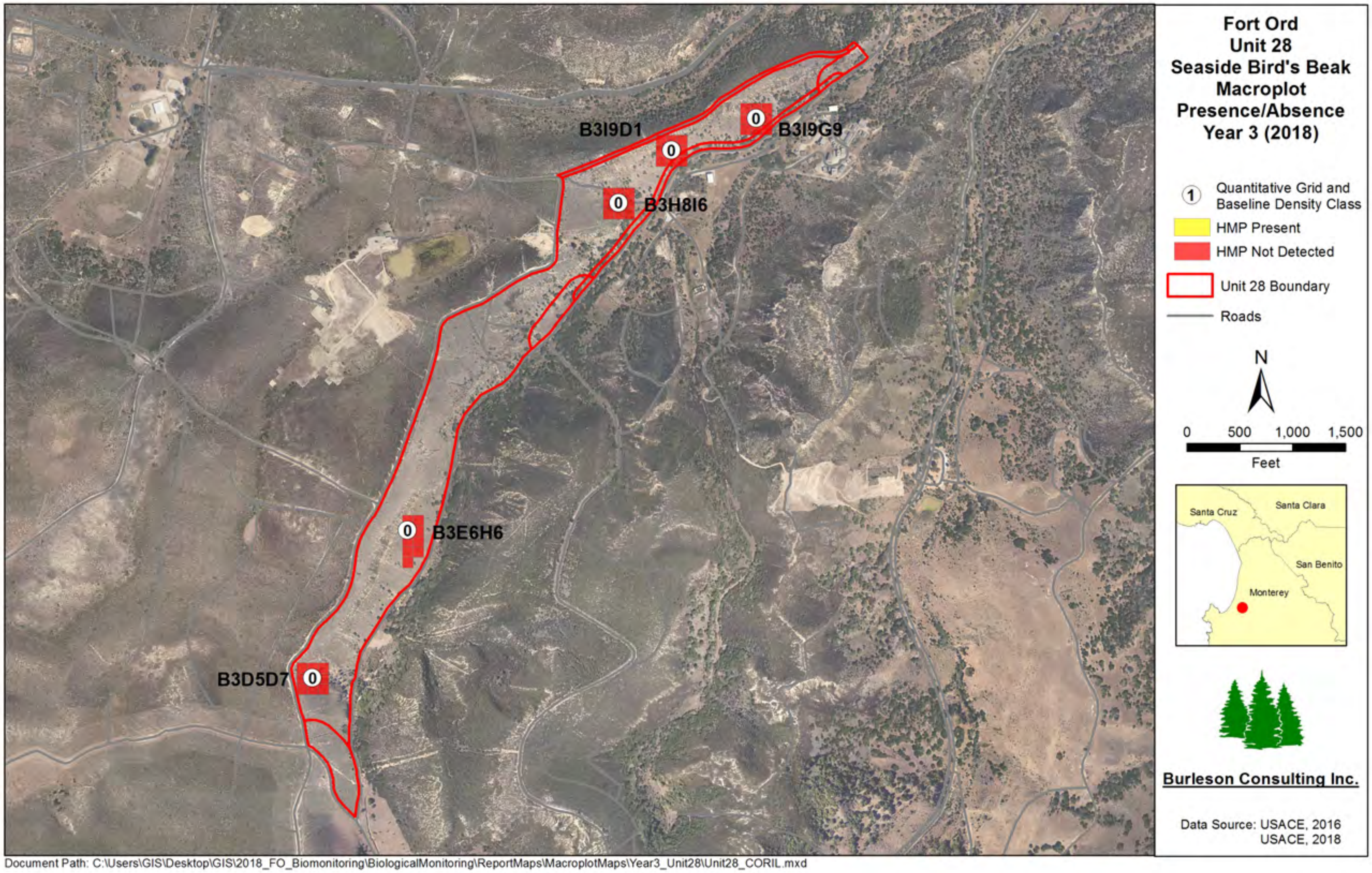

Figure H-17. Map of Seaside Bird's Beak Macroplot Presence/Absence, Unit 28 ($n_{Masticated}$=5 macroplots)

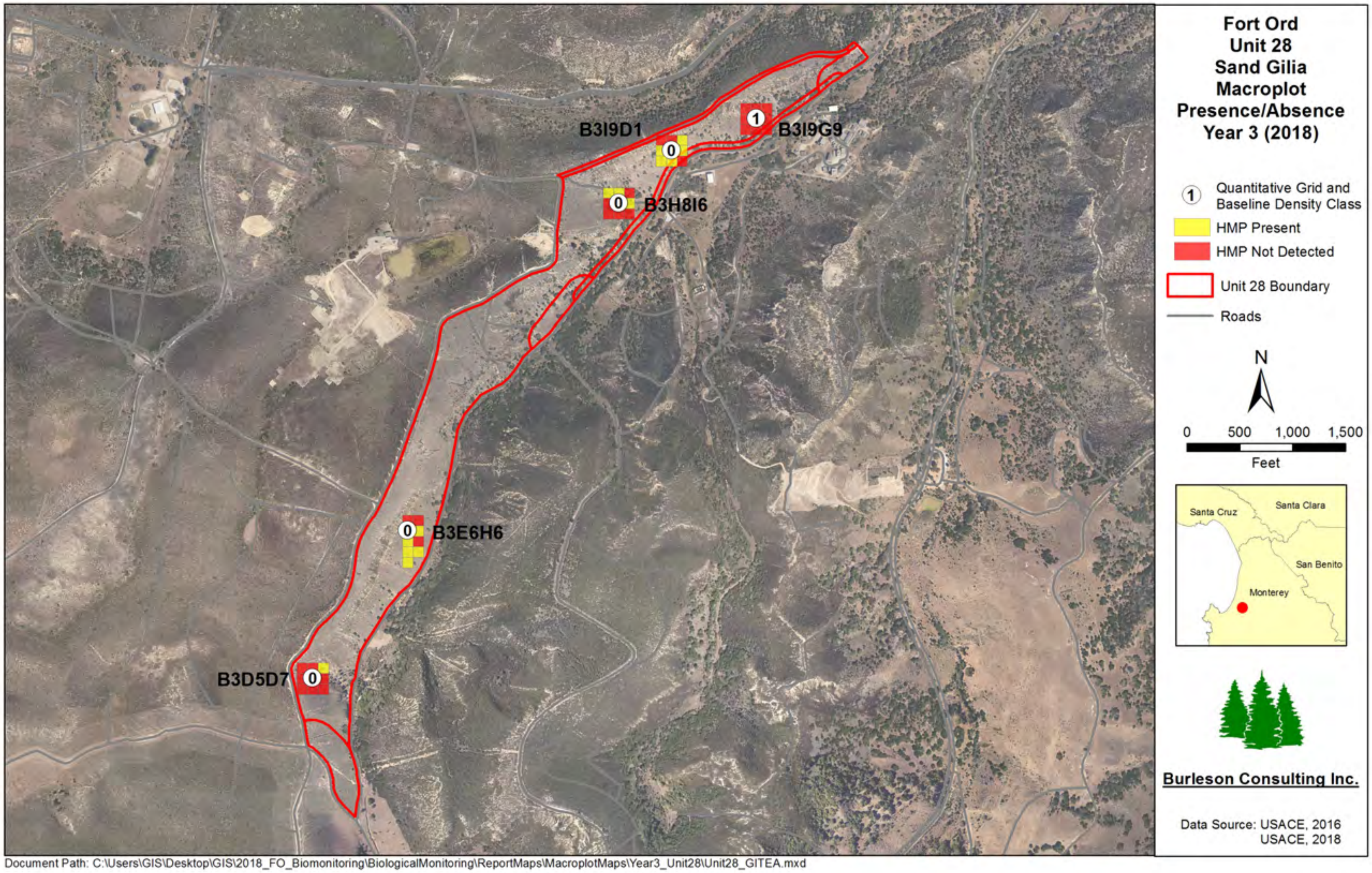

Figure H-18. Map of Sand Gilia Macroplot Presence/Absence, Unit 28 ($n_{Masticated}$=5 macroplots)

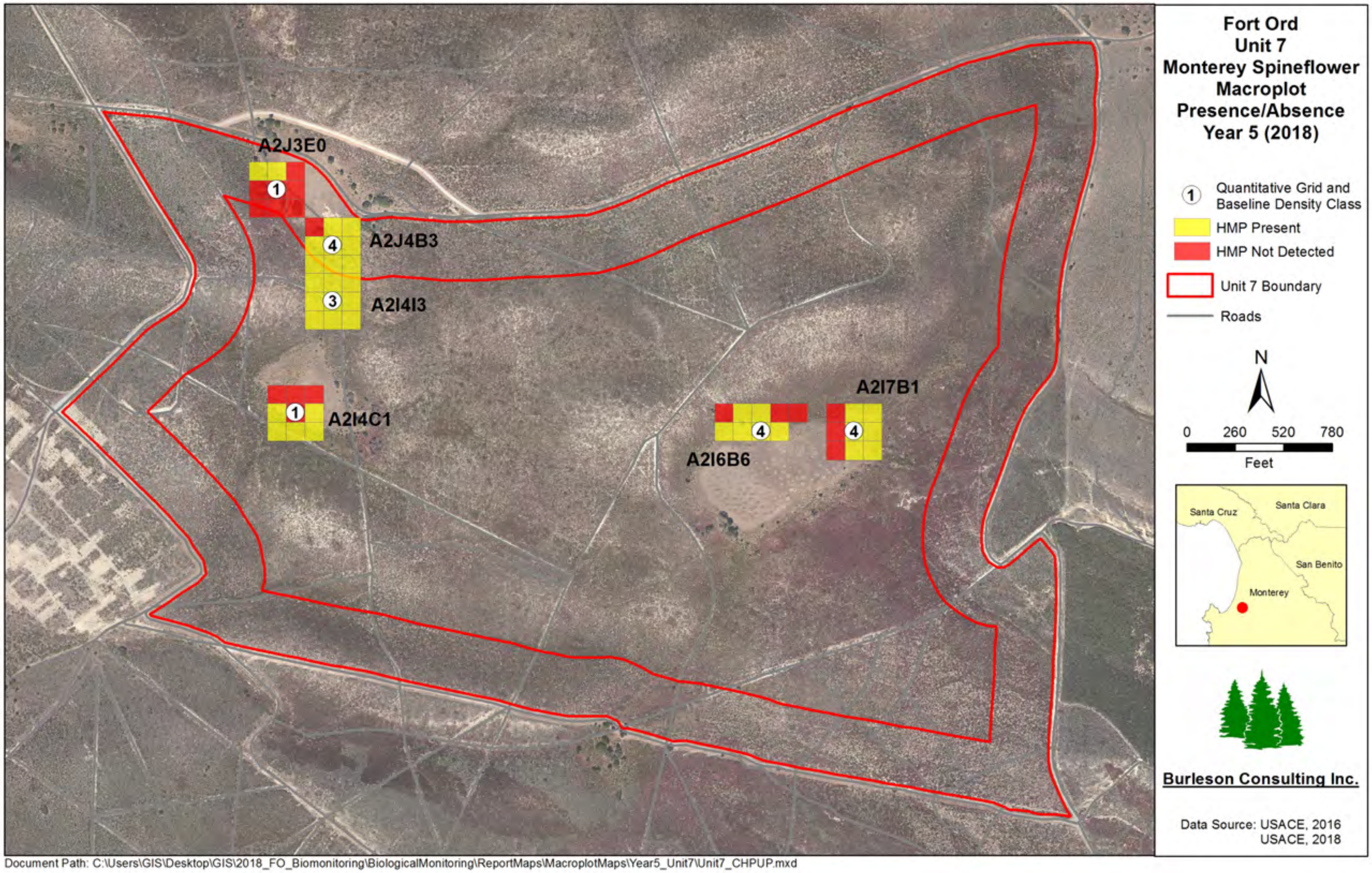

Figure H-19. Map of Monterey Spineflower Macroplot Presence/Absence, Unit 7 (n_{Burned}=4 macroplots; n_{Mixed}=2 macroplots)

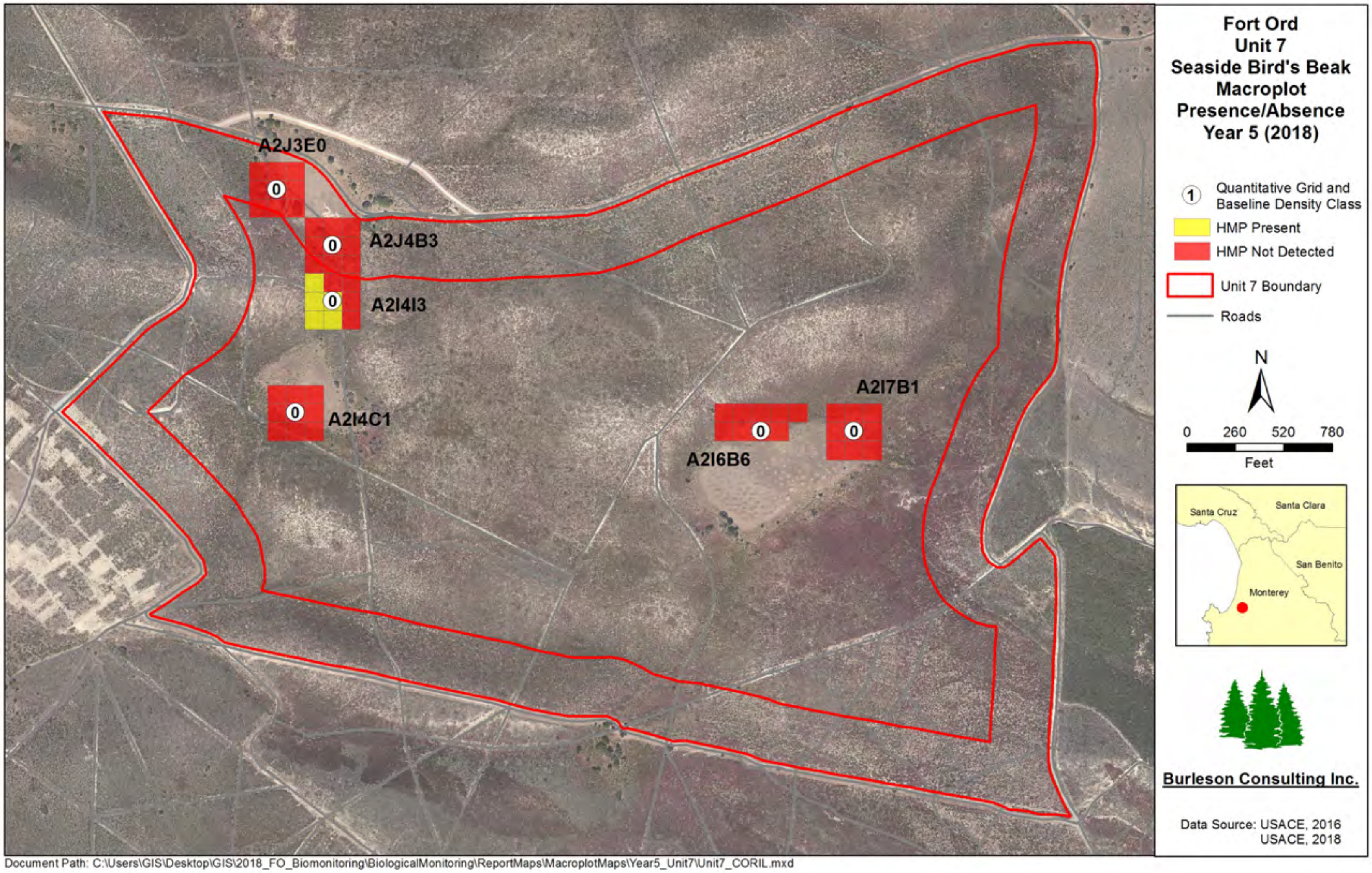

Figure H-20. Map of Seaside Bird's Beak Macroplot Presence/Absence, Unit 7 (n_{Burned}=4 macroplots; n_{Mixed}=2 macroplots)

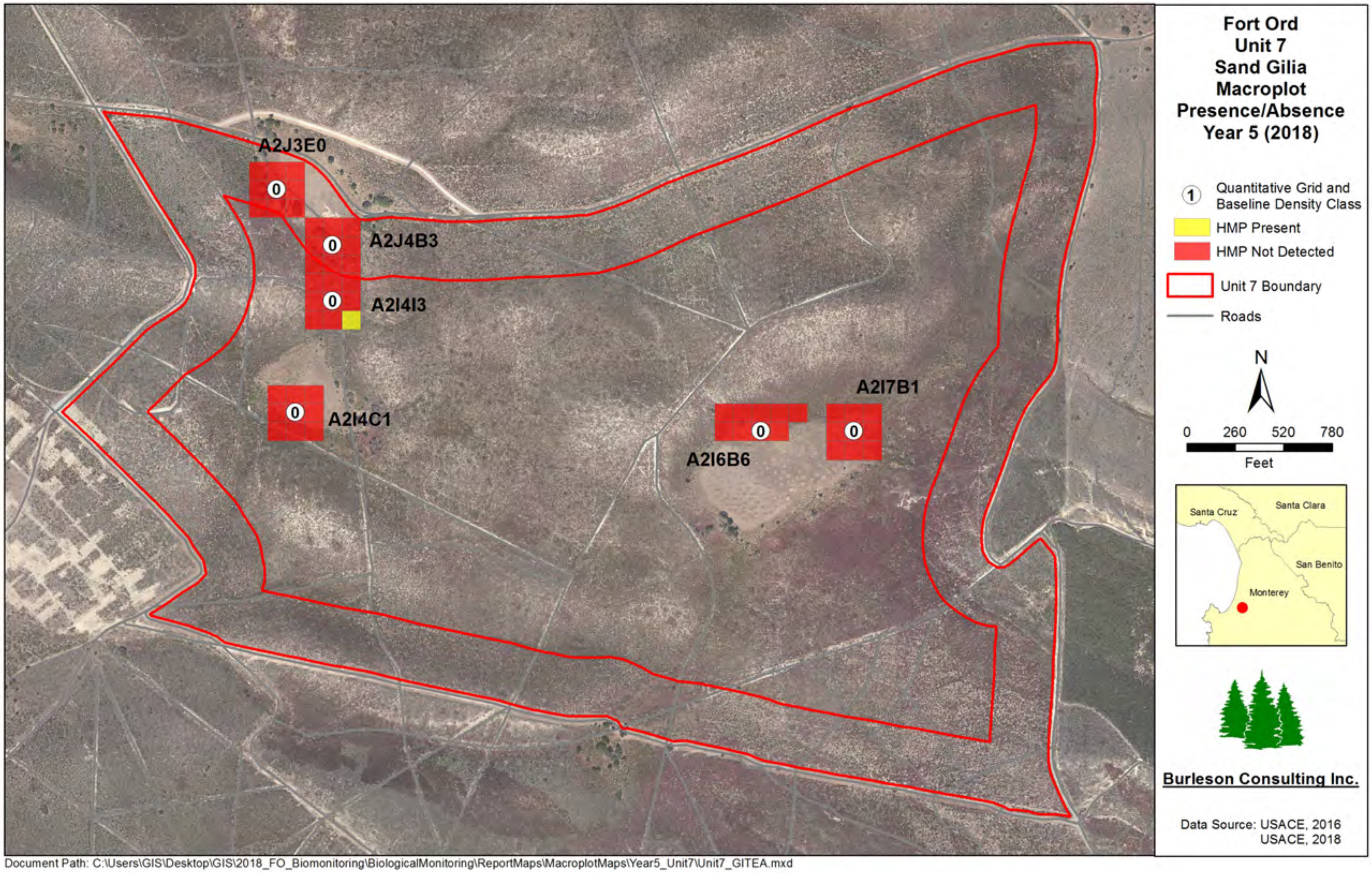

Figure H-21. Map of Sand Gilia Macroplot Presence/Absence, Unit 7 (n_{Burned}=4 macroplots; n_{Mixed}=2 macroplots)

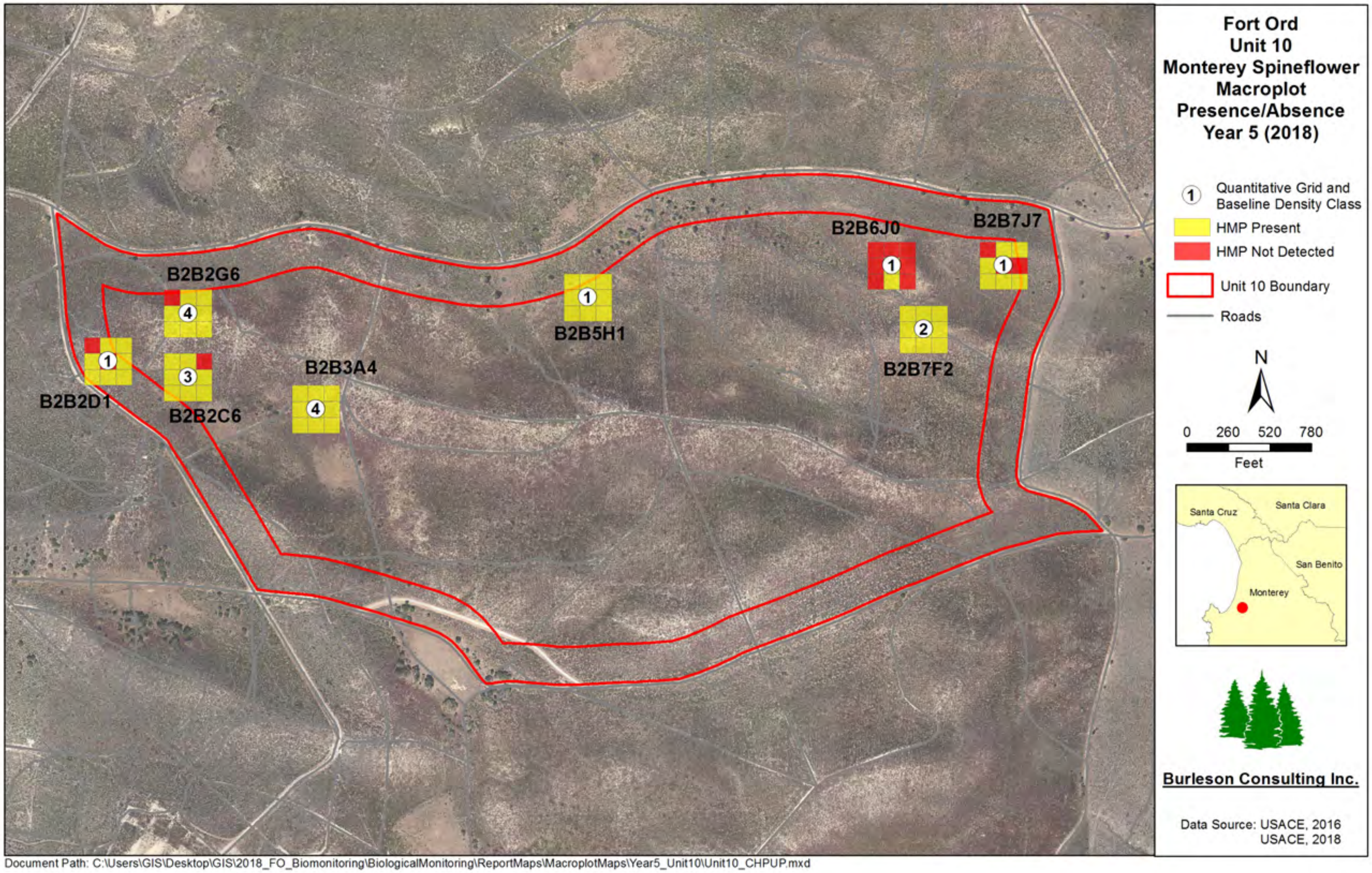

Figure H-22. Map of Monterey Spineflower Macroplot Presence/Absence, Unit 10 (n_{Burned}=7 macroplots; $n_{Masticated\&Burned}$=1 macroplot)

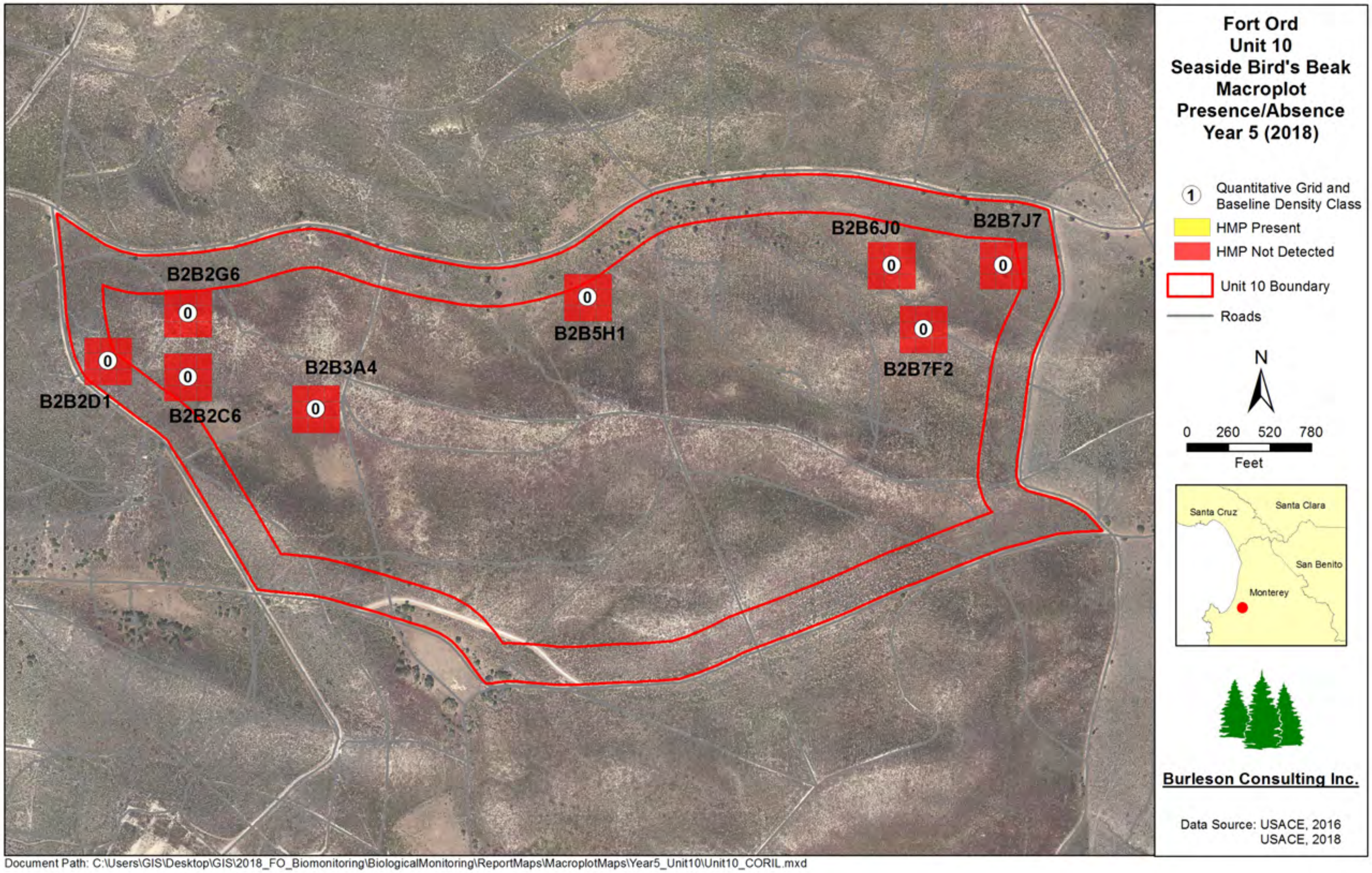

Figure H-23. Map of Seaside Bird's Beak Macroplot Presence/Absence, Unit 10 (n_{Burned}=7 macroplots; $n_{Masticated\&Burned}$=1 macroplot)

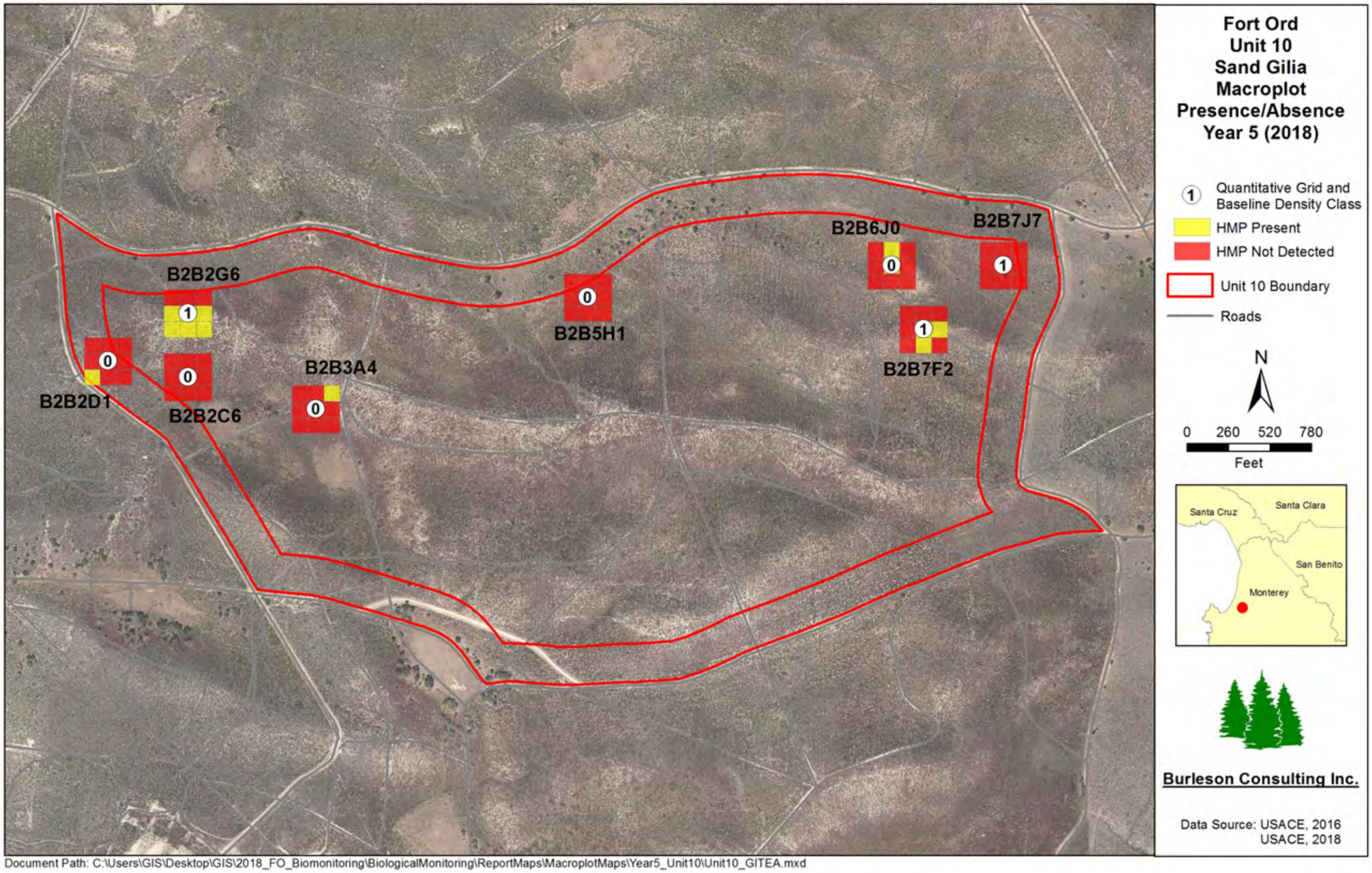

Figure H-24. Map of Sand Gilia Macroplot Presence/Absence, Unit 10 (n_{Burned}=7 macroplots; $n_{Masticated\&Burned}$=1 macroplot)

Figure H-25. Map of Monterey Spineflower Macroplot Presence/Absence, Watkins Gate Burn Area ($n_{Masticated}$=5 macroplots**)**

Figure H-26. Map of Seaside Bird's Beak Macroplot Presence/Absence, Watkins Gate Burn Area ($n_{Masticated}$=5 macroplots)

Figure H-27. Map of Sand Gilia Macroplot Presence/Absence, Watkins Gate Burn Area ($n_{Masticated}$=5 macroplots)