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2022 ANNUAL REPORT
BIOLOGICAL MONITORING

for Range 48; BLM Area B Units B-2A, B-3 West, B-3 East, A Southern Containment Line, B, and C; Units 1 West, 2 West, and 3 West.
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ACRONYMS AND ABBREVIATIONS

AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
Burleson	Burleson Consulting Inc., A Terracon Company
EcoSystems West	EcoSystems West Consulting Group, Inc.
ER	Evidence Ratio
ft	feet
GPS	Global Positioning System
HMP	Habitat Management Plan
HMP annuals	Annual 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 Response Area
NOAA	National Oceanic and Atmospheric Administration
NCEI	National Centers for Environmental Information
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

1 INTRODUCTION

The United States Army Corps of Engineers (USACE) contracted Burleson Consulting, Inc., A Terracon Company (Burleson) to conduct biological monitoring at former Fort Ord, Monterey County, California (see Figures 1-1 and 1-2). 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 (a) Range 48 (Year 3 monitoring); (b) BLM Area B Units B-2A, B-3 West, B-3 East, A Southern Containment Line, B, and C (Year 5 monitoring); and (c) Units 1 West, 2 West, and 3 West (Year 8 monitoring). Monitoring was conducted during spring and summer of 2022 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 annual species of special concern (HMP annuals), shrubs, non-native annual grasses, and invasive plants. Baseline monitoring is conducted prior to cleanup activities (such as vegetation clearance, MEC removal, and other related operations) to establish the 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).

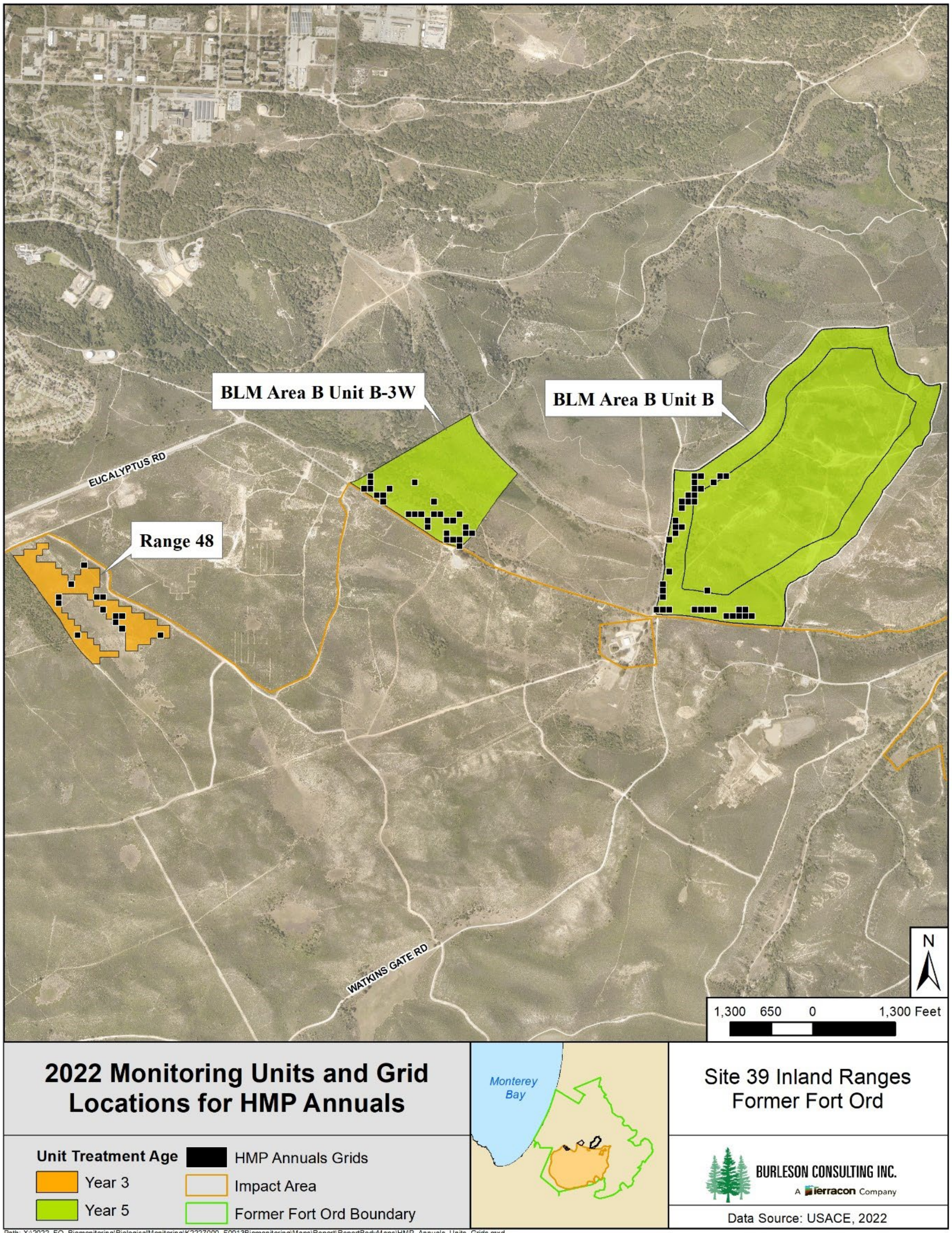

Figure 1-1. Map of Former Fort Ord, Monterey, CA, Showing Locations of Units and Grids Sampled for HMP Annual Species in 2022.

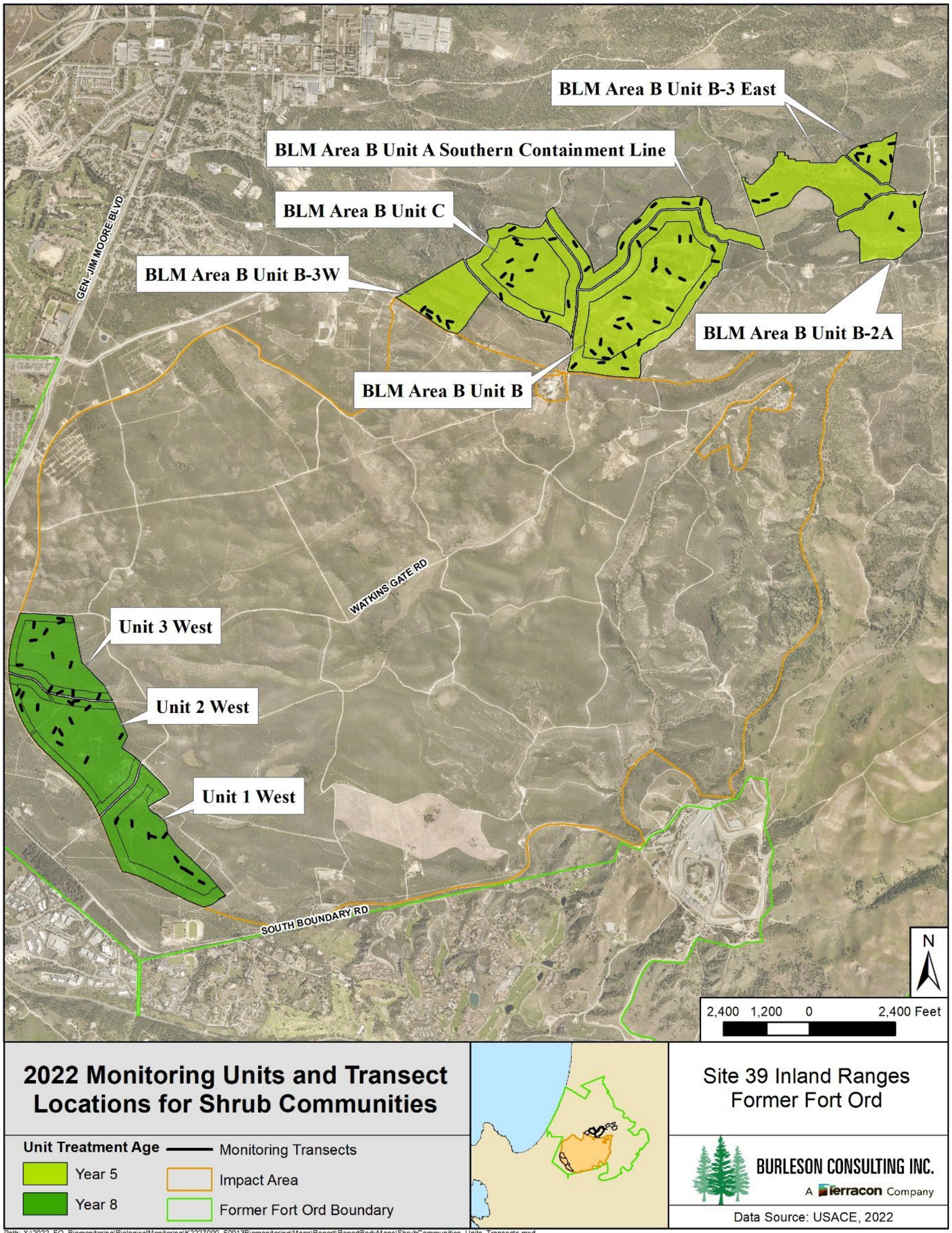

Figure 1-2. Map of Former Fort Ord, Monterey, CA, Showing Locations of Units and Transects Sampled for Shrub Community in 2022.

The 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, vernal pools, meadows, 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 openings for plants to colonize.

Drought is a substantial factor affecting vegetation composition at former Fort Ord (Burleson, 2022). The last two consecutive water-years resulted in drought conditions and were well below the 30-year normal (Figure 1-3; NPS, 2022; NCEI NOAA, 2022). The low water-years likely impacted HMP annual density in 2022 and may have affected recovery of shrub community composition.

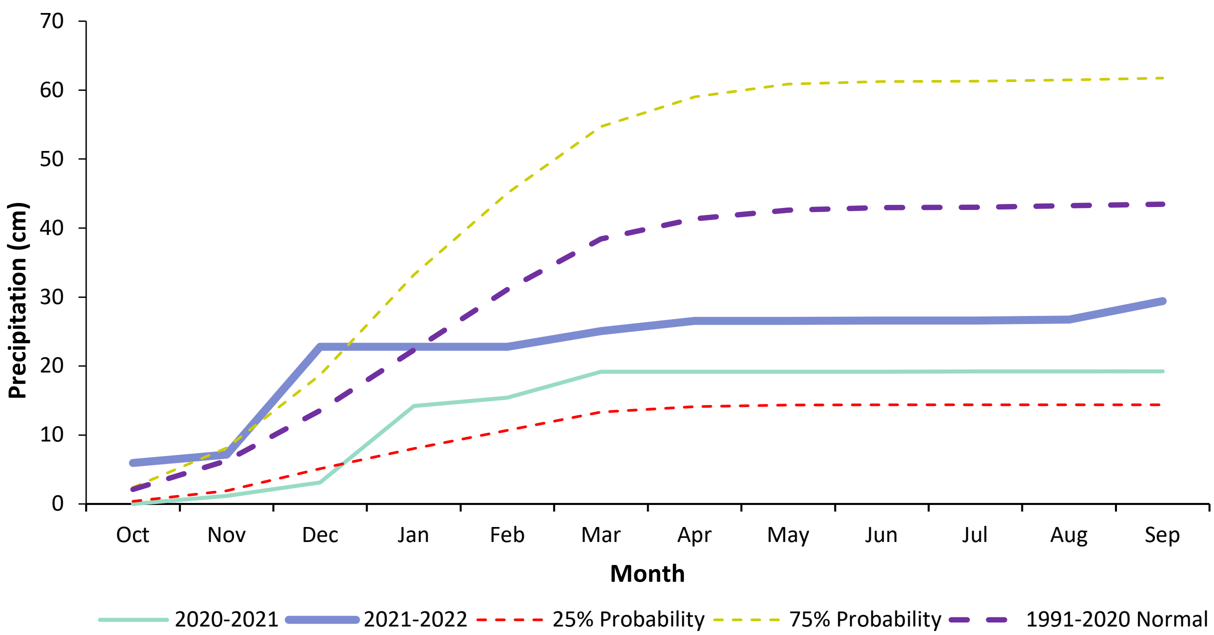

Figure 1-3. Cumulative Monthly Precipitation for the 2021-2022 Water-Year Compared to the 30-Year Normal (mean 1991-2020), the Previous Water-Year, and the 25% and 75% Probabilities (NPS, 2022; NCEI NOAA, 2022).

1.1 Species Included in 2022 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, were the focus of the HMP (USACE, 1997). The focus shrub species (HMP shrubs) include:

- California Native Plant Society (CNPS) 1B.2 listed sandmat manzanita (*Arctostaphylos pumila*),
- 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 focus annual species (HMP annuals) include:

- state threatened, federally endangered, and CNPS 1B.2 listed sand gilia (*Gilia tenuiflora* ssp. *arenaria*),
- federally threatened and CNPS 1B.2 listed Monterey spineflower (*Chorizanthe pungens* var. *pungens*),
- and state endangered and CNPS 1B.1 listed seaside bird's-beak (*Cordylanthus rigidus* ssp. *littoralis*).

Survey teams also report the locations of federally endangered and CNPS 1B.1 listed Yadons's piperia (*Piperia yadonii*) when encountered incidentally 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 2022 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, 1999 and 2001; MACTEC, 2004; Tetra Tech and EcoSystems West, 2011 – 2015b; Burleson, 2016 – 2022).

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.

Three treatment classes were identified based on treatments applied:

- Masticate – 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.

In addition, another treatment class was 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.

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, 2022).

Table 1-1. Previous Monitoring Surveys at 2022 Study Units on Fort Ord.

Survey Year	Survey
1997, 2000	Harding Lawson Associates (1997 & 2001) performed broad scale Baseline surveys on Units 1 West, 2 West, and 3 West (formerly called the Multirange Area). Harding Lawson Associates (2001) performed Baseline surveys in Unit B (formerly called OE Site 9) and Range 48.
1998	Harding Lawson Associates (1999) performed Baseline surveys in Unit B-2A (formerly called OE Site 48).
2007	Shaw (2008) performed Baseline surveys in Units 1 West, 2 West, and 3 West.
2013	Tetra Tech and EcoSystems West (2014) performed Year 10 (Pre-treatment) surveys in Range 48.
2015	Burleson (2016) performed Baseline surveys in BLM Area B Units B-3 West, B-3 East, B, C, and the Containment Lines of BLM Area B Unit A, and Unit B-2A.
2017	Burleson (2018) performed Year 3 surveys in Units 1 West, 2 West, and 3 West.
2018	Burleson (2019) performed Year 1 HMP annual surveys in Units B and B-3 West; Year 1 annual grasses monitoring in Units B, B-3 West, and the Southern Containment Line of Unit A; and Year 3 shrub transect monitoring of Units.
2019	Burleson (2020) performed Year 5 surveys in Units 1 West, 2 West, and 3 West.
2020	Burleson (2021) performed Year 1 surveys in Range 48; and Year 3 surveys in BLM Area B Units B-2A, B-3 West, B-3 East, B, C, and the Southern Containment Line of Unit A.

2 METHODS

This section describes the standard monitoring methods used during the 2022 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 result.

2.1 Soils

The U.S. Department of Agriculture (USDA) mapped five soil types occurring in Units monitored in 2022, shown in Table 2-1 (USDA, 2022). Antioch very fine sandy loam with 2 to 9 percent slopes occur in the BLM Area B-3 East and B-2A Units, and the BLM Area B Unit A Containment Line and Unit B. Arnold-Santa Ynez complex is a large portion of the munitions remediation area (MRA) and occurs in BLM Area B Units B-3 East, B-3 West, B-2A, B, C, A Southern Containment Line, Units 1 West and 2 West; and Range 48. Baywood sand with 2 to 15 percent slopes, occurs in Range 48, Unit 2 West, and Unit 3 West. Oceano loamy sand with 2 to 15 percent slopes occur in BLM Area B-3 West. Xerorthents, dissected, occurs in BLM Area B Unit B-2A.

Burleson identified at least two distinct types of soil during previous surveys in areas where the soil was mapped as Arnold-Santa Ynez complex. The first type of this soil consists primarily of relatively coarse, loose sand, generally without gravel. The other type consists of harder-packed sand with finer material, and typically contains large numbers of small, reddish, round pebbles. The HMP annual species Monterey spineflower, sand gilia, and seaside bird's-beak occur almost exclusively on the former soil type. The soils mapped by the USDA (2022) as Arnold-Santa Ynez complex in the MRA may reflect co-occurring soil types or be too coarsely mapped to reflect soil variability at a relatively fine scale.

Table 2-1. Distribution of Soil Types in Former Fort Ord Biological Monitoring Areas of 2022 (USDA, 2022).

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-3 East, BLM Area B-2A, BLM Area B Unit A Containment Line, BLM Area B Unit B
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	BLM Area B-3 East, BLM Area B-3 West, BLM Area B-2A, BLM Area B Unit C, BLM Area B Unit A Containment Line, BLM Area B Unit B, Range 48, Unit 1 West, Unit 2 West
BbC, Baywood sand, 2 to 15 percent slopes	Sand; somewhat excessively drained; derived from stabilized sandy aeolian sands	Range 48, Unit 2 West, Unit 3 West
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
Xd, Xerorthents, dissected	Loam, clay loam; well drained; derived from mixed unconsolidated alluvium	BLM Area B-2A

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 2022 monitoring season. These surveys occurred in Range 48 and BLM Area B Units B-2A, B-3W, B-3 East, Unit A Southern Containment Line, B, and C. 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 Trimble® Juno® T41/5 Series GPS unit with an external Trimble® R1 GNSS receiver and occurrences were noted for comparison with future monitoring efforts; the Army and BLM were informed of these locations for possible avoidance during future remediation work. Piperia individuals were recorded to genus due to the difficulty of identifying to species when not in flower.

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 2022 (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 2022 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 was when more than 500 individuals of any species were recorded, surveyors stopped counting individuals 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 2022 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, the 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 is 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 proportionally 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 the 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 the following:

- 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 that 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, 2022). 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, 2022; USACE, 2022). 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 or a portion was only masticated. Neither treatment was 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.

Unit B was the only unit with a mixture of treatment types. Effects due to treatment were evaluated using histograms of grid counts by density class, density class maps, and professional field knowledge of Unit B. The histograms were grouped by *treatment* and *age*. The Unit B map was color-coded to distinguish density class as well as treatment types (Figures B-7 through B-9). Statistical hypothesis tests were not conducted due to the confounding nature of the edaphic and community differences reported by field biologists.

2.3 HMP Shrub Transects Methods

2.3.1 Field Methods

Burleson conducted shrub transect monitoring in maritime chaparral in BLM Area B Units B-2A, B-3 West, B-3 East, A Southern Containment Line, B, and C; and Units 1 West, 2 West, and 3 West during the 2022 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® GeoXH GPS unit to locate the previously recorded start points of each transect sampled. One transect was allocated in the Baseline year for approximately 11 acres each. Transects were allocated separately within the masticated primary Containment Lines or 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 Unit 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 that were unsuitable (difficult terrain, crossing roads, etc.) once the field crew was on-site. These grids were randomly ranked. The field biologist determined field suitability of transect placement within each selected grid based on ability to physically sample the transect line. When a grid was deemed unsuitable, the subsequently 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 represented the surrounding area and most of the transect crossed the selected grid.

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

- Navigating to the transect start point using Trimble® GeoXH GPS receiver and following line shapefiles of transects from the FODIS database.
- Laying out a 50-m transect along the line, repeating direction from previous sampling year.
- Recording plants greater than or equal to 0.1 m contiguous cover directly beneath the transect.
- Identifying shrubs to species and recording start/end points on the transect. Bare ground was also recorded.
- Recording 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).
- Recording transect direction, clarifying species codes for uncommon species, and noting areas of new mastication or fuel breaks that may have reduced the effective length of a transect since the baseline sampling year.
- When transects were less than 50 m, calculating cover values with the new transect length. The shortened transects were then analyzed as if they were 50 m. This was deemed appropriate since the differences in length occurred on few transects and was 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 2022 shrub transect monitoring was conducted (e.g., 5-year-old vs 3-year-old). Within these groups, Burleson conducted either one-way, two-way, or three-way permutational analysis of variance (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 that 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, 2021; R Core Team, 2021). Burleson used Bray-Curtis dissimilarity matrices to measure community composition, and partitioned between factors. The function *adonis* uses permutation testing to detect the potential influence of those partitions. Two-way PERMANOVA testing was conducted on

Units that contained more than one treatment to examine the influence of *treatment* on community composition. PERMANOVA testing is a robust alternative to other analyses (e.g. Kruskal-Wallis or 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 (i.e., some community structure data do not meet normality assumption).

Following Legendre and Legendre (1998), Burleson conducted nonmetric multidimensional scaling (NMDS) ordinations. These allowed qualitative visualizations of the differences detected in PERMANOVA testing. NMDS is a reduced-space ordination method that 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, 2021).

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 (number of species present), and species evenness index. Total cover is sometimes greater than 100 percent due to overlapping growth of some species (e.g., a coast live oak tree growing within a sandmat manzanita individual). 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, 2021).

One-way, two-way, or mixed-design 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 that were used for community metrics. These methods were also utilized to evaluate HMP species cover differences between *treatment* types in the Year 8 units.

When conducting two- or three-way ANOVA tests, the *F*-statistic and *p*-value were used to assess potential differences. 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 that 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.

In Former Fort Ord Biomonitoring Annual Reports issued prior to 2020, statistical differences were considered significant when the *p*-value was less than a 0.05 significance level and when the *F*-statistic was considerably greater than one. For this year's report, less emphasis was placed on *p*-values in comparison to a significance level. This shift is based on a recent statement by the American Statistical Association (Wasserstein and Lazar, 2016) that discussed potential misinterpretation of the *p*-value and the "bright line" created between significant and not significant when compared against a predetermined significance level (Wasserstein and Lazar, 2016; Wasserstein et al, 2019). Instead, for this year's report while the *F*-statistic and *p*-value are reported, no significance level is identified and interpretation of the factors affecting recovery is based on an overall assessment of the data and descriptive statistics.

When two- or three-way ANOVAs were conducted, *F*-statistic and *p*-value were reported for interaction terms. Interaction terms may suggest if 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). RACs were plotted 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). Rank abundance curves were created using the *rankabundance* function in the BiodiversityR package (Kindt, 2019; R Core Team, 2021).

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 2022. 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 maps of annual grass polygons were initially hand-drawn on hard copies of ArcGIS derived aerial maps. The 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, 2022). 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 or when traversing the Units to reach sampling locations, HMP annuals density monitoring, and annual grass monitoring. Emphasis was placed on iceplant (*Carpobrotus edulis*), jubata 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 Trimble® Juno® T41/5 Series GPS unit with an external Trimble® R1 GNSS receiver or a Trimble® GeoXH GPS unit.

2.5.2 Reporting Methods

Invasive species are presented on maps developed in ArcGIS (ESRI, 2022). 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 (BLM).

3 YEAR 3 VEGETATION SURVEYS: RANGE 48

3.1 Introduction

Year 3 surveys were completed at Range 48 (Figure 3-1). The area was masticated in 2019 as part of environmental cleanup operations involving MEC removal activities. Prior to mastication efforts in 2019, Range 48 vegetation was monitored over thirteen years (2000-2013), including after a controlled burn in 2003. Baseline monitoring for Range 48 was conducted in 2000 following previous HMP Annual monitoring protocols (HLA, 2001). The Baseline data from 2000 were documented by mapping patches of HMP Annual species instead of recording numbers of individuals by grid. Results from 2013 HMP Annual grid surveys (Year 10 post-burn) supplement Baseline comparisons as the 2013 results were collected using the current protocol and the data represent pre-mastication conditions (Tetra Tech and Ecosystems West 2014). No shrub transects, or annual grass monitoring was conducted during Year 3 surveys of Range 48.

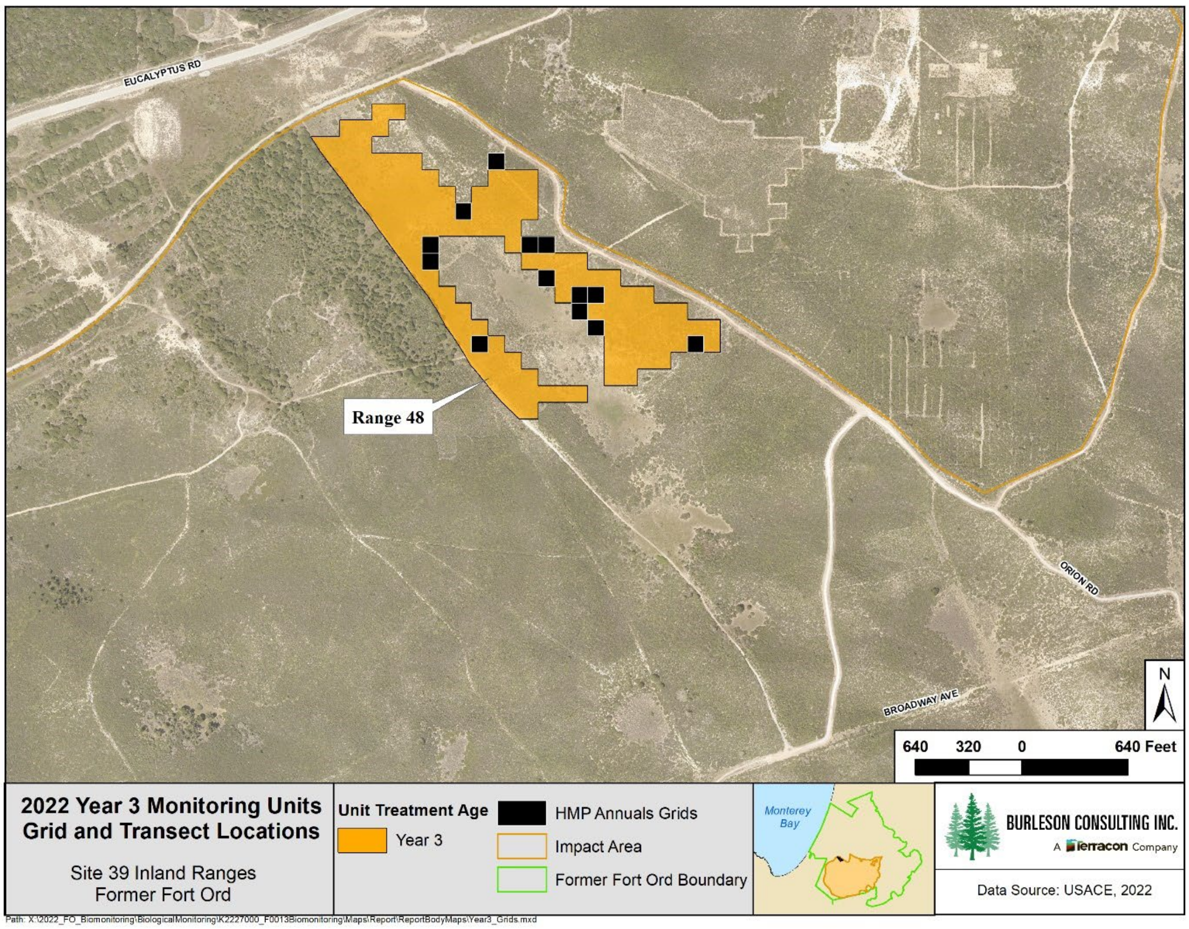

Figure 3-1. Year 3 HMP Annuals Grids Surveyed in 2022.

3.2 Range 48: Setting

Range 48 2022 monitoring is a subset of the 2013 monitoring and the 2008 and 2010 monitoring (Burleson 2008; Tetra Tech and EcoSystems West 2011). It encompasses approximately 30 acres of generally rolling terrain that was masticated in 2019. Range 48 is treated as the area west and northwest of the intersection of Orion Road and Broadway Avenue and south of Eucalyptus Road. Two major vegetation types predominate in the area: maritime chaparral, and areas dominated by grasses and herbs with only scattered shrubs.

3.3 Range 48: Methods

In accordance with methods outlined in the Revised Protocol and Section 2 of this report, the 2022 Year 3 vegetation monitoring surveys in Range 48 comprised 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. Surveys occurred on April 27, 2022.

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

3.4 Range 48: Results and Discussion

Year 3 surveys included 13 HMP monitoring grids in the Year 3 Units in 2022. Maps of HMP survey grids for Range 48 are provided in Appendix B (Appendix B, Figure B-1 through B-3).

3.4.1 Sand Gilia

Sand gilia was observed in Range 48 in all survey years. In Baseline (2013), sand gilia had a frequency of occurrence of 46% (6 of 13 grids). During Year 1 surveys sand gilia was observed at a frequency of occurrence of 85% (11 of 13 grids). The frequency of occurrence in Year 3 surveys was 46%, the same as Baseline conditions (Figure 3-2).

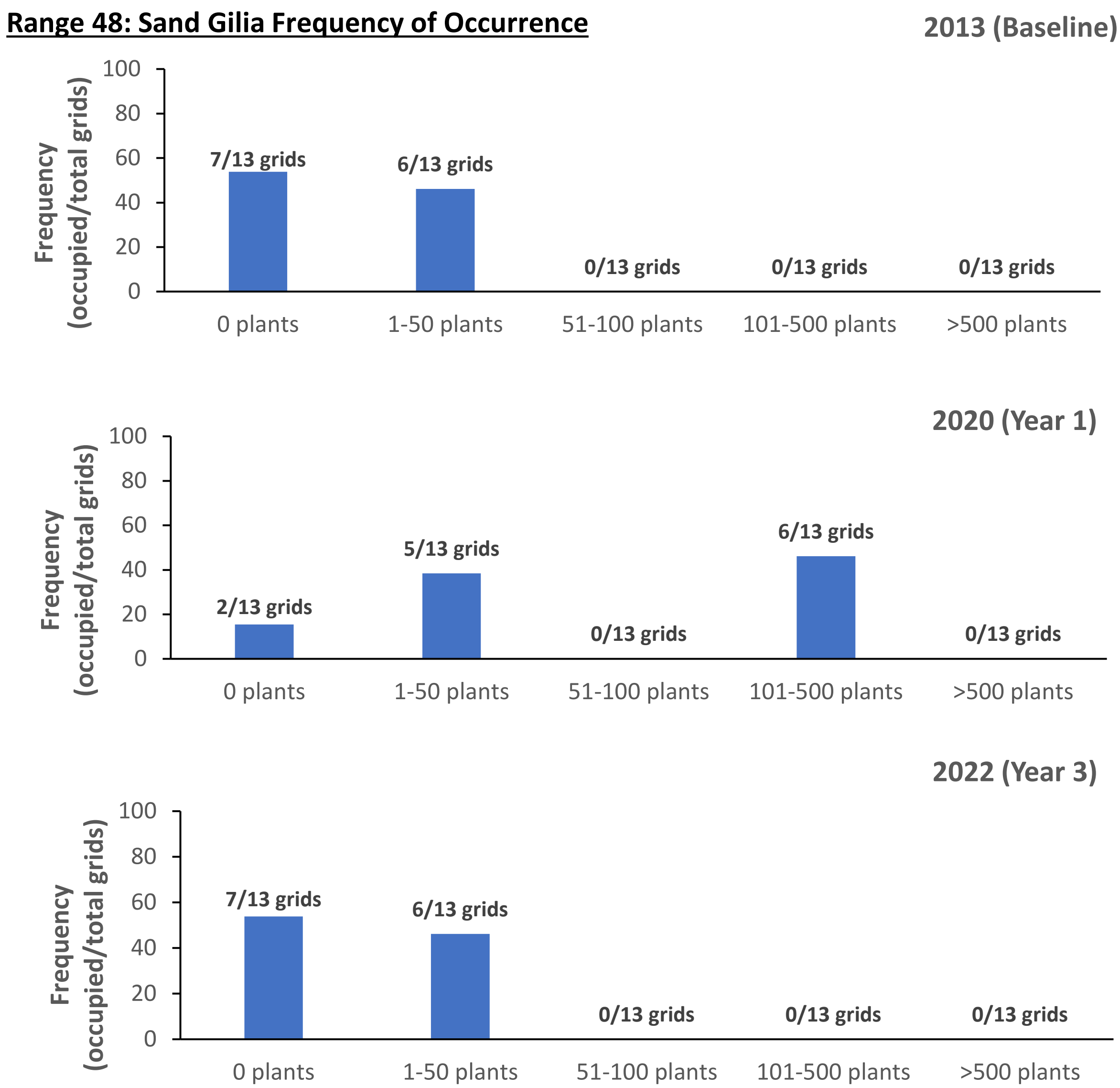

Figure 3-2. Range 48 Sand Gilia Occurrence in Surveyed Grids (n=13) for Baseline (2013), Year 1 (2020), and Year 3 (2022).

3.4.2 Seaside Bird's-Beak

Seaside bird's-beak was observed in Range 48 in Baseline (2013) and Year 1 (2020) but was not observed in Year 3 (Figure 3-3; Appendix B, Figure B-2). Seaside bird's-beak had a frequency of occurrence of 15% (2 of 13 grids) in Baseline, 8% (1 of 13 grids) in Year 1, and 0% (0 of 13 grids) in Year 3.

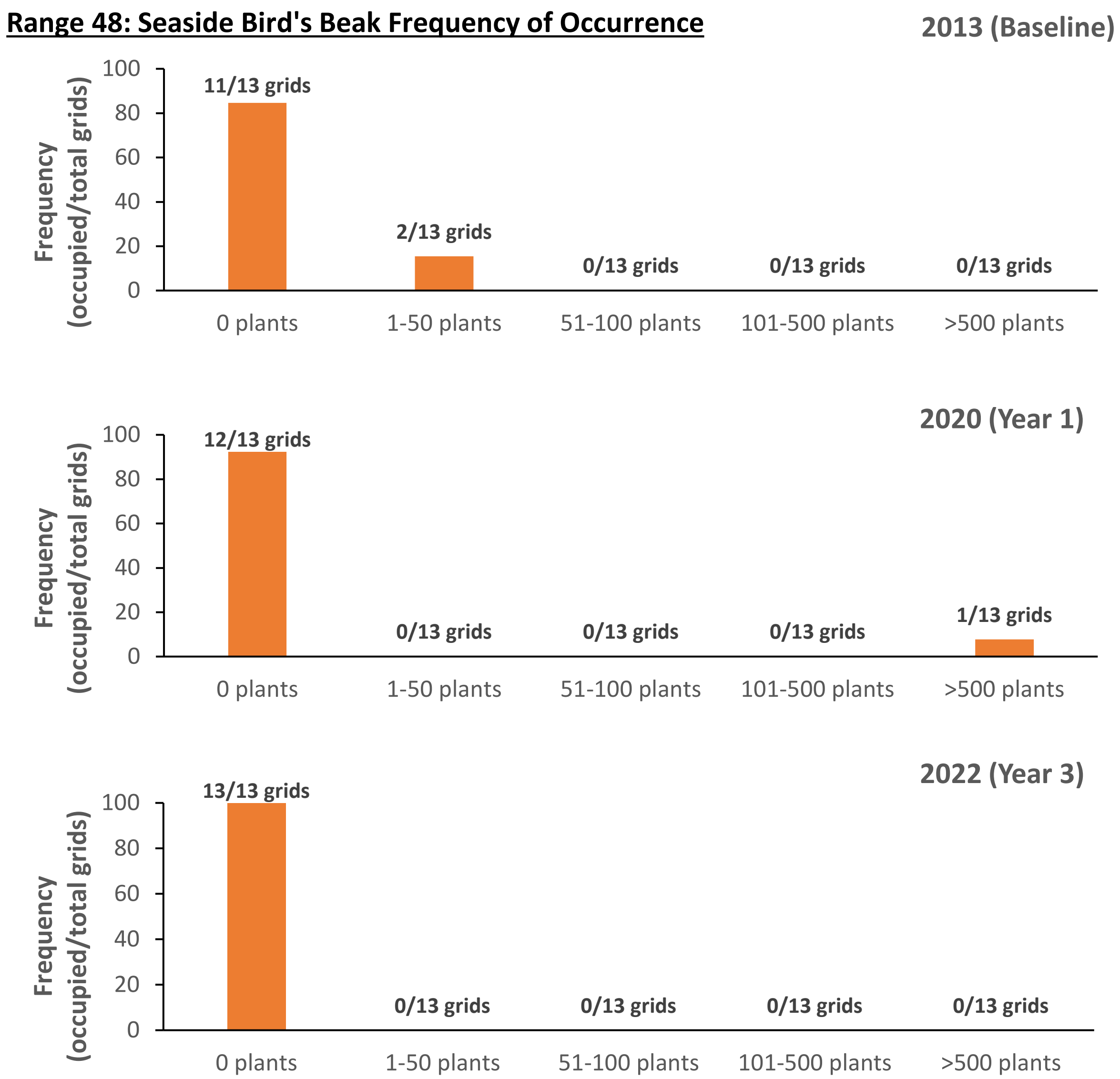

Figure 3-3. Range 48 Seaside Bird's Beak Occurrence in Surveyed Grids (*n*=13) for Baseline (2013), Year 1 (2020), and Year 3 (2022).

3.4.3 Monterey Spineflower

Monterey spineflower was observed in Range 48 in all survey years and has increased in density since Baseline (Figure 3-4). In Baseline, Monterey spineflower was observed with a frequency of occurrence of 92% (12 of 13 grids). The frequency of occurrence increased to 100% (13 of 13 grids) by Year 1 and remained at 100% in Year 3, with 77% of grids falling within the highest density class (Figure 3-4; Appendix B, Figure B-3).

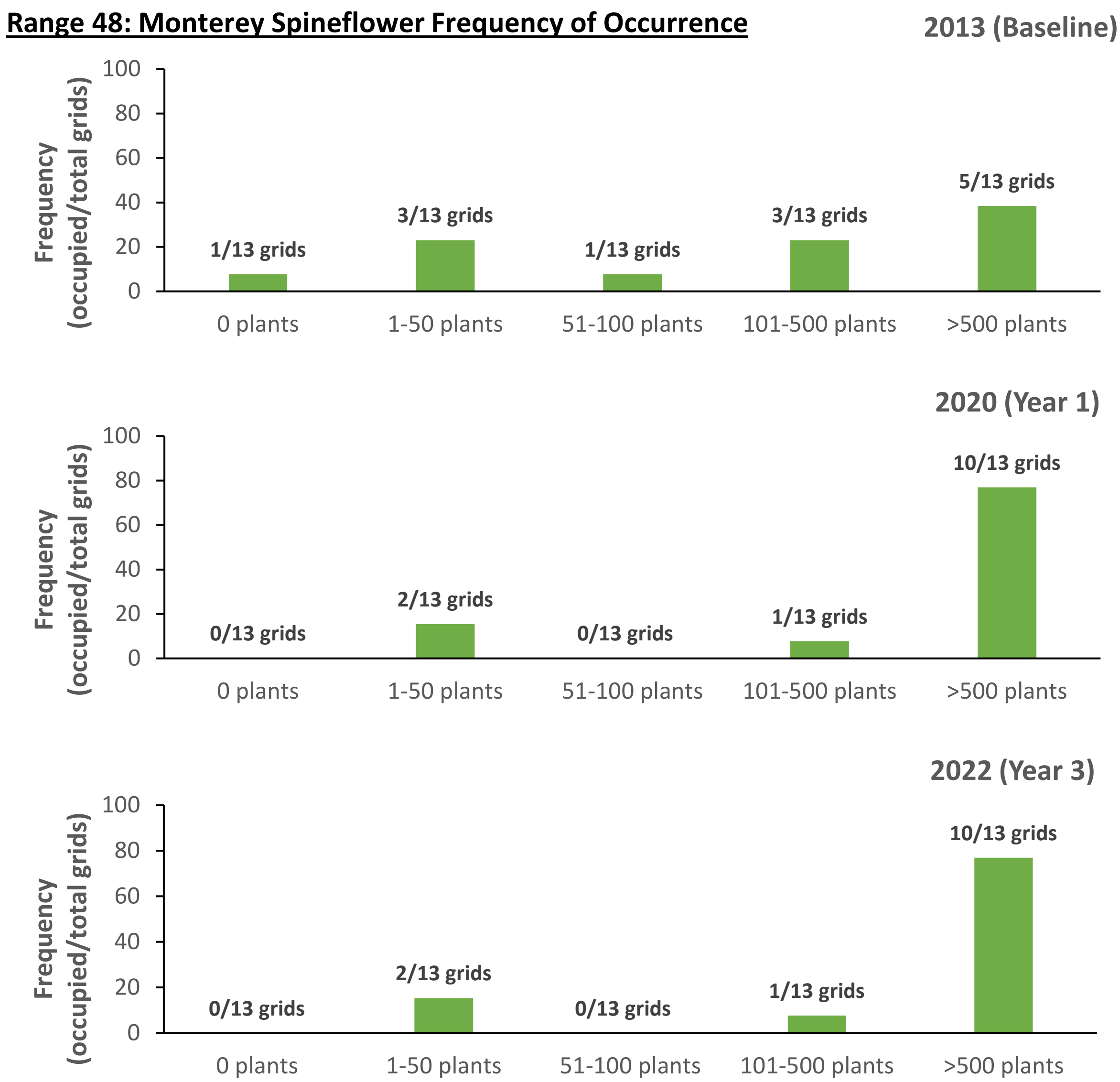

Figure 3-4. Range 48 Monterey Spineflower Occurrence in Surveyed Grids (*n*=13) for Baseline (2013), Year 1 (2020), and Year 3 (2022).

3.4.4 Yadon's Piperia

No piperia plants were observed within Range 48 during Year 3 monitoring.

3.4.5 Effect of Treatment on HMP Density

The effect of treatment type on HMP annuals density could not be evaluated at Range 48 since this area was masticated only, with no prescribed burns.

3.4.6 Year 3 Invasive and Non-Native Species Monitoring

None of the target invasive species (iceplant, pampas grass, and French broom) were observed during Year 3 monitoring at Range 48.

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4 YEAR 5 VEGETATION SURVEYS: BLM AREA B UNITS B-2A, B-3 WEST, B-3 EAST, A SOUTHERN CONTAINMENT LINE, B, AND C

4.1 Introduction

Year 5 Units included BLM Area B Units B-2A, B-3 West, B-3 East, A Southern Containment Line, B, and C (Figure 4-1). Units B-3 West, B-3 East, A Southern Containment line, and B and C Containment Lines were masticated in 2017. Prescribed burns were conducted at Units B and C after containment line mastication to facilitate environmental cleanup operations involving MEC removal. Subsequently, portions of Unit B and C containment lines were burned. Baseline monitoring for Year 5 Units was conducted in 2015, except for Unit B-2A (Baseline Year 1998) and two Unit B shrub transects (Baseline Year 1999). Year 3 monitoring included 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, 2021).

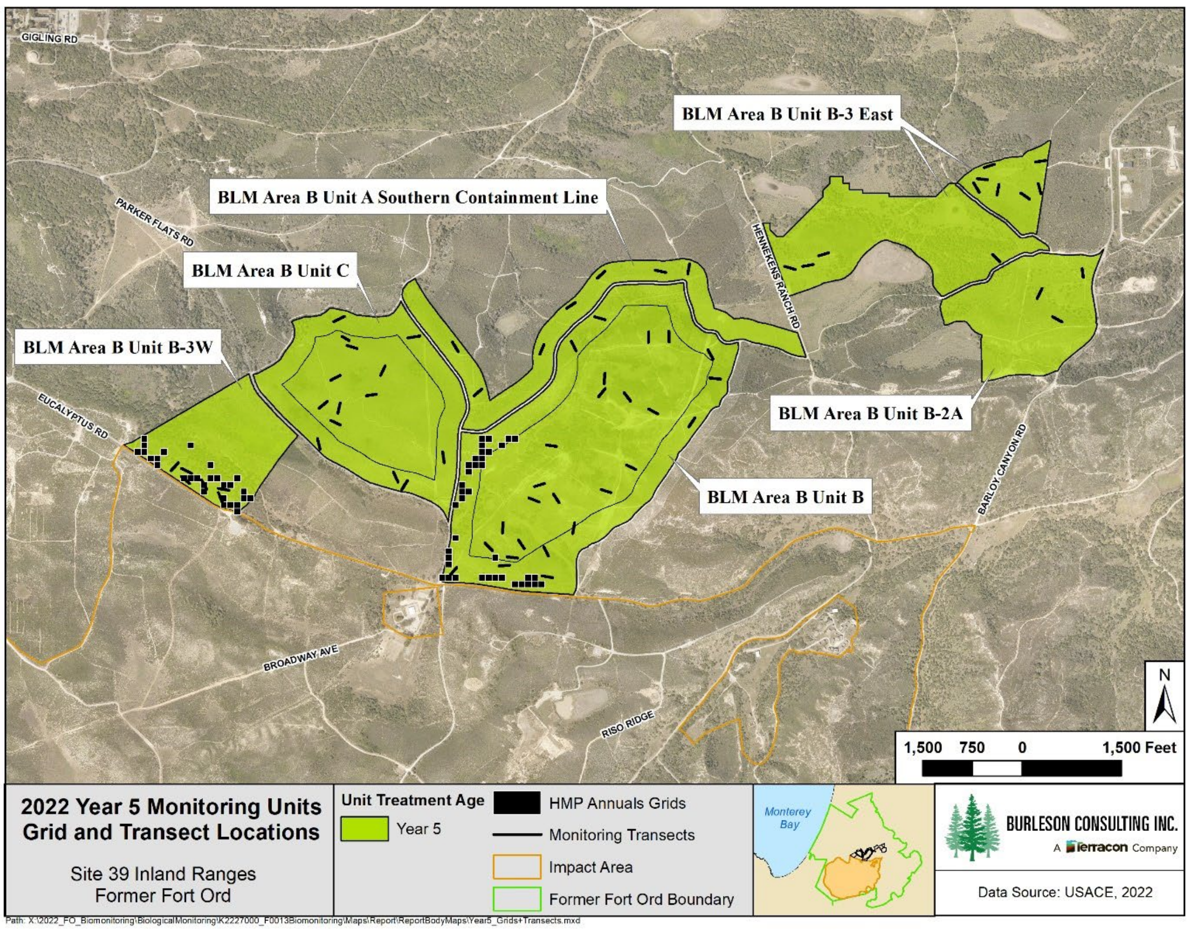

Figure 4-1. BLM Area B Units B-3 West, B-3 East, B-2A, A Southern Containment Line, B, and C HMP Annuals Grids and Shrub Transects Surveyed for Year 5 in 2022.

4.2 BLM Area B Units B-2A, B-3 West, B-3 East, A Southern Containment Line, B, and C: Setting

BLM Area B is a 1,646-acre area and is part of the publicly accessible lands on 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 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.

Unit 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 63 acres in size. Chaparral habitat in the southern portion of this area is dominated primarily by sandmat manzanita and other low-growing shrubs, which may indicate an adaptation to the sandy aeolian soils or reflect relatively recent disturbance.

Unit B-3 East is dissimilar from the majority of BLM Area B. The majority of this area is dominated by oak woodland and expansive native grasslands interspersed with vernal pools. Maritime chaparral is limited in this subarea to immediately east of Hennekens Ranch Road and Addington Road. A vernal pool (Pond 60) located in the center of this subarea is known to support federally threatened California tiger salamanders (*Ambystoma californiense*).

Unit 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 Unit A Southern Containment Line was the only portion surveyed in 2022 and comprises 64 acres.

Unit 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. This subarea contains many old roads and trails that have been rerouted, restored, and closed by BLM in recent years. This subarea also contains several vernal pools, two of which support populations of Contra Costa goldfields (*Lasthenia conjugens*), a federally endangered plant species.

Unit C contains rolling topography and has several prominent east to west trending ridges and low-lying valleys. The area comprises nearly ubiquitous, dense maritime chaparral dominated by shaggy bark manzanita and chamise with areas of locally dense Hooker's manzanita and Monterey ceanothus.

Unit B-2A contains mostly maritime chaparral with transitional oak woodland areas. The rolling terrain of the unit also contains erodible roads with underlying compacted soils. Small mesic areas are located in the interior of the Unit.

4.3 BLM Area B Units B-2A, B-3 West, B-3 East, A Southern Containment Line, B, and C: Methods

In accordance with methods outlined in the Revised Protocol and Section 2 in this report, the 2022 Year 5 vegetation monitoring surveys in BLM Area B Units B-3 West, B-3 East, B, C, A Containment Line, and B-2A 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. Surveys occurred on April 12, 13, 14, 18, 19, 20, 21, 25, 26, and 28, 2022.

- 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. Surveys occurred on April 13, 19, 25, 26, and 28, 2022.

- Repeated sampling of transects that were monitored in 1998, 1999, 2015, and 2020 surveys (Burleson, 2021). This survey effort was conducted to assess shrub species composition of the sensitive maritime chaparral community after treatment. Surveys occurred on May 9, 10, 11, 12, 17, 18, 19, 23, 24, 25, and 31, 2022.

- 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. Surveys occurred on July 7, 8, 11, 12, and 13, 2022.

- 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 Unit B-2A, B-3 West, B-3 East, A Southern Containment Line, B, and C: Results and Discussion

Burleson surveyed 66 HMP monitoring grids in the Year 5 Units in 2022, with 28 grids in BLM Area B Unit B-3 West ($n_{masticated}$=28) and 38 grids in the Containment Line of BLM Area B Unit B ($n_{masticated}$=15; $n_{masticated\&burned}$=6; n_{mixed}=17). Maps of survey grids for the sampled Units are provided in Appendix B (Figures B-4 through B-9).

4.4.1 Sand Gilia

Sand gilia was not observed in Unit B-3 West in any survey year; however, sand gilia was present in Unit B in all in survey years (Figure 4-2; Appendix B, Figures B-4 and B-7). The frequency of occurrence in Unit B was 21% (8 of 38 grids) in 2015, 32% (12 of 38 grids) in 2018, 32% (12 of 38 grids) in 2020, and 37% (14 of 38 grids) in 2022 (Figure 4-2).

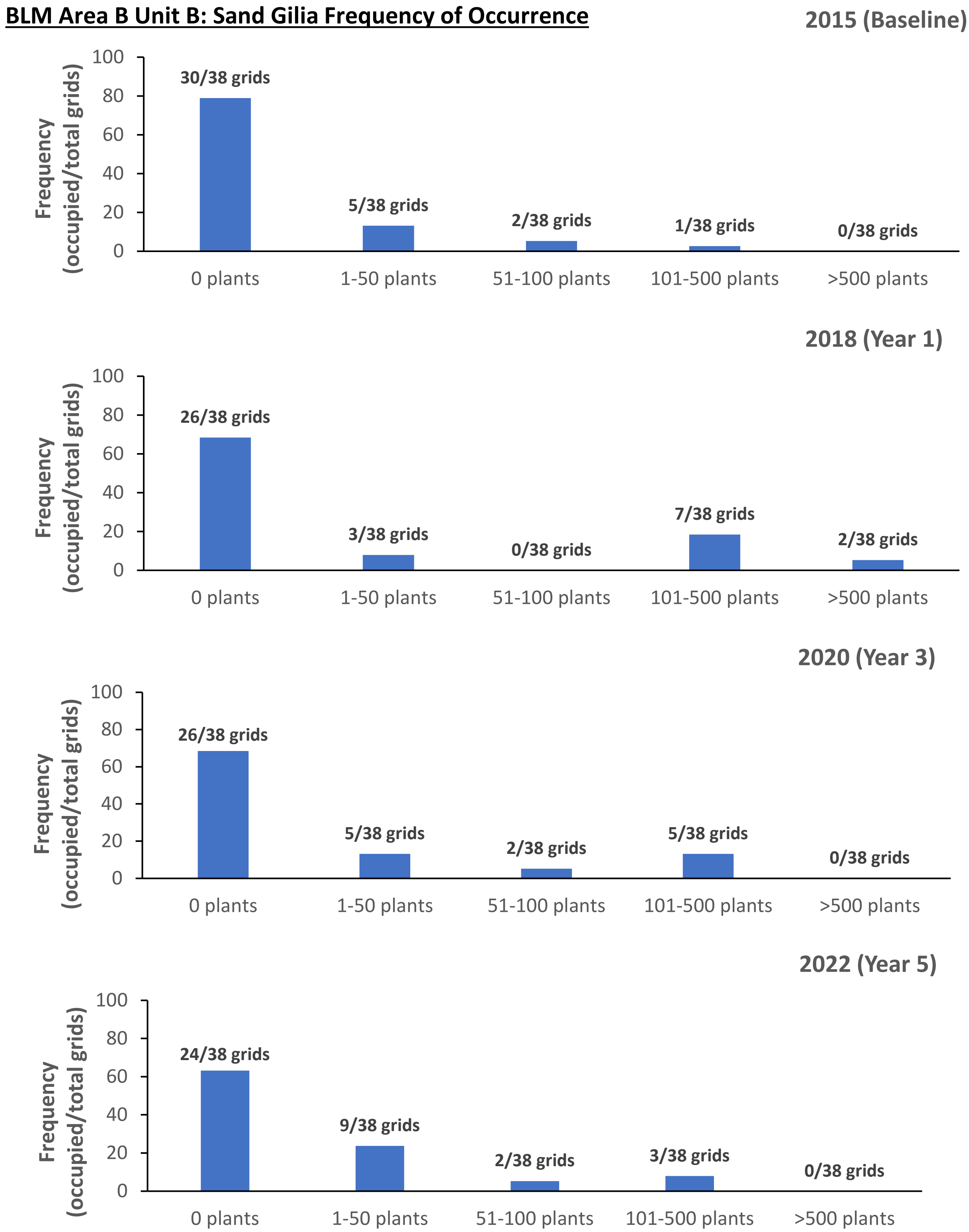

Figure 4-2. BLM Area B Unit B Containment Sand Gilia Occurrence in Surveyed Grids (*n*=38) for Baseline (2015), Year 1 (2018), Year 3 (2020), and Year 5 (2022).

4.4.2 Seaside Bird’s-Beak

Seaside bird’s-beak was not present in Unit B or B-3 West in 2022. Seaside bird’s-beak was only present in Unit B in Year 1 surveys. The frequency of occurrence in Unit B was 0% (0 of 38 grids) in 2015, 2020, and 2022, and 3% (1 of 38 grids) in 2018 (Figure 4-3; Appendix B, Figure B-5). Seaside bird’s-beak has never been observed in Unit B-3 West (Appendix B, Figure B-8).

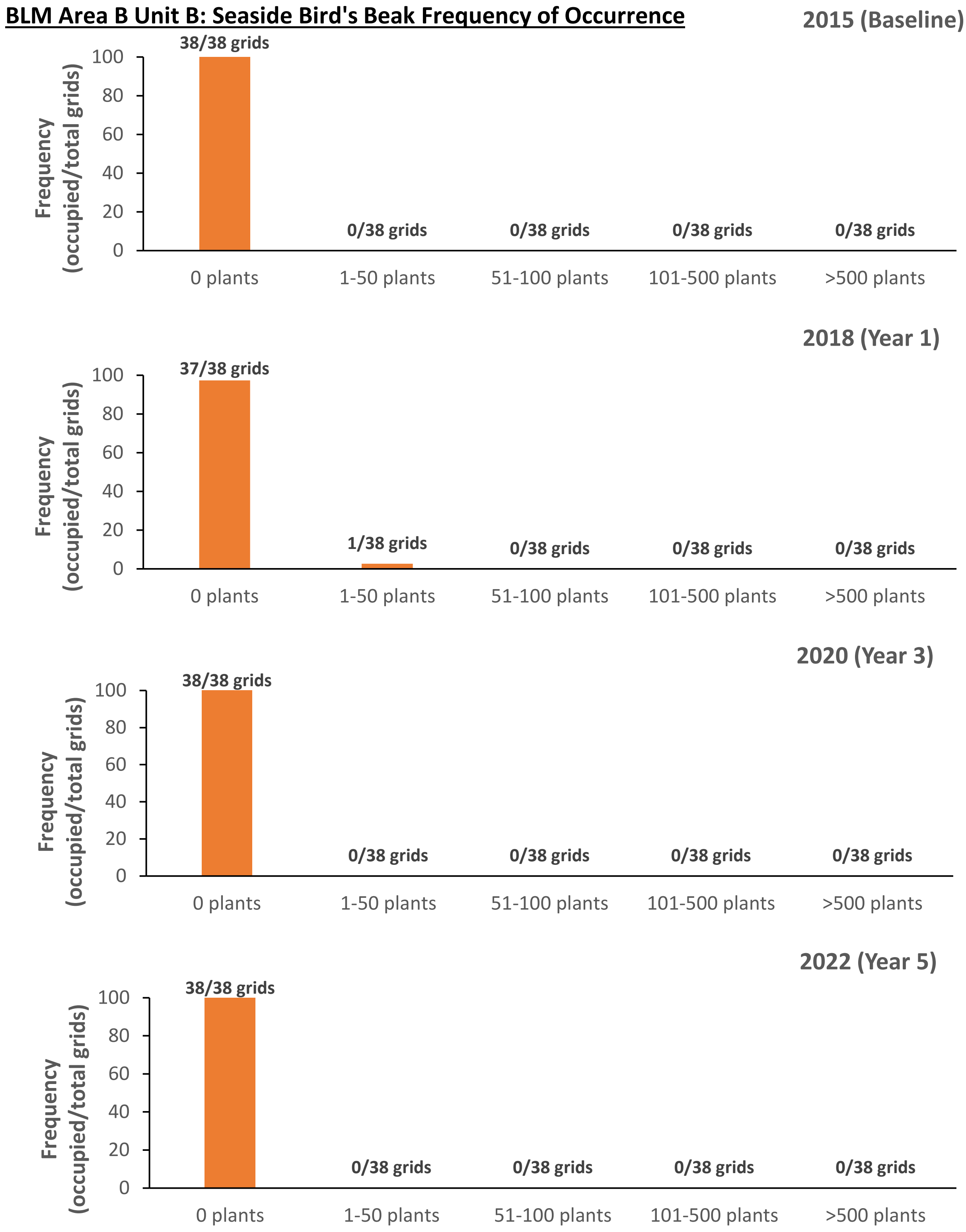

Figure 4-3. BLM Area B Unit B Containment Seaside Bird's Beak Occurrence in Surveyed Grids (*n*=38) for Baseline (2015), Year 1 (2018), Year 3 (2020), and Year 5 (2022).

4.4.3 Monterey Spineflower

Monterey spineflower was present in both Year 5 Units (Figures 4-4 through 4-5; Appendix B, Figures B-6 and B-9). The frequency of occurrence in Unit B-3 West was 100% (28 of 28 grids) in 2015, 89% (25 of 28 grids) in 2018, 89% (25 of 28 grids) in 2020, and 86% (24 of 28 grids) in 2022. The frequency of occurrence in Unit B was 100% (38 of 38 grids) in 2015, 89% (34 of 38 grids) in 2018, 87% (33 of 38 grids) in 2020, and 89% (34 of 38 grids) in 2022.

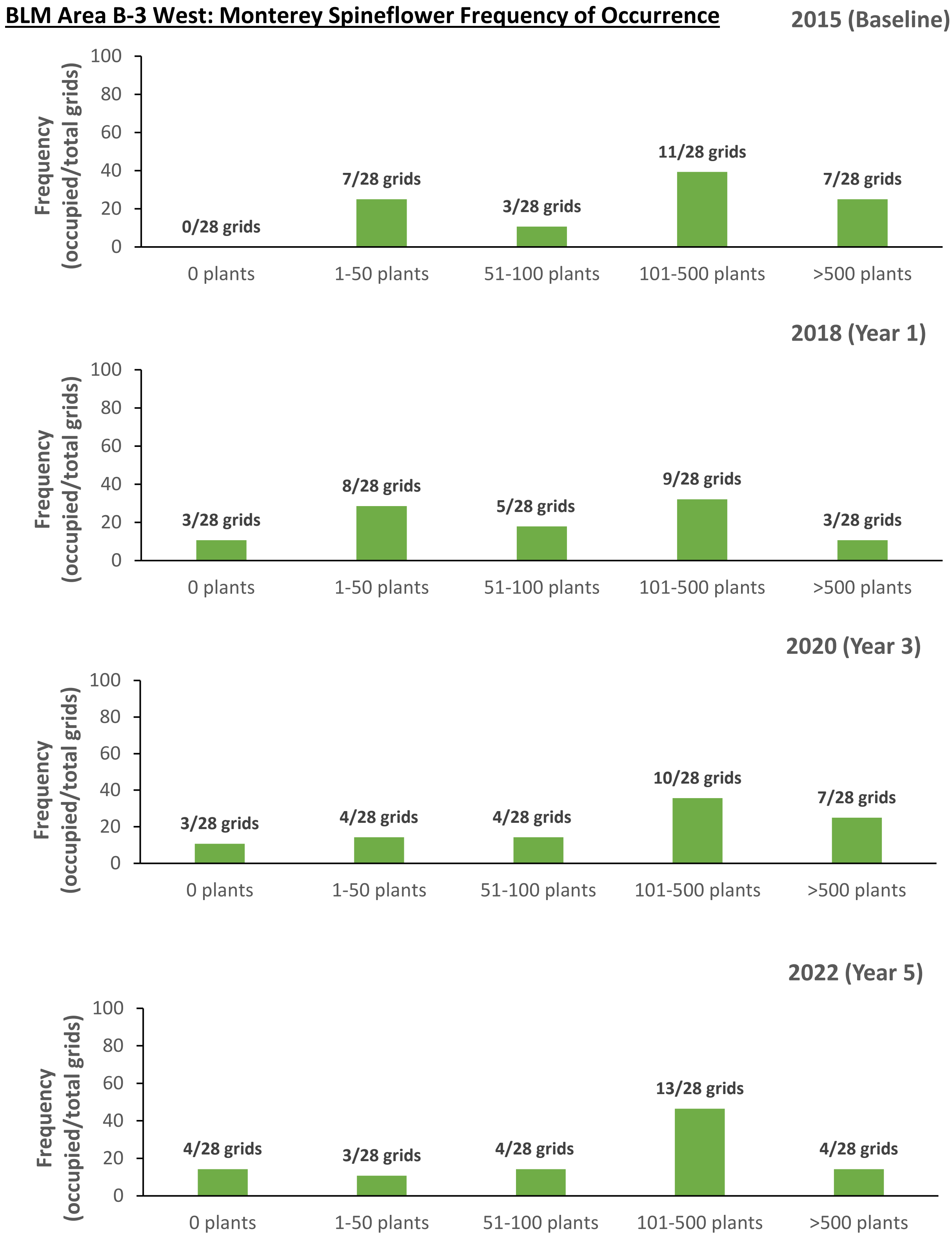

Figure 4-4. BLM Area B-3 West Monterey Spineflower Occurrence in Surveyed Grids (*n*=28) for Baseline (2015), Year 1 (2018), Year 3 (2020), and Year 5 (2022).

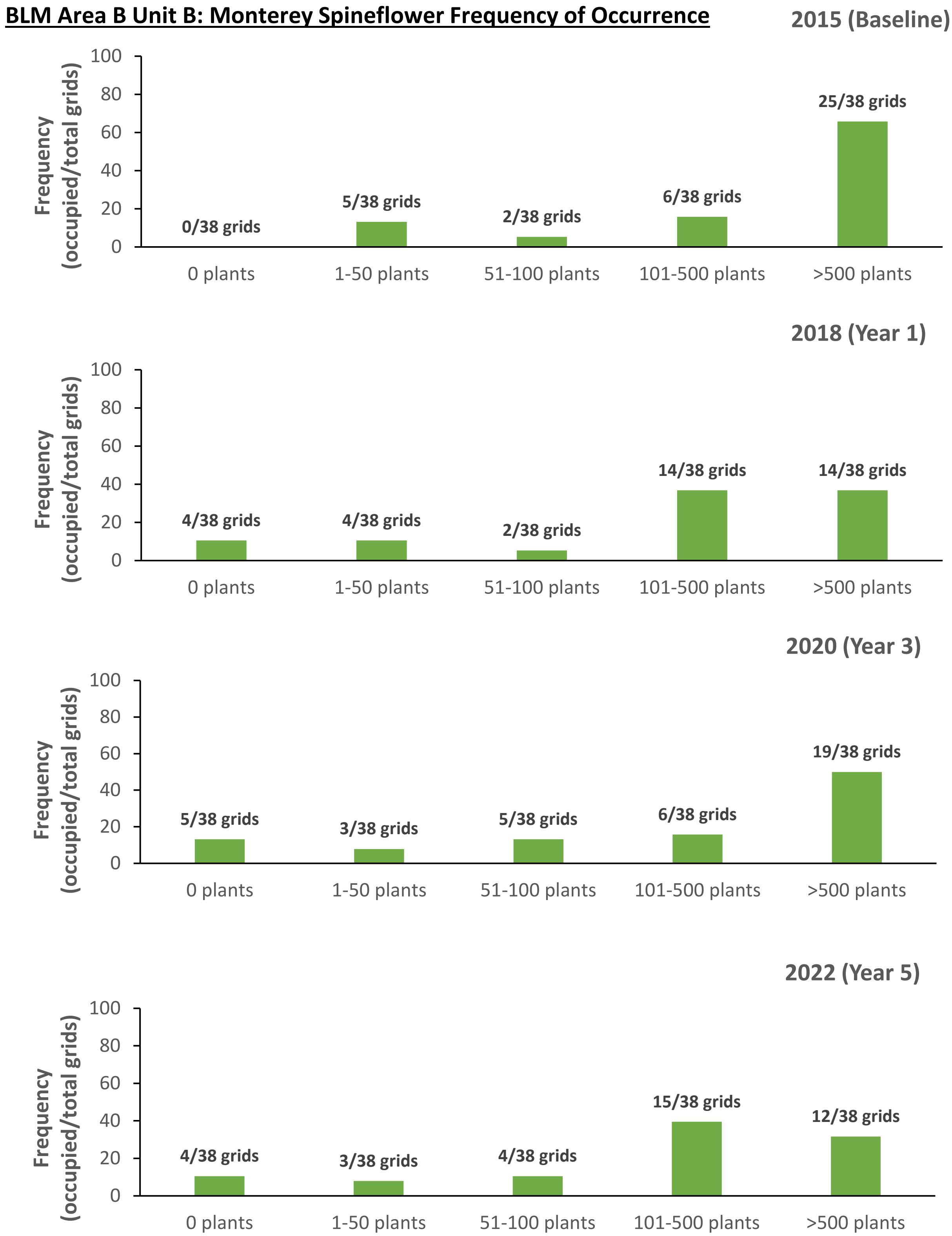

Figure 4-5. BLM Area B Unit B Monterey Spineflower Occurrence in Surveyed Grids (*n*=38) for Baseline (2015), Year 1 (2018), Year 3 (2020), and Year 5 (2022).

4.4.4 Yadon's Piperia

Piperia was observed within BLM Area B Units B-3 West, B, and C during 2022 (Year 5) surveys (Appendix E, Figures E-2 through E-3). Piperia was not observed within Units B-2A, B-3 East, or A Southern Containment Line. Thirty individuals were observed in Unit B-3 West; 29 individuals were observed in the southwestern part of Unit B, with two patches containing greater than 10 individuals; and one individual was observed in Unit C. Due to the timing of monitoring, these individuals were not in flower and could not be identified to their specific taxon.

4.4.5 Effect of Treatment on HMP Density

The effect of treatment type on HMP annuals density was evaluated in Unit B. Unit B-3 West could not be evaluated for differential effects due to treatment since only mastication occurred in the area.

Since 2015, regional differences in sand gilia recruitment were observed at the southern and western extent of Unit B (Appendix B, Figure B-7). In the western region, across all treatments, there was consistently no sand gilia recruitment, whereas recruitment did occur in the southern region treatment grids. Based on field observations and professional judgement, the variability of edaphic conditions and community composition within Unit B likely contributed to the differences in sand gilia recruitment, and the separation of treatments between the western and southern regions confound their possible effects. As a result, there is limited validity of using PERMANOVA to analyze sand gilia response to treatment in Unit B. Figure 4-6 illustrates that even in pre-treatment baseline surveys, a greater percentage of the "Mixed" grids had sand gilia present (35%) than in either "Masticate" (6%) or "Masticate & Burn" (17%) grids. This is likely because the majority (70%) of mixed grids are located in the southern portion of the Unit, whereas only 27% of masticated grids and 33% of masticated and burned grids are located in the southern region, where edaphic conditions are conducive to supporting gilia recruitment.

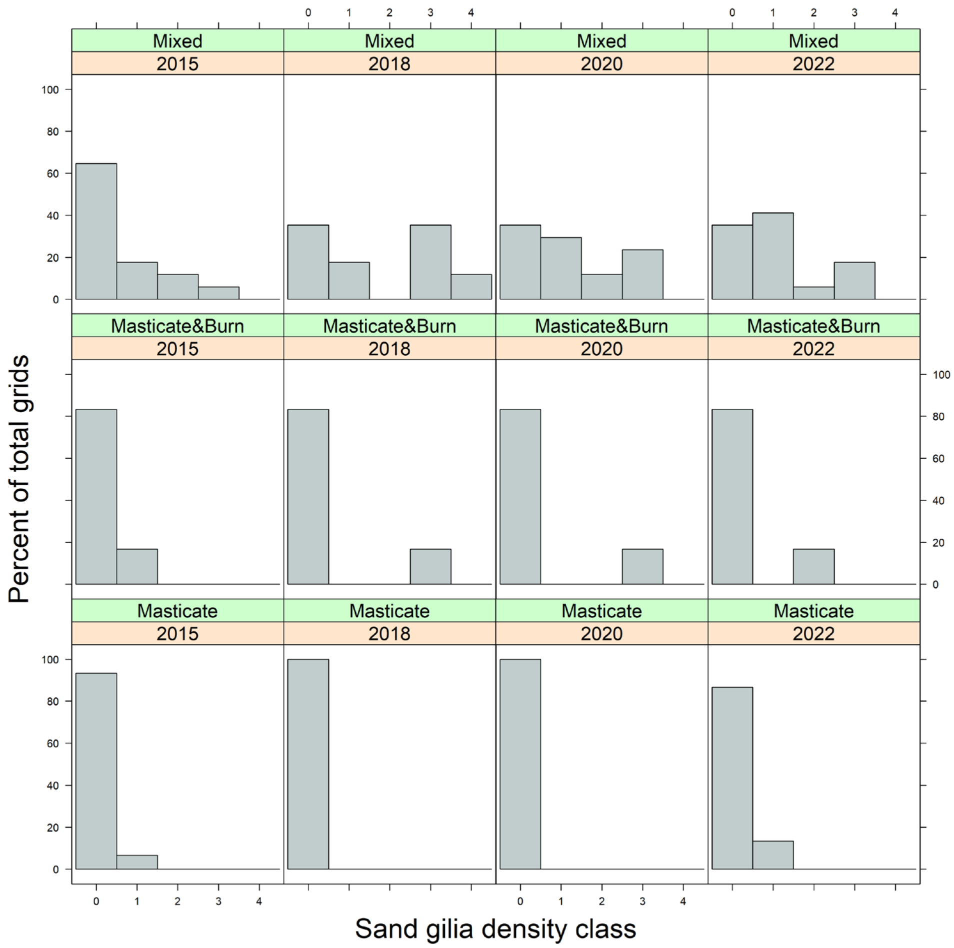

Figure 4-6. Percent of Total Grids for Sand Gilia Density Classes for All Treatment Types in Baseline (2015), Year 1 (2018), Year 3 (2020), and Year 5 (2022) in BLM Area B Unit B. Masticate grids n=15 grids, Masticate&Burn grids n=6 grids, Mixed grids n=17 grids.

Monterey spineflower recruitment appears ubiquitous across the southern and western extent of Unit B (Appendix B, Figure B-9). A two-way PERMANOVA was conducted to evaluate the effect of treatment and age on the distribution of Monterey spineflower in Unit B. Based on PERMANOVA results and examination of the density distribution by treatment over time, neither treatment nor age appear to influence differences observed in density distributions (Table 4-1; Figure 4-7). In Baseline, Monterey spineflower was observed in all grids regardless of treatment. Over time, Monterey spineflower generally remains present in the majority of grids within each treatment class. Mixed treatment grids tend to maintain higher densities of Monterey spineflower than mastication only or masticate and burn treatments (Figure 4-7).

Seaside bird's-beak recruitment is consistently low across the southern and western extent of Unit B (Appendix B, Figure B-8). No seaside bird's beak was observed during Year 5 surveys. Additionally, seaside bird's beak has only occupied one grid (within density class 1) over the course of Baseline, Year 1, Year 3, and Year 5 surveys (Figure 4-8). As a result of minimal species observations, conducting a PERMANOVA was not necessary to illustrate that post-treatment survey results are very similar to Baseline survey results.

Table 4-1. Two-way PERMANOVA results for Monterey spineflower in Unit B, based on Bray distance matrices.

Factor	***F***	***p***
Age	0.787	0.642
Treat	1.17	0.311
Treat*Age	1.21	0.241

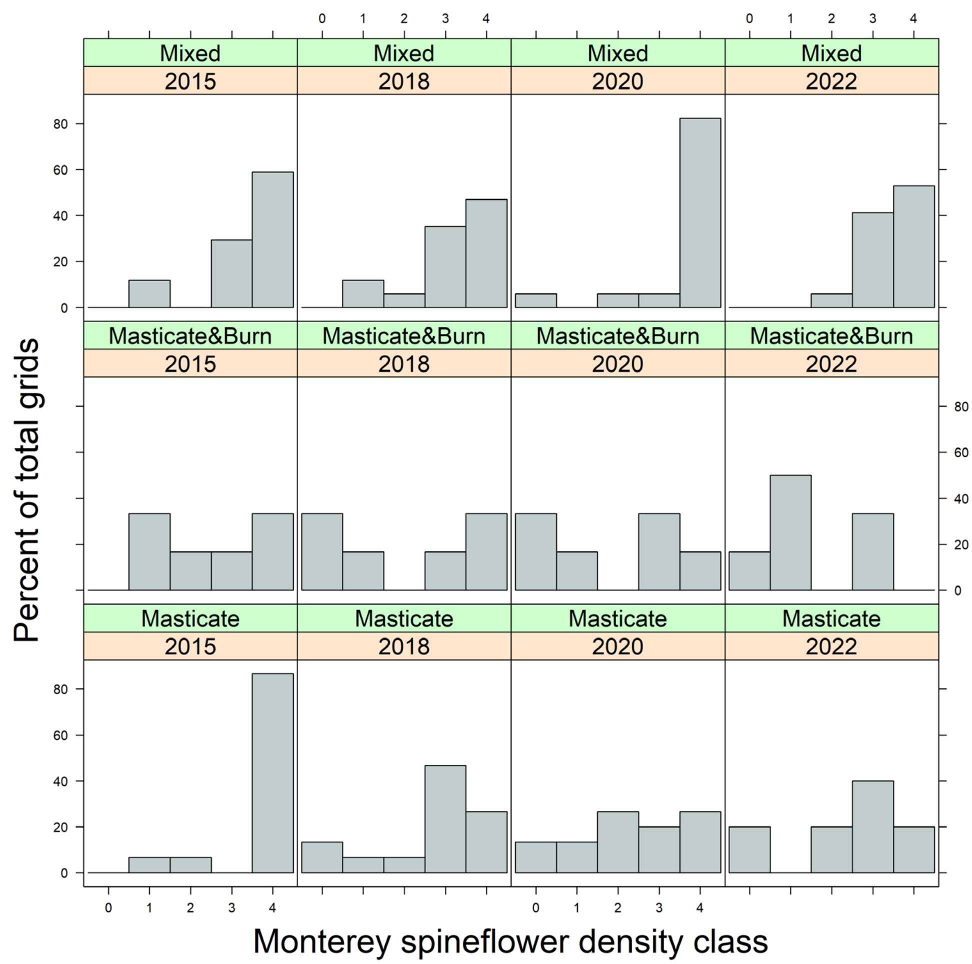

Figure 4-7. Percent of Total Grids for Monterey Spineflower Density Classes for All Treatment Types in Baseline (2015), Year 1 (2018), Year 3 (2020), and Year 5 (2022) in BLM Area B Unit B. Masticate grids n=15 grids, Masticate&Burn grids n=6 grids, Mixed grids n=17 grids.

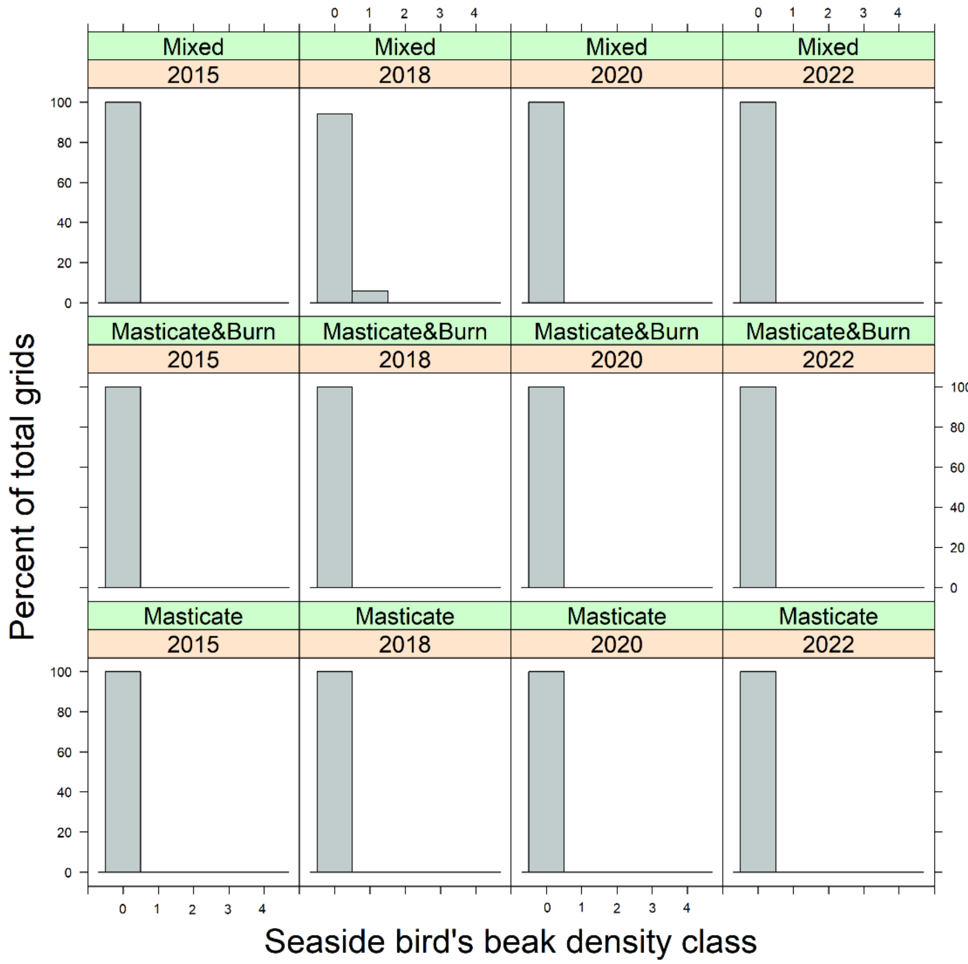

Figure 4-8. Percent of Total Grids for Seaside Bird's Beak Density Classes for All Treatment Types in Baseline (2015), Year 1 (2018), Year 3 (2020), and Year 5 (2022) in BLM Area B Unit B. Masticate grids n=15 grids, Masticate&Burn grids n=6 grids, Mixed grids n=17 grids.

4.4.6 Shrub Transect Monitoring

Shrub transects were sampled in BLM Area B Units B-3 West (*n*=6), B-3 East (*n*=11), A Southern Containment Line (*n*=7), B (*n*=26), C (*n*=14), and B-2A (*n*=3) in 2022 (Appendix C; Figures C-1 through C-6). Baseline transects were collected in 2015 for Units A Southern Containment Line, C, B-3 East, B-3 West, and B and in 1998 for Unit B-2A (Burleson, 2016; HLA, 1999). Additionally, two Baseline transects were collected in Unit B in 2000 (HLA, 2000). Data from Unit B-2A were evaluated separately from the other Year 5 units to reduce potential influence from differing Baseline data years.

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 – 2022). Community structure parameters in Year 5 Units changed similarly through time in most cases.

Mixed-design ANOVAs were conducted to examine the effects of Unit and age on mean percent cover, species richness, species evenness, and species diversity for all Year 5 units combined, except for Unit

B-2A. Age and Unit appeared to influence total percent cover and species evenness where, generally, total cover was lower in Year 5 than in Baseline and species evenness increased between Baseline and Year 5; however, there was evidence of an interaction between age and Unit, indicating that the inherent relationships between age and Unit may mask the true effects of these factors separately on total cover and evenness. Similarly, Unit appeared to influence species diversity, however the interaction between Unit and age may mask some of the effect of Unit alone. Species richness appears to be influenced by age, with no interaction between age and Unit on this parameter (Table 4-2).

Mixed design ANOVAs were also conducted on Units B and C separately to examine the effects of treatment on mean percent cover, species richness, species evenness, and species diversity. These Units were selected to assess treatment as these were the only Year 5 Units with multiple treatments. Treatment did not appear to affect any community metrics in Unit B whereas age appeared to affect all community metrics in this Unit. Additionally, there was no evidence of an interaction between age and treatment affecting changes in community metrics in Unit B (Table 4-3). Treatment appeared to influence differences in total shrub cover in Unit C. There was evidence that age influenced total cover and species richness and there was evidence of an interaction between treatment and age affecting differences in total cover and species diversity in Unit C (Table 4-4).

Table 4-2. Mixed-design ANOVA results for BLM Area B Units B-3 West, B-3 East, B, C, and A Containment Line.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*P*	*F*	*p*	*F*	*p*	*F*	*p*
Unit	12.14	2.914E-07	1.810	0.1389	5.960	4.257E-04	6.345	2.575E-04
Age	47.54	7.181E-16	81.46	5.950E-23	34.91	1.232E-12	1.488	0.2300
Unit*Age	9.311	6.867E-10	1.482	0.1708	4.052	2.756E-04	2.862	6.042E-03

Table 4-3. Mixed-design ANOVA results for BLM Area B Unit B. Sixteen transects received burn treatment, seven transects received masticate and burn treatments, and three transected received mixed treatment.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*P*	*F*	*p*	*F*	*p*	*F*	*p*
Treatment	0.6491	0.5318	0.2550	0.7771	0.03611	0.9646	0.01791	0.9823
Age	5.064	0.01029	26.20	2.534E-08	26.51	2.193E-08	7.000	2.235E-03
Treatment*Age	0.5334	0.7118	0.5636	0.6902	0.5140	0.7257	0.4465	0.7744

Table 4-4. Mixed-design ANOVA results for BLM Area B Unit C. Eight transects received burn treatment, four transects received masticate and burn treatment, and two transects received masticate treatment.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*P*	*F*	*p*	*F*	*p*	*F*	*p*
Treatment	4.236	0.04323	2.013	0.1799	0.6122	0.5596	2.251	0.1516
Age	12.920	1.948E-04	11.73	3.412E-04	1.842	0.1821	1.202	0.3194
Treatment*Age	3.877	0.01568	0.5329	0.7129	1.737	0.1778	3.973	0.01419

Shrub cover was lower in Year 5 than in Baseline for all Year 5 Units (Table 4-5; Figures 4-9 through 4-14). Units B-3 West, B-3 East, A Containment Line, and B-2A cover decreased from Baseline to Year 3. By Year 5, cover decreased in Unit B-3 West and increased in Unit B-3 East, Unit A Containment Line, and Unit B-2A. Unit B cover decreased between Baseline and Year 3, regardless of treatment type. Between

Years 3 and 5, cover continued to decrease along burned transects and masticated and burned transects but increased slightly between along mixed transects. Unit C shrub cover increased between Baseline and Year 3 along burned transects and masticated and burned transects and decreased along masticated transects. Between Years 3 and 5, cover decreased along burned and masticated and burned transects by 42% and 29%, respectively. Cover along masticated transects continued to decrease between Years 3 and 5 but at a slower rate than other treatment types.

Table 4-5. Percent of total cover between Baseline and Year 5 for Units B-3 West, B-3 East, A Containment Line, B, C, and B-2A.

Unit	Treatment	Baseline	Year 3	Year 5
B-3 West	Masticate	83.3	55.6	53.8
B-3 East	Masticate	115	72.1	73.3
A Containment Line	Masticate	112	74.7	77.7
B	Burn	101	96.8	88.7
B	Masticate&Burn	101	91.2	82.6
B	Mixed	99.1	74.1	75.2
C	Burn	110	134	92.0
C	Masticate	117	93.4	86.1
C	Masticate&Burn	104	127	98.2
B-2A	Masticate	92.9	73.0	78.2

Species diversity in Year 5 Units generally increased or remained stable between Baseline and Year 5 surveys (Table 4-6; Figures 4-9 through 4-11 and 4-14). Units B-3 West, B-3 East, and B-2A diversity increased from Baseline to Year 3. In Year 5, diversity continued to increase in Unit B-3 West and decreased slightly in Units B-3 East and B-2A. Unit A Containment Line diversity remained relatively stable over time. Species diversity in Units B and C was generally similar between treatments within each unit (Table 4-6; Figures 4-12 and 4-13). In Unit B, diversity increased between Baseline and Year 5 for all treatment types. In Unit C, diversity increased between Baseline and Year 5 along burned and masticated and burned transects. Diversity along masticated transects increased between Baseline and Year 3 and decreased between Years 3 and 5.

Table 4-6. Species diversity between Baseline and Year 5 for Units B-3 West, B-3 East, A Containment Line, B, C, and B-2A.

Unit	Treatment	Baseline	Year 3	Year 5
B-3 West	Masticate	1.15	1.9	1.98
B-3 East	Masticate	1.03	1.36	1.26
A Containment Line	Masticate	0.98	0.96	1.02
B	Burn	1.21	1.56	1.67
B	Masticate&Burn	1.17	1.59	1.63
B	Mixed	1	1.58	1.7
C	Burn	1.14	1.33	1.63
C	Masticate	1.43	1.47	1.34
C	Masticate&Burn	1.42	1.46	1.59
B-2A	Masticate	0.96	1.07	0.99

Species richness increased in all Year 5 Units between Baseline and Year 5 except in Unit B-2A (Table 4-7; Figures 4-9 through 4-11 and 4-14). Units B-3 West, B-3 East, A Containment Line, and B-2A species richness increased from Baseline to Year 3. By Year 5, richness increased in Units B-3 West, and B-3 East, remained stable in Unit A Containment Line, and decreased in Unit B-2A. Units B and C species richness increased between Baseline and Year 3 and remained stable or slightly increased between Years 3 and 5, regardless of treatment.

Table 4-7. Species richness between Baseline and Year 5 for Units B-3 West, B-3 East, A Containment Line, B, C, and B-2A.

Unit	Treatment	Baseline	Year 3	Year 5
B-3 West	Masticate	6	11	12
B-3 East	Masticate	6	9	10
A Containment Line	Masticate	6	8	8
B	Burn	7	10	10
B	Masticate&Burn	7	9	10
B	Mixed	6	10	11
C	Burn	7	9	10
C	Masticate	9	11	12
C	Masticate&Burn	6	10	10
B-2A	Masticate	6	8	6

Species evenness remained relatively stable between Baseline and Year 5 for all Year 5 Units (Table 4-8; Figures 4-9 through 4-11 and 4-14). In Units B-3 West, B-3 East, A Containment Line, and B-2A evenness changed minimally between Baseline and Year 5. Evenness in Unit B was similar between treatment and over time while Unit C species evenness was generally more variable between treatments.

Table 4-8. Species evenness between Baseline and Year 5 for Units B-3 West, B-3 East, A Containment Line, B, C, and B-2A.

Unit	Treatment	Baseline	Year 3	Year 5
B-3 West	Masticate	0.67	0.77	0.8
B-3 East	Masticate	0.57	0.61	0.55
A Containment Line	Masticate	0.55	0.44	0.47
B	Burn	0.62	0.67	0.71
B	Masticate&Burn	0.6	0.71	0.7
B	Mixed	0.57	0.69	0.72
C	Burn	0.57	0.59	0.7
C	Masticate	0.65	0.62	0.54
C	Masticate&Burn	0.79	0.63	0.7
B-2A	Masticate	0.55	0.52	0.59

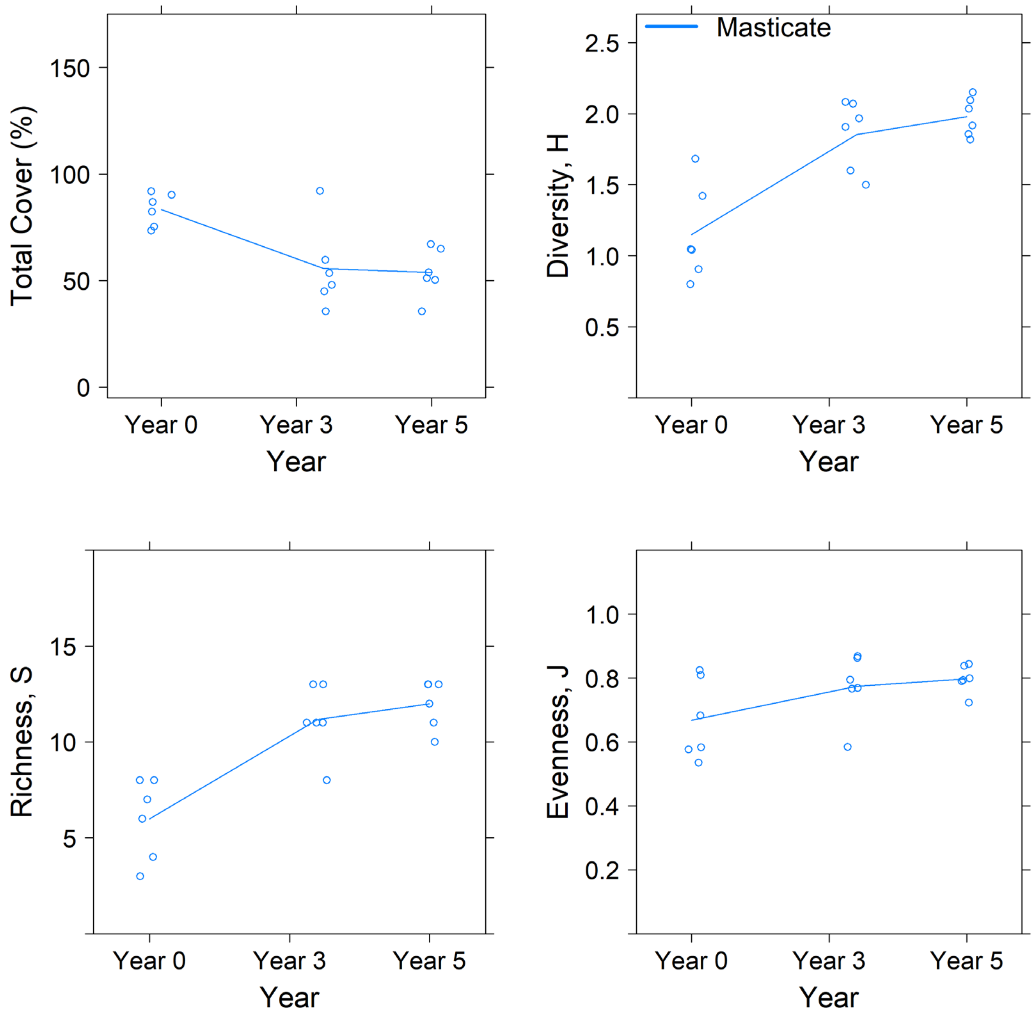

Figure 4-9. Unit B-3 West Community Structure from Baseline (2015) to Five Years After Mastication (2022). Six masticated transects were analyzed in Unit B-3 West.

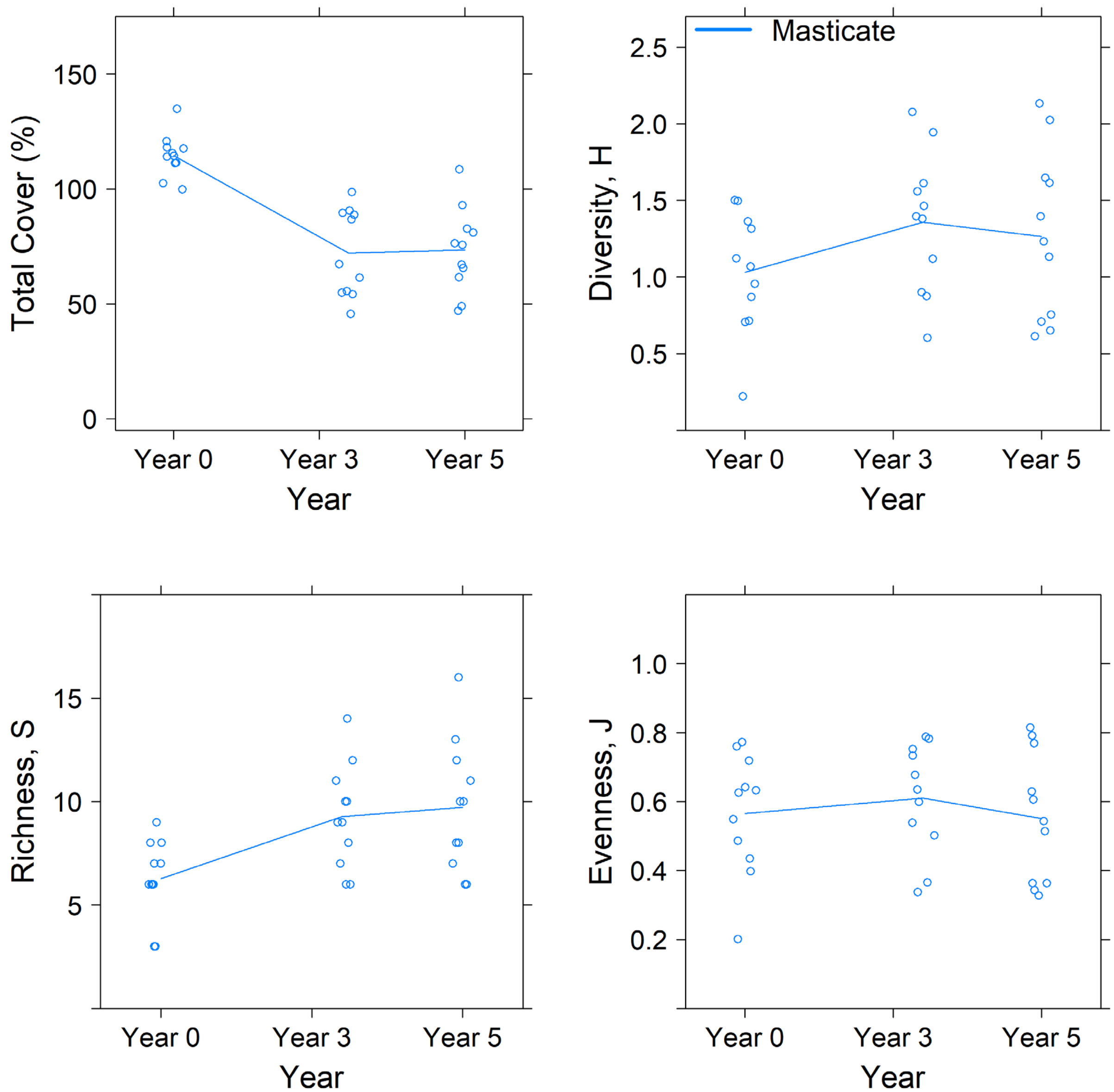

Figure 4-10. Unit B-3 East Community Structure from Baseline (2015) to Five Years After Mastication (2022). Eleven masticated transects were analyzed in Unit B-3 East.

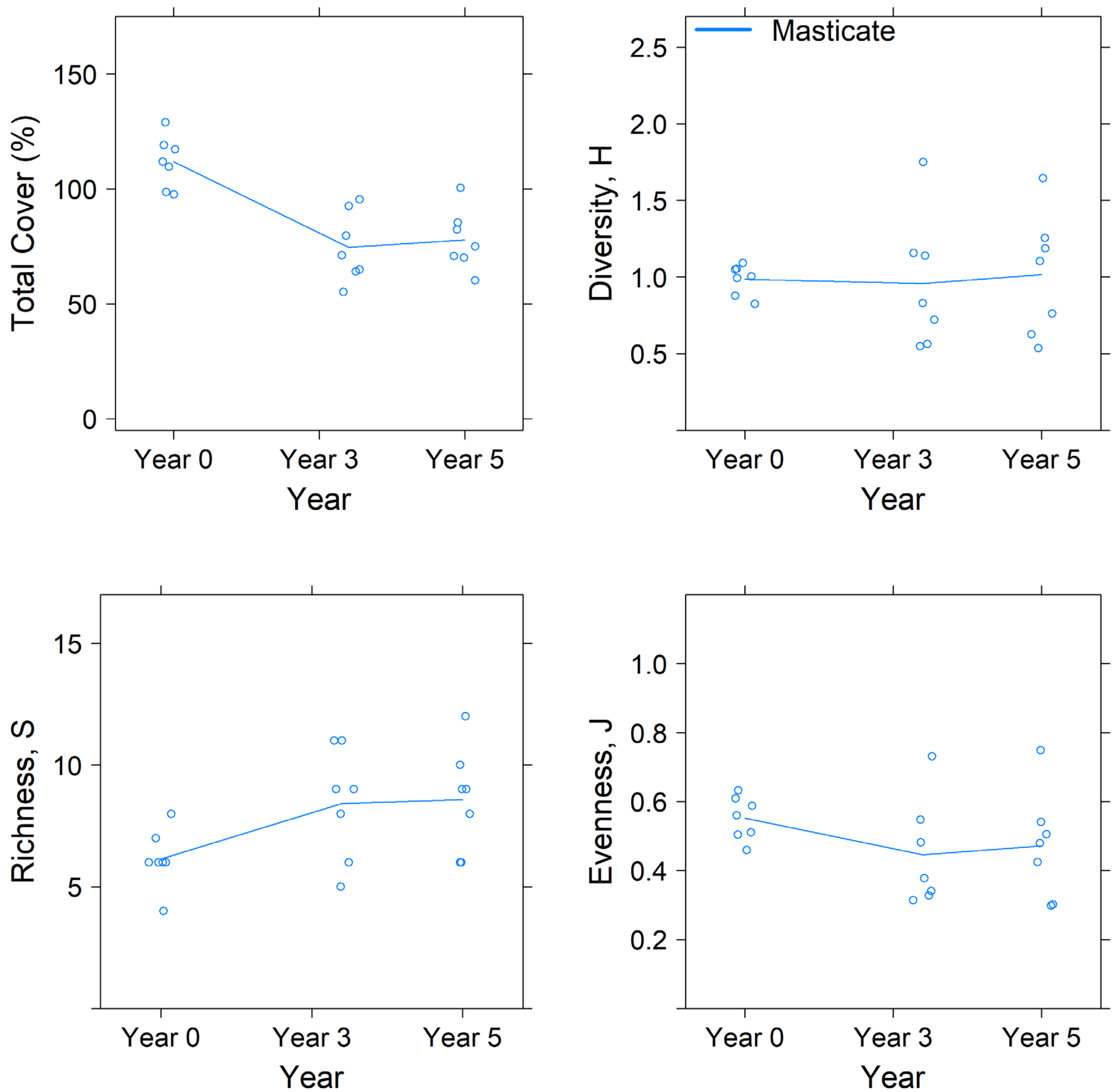

Figure 4-11. BLM Area B Unit A Containment Line Community Structure from Baseline (2015) to Five Years After Mastication (2022). Seven masticated transects were analyzed in BLM Area B Unit A Containment Line.

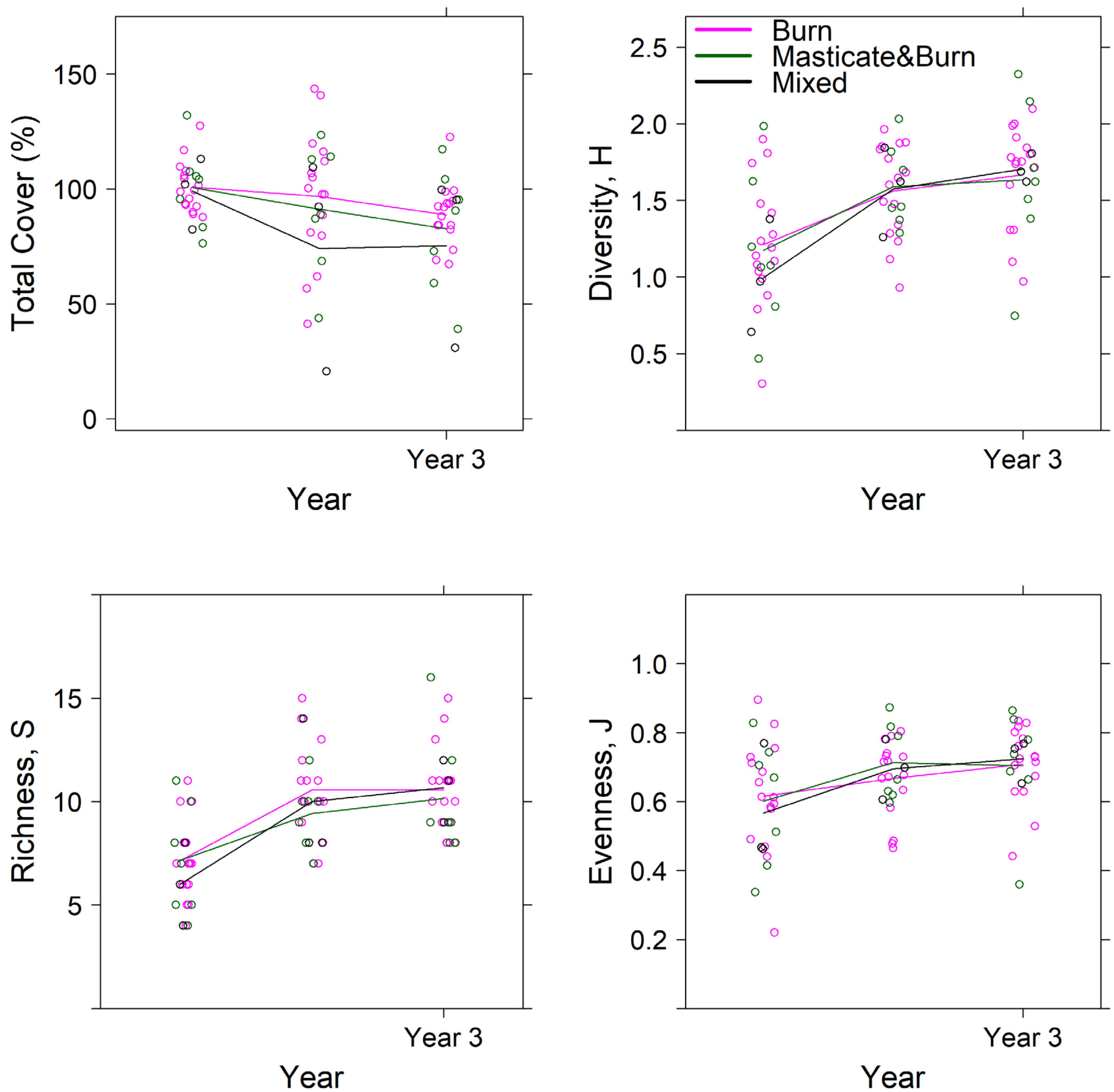

Figure 4-12. BLM Area B Unit B Community Structure from Baseline (2015 and 1999) to Five Years After Treatment (2022). Sixteen burned transects, seven masticated and burned transects, and three mixed (masticate and burn and masticate [2 transects]; masticate and burn [1 transect]) transects were analyzed in BLM Area B Unit B.

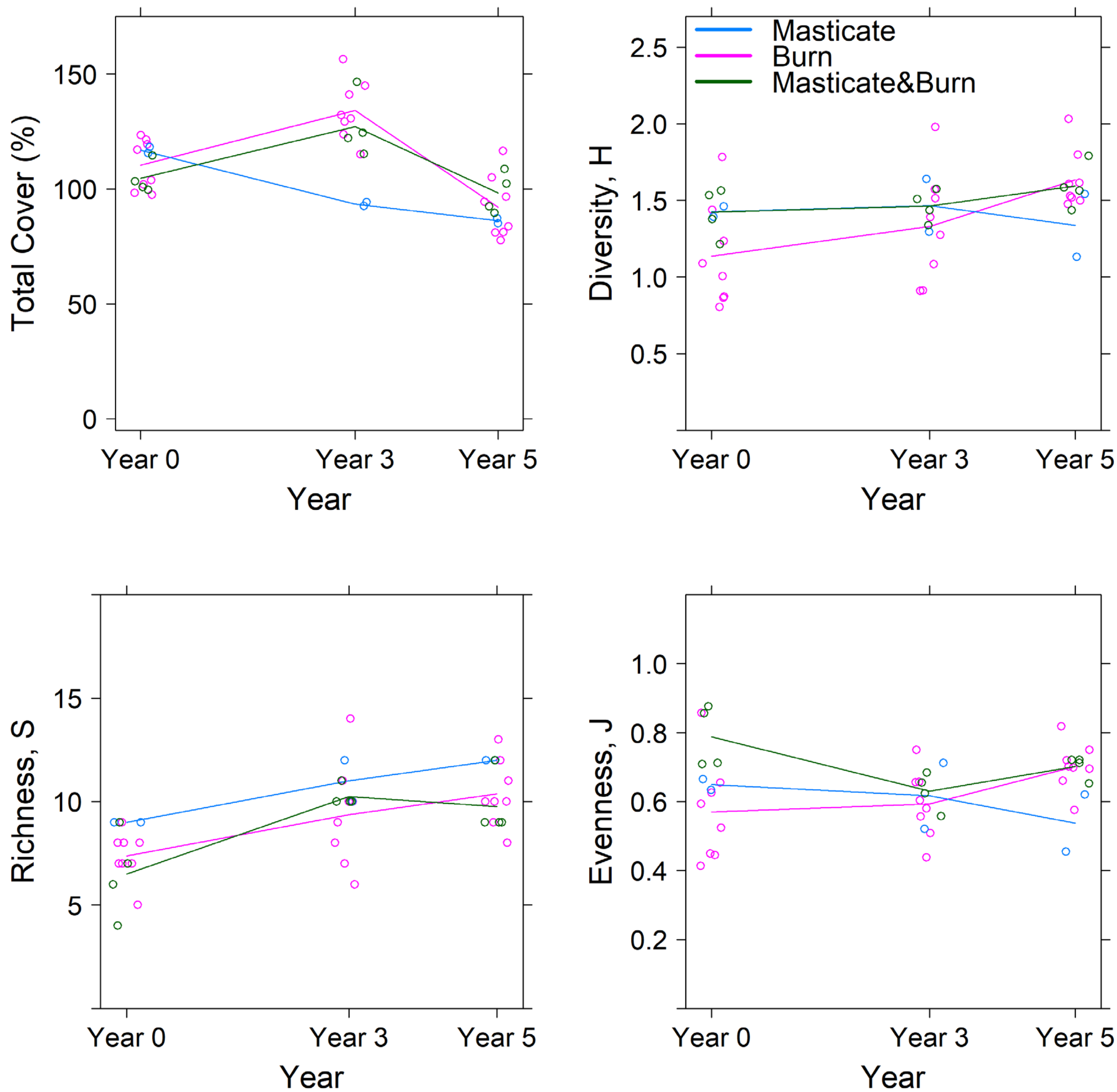

Figure 4-13. BLM Area B Unit C Community Structure from Baseline (2015) to Five Years After Treatment (2022). Eight burned transects, four masticated and burned transects, and two masticated transects were analyzed in BLM Area B Unit C.

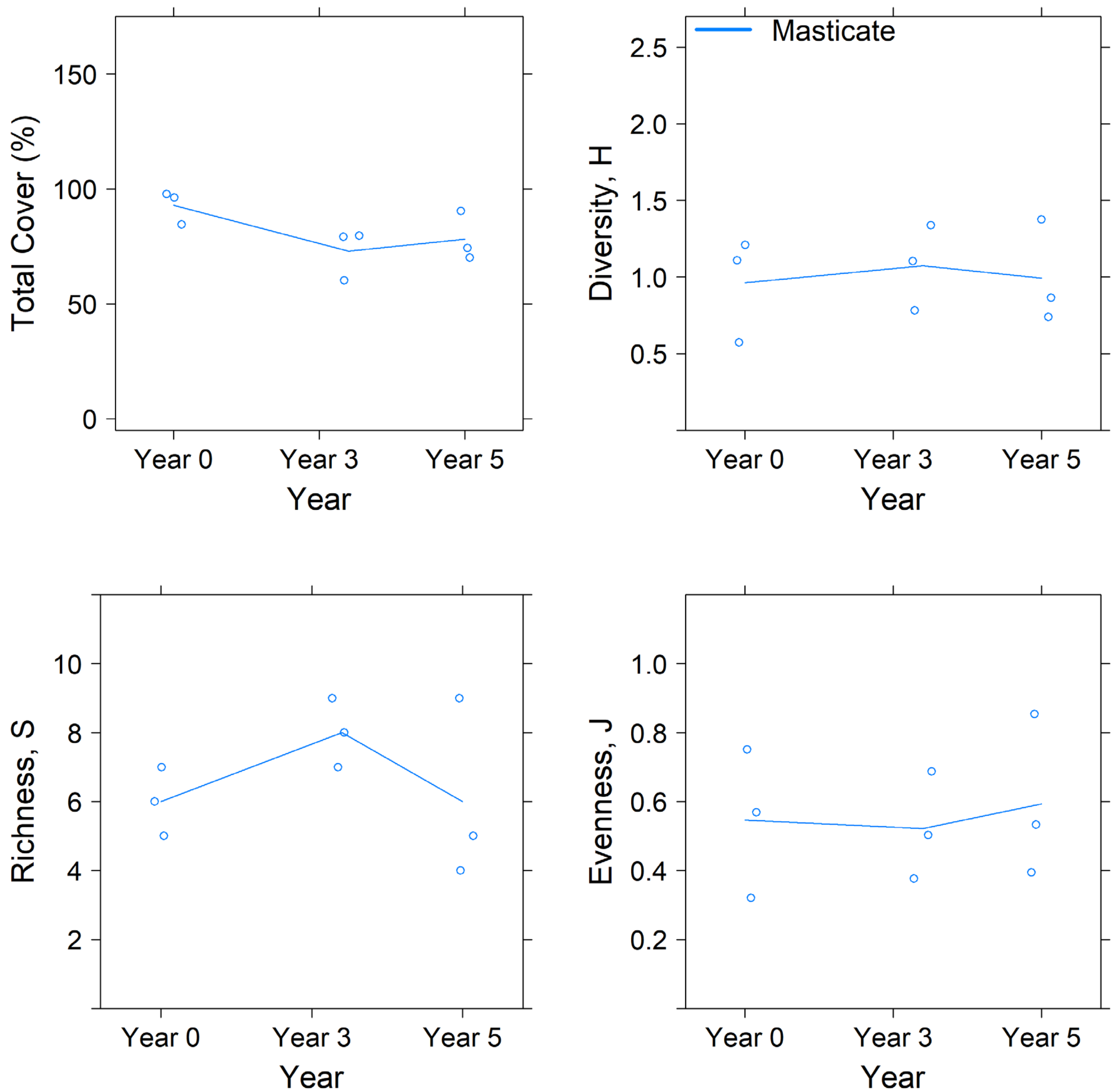

Figure 4-14. Unit B-2A Community Structure from Baseline (1998) to Five Years After mastication (2022). Three masticated transects were analyzed in Unit B-2A.

Mixed-design ANOVAs were conducted to examine the effects of Unit and age on mean percent bare ground and herbaceous cover. Age and Unit may each affect bare ground and herbaceous cover although there was evidence that an interaction between age and Unit may also be influencing differences in bare ground and herbaceous cover (Table 4-9). These differences are illustrated in Figures 4-15 through 4-20, where bare ground and herbaceous cover are different between Units and tend to noticeably increase between Baseline and Year 3, then decrease between Years 3 and 5.

Mixed design ANOVAs were conducted on Units B and C separately to compare the effects of treatment on bare ground and herbaceous cover. Treatment did not appear to influence differences observed in bare ground or herbaceous cover in either Unit B or Unit C (Tables 4-10 and 4-11). In Unit B, bare ground and herbaceous cover appear to be influenced by age and there was no evidence of an interaction between age and treatment influencing bare ground and herbaceous cover. In Unit C, age may affect bare ground and herbaceous cover; however, there was evidence of an interaction between treatment and age, indicating the true effects of either parameter alone may be masked by an inherent relationship between the two (Tables 4-9 and 4-11).

Table 4-9. Mixed-design ANOVA results for BLM Area B Units B-3 West, B-3 East, B, C, and A Containment Line bare ground and herbaceous cover.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*p*
Unit	12.04	3.239E-07	8.168	2.601E-05
Age	87.86	4.296E-24	40.97	1.471E-09
Unit*Age	2.548	0.01347	8.224	4.367E-06

Table 4-10. Mixed-design ANOVA results for BLM Area B Unit B bare ground and herbaceous cover.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*p*
Treatment	2.406	0.1125	0.1537	0.8584
Age	17.16	2.705E-06	9.917	0.002437
Treatment*Age	0.9924	0.4212	0.1419	0.9028

Table 4-11. Mixed-design ANOVA results for BLM Area B Unit C bare ground and herbaceous cover.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*p*
Treatment	0.6618	0.5353	2.148	0.1631
Age	44.33	1.919E-08	6.932	0.004628
Treatment*Age	2.839	0.04874	2.575	0.06596

Bare ground cover increased over time for all Year 5 Units (Figures 4-15 through 4-20). Units B-3 West, B-3 East, A Containment Line, and B-2A increased from 22%, 5%, 5%, and 9% in Baseline to 36%, 19%, 30%, and 22% in Year 3, respectively. By Year 5, bare ground cover in these Units increased to 50%, 30%, 30%, and 26%, respectively.

Treatment generally did not appear to influence bare ground cover, as bare ground varied similarly between treatments within Units B and C, except for mixed treatment transects in Unit B. In Year 3, mixed treatment transects in Unit B contained over double the bare ground cover of other treatments. Between Year 3 and Year 5, bare ground cover increased by only 1% along mixed transects; 9% along burned and masticated transects; and 7% along burned transects (Figure 4-18). In Unit C, bare ground along burned transects was 5% in Baseline, 9% in Year 3, and 27% in Year 5. Bare ground along masticated and burned transects was 10% in Baseline, 12% in Year 3, and 24% in Year 5. Bare ground along masticated transects was 2% in Baseline, 18% in Year 3, and 24% in Year 5 (Figure 4-19).

Herbaceous cover in Year 5 Units generally increased between Baseline and Year 3, then decreased between Years 3 and 5 (Figures 4-15 through 4-20; Table 4-5). Units B-3 West, B-3 East, A Containment Line, and B-2A all increased from 0.4%, 0.3%, 0.3%, and 4% in Baseline to 16%, 32%, 4%, and 21% in Year

3, respectively. By Year 5, herbaceous cover in these Units decreased to 4%, 16%, 2%, and 10%, respectively.

Herbaceous cover varied similarly between treatments within Units B and C (Figures 4-18 and 4-19). In Unit B, herbaceous cover on burned transects increased from 1% in Baseline to 14% in Year 3, then decreased to 5% by Year 5. Herbaceous cover along masticated and burned transects increased from 1% in Baseline to 12% in Year 3, then decreased to 6% by Year 5. Herbaceous cover along mixed treatment transects increased from 4% in Baseline to 18% in Year 3, then decreased to 6% by Year 5. In Unit C, herbaceous cover along burned transects increased from 0.1% in Baseline to 1% in Year 3, then increased to 4% by Year 5. Herbaceous cover along masticated and burned transects increased from 0.4% in Baseline to 2% in Year 3, then decreased to 1% by Year 5. Herbaceous cover along masticated transects increased from 0% in Baseline to 8% in Year 3, then decreased to 7% by Year 5.

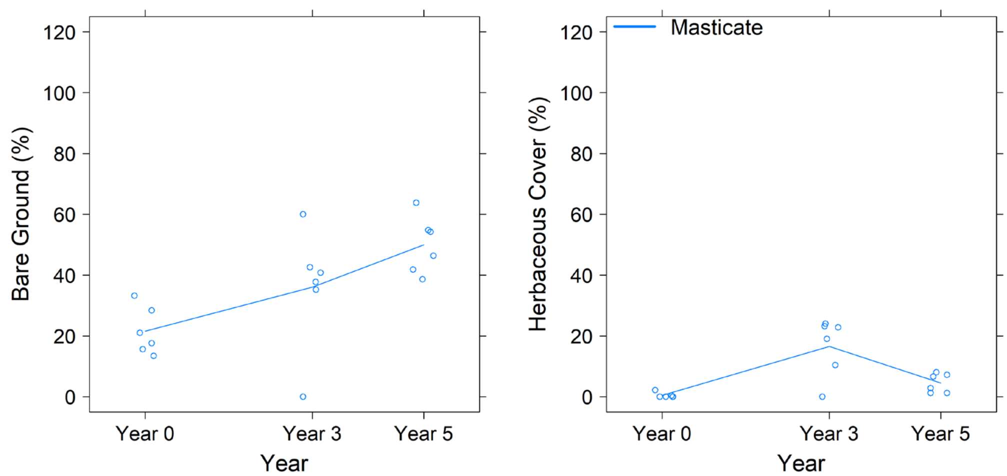

Figure 4-15. Unit B-3 West Bare Ground and Herbaceous Cover Between Baseline (2015) and Year 5 (2022). Six masticated transects were analyzed in Unit B-3 West.

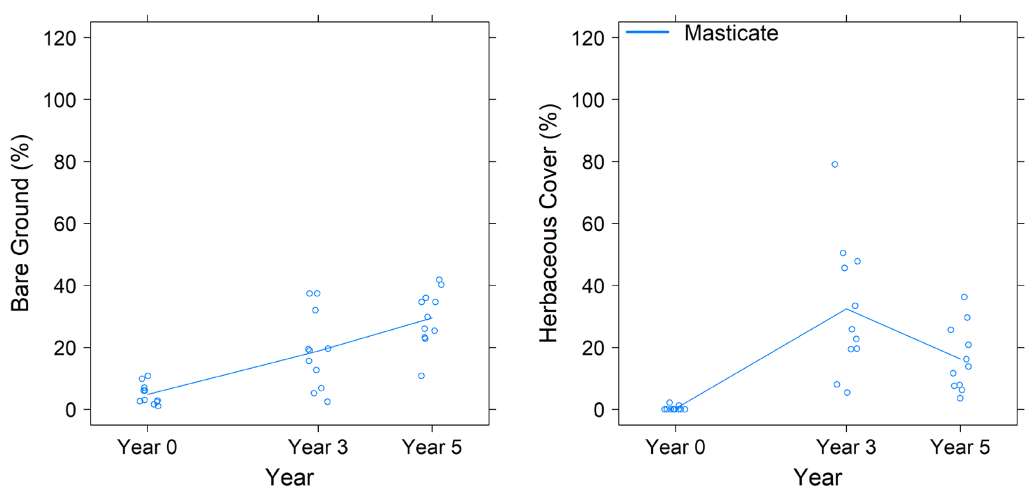

Figure 4-16. Unit B-3 East Bare Ground and Herbaceous Cover from Baseline (2015) and Year 5 (2022). Eleven masticated transects were analyzed in Unit B-3 East.

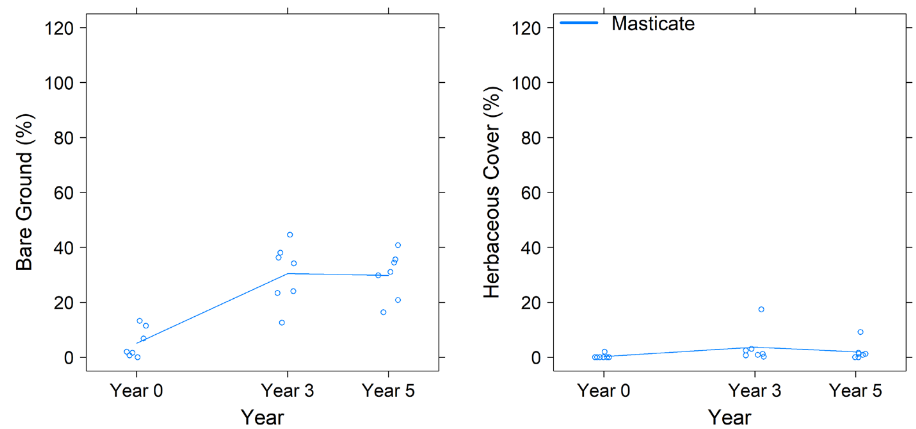

Figure 4-17. BLM Area B Unit A Containment Line Bare Ground and Herbaceous Cover from Baseline (2015) and Year 5 (2022). Seven masticated transects were analyzed in Unit A Containment Line.

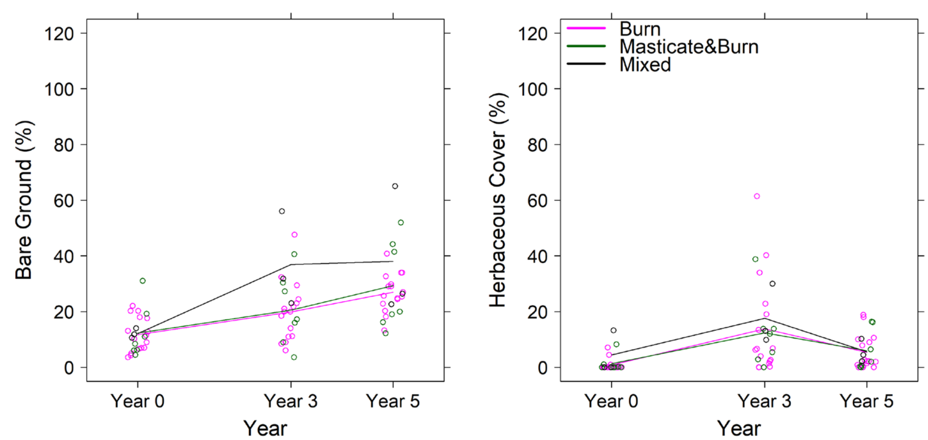

Figure 4-18. BLM Area B Unit B Bare Ground and Herbaceous Cover from Baseline (2015 & 1999) and Year 5 (2022). Sixteen burned transects, seven masticated and burned transects, and three mixed (masticated, and masticated and burned) transects were analyzed in Unit B.

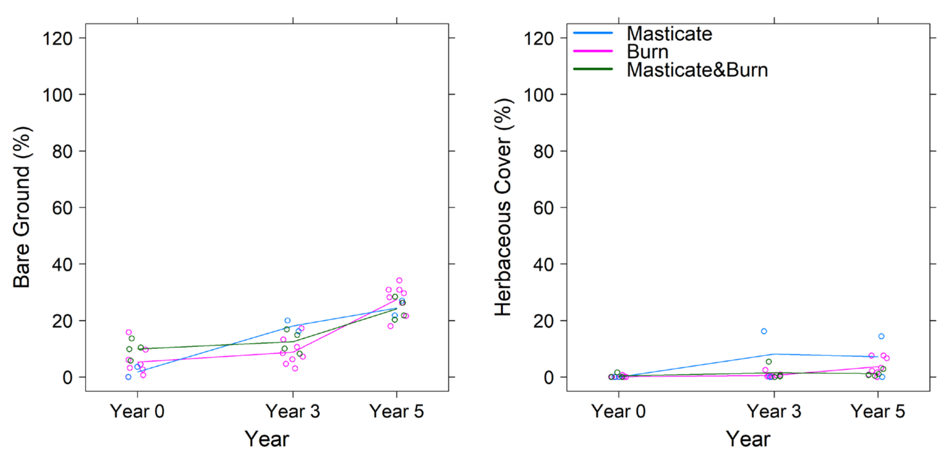

Figure 4-19. BLM Area B Unit C Bare Ground and Herbaceous Cover from Baseline (2015) and Year 5 (2022). Eight burned transects, four masticated and burned transects, and two masticated transects were analyzed in Unit C.

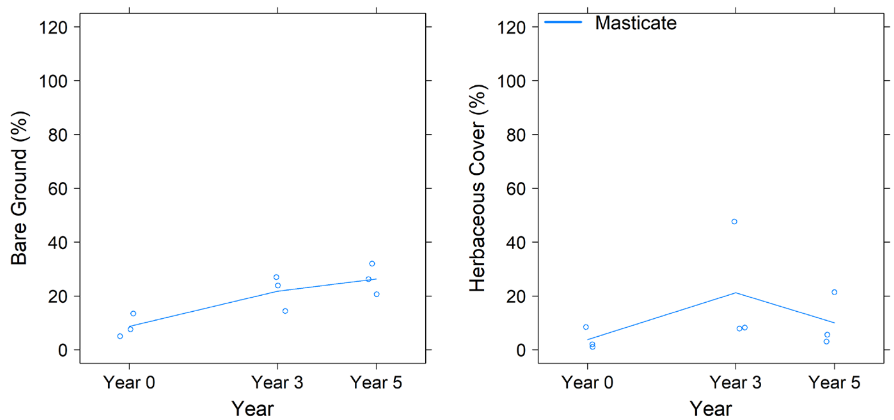

Figure 4-20. Unit B-2A Bare Ground and Herbaceous Cover from Baseline (1998) and Year 5 (2022). Three masticated were analyzed in Unit B-2A.

PERMANOVAs were conducted to examine differences in community composition among age, treatments, and Units. The results show that overall community composition differences may be influenced by Unit, age, and treatment; however, there was also evidence of interactions between age and Unit, age and treatment, and Unit and treatment (Table 4-12). This suggests that community composition may vary through time and between Units and treatments; however, these results also indicate that the inherent relationships between age and Unit, age and treatment, and Unit and treatment may mask the true effects of these factors separately on community composition.

PERMANOVAs conducted for Units B and C separately suggest that age and treatment influence community composition but in Unit C there was also evidence of a relationship between age and treatment, which may mask the individual effects of these factors within the Unit (Tables 4-13 and 4-14). Results for Unit B indicate that when Unit is not considered a factor, age and treatment have real effects on community composition that are not overshadowed by an underlying relationship between Unit and treatment. Additionally, these results provide evidence of inherent differences in community composition between Year 5 Units.

Table 4-12. Three-way PERMANOVA results for Units B-3 West, B-3 East, A, B, and C community compositions, based on Bray-Curtis distance matrices.

Factor	***F***	***p***
Age	28.43	0.0001
Unit	21.56	0.0001
Treatment	4.031	0.0001
Unit*Age	3.473	0.0001
Age*Treatment	1.433	0.0424
Unit*Treatment	2.568	0.0034
Unit*Age*Treatment	1.418	0.1448

Table 4-13. Two-way PERMANOVA results for Unit B community composition, based on Bray-Curtis distance matrices.

Factor	*F*	*p*
Age	19.16	0.0001
Treatment	2.216	0.0142
Age*Treatment	1.036	0.3998

Table 4-14. Two-way PERMANOVA results for Unit C community composition, based on Bray-Curtis distance matrices.

Factor	*F*	*p*
Age	18.76	0.0001
Treatment	5.806	0.0001
Age*Treatment	2.405	0.0331

Dominant species differed between Year 5 Units over time; however, Year 5 Units generally respond similarly over time with respect to richness and evenness, where richness typically increased over time and evenness generally remained stable between years. Additionally, subshrubs such as peak rush-rose and deerweed tended to become more abundant between Baseline and Year 3. Peak rush-rose remained fairly dominant in Year 5 In Units B-3 West, B, and along transects that were burned or masticated and burned in Unit C (Figures 4-21 through 4-26).

Dominant species among Units that were masticated were generally similar, with either chamise or shaggy-barked manzanita as the dominant species between years (Figures 4-21 through 4-23 and 4-26). Unit B-3 West was dominated by sandmat manzanita in Baseline (40% cover) and was dominated in Years 3 and 5 by peak rush-rose ($C_{Year\ 3}$ = 11%, $C_{Year\ 5}$ = 13%). Unit B-3 East was dominated by chamise in all three survey years ($C_{Baseline}$ = 54%, $C_{Year\ 3}$ = 30%, $C_{Year\ 5}$ = 32%). Shaggy-barked manzanita was the clear dominant species in Unit A Containment Line in all survey years ($C_{Baseline}$ = 78%, $C_{Year\ 3}$ = 55%, $C_{Year\ 5}$ = 56%). Unit B-2A was dominated by chamise in Baseline and Year 5 surveys ($C_{Baseline}$ = 37%, $C_{Year\ 5}$ = 34%) but was temporarily dominated by shaggy-barked manzanita in Year 3 ($C_{Year\ 3}$ = 29%).

Community composition along mixed transects was different from the composition along burned and masticated and burned transects in Unit B (Figure 4-24). During Baseline surveys, shaggy-barked manzanita was the dominant species along burned ($C_{Baseline,\ burn}$ = 46% cover) and masticated and burned transects ($C_{Baseline,\ M\&B}$ = 56%), while Hooker's manzanita was the dominant species along mixed transects (C_{mixed} = 27%). Dwarf ceanothus became the most dominant species after treatment in Year 3 along burned transects ($C_{Year\ 3,\ burn}$ = 35%) and masticated and burned transects ($C_{Year\ 3,\ M\&B}$ = 36%) even though this species was not detected in Unit B during Baseline surveys. This species remained dominant in Year 5 along burned transects ($C_{Year\ 5,\ burn}$ = 23%) and was the second-most dominant species along masticated and burned transects ($C_{Year\ 5,\ M\&B}$ = 16%), with shaggy-barked manzanita being the most dominant ($C_{Year\ 5,\ M\&B}$ = 20%). Deerweed and peak rush-rose were co-dominant along mixed treatment transects in Year 3 ($C_{Year\ 3,\ ACGL}$ = 24%; $C_{Year\ 3,\ CRSC}$ = 23%); however, in Year 5 peak rush-rose became the clear dominant species ($C_{Year5,\ CRSC}$ = 27%). Additionally, Hooker's manzanita was the dominant species along mixed transects in Baseline ($C_{Year\ 0,\ Mixed}$ = 27%) but became the least abundant species in Year 3 ($C_{Year\ 3,\ Mixed}$ = 0.13%). In Year 5, this species began a trajectory toward recovery, increasing by 0.33% between Year 3 and Year 5. Similarly, community composition in Unit C appeared variable between treatments (Figure 4-25). During Baseline surveys, shaggy-barked manzanita was the dominant species across all treatments (C_{burn} = 70%, $C_{M\&B}$ = 46%, $C_{masticate}$ = 59%). Shaggy-barked manzanita remained the dominant species on masticated transects in Years 3 and 5 ($C_{Year\ 3}$ = 47%, $C_{Year\ 5}$ = 47%). Dwarf ceanothus became the dominant species among burned transects in Year 3 ($C_{Year\ 3,\ burn}$ = 69%) but by Year 5, shaggy-barked manzanita was again the most dominant species ($C_{Year\ 5,\ burn}$ = 25%), followed closely by peak rush-rose ($C_{Year\ 5,\ burn}$ = 22%). Peak rush-rose and dwarf ceanothus co-dominated masticated and burned transects in Year 3 (C_{CRSC} = 43%, C_{CEDE} = 41%). By Year 5, peak rush-rose was the dominant species ($C_{Year\ 5,\ M\&B}$ = 39%), and dwarf ceanothus was the second most dominant species ($C_{Year\ 5,\ M\&B}$ = 23%).

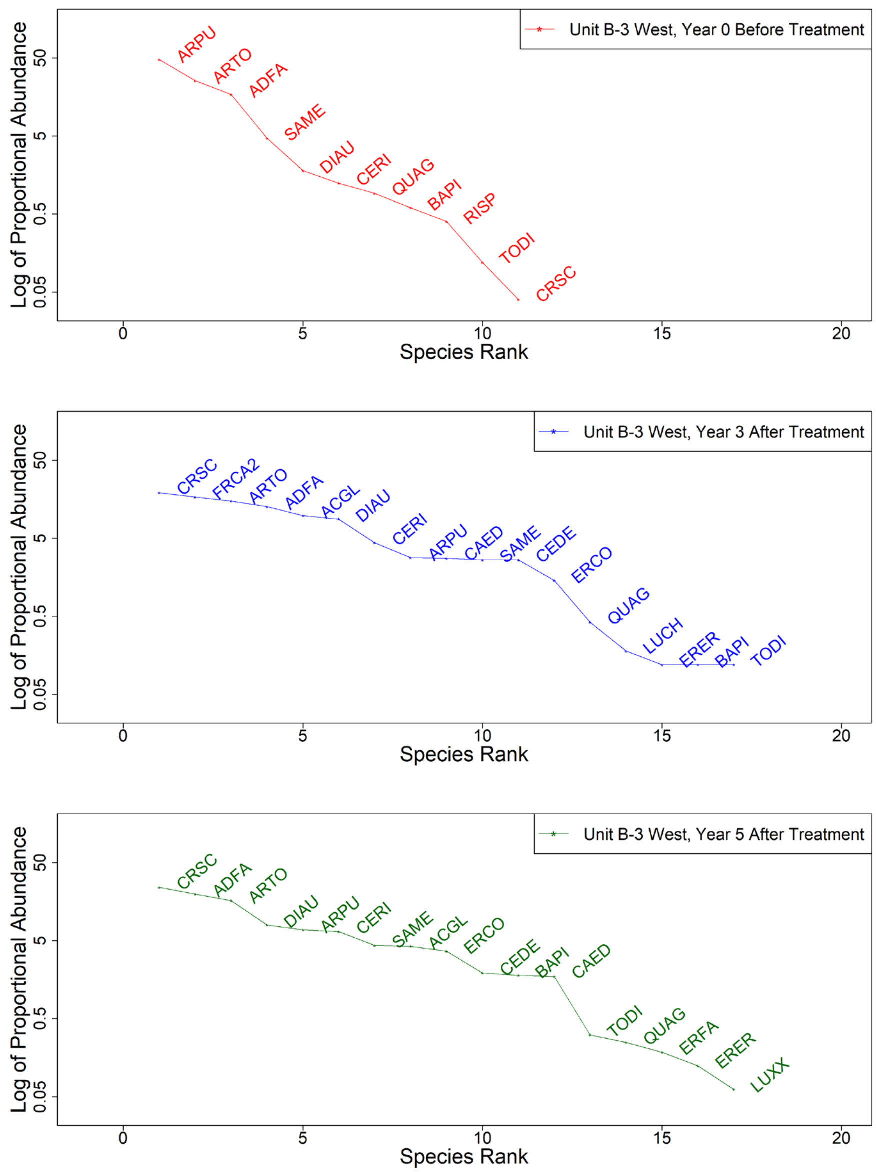

Figure 4-21. Unit B-3 West Rank Abundance Curves Between Baseline (2015) and Year 5 (2022). New species present in Year 5 surveys include deerweed (*Acmispon glaber*), golden yarrow (*Eriophyllum confertiflorum*), dwarf ceanothus (*Ceanothus dentatus*), iceplant (*Carpobrotus edulis*), Eastwood's goldenbush (*Ericameria fasciculata*), mock heather (*Ericameria ericoides*), and lupine sp. (likely silver beach lupine [*Lupinus chamissonis*] that was observed in Year 3 surveys). One species present in Baseline surveys, but absent in Year 5 was fuchsia-flowered gooseberry (*Ribes speciosum*). Six masticated transects were analyzed in Unit B-3 West. Y-axis is in log_{10} scale.

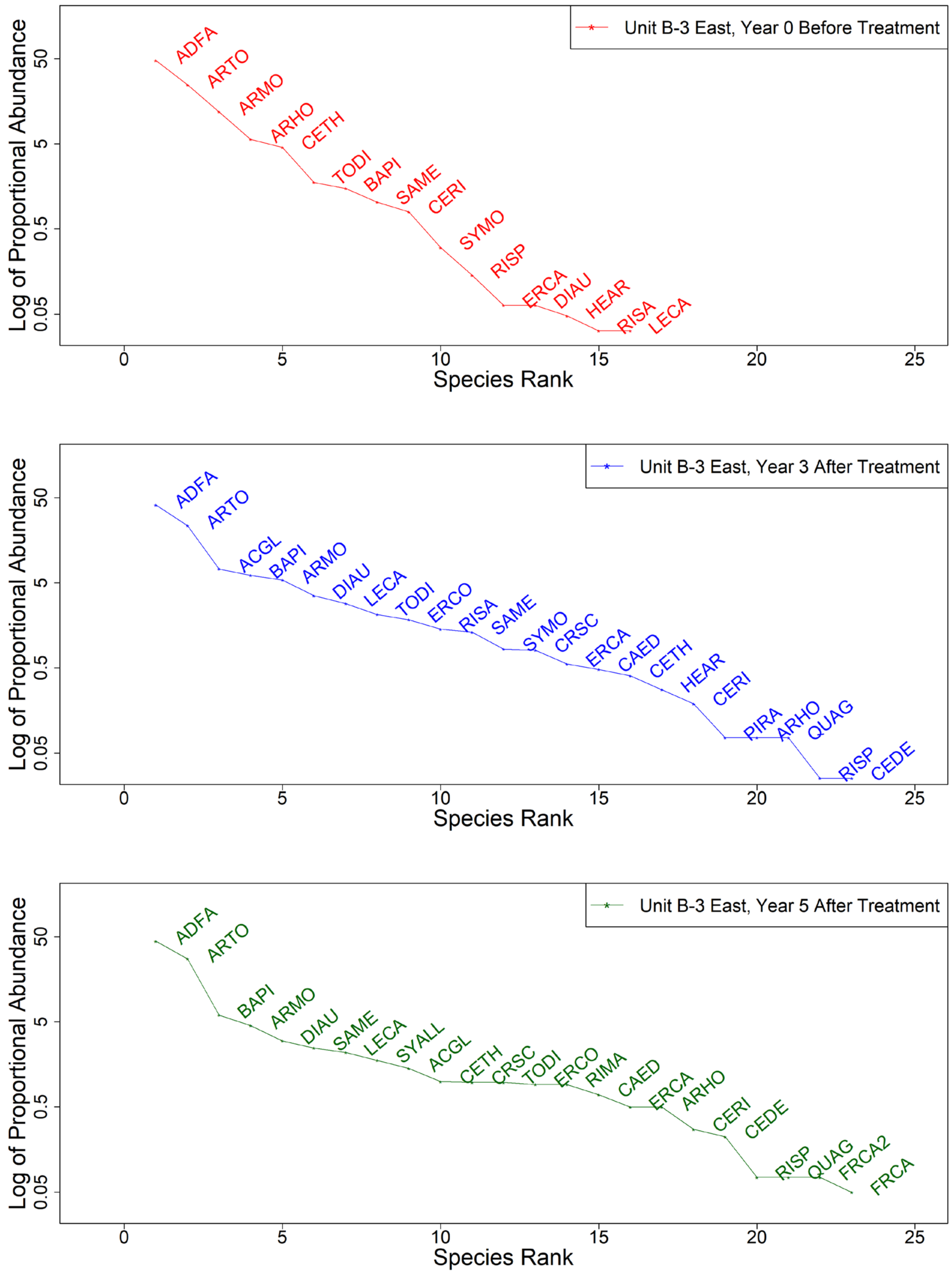

Figure 4-22. Unit B-3 East Rank Abundance Curves Between Baseline (2015) and Year 5 (2022). New species present in Year 5 surveys include common snowberry (*Symphoricarpos albus* var. *laevigatus*), deerweed, peak rush-rose (*Crocanthemum scoparium*), golden yarrow, chaparral currant (*Ribes malvaceum*), iceplant, dwarf ceanothus, coast live oak (*Quercus agrifolia*), coffeeberry (*Frangula californica*), and California flannelbush (*Fremontodendron californicum*). Species present in Baseline surveys, but absent in Year 5 include creeping snowberry (*Symphoricarpos mollis*), toyon (*Heteromeles arbutifolia*), and red flowering currant (*Ribes sanguineum*). Eleven masticated transects were analyzed in Unit B-3 East. Y-axis is in log_{10} scale.

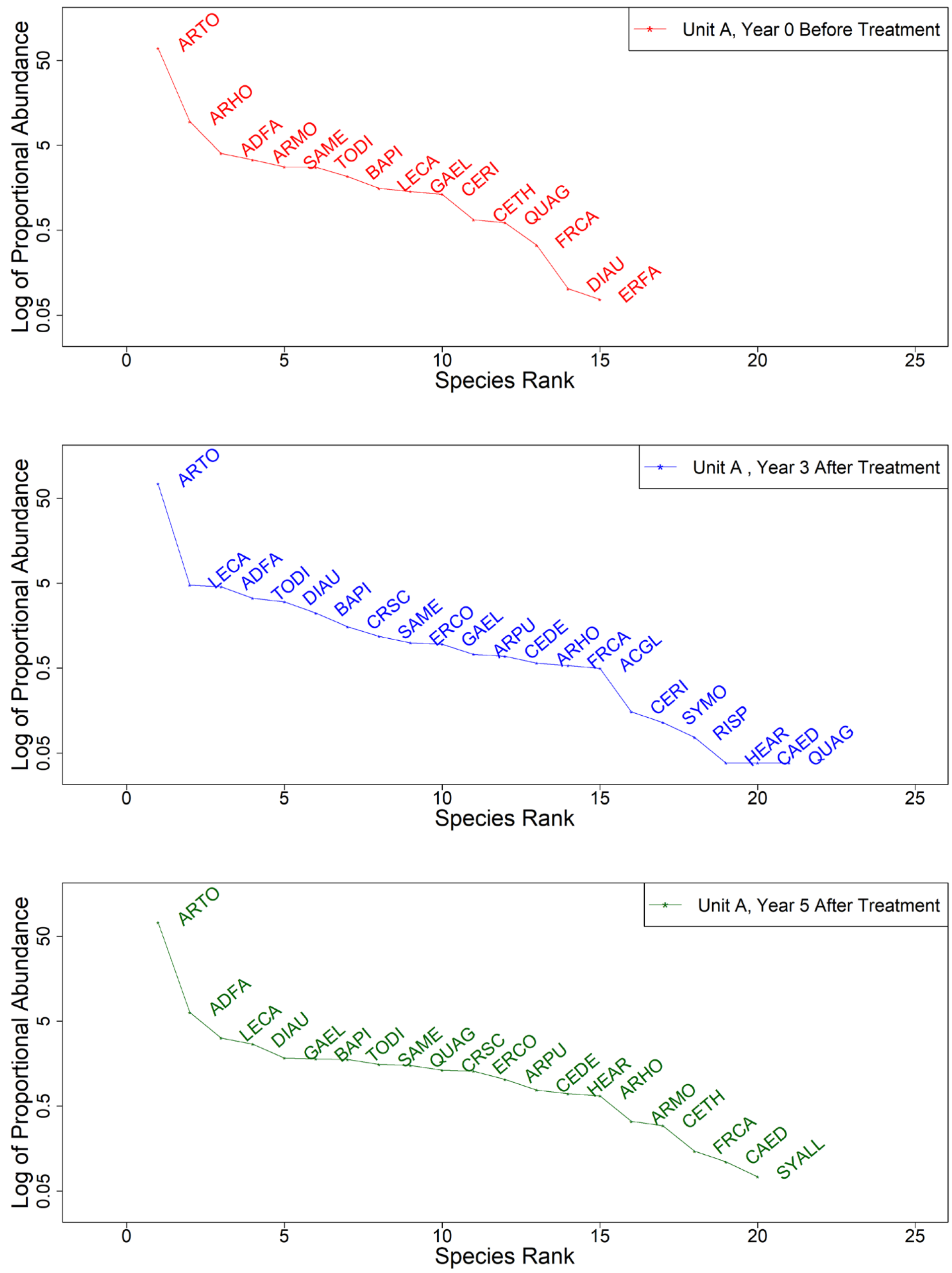

Figure 4-23. BLM Area B Unit A Containment Line Rank Abundance Curves Between Baseline (2015) and Year 5 (2022). New species present in Year 5 surveys include peak rush-rose, golden yarrow, sandmat manzanita (*Arctostaphylos pumila*), dwarf ceanothus, toyon, iceplant, and common snowberry. Species present in Baseline surveys, but absent in Year 5 include Monterey ceanothus (*Ceanothus rigidus*) and Eastwood's goldenbush. Seven masticated transects were analyzed in Unit A Containment Line. Y-axis is in $\log_{10}$ scale.

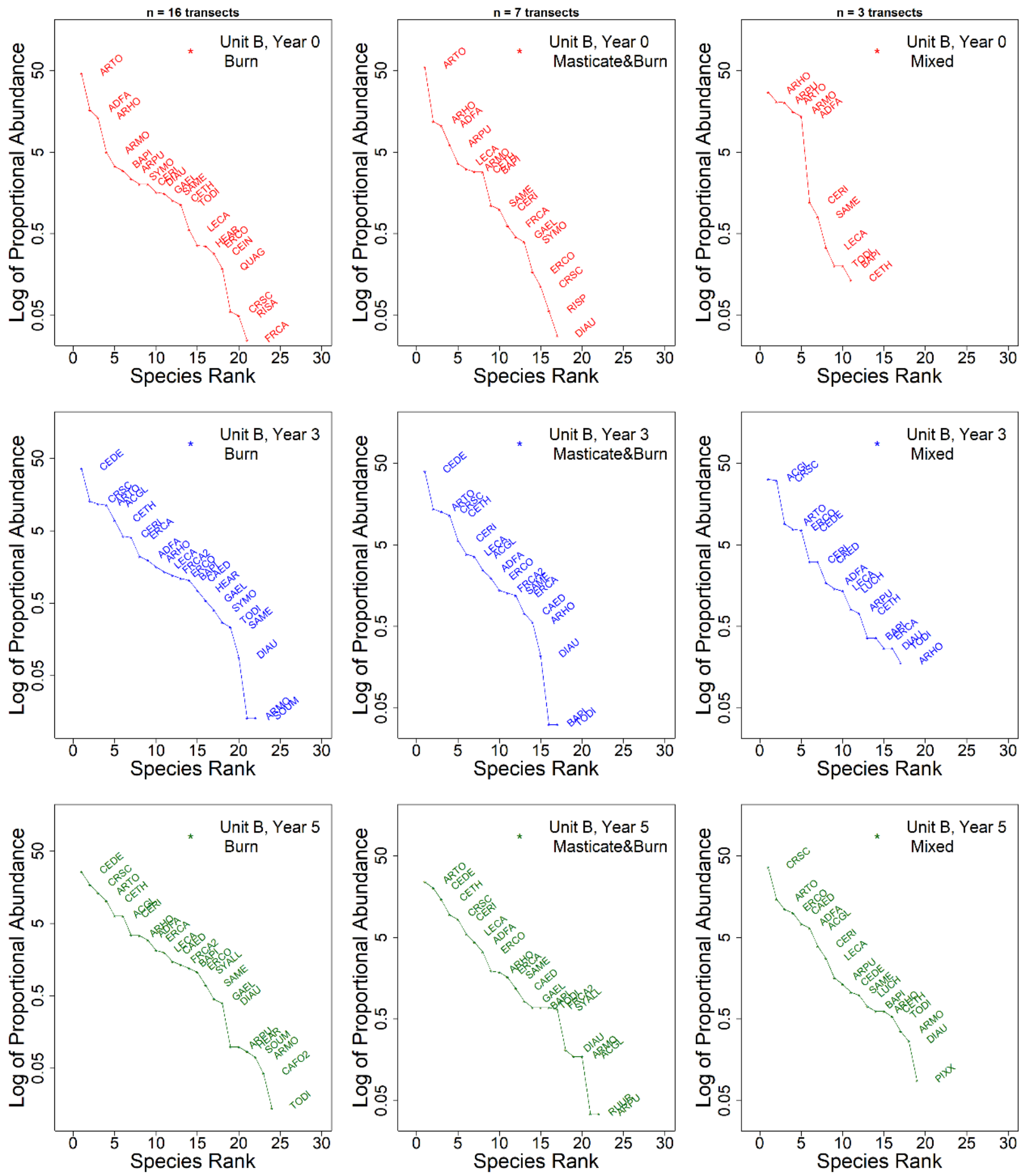

Figure 4-24. BLM Area B Unit B Rank Abundance Curves Between Baseline (2015 & 1999 [n= 2]) and Year 5 (2022). The left column represents burned transects (n=16). New species present along Year 5 burned transects include dwarf ceanothus, deerweed, yerba santa, iceplant, California flannelbush, common snowberry, blue witch (*Solanum umbelliferum*), and Texas Indian paintbrush (*Castilleja foliolosa*). Species present in Baseline surveys, but absent on Year 5 burned transects include red flowering currant, coast whitehorn (*Ceanothus incanus*), coast live oak, and coffeeberry. The middle column represents masticated and burned transects (n=7). New species present on Year 5 masticated and burned transects include dwarf ceanothus, yerba santa, California flannelbush, poison oak, common snowberry, iceplant, deerweed, and California blackberry (*Rubus ursinus*). Species present in Baseline surveys, but absent on Year 5 masticated and burned transects include California coffeeberry, creeping snowberry, and fuchsia-flowered gooseberry. The right column represents mixed treatment transects (n=3). New species present on Year 5 mixed treatment transects include peak rush-rose, golden yarrow, iceplant, deerweed, dwarf ceanothus, silver beach lupine, sticky monkeyflower (*Diplacus aurantiacus*), and Piperia sp. No species were present in Baseline but absent on Year 5 mixed treatment transects. Y-axis is in log_{10} scale.

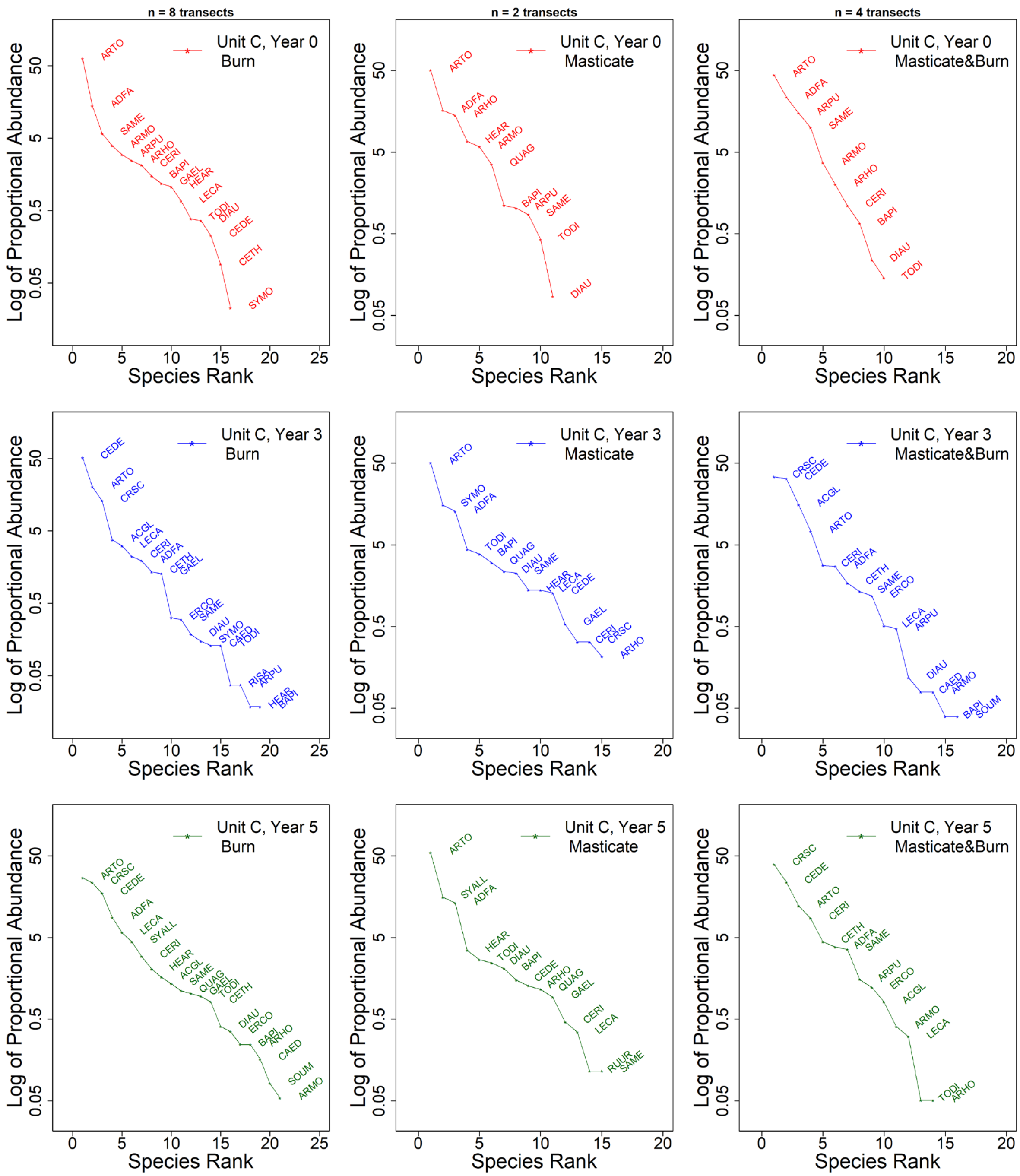

Figure 4-25. BLM Area B Unit C Rank Abundance Curves Between Baseline (2015) and Year 5 (2022). The left column represents burned transects (n=8). New species present on Year 5 burned transects include peak rush-rose, common snowberry, deerweed, coast live oak, golden yarrow, iceplant, and blue witch. Species present in Baseline surveys, but absent on Year 5 burned transects include sandmat manzanita and creeping snowberry. The middle column represents masticated transects (n=2). New species present on Year 5 masticated transects include common snowberry, dwarf ceanothus, coast silk tassel, Monterey ceanothus, pitcher sage (*Lepechinia calycina*), and California blackberry. Species present in Baseline surveys, but absent on Year 5 masticated transects include Toro manzanita and sandmat manzanita. The right column represents masticated and burned transects (n=4). New species present on Year 5 masticated and burned transects include peak rush-rose, dwarf ceanothus, blue blossom, golden yarrow, deerweed, and pitcher sage. Species present in Baseline but absent on Year 5 masticated and burned transects include coyote brush and sticky monkeyflower. Y-axis is in log_{10} scale.

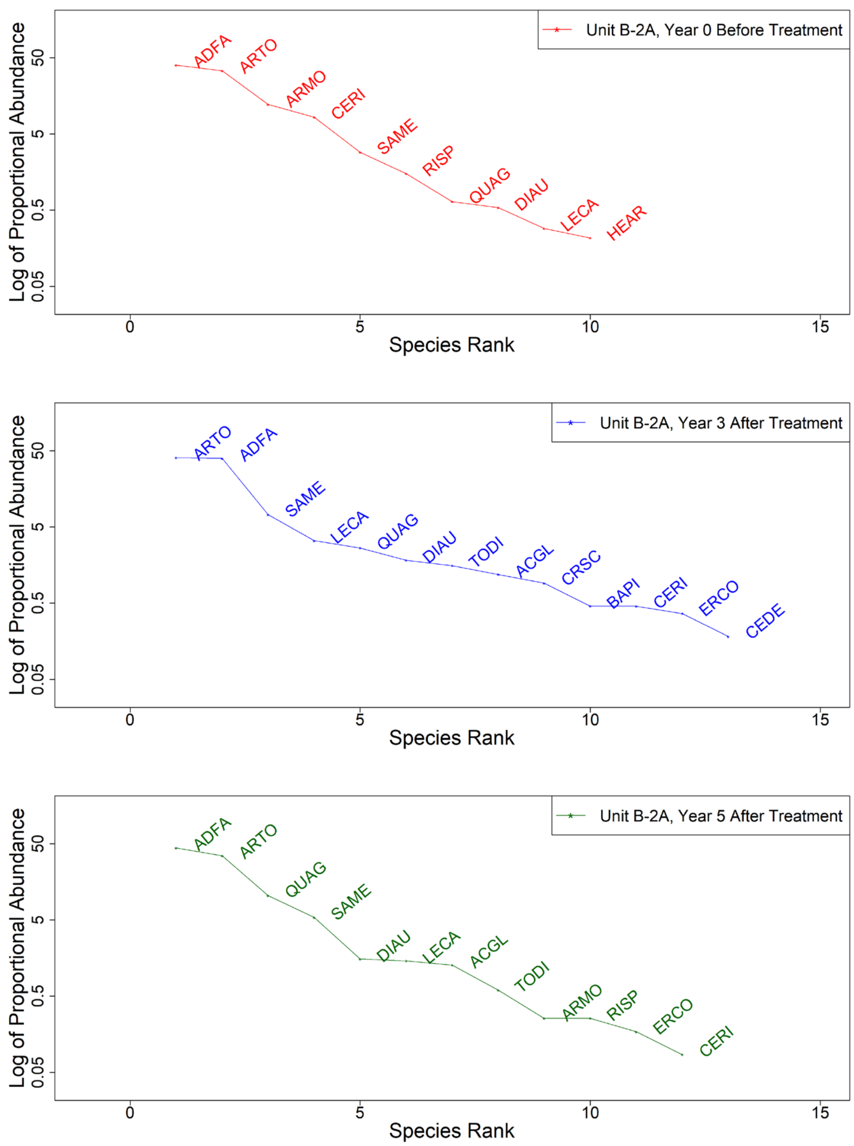

Figure 4-26. Unit B-2A Rank Abundance Curves Between Baseline (1998) and Year 5 (2022). New species present in Year 5 surveys include deerweed, poison oak (*Toxicodendron diversilobum*), and golden yarrow. The only species present in Baseline surveys, but absent in Year 5 is toyon. Three transects were analyzed in Unit B-2A. Y-axis is in $\log_{10}$ scale.

The HMP shrub species present in Year 5 Units varied by Unit and treatment, and their recovery tended to occur at a slower rate than non-HMP shrub species (Figures 4-27 through 4-32). HMP species that were present in Unit B-3 West during Baseline surveys were sandmat manzanita and Monterey ceanothus. These species were present in Year 3 and were observed in Year 5 at higher abundance than in Year 3. Additionally, Eastwood's goldenbush was present along one transect in Year 5. HMP species that were present in Unit B-3 East during Baseline surveys were Monterey ceanothus, Toro manzanita, and Hooker's manzanita. All three species were still present in Year 5 surveys; however, Hooker's manzanita was observed at lower abundance in Year 5 (0.4% cover) than in Baseline (6% cover). HMP species that were present in Unit A Containment Line during Baseline surveys were Monterey ceanothus, Toro manzanita, Hooker's manzanita, and Eastwood's goldenbush. In Year 3, Toro manzanita and Eastwood's goldenbush were not observed in Unit A Containment Line; however, sandmat manzanita was newly observed and Hooker's manzanita and Monterey ceanothus were present in low abundance. In Year 5, abundance of Hooker's manzanita remained approximately the same as in Year 3, abundance of sandmat manzanita and Toro manzanita increased slightly from Year 3, and Monterey ceanothus was not detected. HMP species that were present in Unit B-2A during Baseline (1998) surveys were Monterey ceanothus and Toro manzanita, of which only Monterey ceanothus was observed in Year 3. Both Monterey ceanothus and Toro manzanita were observed in Year 5, suggesting Toro manzanita may take longer to recover from mastication than Monterey ceanothus.

HMP shrub species in Units B and C were evaluated separately by treatment since community composition varied by Treatment (Figures 4-30 and 4-31). In Unit B, Monterey ceanothus and Hooker's manzanita were present in all survey years and across all treatment types. Toro manzanita was present in Baseline and Year 5 surveys but was absent in Year 3 across all treatment types. Sandmat manzanita was present in Baseline and persisted in Year 5 along burned transects and mixed transects but was absent in Year 5 along masticated and burned transects. Monterey ceanothus was the only species with greater abundance in Year 5 than in Baseline, regardless of treatment type ($C_{Baseline, Burn}$ = 2%, $C_{Year 5, Burn}$ = 6%, $C_{Baseline, Mixed}$ = 1%, $C_{Year 5, Mixed}$ = 3%, $C_{Baseline, M\&B}$ = 1%, $C_{Year 5, M\&B}$ = 7%).

In Unit C, sandmat manzanita was present both in Baseline and Year 5 only along masticated and burned transects; sandmat manzanita was present in Baseline but absent in Year 5 along masticated transects and masticated and burned transects. As with Unit B, in Unit C Monterey ceanothus was the only species present at higher abundance in Year 5 than in Baseline, regardless of treatment type $B_{Baseline, Burn}$ = 2%, $B_{Year 5, Burn}$ = 3%, $B_{Baseline, Masticate}$ = 0%, $B_{Year 5, Masticate}$ = 0.4%, $B_{Baseline, M\&B}$ = 1%, $B_{Year 5, M\&B}$ = 8%). Toro manzanita recovered at a faster rate along masticated and burned transects compared to burned transects or masticated transects, where Toro manzanita along burned transects decreased from 4% to only 0.05% between Baseline and Year 5 and this species was no longer present in Years 3 and 5 along masticated transects. Hooker's manzanita persisted from Baseline to Year 5 along masticated transects but was absent in Year 3 and is just beginning to recover in Year 5 at very low abundance along burned transects and masticated and burned transects ($C_{Year 5, Burn}$ = 0.2%, $C_{Year 5, M\&B}$ = 0.05%).

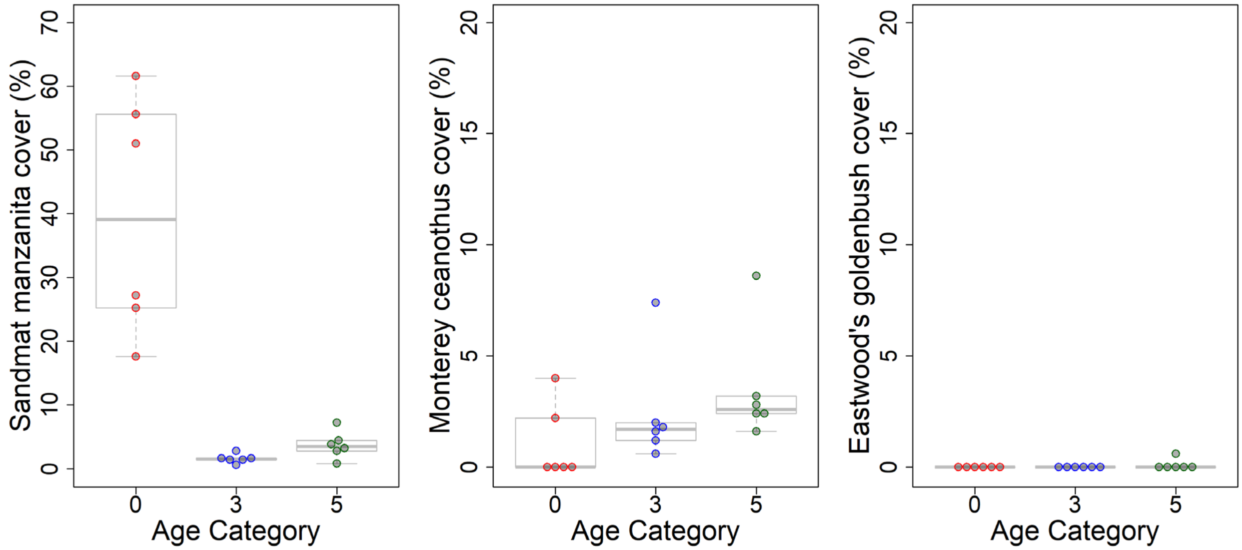

Figure 4-27. Unit B-3 West HMP Shrub Species Cover Between Baseline (2015) and Year 5 (2022). Scales Not Equivalent. The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Six masticated transects were analyzed in Unit B-3 West.

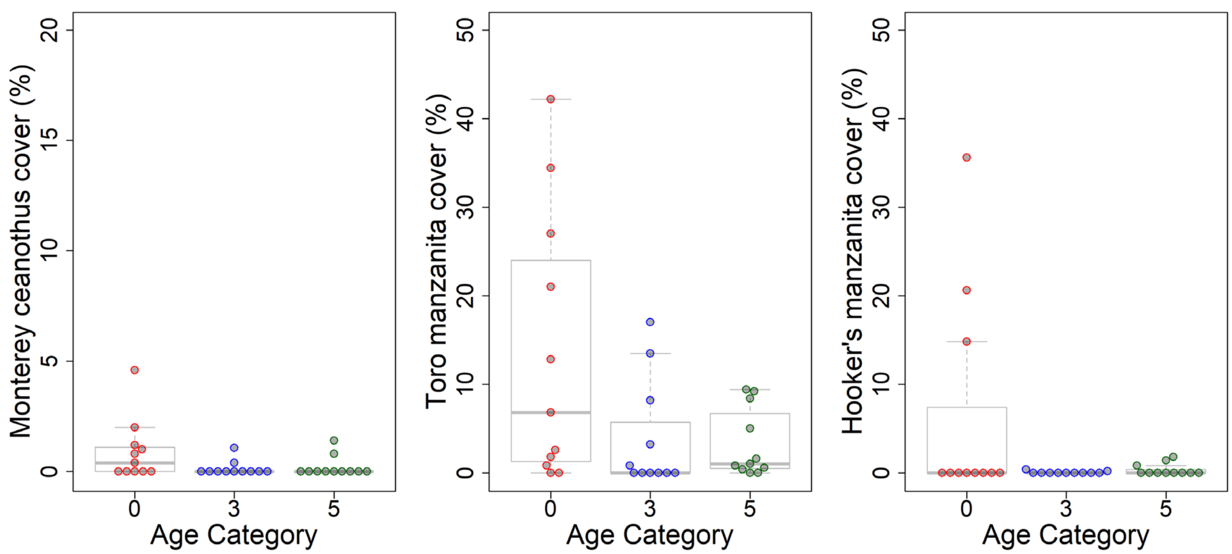

Figure 4-28. Unit B-3 East HMP Shrub Species Cover Between Baseline (2015) and Year 5 (2022). Scales Not Equivalent. The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Eleven masticated transects were analyzed in Unit B-3 East.

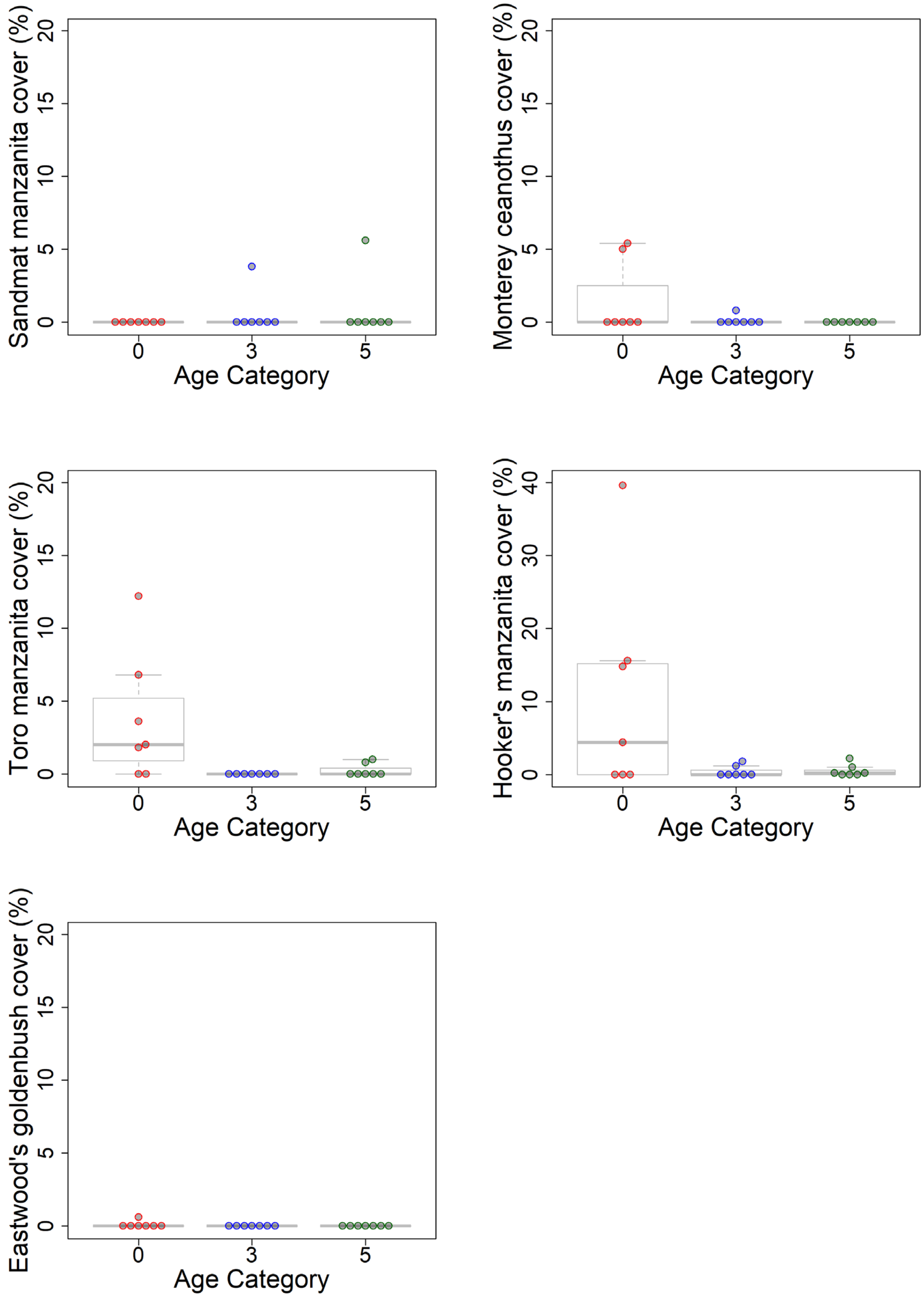

Figure 4-29. BLM Area B Unit A Containment Line HMP Shrub Species Cover Between Baseline (2015) and Year 5 (2022). Scales Not Equivalent. The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Seven transects were analyzed in Unit A Containment Line.

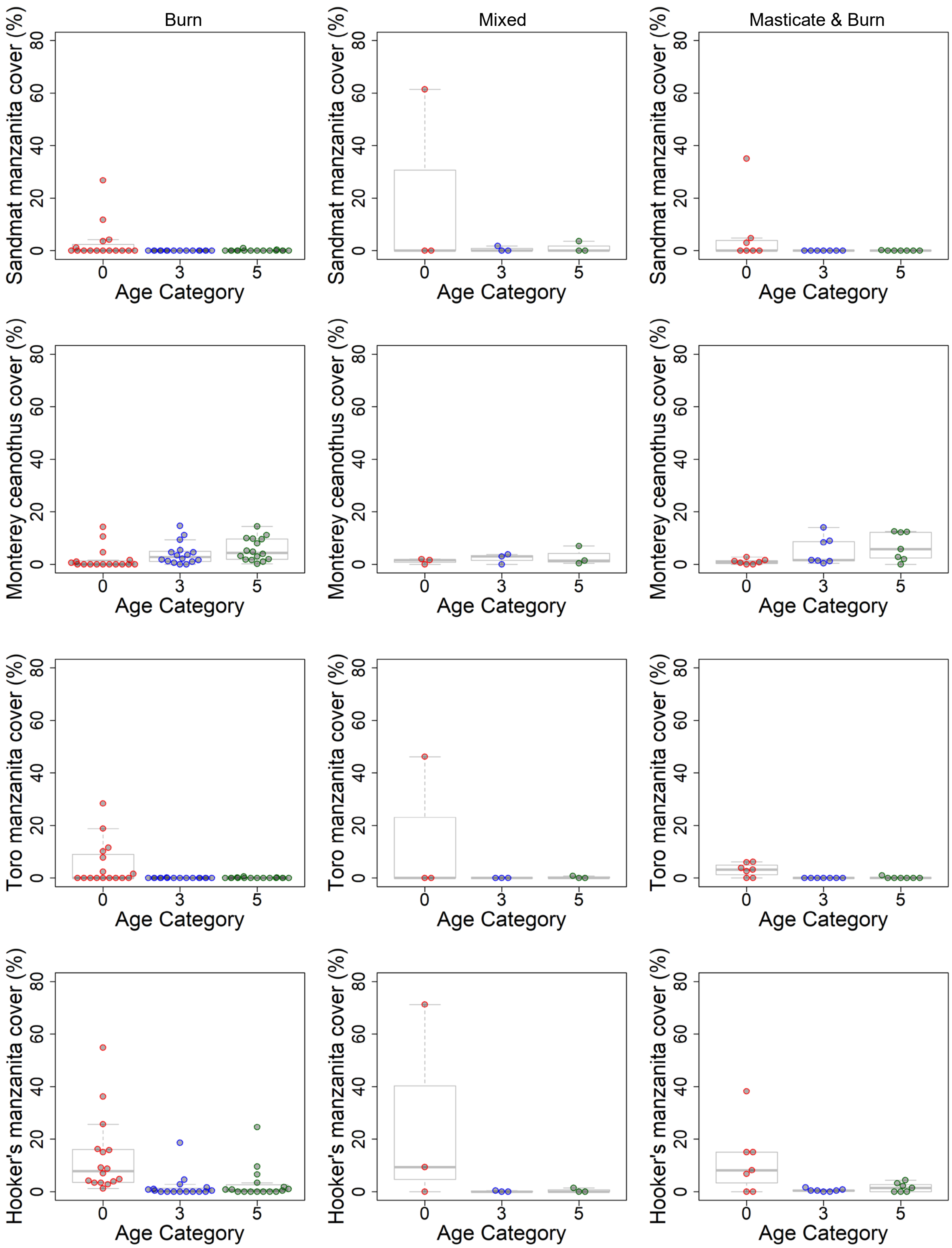

Figure 4-30. BLM Area B Unit B HMP Shrub Species Cover Between Baseline (2015 & 1999 [2 transects]) and Year 5 (2022). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Twenty-six transects were analyzed in Unit B.

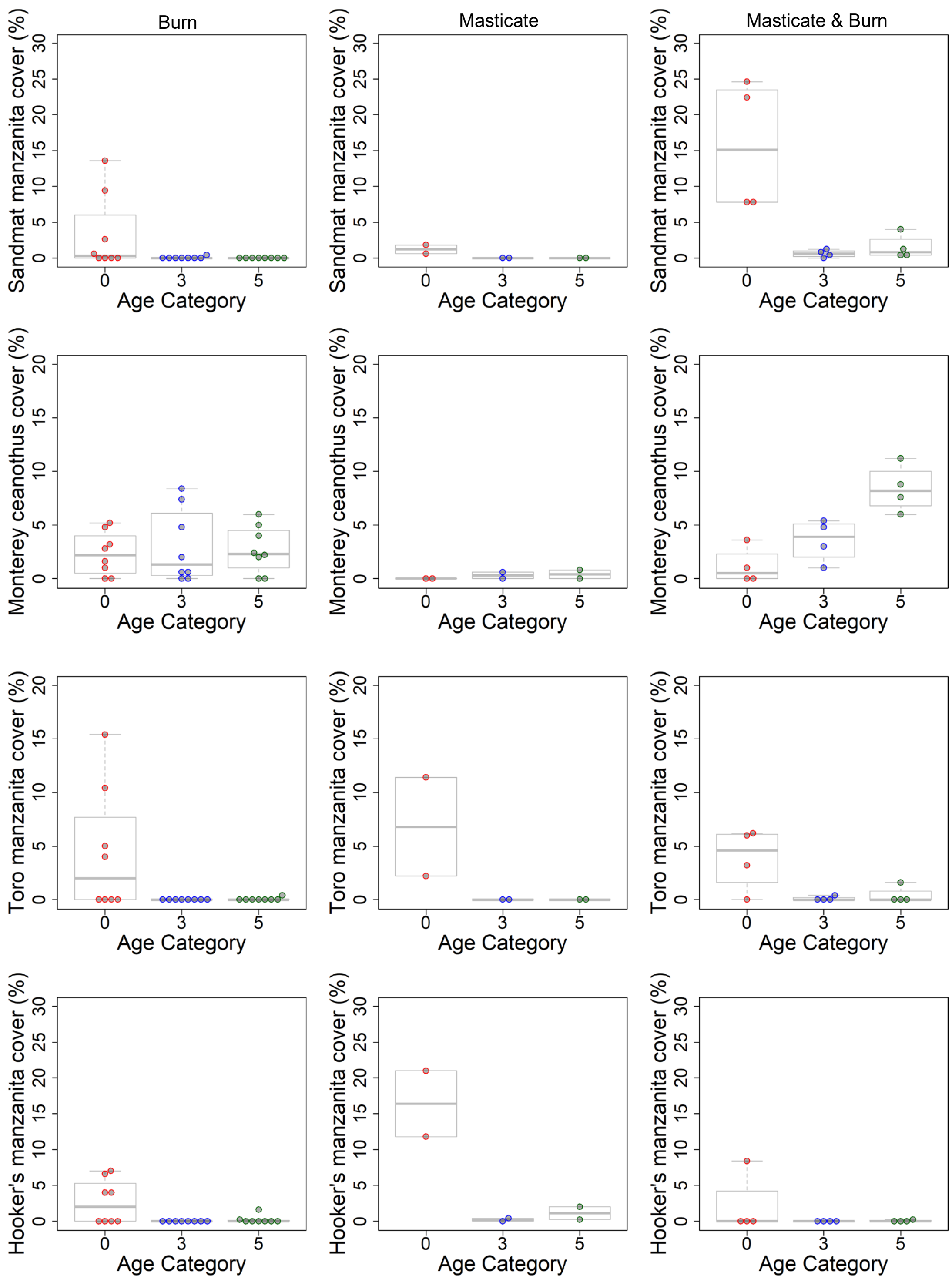

Figure 4-31. BLM Area B Unit C HMP Shrub Species Cover Between Baseline (2015) and Year 5 (2022). Scales Not Equivalent. The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. The left column represents burned transects (n = 8 transects). The middle column represents masticated transects (n = 2 transects). The right column represents masticated and burned transects (n = 4 transects).

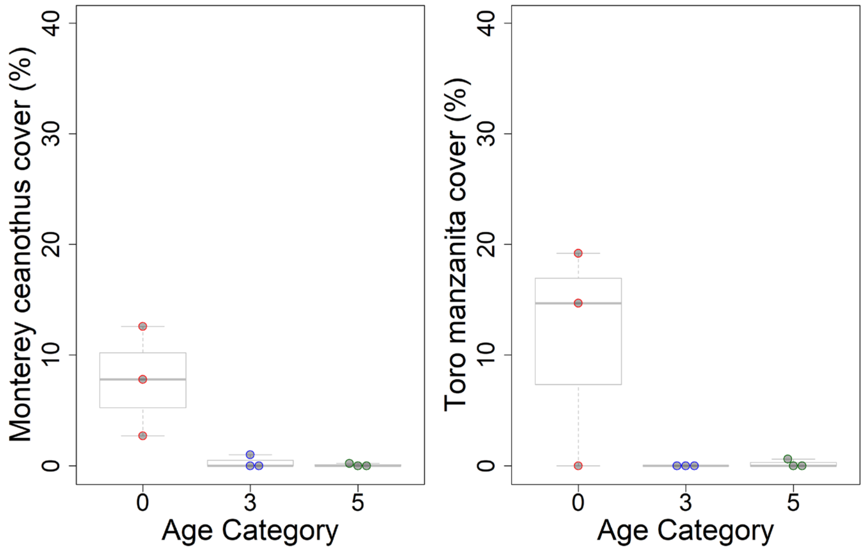

Figure 4-32. Unit B-2A HMP Shrub Species Cover Between Baseline (1998) and Year 5 (2022). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Three masticated transects were analyzed in Unit B-2A.

NMDS ordinations illustrate that the community compositions of Units B-3 West, B-3 East, A, B, and C diverged from their respective Baseline compositions in Year 3 and are on a trajectory back toward Baseline conditions in Year 5 (Figures 4-33 through 4-37). 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. Unit B-2A had an insufficient number of transects (n = 3) to conduct NMDS ordination and a plot is not provided for this Unit; however, based on the results of analyses assessing changes in total cover, species diversity, richness, and evenness (see Figure 4-14), Unit B-2A appears to be following the same pattern of beginning a trajectory toward Baseline that is typical of Year 5 Units.

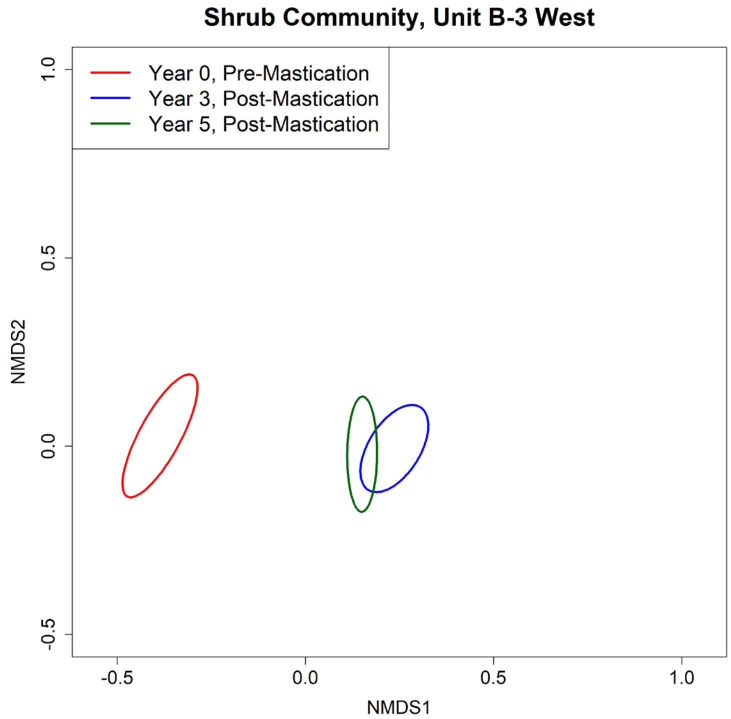

Figure 4-33. NMDS Ordination Plot Showing Unit B-3 West Community Composition Changes Between Baseline Surveys (2015), Year 3 Surveys (2020), and Year 5 Surveys (2022). Six masticated transects were analyzed in Unit B-3 West.

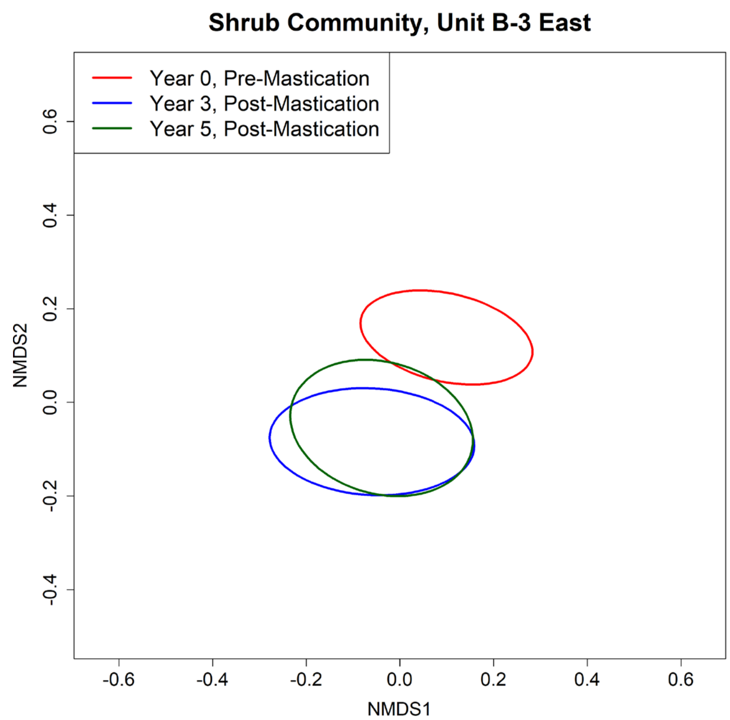

Figure 4-34. NMDS Ordination Plot Showing Unit B-3 East Community Composition Changes Between Baseline Surveys (2015), Year 3 Surveys (2020), and Year 5 Surveys (2022). Eleven masticated transects were analyzed in Unit B-3 East.

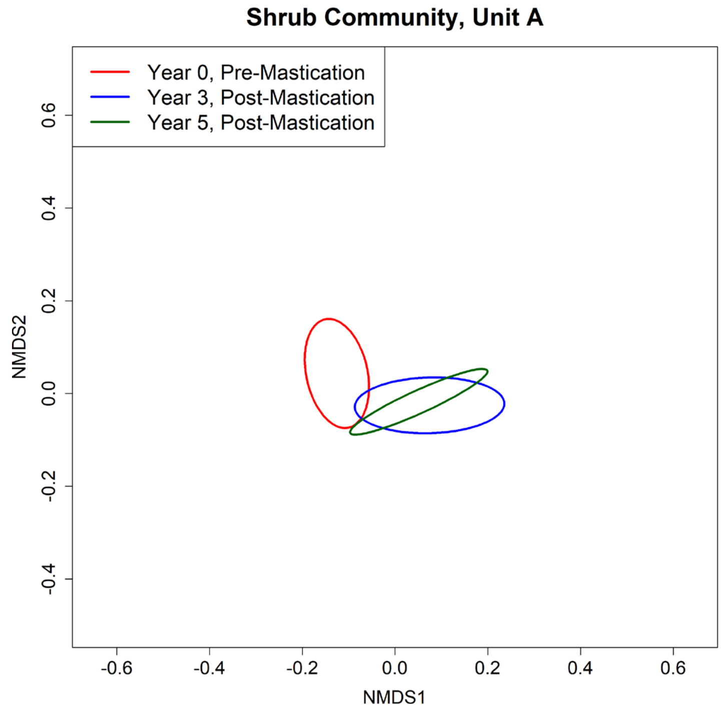

Figure 4-35. NMDS Ordination Plot Showing BLM Area B Unit A Community Composition Changes Between Baseline Surveys (2015), Year 3 Surveys (2020), and Year 5 Surveys (2022). Seven masticated transects were analyzed in Unit A.

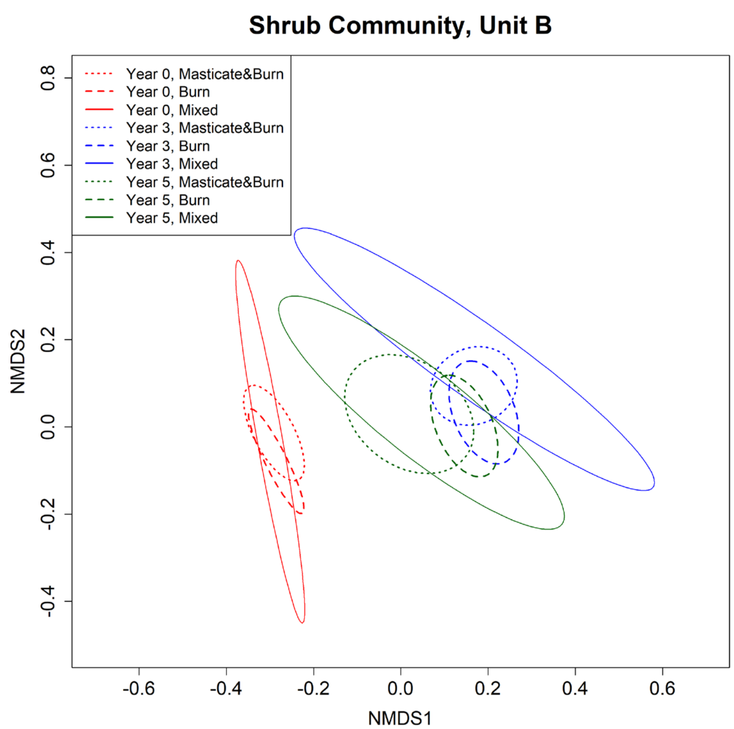

Figure 4-36. NMDS Ordination Plot Showing BLM Area B Unit B Community Composition Changes Between Baseline Surveys (2015 and 1999 [2 transects]), Year 3 Surveys (2020), and Year 5 Surveys (2022). Twenty-six transects were analyzed in Unit B.

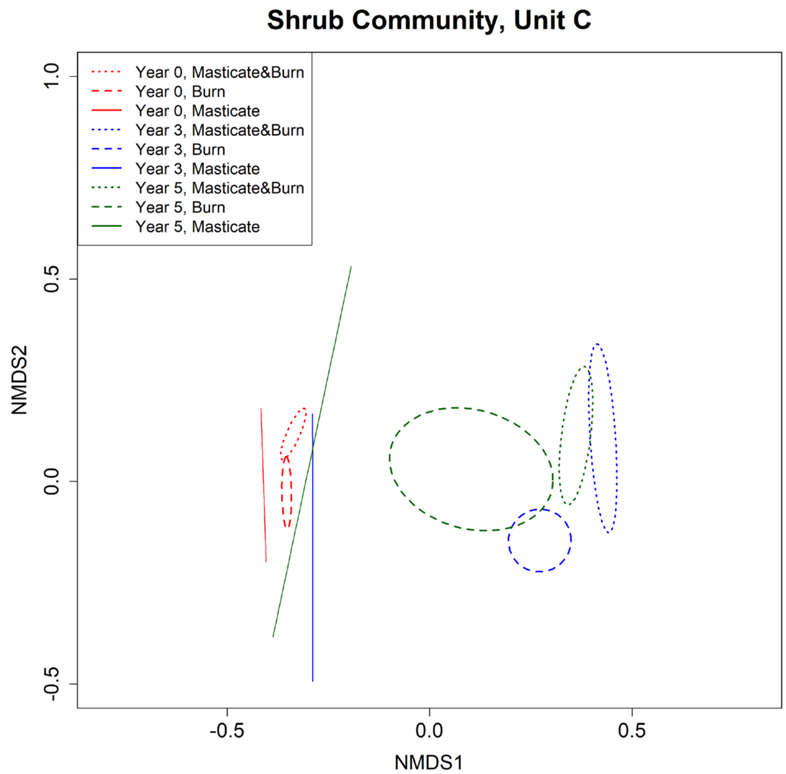

Figure 4-37. NMDS Ordination Plot Showing BLM Area B Unit C Community Composition Changes Between Baseline Surveys (2015), Year 3 Surveys (2020), and Year 5 Surveys (2022). Eight burned transects (dashed lines), four masticated and burned transects (dotted lines), and two masticated transects (solid lines) were analyzed in Unit C.

4.4.7 Annual Grass Monitoring

Non-native annual grasses were observed and mapped within the Containment Lines and roadside fuel breaks of BLM Area B Units B-3W, A Southern Containment Line, and B (Appendix D, Figures D-1 through D-3). Non-native annual grasses were not mapped in Units B-2A, B-3 East, or C. Estimated areas occupied by each density class in 2022 are summarized in Table 4-15. Annual grass cover increased between Baseline and Year 3 and decreased between Year 3 and Year 5 for all Units. Density class 3 (>25% cover) had the largest areal extent in all surveyed areas. In 2022, density class 3 contained an area of 41.16 acres in Unit B-3W, 18.09 acres in the Unit A Southern Containment Line, and 30.14 acres in Unit B at the time of Year 5 monitoring.

Table 4-15. Estimated Area Occupied by Annual Grasses between Baseline (2015) and Year 5 (2022) in BLM Area Unit B-3 West, A Southern Containment Line, and B.

Cover Class	Baseline (acres)	Year 1 (acres)	Year 3 (acres)	Year 5 (acres)
BLM Area B Unit B-3W				
1 (Low) = 1 – 5%	22.61	9.25	20.47	6.92
2 (Medium) = 6 – 25%	1.98	3.98	13.65	10.23
3 (High) = > 25%	2.24	14.61	28.87	41.16
Total Acreage	**26.83**	**27.84**	**62.99**	**58.31**
BLM Area B Unit A Southern Containment Line*				
1 (Low) = 1 – 5%	13.79	2.41	12.04	5.90
2 (Medium) = 6 – 25%	0.45	1.97	5.46	2.02
3 (High) = > 25%	0.51	13.14	22.19	18.09
Total Acreage	**14.75**	**17.52**	**39.69**	**26.01**
BLM Area B Unit B				
1 (Low) = 1 – 5%	3.56	14.61	29.86	27.48
2 (Medium) = 6 – 25%	7.31	15.64	13.19	13.40
3 (High) = > 25%	8.94	10.03	54.57	30.14
Total Acreage	**19.81**	**40.28**	**97.62**	**71.01**

*Only the southern containment line of Unit A was monitored in 2022. 2015 and 2018 data were clipped in ArcGIS to only include data for the southern containment line so that 2022 data could be compared to that of previous years.

4.4.8 Invasive and Non-Native Species Monitoring

Of the target invasive species, only iceplant was observed in Units B-3 West and B. No target invasive species were observed in Units B-3 East, B-2A, C or A Southern Containment Line. Sixteen small patches of iceplant were observed in Unit B-3 West. In Unit B, small-to-medium sized patches were fairly abundant, with a total of 51 patches mapped in this Unit (Appendix E, Figures E-2 through E-6). Additionally, minor occurrences of non-native herbaceous cover were observed during transect monitoring in all Year 3 Units (Appendix G, Tables G-1 through G-6).

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5 YEAR 8 VEGETATION SURVEYS: UNITS 1 WEST, 2 WEST, AND 3 WEST

5.1 Introduction

Year 8 Units included Units 1 West, 2 West, and 3 West (Figure 5-1). These Units were masticated in 2014. Due to the close proximity of these Units to urban areas and the Monterey airport, the Army initiated formal consultation with USFWS to change vegetation clearance from burning to masticating these areas. USFWS agreed that the Army should masticate and conduct a follow-up prescribed burn when the vegetation regrows tall enough to carry a fire. This would stimulate fire dependent species and benefit maritime chaparral recovery in those Units (USFWS, 2017).

The majority of Baseline monitoring in Units 1 West, 2 West, and 3 West was conducted by Harding Lawson Associates (1997 and 2000) and Shaw Environmental Inc. (2008). These surveys included shrub transect sampling. Two additional shrub transects were surveyed in 2007 and were included in Burleson's analyses as Baseline transects (Shaw, 2008). Year 1 follow-up HMP annuals surveys occurred in 2015 (Burleson, 2016). Years 3 and 5 follow-up surveys occurred in 2017 and 2019, respectively, and included HMP annuals surveys, shrub transects, annual grass surveys, and invasive species surveys (Burleson, 2018; Burleson, 2020).

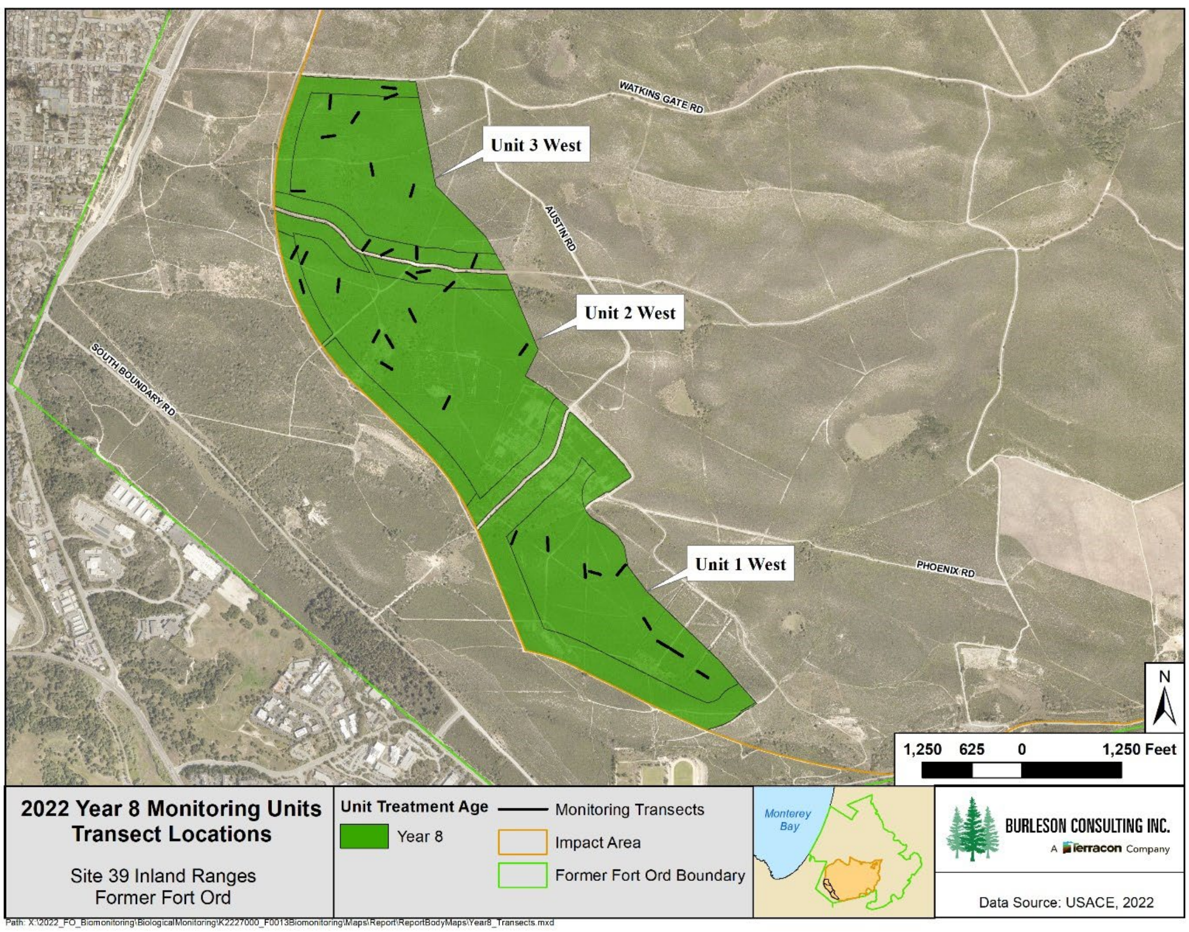

Figure 5-1. Units 1 West, 2 West, and 3 West HMP Shrub Transects Surveyed for Year 8 in 2022.

5.2 Units 1 West, 2 West, and 3 West: Setting

Unit 1 West contains 122 acres and is situated in the southwest portion of the former Fort Ord Impact Area. This Unit was reported to consist largely of structurally heterogeneous maritime chaparral reflecting varying levels of disturbance from past military staging activities (Shaw, 2008). No wetlands or oak woodland are located within this Unit; the Unit is dominated by maritime chaparral, with patches of coastal scrub and grassland in areas that were exposed to the greatest amount of ground disturbance during past military staging activities. The Army has been working on eradicating dense infestations of jubata grass and iceplant towards the south and west portions of the Unit through the Service Agreement with BLM. A large soil remediation area (HA 26) is located in the northern portion of the Unit that was actively restored and is currently in the monitoring phase (Burleson, 2021a).

HA 26 extends into Unit 2 West to the north. Prior to treatment, Unit 2 West encompassed 193 acres and comprised dense maritime chaparral with widely scattered coast live oaks. Dry meadow habitat was located in the center of the Unit and scattered sandy openings were dispersed throughout.

Unit 3 West contains 146 acres and is immediately north of Unit 2 West. In pretreatment condition, this area comprised dense maritime chaparral with several areas of locally clustered coast live oaks along the western perimeter.

5.3 Units 1 West, 2 West, and 3 West: Methods

In accordance with methods outlined in the Revised Protocol (Tetra Tech and EcoSystems West, 2015b) and Section 2 of this report, the 2022 Year 8 follow-up monitoring in Units 1 West, 2 West, and 3 West consisted of the following activities:

- Repeated sampling of transects that were monitored in 2019 (Burleson, 2020). This survey effort was conducted to assess shrub species composition of the sensitive maritime chaparral community after treatment. Surveys occurred on June 1, 13, 14, 15, 16, and 20, 2022.

- 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.

5.4 Units 1 West, 2 West, and 3 West: Results and Discussion

A total of 34 shrub transects were monitored in Year 8 Units, with 9 in Unit 1 West, 13 in Unit 2 West, and 12 in Unit 3 West. Maps of monitored transects are provided in Appendix C, Figures C-7 through C-9.

5.4.1 Yadon's Piperia

No piperia were observed in any Year 8 Units (Appendix E).

5.4.2 Shrub Transect Monitoring

Shrub transects were sampled in Units 1 West (*n*=9), 2 West (*n*=13), and 3 West (*n*=12) in 2022 (Appendix C, Figures C-7 through C-9). Baseline transects were collected in 1997 for Unit 1 West, in 1997 and 2000 for Unit 2 West, and in 1997 and 2007 for Unit 3 West (Harding Lawson Associates, 1997; Harding Lawson Associates, 2001; Shaw, 2008).

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 2022). Community structure parameters in all Year 8 Units changed similarly through time in most cases.

Mixed-design ANOVAs conducted to examine the effects of Unit and age on mean percent cover, species richness, species evenness, and species diversity for Year 8 Units suggest age influences all community composition metrics (Table 5-1). Unit did not appear to influence community composition and there was no evidence of an interaction between Unit and age.

Table 5-1. Mixed-design ANOVA results for Units 1 West, 2 West, and 3 West.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Unit	0.7340	0.4881	0.2450	0.7842	0.05985	0.9420	0.3679	0.6952
Age	32.88	1.408E-14	25.63	3.577E-12	10.41	5.686E-06	3.494	0.01869
Unit*Age	2.015	0.07129	1.085	0.3774	0.996	0.4329	1.263	0.2819

Mean shrub cover in all Year 8 Units responded similarly to mastication between Baseline and Year 8 (Figures 5-2 through 5-4). Mean cover decreased for all Year 8 Units between Baseline ($C_{1West,\ Baseline}$ = 119%; $C_{2West,\ Baseline}$ = 112%; $C_{3West,\ Baseline}$ = 121%) and Year 5 ($C_{1West,\ Year\ 5}$ = 77%; $C_{2West,\ Year\ 5}$ = 79%; $C_{3West,\ Year\ 5}$ = 88%) Subsequently, cover increased in Units 1 West and 2 West between Year 5 and Year 8, while cover in Unit 3 West did not change ($C_{1West,\ Year\ 8}$ = 98%; $C_{2West,\ Year\ 8}$ = 92%; $C_{3West,\ Year\ 8}$ = 88%).

Species diversity in all Year 8 Units responded similarly to mastication between Baseline and Year 8, where diversity increased between Baseline and Year 3 then decreased between Year 3 and Year 8 (Figures 5-2 through 5-4). Units 1 West, 2 West, and 3 West diversities increased between Baseline and Year 3 by 0.11, 0.38, and 0.34, respectively. Diversities subsequently decreased between Year 3 and Year 8 by 0.14, 0.20, and 0.19, respectively.

Species richness in Year 8 Units responded variably to mastication, but generally increased following treatment (Figures 5-2 through 5-4). Species richness in all Year 8 Units increased between Baseline ($S_{1\ West,\ Baseline}$ = 7 species; $S_{2\ West,\ Baseline}$ = 7 species; $S_{3\ West,\ Baseline}$ = 6 species) and Year 8 ($S_{1\ West,\ Year\ 8}$ = 8 species; $S_{2\ West,\ Year\ 8}$ = 9 species; $S_{3\ West,\ Year\ 8}$ = 9 species). Richness in Units 1 West and 2 West decreased between Year 3 and Year 5 before increasing between Year 5 and Year 8, whereas richness in Unit 3 West increased between Year 3 and Year 5 then remained relatively stable between Year 5 and Year 8.

Species evenness in Year 8 Units responded variably to mastication but remained relatively stable between years (Figures 5-2 through 5-4). In Unit 1 West, evenness decreased by 0.07 between Baseline and Year 3, increased by 0.01 between Year 3 and Year 5, and decreased by 0.03 between Year 5 and Year 8. Species evenness in Units 2 West and 3 West increased between Baseline and Year 3 by 0.08 and 0.04; decreased between Year 3 and Year 5 by 0.05 and 0.04; and decreased between Year 5 and Year 8 by 0.06 and 0.05, respectively.

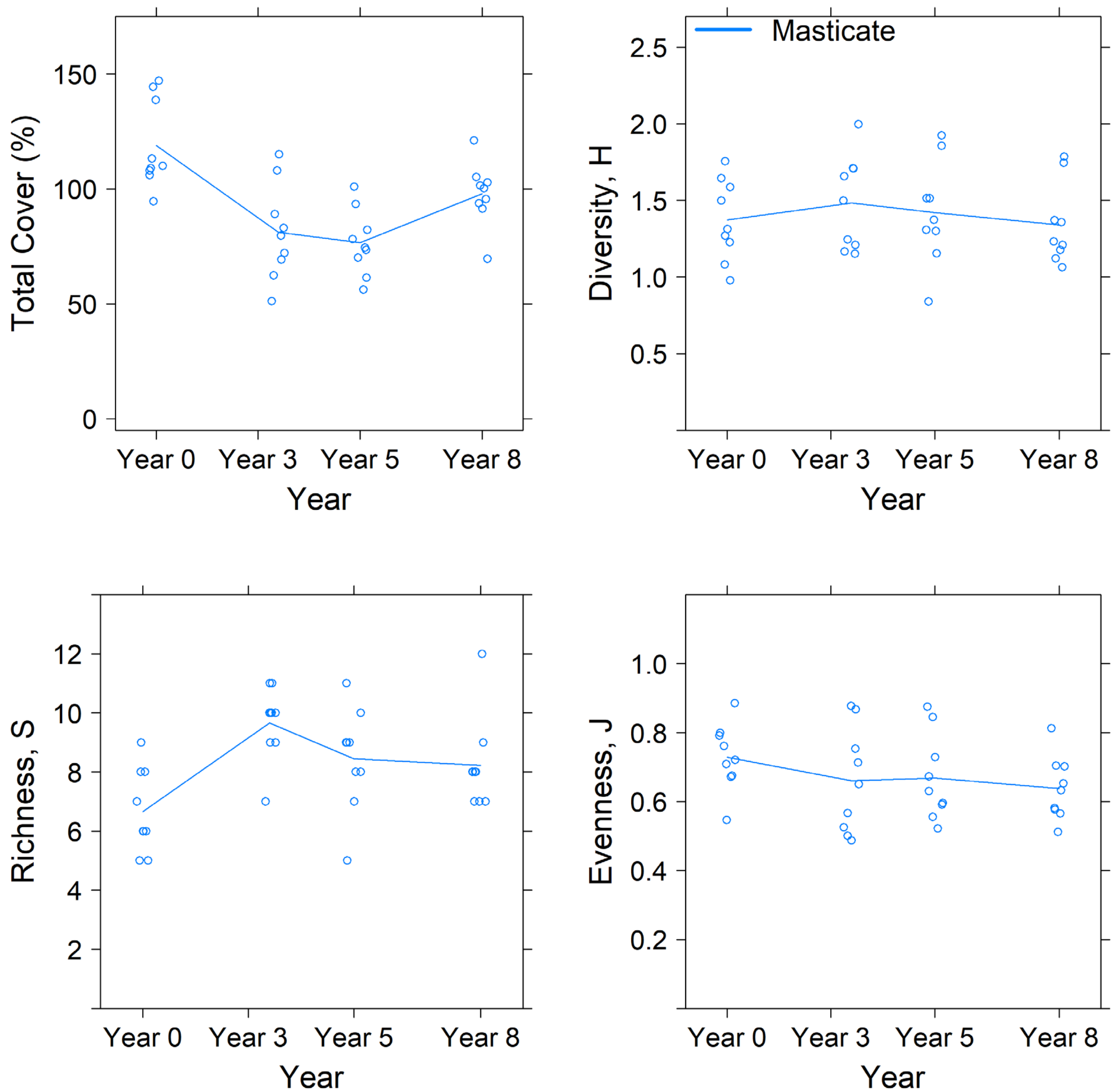

Figure 5-2. Unit 1 West Community Structure from Baseline (1997) to Eight Years After Mastication (2022). Nine masticated transects were analyzed in Unit 1 West.

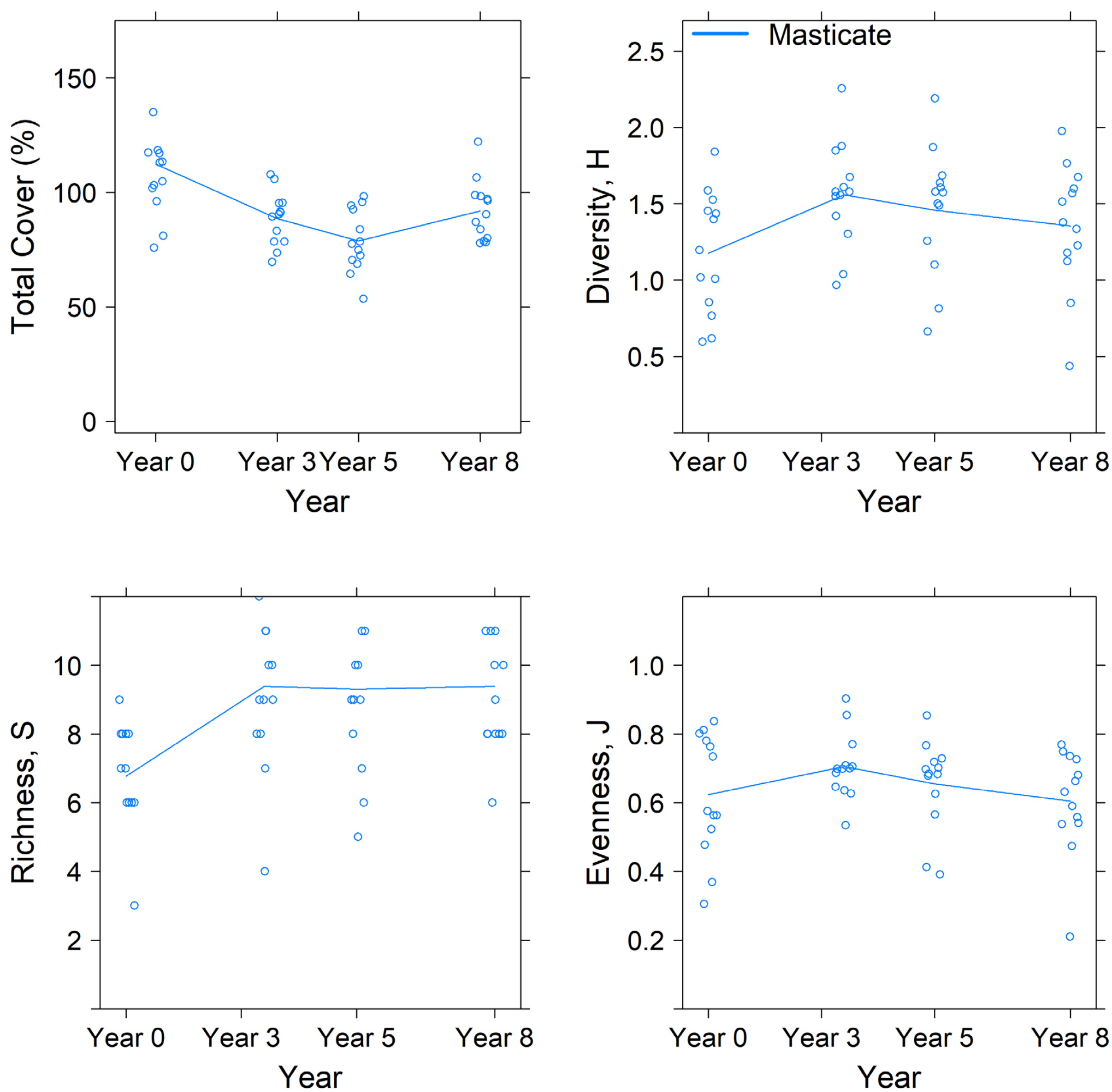

Figure 5-3. Unit 2 West Community Structure from Baseline (1997 and 2000) to Eight Years After Mastication (2022). Thirteen masticated transects were analyzed in Unit 2 West.

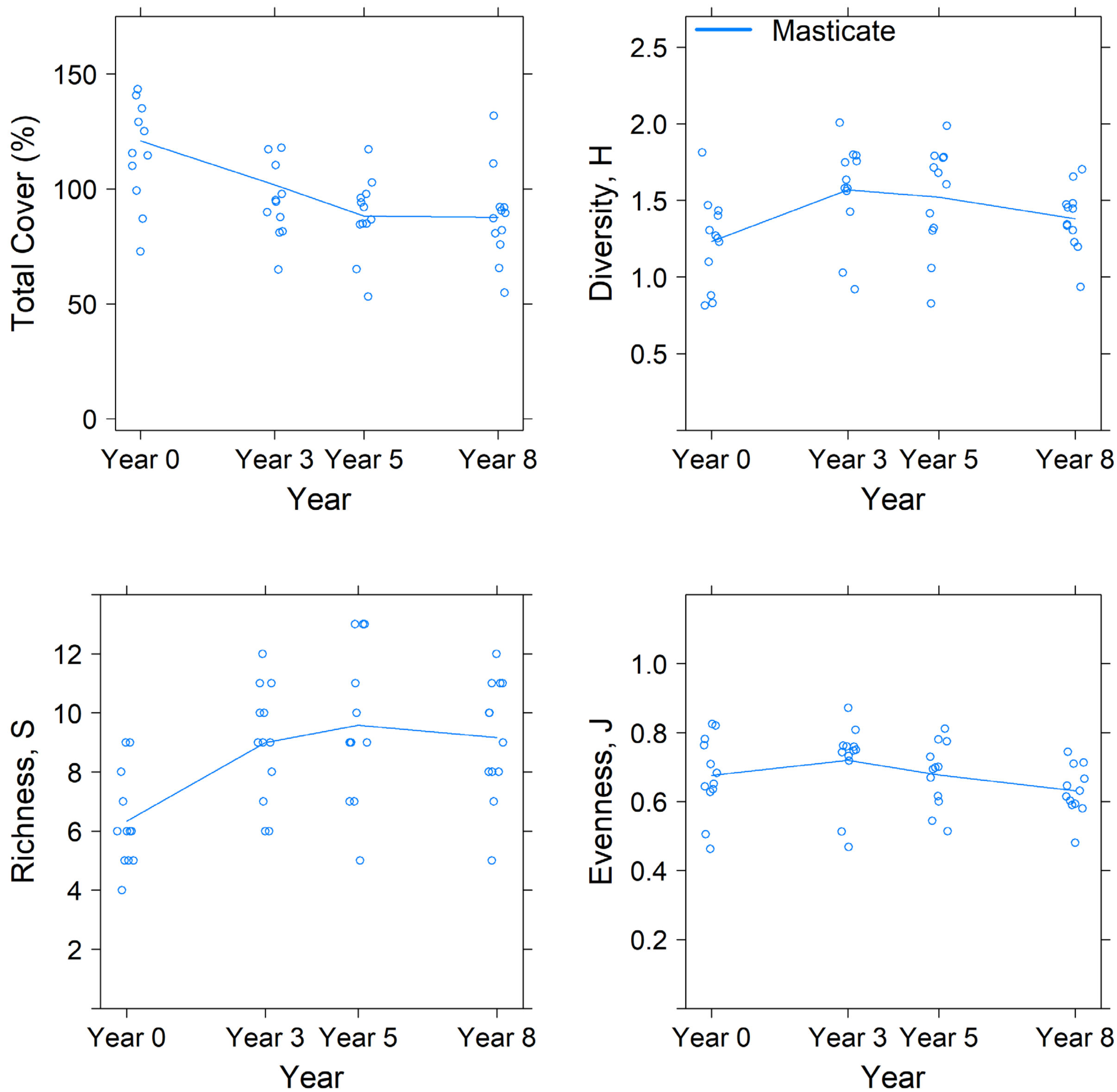

Figure 5-4. Unit 3 West Community Structure from Baseline (1997 and 2007) to Eight Years After Mastication (2022). Twelve masticated transects were analyzed in Unit 3 West.

Unit and age appeared to influence herbaceous cover while only age appeared to influence bare ground cover in Year 8 Units. There was also evidence of an interaction between Unit and age influencing herbaceous cover; this indicates that the inherent relationship between Unit and age may be masking effects of these factors individually on differences in herbaceous cover between Units and through time (Table 5-2).

Table 5-2. Mixed-design ANOVA results for Units 1 West, 2 West, and 3 West bare ground and herbaceous cover.

Factor	Bare Ground		Herbaceous Cover	
	F	*p*	*F*	*p*
Unit	0.4654	0.6322	5.299	0.01048
Age	51.30	1.184E-19	26.80	1.600E-06
Unit*Age	1.933	0.08347	9.635	1.537E-04

Bare ground cover increased in all Year 8 Units between Baseline and Year 5, with the greatest increase occurring between Baseline and Year 3. Bare ground decreased in all Year 8 Units between Year 5 and Year 8 by an average of 7.6%. All Year 8 Units increased in herbaceous cover between Baseline and Year 3, then gradually decreased between Year 3 and Year 8 (Table 5-3).

Table 5-3. Average percent of bare ground and herbaceous cover in Units 1 West, 2 West, and 3 West.

Cover Type % (Year)	Unit 1 West	Unit 2 West	Unit 3 West
Bare ground (Baseline)	11.0%	12.7%	7.74%
Bare ground (Year 3)	26.8%	29.3%	23.9%
Bare ground (Year 5)	32.5%	32.1%	29.3%
Bare ground (Year 8)	20.4%	22.9%	27.8%
Herbaceous (Baseline)	0.37%	0.69%	0.14%
Herbaceous (Year 3)	10.5%	2.68%	1.98%
Herbaceous (Year 5)	1.04%	1.17%	1.32%
Herbaceous (Year 8)	0.31%	0.80%	0.42%

Bare ground cover in Year 8 Units responded similarly to mastication. Bare ground increased between Baseline and Year 5 by 22%, 19%, and 22% for Units 1 West, 2 West, and 3 West, respectively. Subsequently, bare ground decreased between Year 5 and Year 8 by 12%, 9%, and 2%, respectively (Figures 5-5 through 5-7).

Herbaceous cover in Year 8 Units responded similarly to mastication; however, the magnitude of increase and decrease of herbaceous cover in Unit 1 West between Baseline and Year 5 varied between five and fifteen times those of Units 2 West and 3 West. (Figures 5-5 through 5-7). Herbaceous cover increased between Baseline and Year 3 by 10%, 2.0%, and 1.8% in Units 1 West, 2 West, and 3 West, respectively. Herbaceous cover decreased between Year 3 and Year 5 by 9%, 2%, and 0.66% for Units 1 West, 2 West, and 3 West, respectively. Between Year 5 and Year 8, herbaceous cover remained stable, decreasing minimally in Units 1 West, 2 West, and 3 West by 0.7%, 0.4%, and 0.9%, respectively

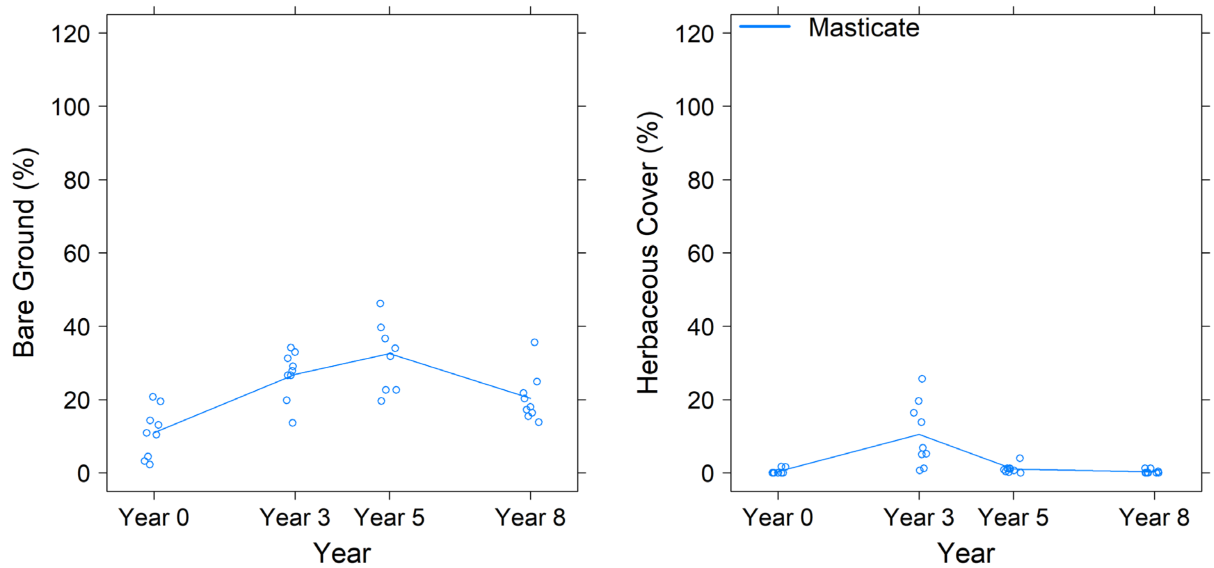

Figure 5-5. Unit 1 West Bare Ground and Herbaceous Cover Between Baseline (1997), Year 3 (2017), Year 5 (2019), and Year 8 (2022). Nine masticated transects were analyzed in Unit 1 West.

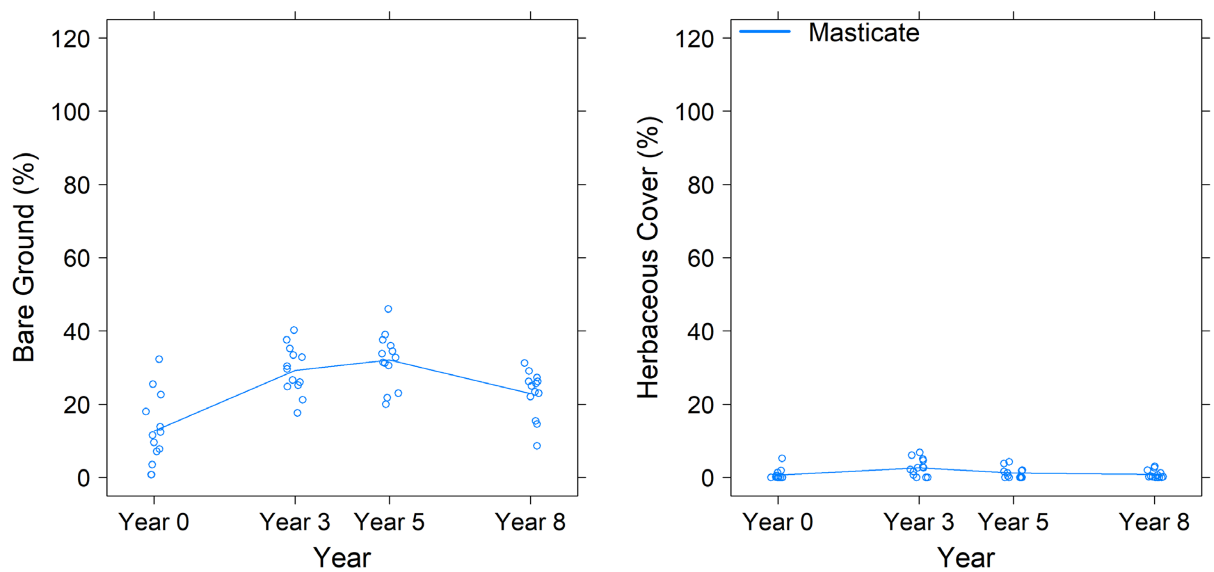

Figure 5-6. Unit 2 West Bare Ground and Herbaceous Cover from Baseline (1997 and 2000), Year 3 (2017), Year 5 (2019), and Year 8 (2022). Thirteen masticated transects were analyzed in Unit 2 West.

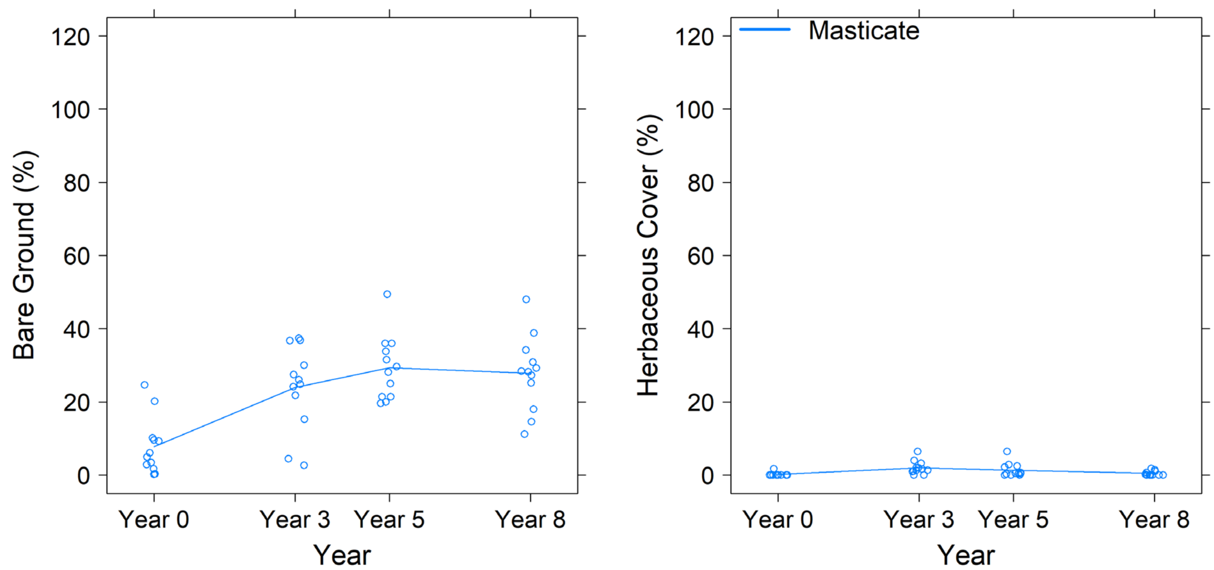

Figure 5-7. Unit 3 West Bare Ground and Herbaceous Cover from Baseline (1997 and 2007), Year 3 (2017), Year 5 (2019), and Year 8 (2022). Twelve masticated transects were analyzed in Unit 3 West.

Community structure appeared to be influenced by age and by Unit. There was no evidence of an interaction between age and Unit, suggesting there are true differences in community structure between Units and over time (Table 5-4).

Table 5-4. Two-way PERMANOVA results for Units 1 West, 2 West, and 3 West community compositions, based on Bray-Curtis distance matrices.

Factor	*F*	*p*
Age	9.715	0.0001
Unit	8.326	0.0001
Unit*Age	0.3916	1.0000

Community composition of Year 8 Units generally responded similarly to treatment over time (Figures 5-8 through 5-10). All Year 8 Units were dominated by shaggy-barked manzanita in Baseline, Year 3, Year 5, and Year 8 except for Unit 3 West in Year 3 which was temporarily co-dominated by deerweed (30% cover) and shaggy-barked manzanita (28% cover). Following similar trends as Year 5 Units, subshrubs became more dominant in Year 3 than in Baseline then receded after Year 3. Additionally, richness tended to increase between Baseline and Year 8 and evenness remained relatively stable over time.

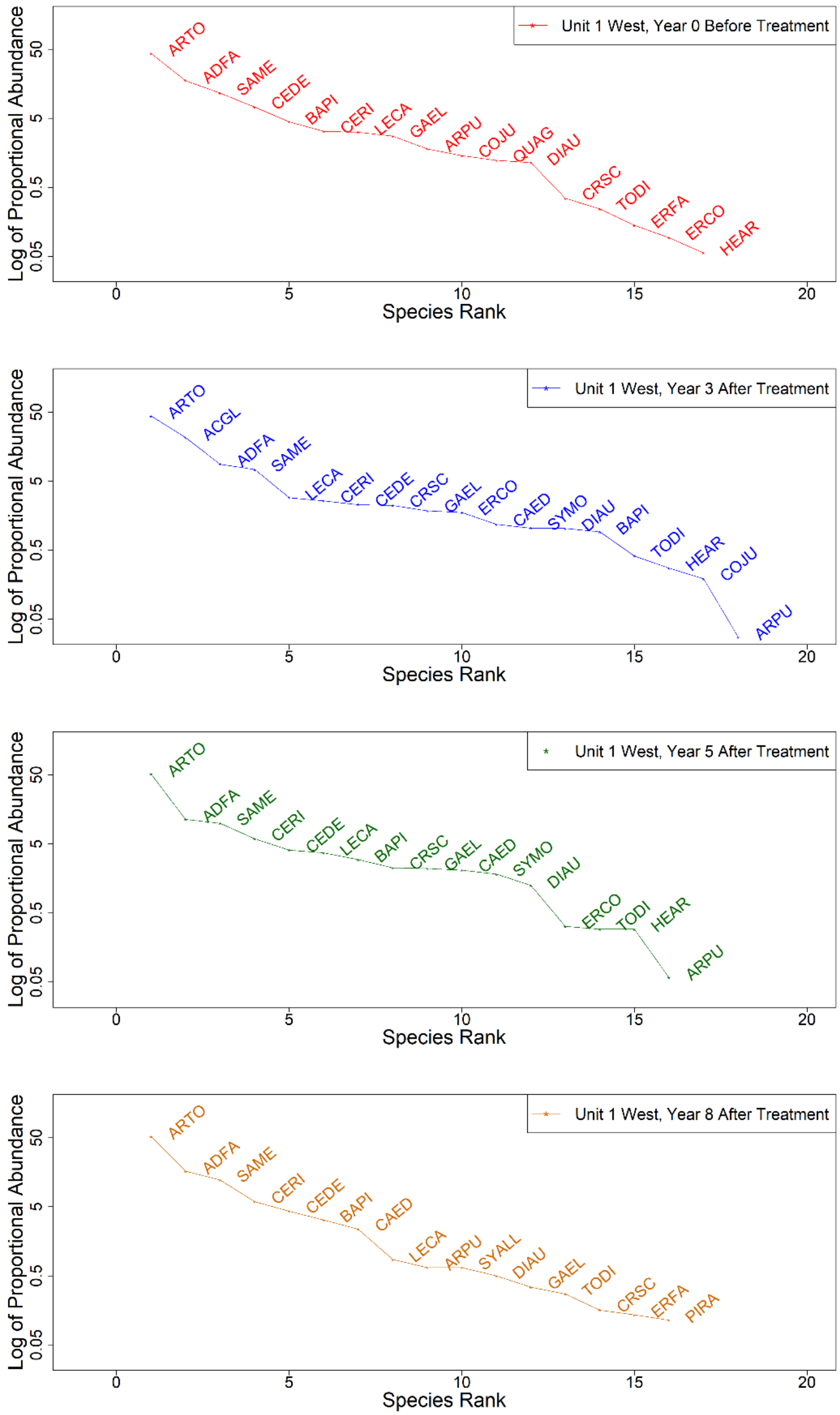

Figure 5-8. Unit 1 West Rank Abundance Curves Between Baseline (1997) and Year 8 (2022). New species present in Year 8 surveys compared to Baseline include iceplant, common snowberry, and Monterey pine. Species present in Baseline surveys, but absent in Year 8 include jubata grass, coast live oak, golden yarrow, and toyon. Nine masticated transects were analyzed in Unit 1 West. Y-axis is in log_{10} scale.

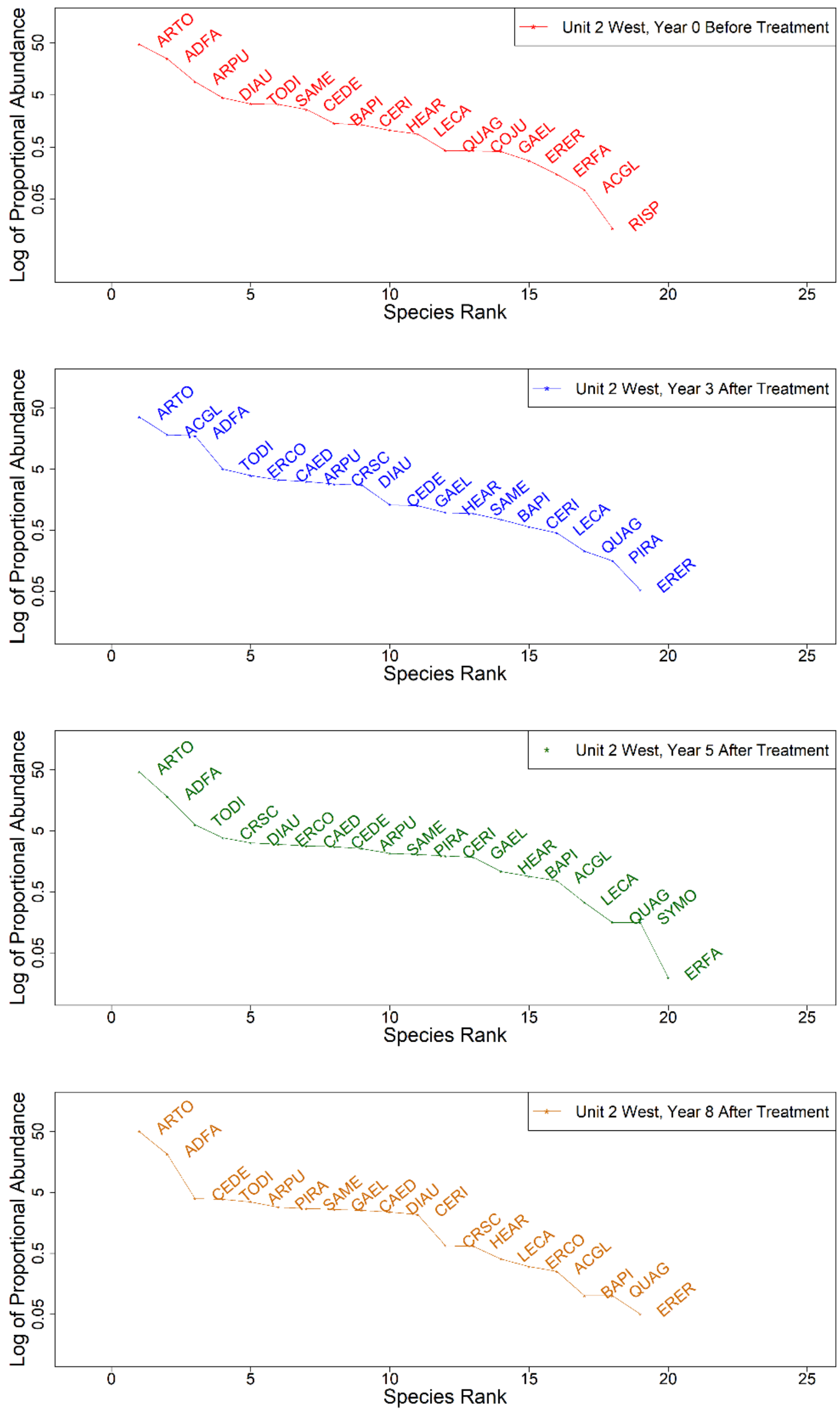

Figure 5-9. Unit 2 West Rank Abundance Curves Between Baseline (1997 and 2000) and Year 8 (2022). New species present in Year 8 surveys compared to Baseline include Monterey pine, iceplant, peak rush-rose, and golden yarrow. Species present in Baseline surveys, but absent in Year 8 include jubata grass, Eastwood's goldenbush, and fuchsia-flowered gooseberry. Thirteen masticated transects were analyzed in Unit 2 West. Y-axis is log_{10} scale.

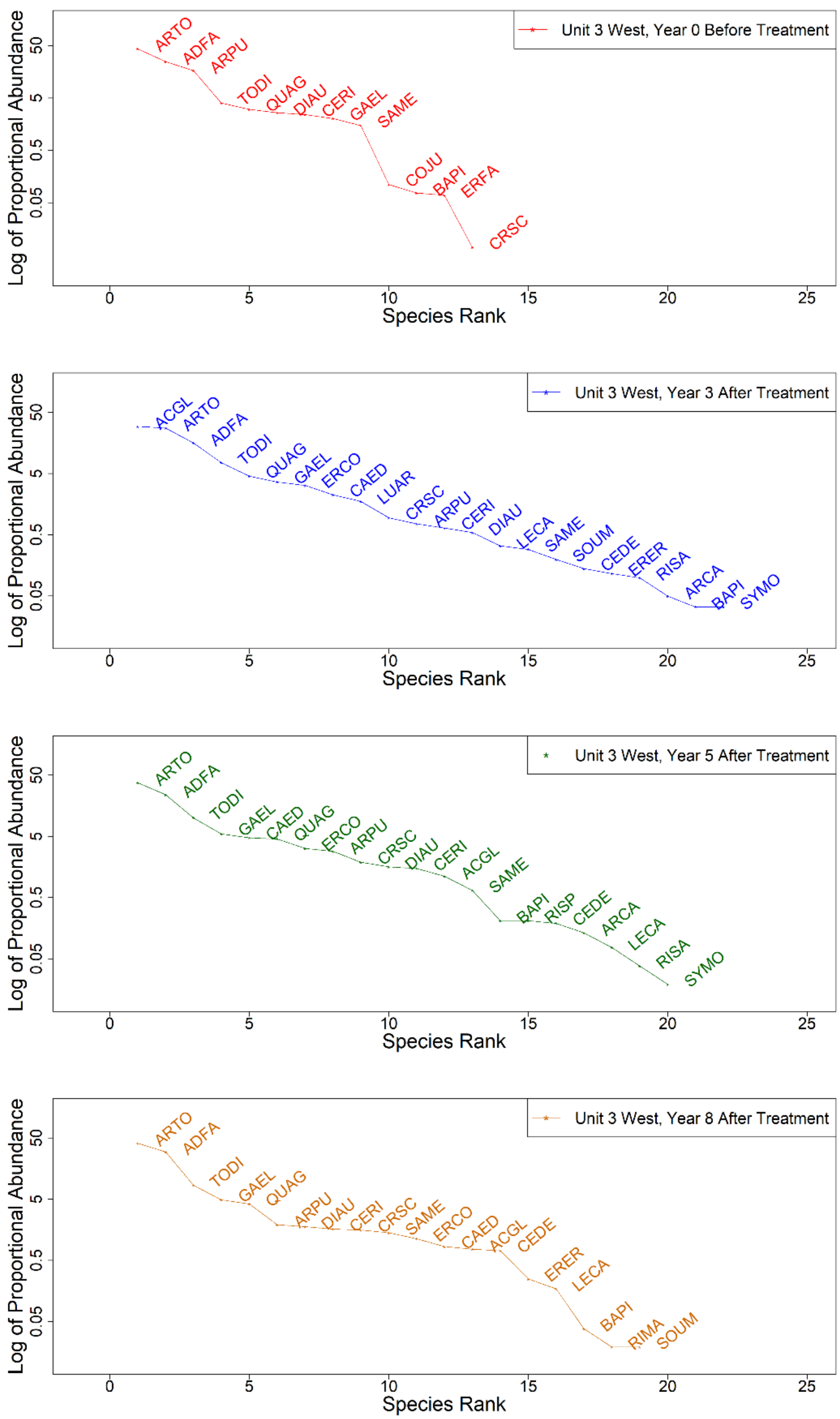

Figure 5-10. Unit 3 West Rank Abundance Curves Between Baseline (1997 and 2007) and Year 8 (2022). New species present in Year 8 surveys compared to Baseline include golden yarrow, iceplant, deerweed, dwarf ceanothus, mock heather, pitcher sage, chaparral currant, and blue witch. Species present in Baseline surveys, but absent in Year 8 include jubata grass and Eastwood's goldenbush. Twelve masticated transects were analyzed in Unit 3 West. Y-axis is log_{10} scale.

Generally, HMP shrub species that were present in Year 8 Units in Baseline persisted in Year 8 (Figures 5-11 through 5-13). Sandmat Manzanita, Monterey ceanothus, and Eastwood's goldenbush were all present in Baseline; sandmat manzanita and Monterey ceanothus tended to recover at a faster rate compared to Eastwood's goldenbush, with Monterey ceanothus having the fastest recovery rate. Eastwood's goldenbush in Unit 1 West was absent in Years 3 and 5 but recovered to near Baseline abundance by Year 8. However, in Units 2 West and 3 West, Eastwood's goldenbush was not present eight years after mastication.

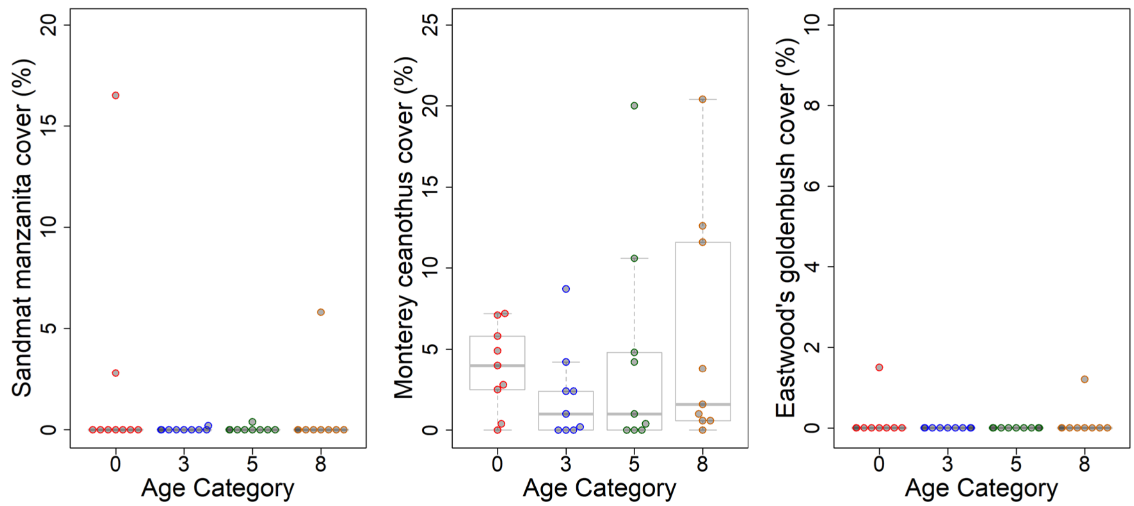

Figure 5-11. Unit 1 West HMP Shrub Species Cover Between Baseline (1997) and Year 8 (2022). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Nine masticated transects were analyzed in Unit 1 West. Scales Not Equivalent.

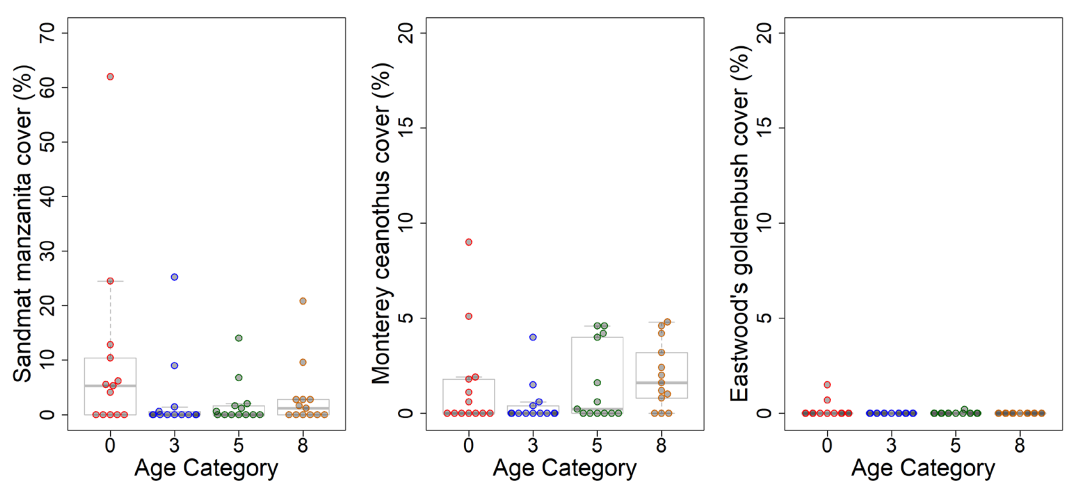

Figure 5-12. Unit 2 West HMP Shrub Species Cover Between Baseline (1997 and 2000) and Year 8 (2022). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Thirteen masticated transects were analyzed in Unit 2 West. Scales Not Equivalent.

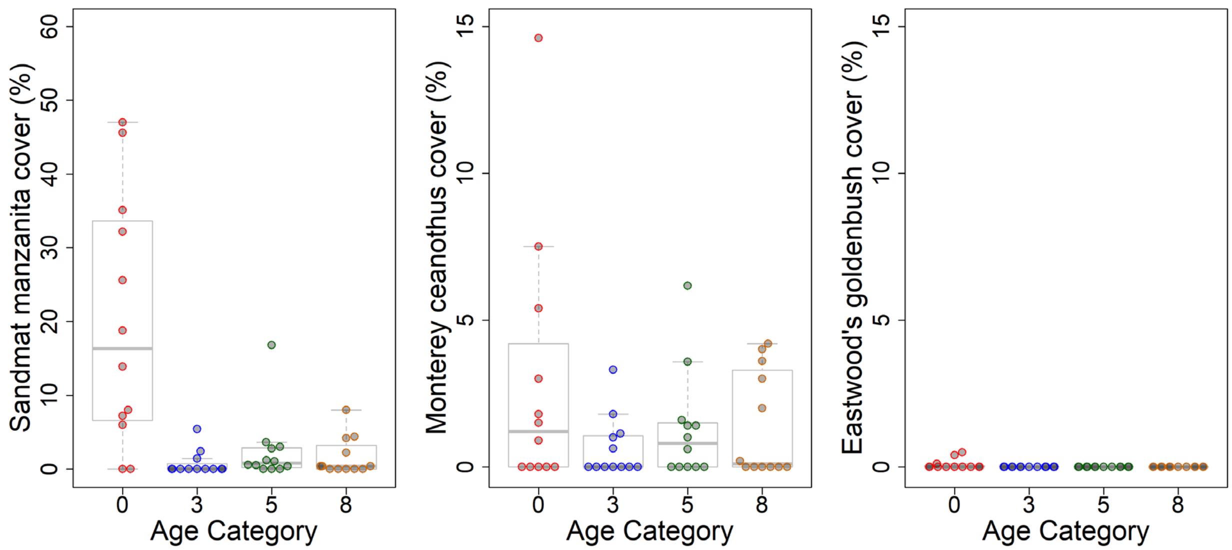

Figure 5-13. Unit 3 West HMP Shrub Species Cover Between Baseline (1997 and 2007) and Year 8 (2022). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Twelve masticated transects were analyzed in Unit 3 West. Scales Not Equivalent.

NMDS ordinations for Year 8 Units illustrate that community compositions in Year 8 are on trajectory toward Baseline compositions (Figures 5-14 through 5-16). 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 in a different location on the ordination than the Baseline ellipses since species composition has shifted. By Year 5, the location of ellipses generally shifts back towards the Baseline ellipse location. Year 8 ellipses, however, tend to overlap with, or are nearer to, the Baseline ellipses than either Year 3 or Year 5, implying that community composition is more like Baseline in Year 8 than in Years 3 and 5.

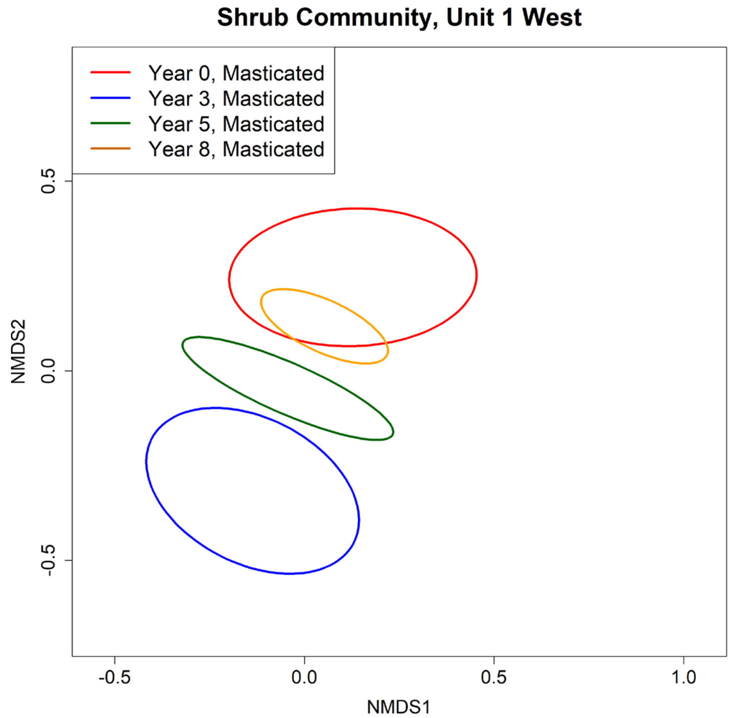

Figure 5-14. NMDS Ordination Plot Showing Unit 1 West Community Composition Changes Between Baseline (1997), Year 3 (2017), Year 5 (2019), and Year 8 (2022). Nine masticated transects were analyzed in Unit 1 West.

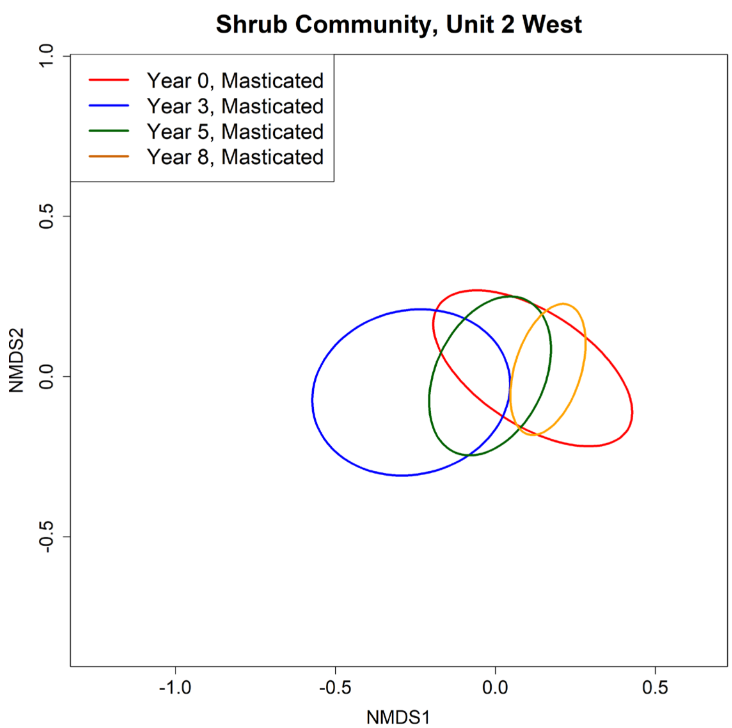

Figure 5-15. NMDS Ordination Plot Showing Unit 2 West Community Composition Changes Between Baseline (1997 and 2000), Year 3 (2017), Year 5 Surveys (2019), and Year 8 (2022). Thirteen masticated transects were analyzed in Unit 2 West.

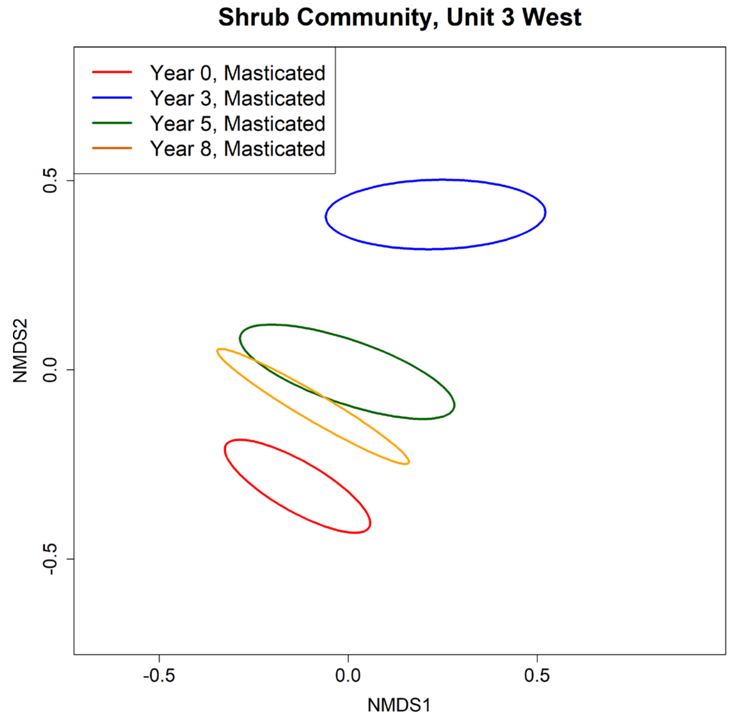

Figure 5-16. NMDS Ordination Plot Showing Unit 3 West Community Composition Changes Between Baseline (1997 and 2007), Year 3 (2017), Year 5 (2019), and Year 8 (2022). Twelve masticated transects were analyzed in Unit 3 West.

5.4.3 Annual Grass Monitoring

Non-native annual grasses were observed and mapped within the Containment Lines and roadside fuel breaks of Units 2 West and 3 West (Appendix D, Figures D-4 and D-5). Total area occupied by annual grasses decreased each year between Year 1 and Year 8 in Unit 2 West. In Unit 3 West, total area decreased between Year 1 and Year 5, then increased between Year 5 and Year 8 by 0.54 acres. The cover class with the largest areal extent in Year 8 for Unit 2 West was cover class 1 (1.03 acres) and in Unit 3 West was cover class 3 (1.14 acres). No Year 8 Units were surveyed in Baseline, and Unit 1 West was surveyed only once in 2015. Estimated areas occupied by each density class are summarized in Table 5-5.

Table 5-5. Estimated Area Occupied by Annual Grasses between Year 1 (2015) and Year 8 (2022) in Units 2 West and 3 West.

Cover Class	Year 1 (acres)	Year 3 (acres)	Year 5 (acres)	Year 8 (acres)
Unit 2 West				
1 (Low) = 1 – 5%	3.14	5.67	3.46	1.03
2 (Medium) = 6 – 25%	6.64	4.81	1.49	0.61
3 (High) = > 25%	9.47	5.58	4.56	0.45
Total Acreage	**19.25**	**16.06**	**9.51**	**2.09**
Unit 3 West				
1 (Low) = 1 – 5%	2.00	1.32	0.53	1.02
2 (Medium) = 6 – 25%	0.81	0.30	0.45	0.47
3 (High) = > 25%	1.84	0.72	1.12	1.14
Total Acreage	**4.65**	**2.34**	**2.10**	**2.64**

5.4.4 Invasive and Non-Native Species Monitoring

Iceplant was the only target invasive species observed in Year 8 Units. This species was not mapped but was observed along shrub transects in all three Year 8 Units during 2022 surveys. Additionally, there were no occurrences of non-native herbaceous cover observed during transect monitoring in any Year 8 Units (Appendix G).

6 MACROPLOT ANALYSES

6.1 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 macroplot sampling is to assess changes in the distribution of HMP annual species in response to treatment.

It was hypothesized that 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. 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 2022. This approach determines if the distributions of the HMP annual species change after treatment.

The second approach Burleson used is referred to as *single-season occupancy analysis* and examines three factors including age, treatment, or density of species in the macroplot grid, any of which may affect the distribution of HMP annual species. This analysis examines only 2022 macroplot survey results.

6.2 Methods

6.2.1 Macroplot Selection

Macroplots consisted of nine standard 100 x 100-ft sampling grids, arranged in a 3 by 3 square. An irregular rectangle arrangement was applied when a square was not feasible due to its proximity to perimeter of a unit or other disturbance. The macroplots were centered on a grid that was sampled for HMP annual 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 chosen 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 potential macroplot locations that had a baseline detection frequency of 5/9 or less.

- Macroplots may not overlap.
- For macroplots established along boundaries (either unit or treatment), their position/shape was adjusted to ensure that it remained within the subject area.
- Macroplot size was maintained at nine grids.
- There was no stratification by treatment (i.e., masticated or masticated and burned) within a unit when selecting macroplots.
- There was no stratification by HMP annual species.

A total of 10 macroplot locations were surveyed in 2022 (see Table 6-1 and Figure 6-1). Year 5 macroplots were previously surveyed in 2018 and in 2020 (Burleson, 2021). Maps showing macroplot survey locations are provided in Appendix H.

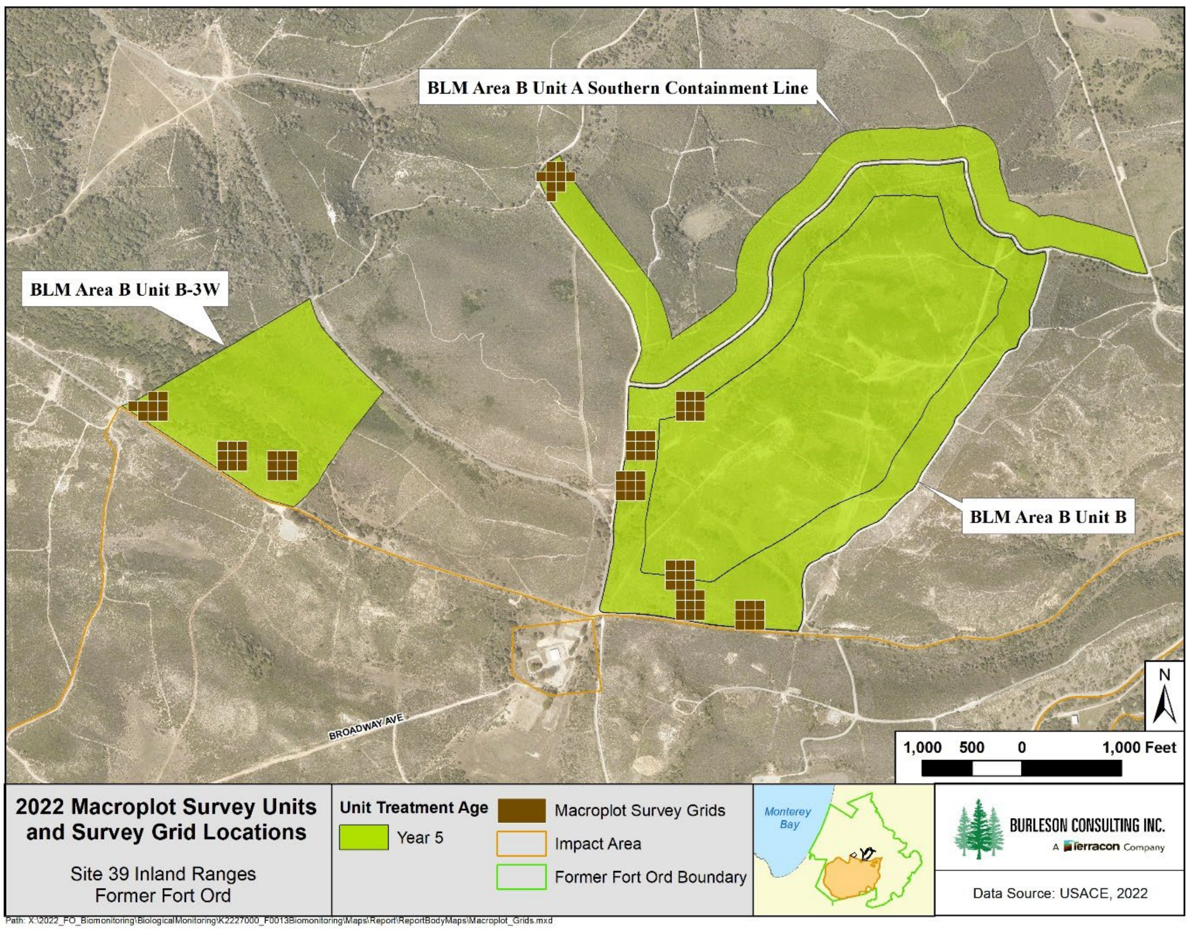

Figure 6-1. Map of Macroplots Surveyed in 2022.

Table 6-1. Survey Years and Treatment Years for Each Macroplot.

MacroplotID	Unit	Age	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
C3D4F2	BLM Area B, Unit A	5					Y0		M	Y1		Y3		Y5
B3J5C6	BLM Area B, Unit B	5					Y0		M&B	Y1		Y3		Y5
B3J6B2	BLM Area B, Unit B	5					Y0		Mix	Y1		Y3		Y5
C3A4E0	BLM Area B, Unit B	5					Y0		M	Y1		Y3		Y5
C3A5I1	BLM Area B, Unit B	5					Y0		Mix	Y1		Y3		Y5
C3B5C6	BLM Area B, Unit B	5					Y0		M&B	Y1		Y3		Y5
B3J5F5	BLM Area B, Unit B	5					Y0		Mix	Y1		Y3		Y5
C2A0H0	BLM Area B-3 West	5					Y0		M	Y1		Y3		Y5
C2B0C2	BLM Area B-3 West	5					Y0		M	Y1		Y3		Y5
C3A1G5	BLM Area B-3 West	5					Y0		M	Y1		Y3		Y5

When possible, the effects of treatment type (masticated, masticated and burned, 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, 2022; USACE, 2022). 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 nor burned portions were greater than 90%.
- Masticated and Burned – Greater than 90% of the macroplot was masticated and then subsequently burned.

6.2.2 Statistical Approach

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

6.2.2.1 Macroplot Level Analysis

The *macroplot-level analyses* were used to evaluate the changes in distribution of HMP annual species between Baseline and 2022. 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 were documented and mapped. These locations were overlaid on top of the macroplot locations using ArcMap, and presence/absence derived (ESRI, 2022). From these presence/absence values, frequency of occurrence was determined, and binary matrices developed for use in the *macroplot-level analyses*.

6.2.2.2 Single-season Occupancy Analysis

Single-season occupancy analysis was used to determine what factors affect the detectability of HMP annuals in macroplots during the 2022 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 2022 surveys. When qualitatively assessing occupancy and detectability rates from 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 treatment type (Treatment) and density class in the central grid (Density). Macroplot age (i.e., time since treatment) could not be included as a covariate in 2022 analyses due to all macroplots being in Year 5 of monitoring (i.e., we could not compare the influence of different age groups on detectability due to there being only one age group in the dataset). 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, 2021). Initial analyses were also conducted in the PRESENCE software developed by the United States Geological Survey to validate results in R (Hines, 2006).

6.3 RESULTS

Ten macroplots were surveyed in 2022. Monterey spineflower was observed in all 10 macroplots, sand gilia was observed in three, and seaside bird's beak observed in one macroplot (see Appendix H). Frequency of occurrence within macroplots where the HMP species were observed varied by species and macroplot.

The best predictor of detectability of Monterey spineflower was the mean of the presence/absence data for all surveyed grids. A confounding environmental factor (soil type) and small sample size appeared to affect the analysis of sand gilia detectability; therefore, there was no clear evidence for any of the covariates assessed influencing detectability of sand gilia in 2022.

6.3.1 Macroplot Level Analysis

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

6.3.1.1 Monterey spineflower

Monterey spineflower frequency of occurrence within macroplots increased between Baseline surveys and Year 3 surveys regardless of age class or treatment type. Frequency of occurrence in masticated macroplots increased between Baseline and Year 1 by 0.09 and increased between Year 1 and Year 3 by 0.2. Frequency of occurrence in masticated and burned macroplots increased between Baseline and Year 1 by 0.39 and increased between Year 1 and Year 3 by 0.16. Frequency of occurrence of the species in mixed macroplots increased between Baseline and Year 1 by 0.15 and increased between Year 1 and Year 3 by 0.07. Only masticated macroplots decreased in frequency between Year 3 and Year 5 (-0.09); frequency of occurrence remained stable between Years 3 and 5 in masticated and burned macroplots and increased by 0.11 in mixed treatment macroplots (Figure 6-2). However, results of a two-way ANOVA suggest that Monterey spineflower frequency of occurrence varied through time in the Year 5 macroplots and treatment did not appear to have a substantial influence on frequency of occurrence (Table 6-2).

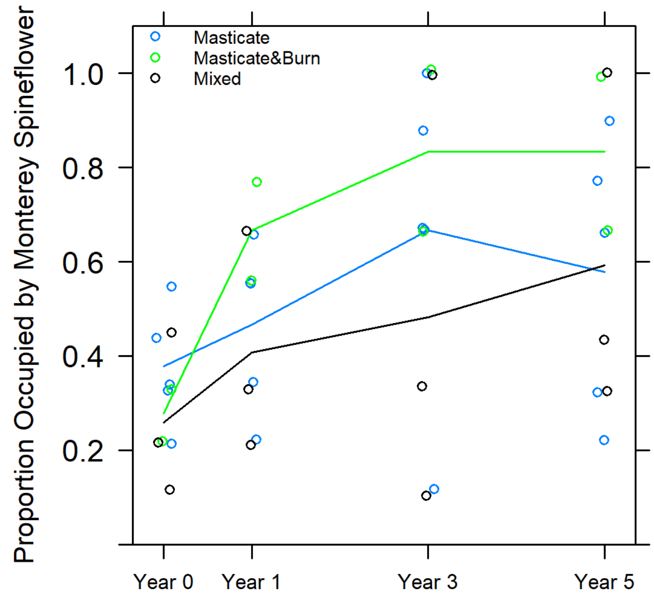

Figure 6-2. Monterey Spineflower Frequency of Occurrence in Year 5 Macroplots.

Table 6-2. Two-way ANOVA results for Monterey spineflower frequency of occurrence in Year 5 macroplots.

Factor	***F***	***p***
Age	3.21	0.038
Treatment	1.60	0.220
Treatment*Age	0.337	0.911

6.3.1.2 Sand Gilia

Sand gilia was only observed in the Year 5 macroplots that were either masticated and burned or that received mixed treatment (Figure 6-3). Sand gilia frequency of occurrence in masticated and burned macroplots increased between Baseline and Year 1 (+0.39) and decreased between Year 1 and Year 3 (-0.17). Frequency of occurrence of sand gilia in mixed macroplots increased between Baseline and Year 1 by 0.15 and continued to increase between Year 1 and Year 3 by 0.11. Between Years 3 and 5, frequency of occurrence increased in masticated and burned macroplots (+0.11) and remained stable in mixed macroplots. Sand gilia data did not meet assumptions to conduct ANOVA, and PERMANOVA could not be conducted due to zero-inflation of the dataset.

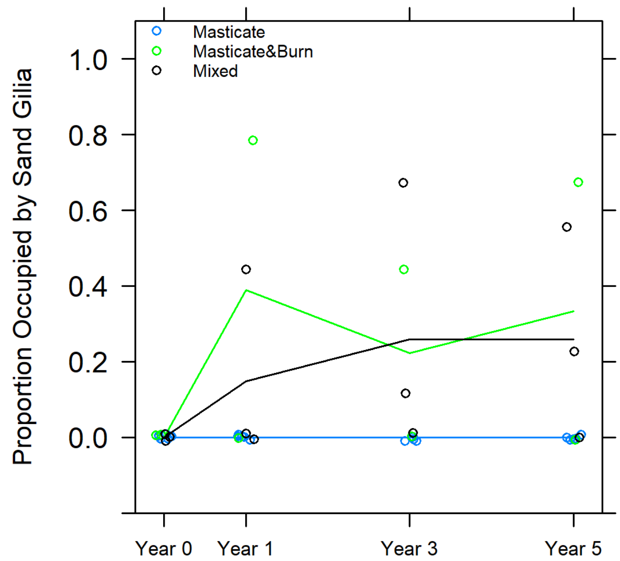

Figure 6-3. Sand Gilia Frequency of Occurrence in Year 5 Macroplots.

6.3.1.3 Seaside Bird's Beak

Seaside bird's beak frequency of occurrence within macroplots was zero in all years and all treatments except Year 5 masticated macroplots (Figure 6-4). In 2022, seaside bird's beak was observed in one macroplot grid in the southeastern portion of Unit B-3 West (Appendix H, Figure H-3). 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.

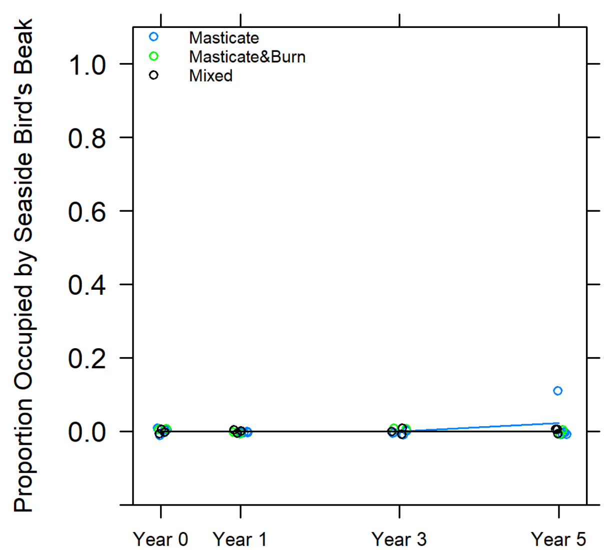

Figure 6-4. Seaside Bird's Beak Frequency of Occurrence in Year 5 Macroplots.

6.3.2 Occupancy Analysis

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

6.3.2.1 Monterey Spineflower

Monterey spineflower occupancy of macroplots was 1.00 (i.e., Monterey spineflower was present in every macroplot in 2022) and detection probability was moderate (0.633) during 2022 surveys. These values were derived from the null model where both occupancy and detectability were held constant.

The best AIC model was the null model, which does not include any covariates (Table 6-3). The evidence ratio for the null model versus the second-best model (Density) was approximately 24, meaning there was strong support that the null was the best model fit for the 2022 data, and none of the covariates assessed were good predictors of detectability of Monterey spineflower. These results suggest that random variability in Monterey spineflower occupancy data was greater than any variability due to influences from initial density or treatment. Log evidence ratios could not be calculated for covariates in the winning model given that the null model does not contain covariates. The design was not balanced across either treatments or density classes.

Table 6-3. 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
nullchp	Null	122	124	0.00	9.47e-01	1.00
dc2	Density	122	130	6.41	3.85e-02	24.6
dc4	Treatment	124	132	8.34	1.46e-02	64.7
dc6	Density + Treatment	122	150	25.8	2.33e-06	407,076

6.3.2.2 Sand Gilia

Sand gilia occupancy of macroplots was moderate (0.301) and detection probability was moderate (0.480) during 2022 surveys. These values were derived from the null model where both occupancy and detectability were held constant.

The best AIC model was the null model, which does not include any covariates (Table 6-4). However, the difference of the evidence ratio for the null model versus the second-best model (Density) was only 0.28, meaning there was weak support that the null was the best model fit for the 2022 data, and initial density was an almost equally good predictor of detectability of sand gilia. The lack of clear support for any single model is possibly due to a combination of small sample size and the inability to account for effects of other environmental factors on detectability; in 2022, only one of ten macroplots, which was located in the southern portion of Unit B, contained sand gilia in central grids during Baseline surveys. Additionally, sand gilia was only observed in three macroplots, also located in the southern portion of Unit B, during 2022 surveys. Therefore, despite the AIC results suggesting a correlation between initial density and detectability, field observations have shown that the northern portion of Unit B comprises soil that is too compact to be considered suitable habitat for sand gilia, whereas the southern portion of Unit B contains substrate that is more conducive to supporting sand gilia. This suggests that 1) the evidence ratio for detectability was heavily biased due to only one macroplot containing sand gilia in Baseline and 2) the evidence for density affecting detectability is more likely evidence of soil type in Unit B affecting detectability. Log evidence ratios could not be calculated for covariates in the winning model given that the null model does not contain covariates. The design was not balanced across either treatments or density classes.

Table 6-4. 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
nullgit	Null	53.6	55.3	0.00	0.548	1.00
dg2	Density	51.8	55.8	0.500	0.427	1.28
dg4	Treatment	53.5	61.5	6.17	2.50e-02	21.9
dg6	Density + Treatment	54.8	69.8	14.5	3.88e-04	1,412

6.3.2.3 Seaside Bird's Beak

The sample size of seaside bird's beak was too small to conduct occupancy analysis, since it was observed in only one macroplot (C3A1G5) during 2022 surveys.

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7 CONCLUSIONS

7.1 HMP Annuals

Results of HMP annual species surveys on multiple units over varying amounts of time since treatment have shown that these species tend to persist following vegetation clearance activities. In 2022, comparison to Baseline was conducted for all age classes. Multiple treatments were used in Unit B grids (Year 5); treatment did not appear to influence differences observed in Monterey spineflower density distributions. Treatment-related effects on sand gilia and seaside bird's-beak were only qualitatively assessed due to confounding factors such as regional edaphic and community conditions that also contributed to HMP response differences. Treatment-related effects were not assessed in other Units due to utilization of only one treatment.

In general, observed densities and frequency of occurrence of HMP annual species were consistent with historical Baseline conditions. Sand gilia and Monterey spineflower seed set, abundance, and survival are highly complex (Fox *et al.*, 2006; Fox, 2007). Both species are generally correlated with rainfall; however, their survival mechanisms are different. Sand gilia is negatively affected by herbivory and its survival mechanism is a persistent seed bank. Monterey spineflower is not affected by herbivory and its survival mechanism is its ability to readily germinate under optimal conditions. Considering these life strategies, the densities of these species would be expected to fluctuate between years in response to rainfall, seed bank conditions, or herbivory.

Seaside bird's-beak densities are also variable (Watts *et al*., 2010). The cause of 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.

7.1.1 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 7-1. The only criterion that could not be assessed was comparison of the percentage of bare ground relative to Baseline conditions for Range 48 because no shrub transect surveys were required in this Unit.

Seventy-three percent of HMP annual success criteria were met for the 2022 survey year (Table 7-1). The criteria not met were seaside bird's beak in Range 48 (Year 3) and Monterey spineflower in BLM Area B-3 West and BLM Area B Unit A Containment Line (Year 5). Since Monterey spineflower vitality is strongly correlated with rainfall, it is possible that the drier than normal 2020-2021 and 2021-2022 water-years affected densities of the species in these areas (Fox et al., 2006; Fox, 2007).

The HMP annual success criterion requires that frequency of occurrence is at least 90% of the Baseline frequency in any post-treatment year. The areas which did not meet this success criteria ranged between 0% and 89% of the respective Baseline frequency. Despite not meeting the success criterion, Monterey spineflower was still found in 86% and 89% of grids in Units B-3 West and B, respectively. While seaside bird's beak did not occupy any Range 48 grids in 2022, there was a decrease in only one grid compared to 2020 surveys and only two grids from Baseline conditions. Due to the low Baseline occupancy of seaside bird's beak in this Unit, a change of occupancy in one grid represents a substantial change in frequency within the Unit. Additionally, these results are consistent with previous survey results (Burleson, 2021) and may be indicative of chance fluctuations that do not necessarily demonstrate a response to remediation activities.

Table 7-1. Evaluation of Success Criteria for HMP Annuals.

Year Class	Units	Criterion	Baseline	2022	Pass/Fail
Year 3	Range 48	Frequency of sand gilia > 90% of baseline frequency	$f_{Range\ 48}$ = 0.46	$f_{Range\ 48}$ = 0.46	Pass
		Frequency of seaside bird's-beak > 90% of baseline frequency	$f_{Range\ 48}$ = 0.15	$f_{Range\ 48}$ = 0.00	Fail
		Frequency of Monterey spineflower > 90% of baseline frequency	$f_{Range\ 48}$ = 0.92	$f_{Range\ 48}$ = 1.00	Pass
		Bare ground > Baseline condition	--	--	--
Year 5	Unit B-3 West, Unit B Containment Line	Frequency of sand gilia > 90% of baseline frequency	$f_{Unit\ B\text{-}3\ West}$ = 0.00 $f_{Unit\ B}$ = 0.21	$f_{Unit\ B\text{-}3\ West}$ = 0.00 $f_{Unit\ B}$ = 0.32	Pass Pass
		Frequency of seaside bird's-beak > 90% of baseline frequency	$f_{Unit\ B\text{-}3\ West}$ = 0.00 $f_{Unit\ B}$ = 0.00	$f_{Unit\ B\text{-}3\ West}$ = 0.00 $f_{Unit\ B}$ = 0.00	Pass Pass
		Frequency of Monterey spineflower > 90% of baseline frequency	$f_{Unit\ B\text{-}3\ West}$ = 1.00 $f_{Unit\ B}$ = 1.00	$f_{Unit\ B\text{-}3\ West}$ = 0.86 $f_{Unit\ B}$ = 0.89	Fail Fail
		Bare ground > Baseline condition	$c_{Unit\ B\text{-}3\ West}$ = 22% $c_{Unit\ B}$ = 12%	$c_{Unit\ B\text{-}3\ West}$ = 50% $c_{Unit\ B}$ = 22%	Pass Pass

7.2 Macroplot Surveys

7.2.1 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.

The distribution of Monterey spineflower generally increased between Baseline and Year 3, with subsequent declines in frequency between Years 3 and Year 5, regardless of treatment. Sand gilia frequency of occurrence appeared to vary between treatments, and seaside bird's beak was observed only in Year 5, in a masticated macroplot in Unit B-3 West (see Figures 6-2 through 6-4). These results are consistent with the observations of the 2018 and 2020 macroplot survey results (Burleson, 2019; Burleson, 2021). However, since each year class had a different Baseline survey year and consisted of different units, interpretation of temporal grid occupancy patterns across year classes should consider these differences.

7.2.2 Single-Season Occupancy Analyses

The *single-season occupancy analyses* were used to determine what factors affect the detectability of HMP annual species in macroplots during the 2022 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 AIC results in 2022 differed from the results of previous surveys. In 2018 and 2020, the most influential factors affecting Monterey spineflower occupancy were initial density and treatment and the null model ranked relatively low in comparison to other models (Burleson, 2019). In contrast, 2022 results suggest that random variability in Monterey spineflower occupancy data was greater than any variability due to influences from initial density or treatment. The evidence for factors influencing sand gilia occupancy was more variable between years. In 2018, there was strong evidence that initial density had the greatest influence on sand gilia occupancy and equivocal evidence of treatment affecting sand gilia occupancy. In 2020 the model including only treatment as a factor was the highest-ranking model; however, the difference in evidence ratios between the treatment model and the next best model (the null) was only 0.16, indicating that random variability was almost as likely as treatment to have influenced sand gilia occupancy (Burleson, 2021). Similar to 2020 results, the sand gilia AIC results in 2022 suggest there was not clear support for a single model. There was therefore no clear evidence for any of the covariates assessed affecting detectability of sand gilia in 2022 (Tables 6-3 and 6-4). The lack of support for any single model may be due to small sample size and the inability to account for certain confounding environmental factors in analyses. It should be noted that these occupancy analyses have unbalanced designs (e.g., the number of grids between treatments are not equal), and that interactions between covariates were not evaluated.

7.3 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 – 2022).

Differential response to treatment was assessed in Year 5 Units B and C, where multiple treatments were applied. Different species and community metrics can be promoted by burning, while others can be promoted by mastication. Mixed treatment generally yielded lower average shrub cover and more bare ground cover compared to burned and masticated or burned treatments (Figures 4-12 and 4-18). In Unit C, mastication generally yielded lower average shrub cover but higher shrub species richness than burned and masticated and burned treatments. Additionally, mastication appeared to diminish species evenness in Unit C compared to other treatments (Figure 4-13).

HMP shrub species in Year 8 Units, which included sandmat manzanita, Monterey ceanothus, and Eastwood's goldenbush, generally persisted in Year 8 (see Figures 5-11 through 5-13). Monterey ceanothus tended to have the fastest recovery rate of the three species. Both Monterey ceanothus and sandmat manzanita were present in all monitoring years, whereas Eastwood's goldenbush was not present in any Units in Year 3 and recovered by Year 8 only in Unit 1 West. Eastwood's goldenbush tends to take substantial time to grow and recover from disturbance and may become more susceptible to herbivory after treatment; small herbivores such as woodrats and rabbits repeatedly browse Eastwood's goldenbush when it is young or resprouting. Additionally, seed viability and recruitment may be diminished in masticated areas, as seeds require bare ground with low levels of duff or mulch for germination (J. Detka, personal communication, March 2023).

7.3.1 Shrub Community Success Criteria

The Revised Protocol identified success criteria for recovery of the shrub community in Years 3 and 5. In 2022, no shrub transect surveys occurred in Year 3 Units. Community composition in Year 5 Units showed a progression toward Baseline conditions (Figures 4-33 through 4-37) and have therefore met the Year 5 success criterion (Table 7-2).

Table 7-2. Evaluation of Success Criteria for Shrub Communities in Year 5.

Year Class	Units	Criterion	Rationale	Pass/Fail
Year 5	B-3 WestB-3 East A Southern Containment Line B C B-2A	Observation of community recovery	Figures 4-33 through 4-37 and Unit B-2A community transect trends over time (Figure 4-14)	Pass

As part of the Revised Protocol development, a series of three major shrub associations were identified based on dominant species present in Baseline surveys. 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 7-3.

All but one of the specified criteria were met in Year 8:

1) the maximum invasive plant cover along Unit 1 West transects greater than 10% cover in Year 8 (17.0%).

Invasive plant cover in Unit 1 West was 7% greater than the 10% threshold to meet the Year 8 success criteria; however, this success criterion was also not met in Baseline. Additionally, cover along Unit 1 West transects has increased by only 2% over eight years of monitoring. Overall, community compositions in Year 8 Units continues to move toward Baseline conditions (see Figures 5-14 through 5-16). Per the Revised Protocol, Year 8 is the final year required for monitoring, and given the overall positive response of vegetation to mastication in Units 1, 2, and 3 West, they will be removed from the monitoring schedule.

Table 7-3. Evaluation of Success Criteria for Dominant Chaparral Shrub Associations on Fort Ord in Year 8 Units Monitored in 2022 (Units 1 West, 2 West, and 3 West).

Plant Association	Criterion	Unit	Baseline value	Year 8 value	P/F
A – ARTO dominated	Average cover of ARTO > 30% of baseline cover	1 West	56.7%	51.4%	Pass
		2 West	61.0%	45.6%	Pass
		3 West	43.7%	43.3%	Pass
	Frequency of dwarf ceanothus > 70% baseline frequency	1 West	0.38	0.88	Pass
		2 West	0.20	0.90	Pass
		3 West	0.20	0.20	Pass
	Frequency of Monterey ceanothus >70% baseline frequency	1 West	1.00	0.88	Pass
		2 West	0.50	0.80	Pass
		3 West	0.48	0.44	Pass
B – ADFA dominated	Average cover of ADFA > 30% of baseline cover	1 West	61.1%	41.6%	Pass
		2 West	33.9%	31.3%	Pass
		3 West	32.1%	29.7%	Pass
	Frequency of dwarf ceanothus > 70% baseline frequency	1 West	0.00	1.00	Pass
		2 West	0.60	0.60	Pass
		3 West	0.40	0.40	Pass
	Frequency of Monterey ceanothus >70% baseline frequency	1 West	0.00	1.00	Pass
		2 West	0.80	1.00	Pass
		3 West	0.80	0.80	Pass
C/D – ARPU dominated	Frequency of ARPU > 70% of baseline frequency	1 West	NA	NA	NA
		2 West	1.00	1.00	Pass
		3 West	0.90	0.90	Pass
	Frequency of dwarf ceanothus > 70% baseline frequency	1 West	NA	NA	NA
		2 West	0.00	0.00	Pass
		3 West	0.11	0.11	Pass
	Frequency of Monterey ceanothus >70% baseline frequency	1 West	NA	NA	NA
		2 West	0.00	0.00	Pass
		3 West	0.56	0.56	Pass
Bare Ground	Bare ground > 90% of baseline cover	1 West	11.0%	20.4%	Pass
		2 West	12.7%	22.9%	Pass
		3 West	7.74%	27.8%	Pass
Invasive plants	Invasive plants <10% cover per transect	1 West	15.4% (max)	17.0% (max)	Fail
		2 West	6.1% (max)	8.0% (max)	Pass
		3 West	1.6% (max)	3.4% (max)	Pass

7.4 Annual Grasses

Annual grasses were present along the edges of roads, masticated areas, other disturbed areas, and occasionally extended into the interior of the Units monitored in 2022 (Appendix D). High annual grass density was present in all cleared fuel break areas; however, it does not appear that colonization by annual grasses is a major concern along fuel breaks because annual grasses generally decrease with time as shrubs begin to colonize these areas post-treatment (Table 5-5).

Response of annual grasses varied between age classes and Units. The cover of annual grasses in all Year 5 Units (BLM Area B Units B-3 West, A Southern Containment Line, and B) increased between Baseline and Year 3 by at least twofold then decreased between Years 3 and 5 (Table 4-11). In Units 2 West and 3 West (Year 8), annual grass cover decreased between Baseline and Year 5 then increased slightly between Year 5 and Year 8 but remained well below Baseline cover (Table 5-5). As shrubs continue to mature in these units, annual grass density is expected to continue to decrease.

8 REFERENCES

Akaike H. 1974. A new look at the statistical model identification. IEEE Transactions on Automatic Control 19(6):716-723.

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. 2008. Final non-Environmental Services Cooperative Agreement Portion of Ranges 43–48 Biological Monitoring Report, Former Fort Ord. Consultant's report submitted to U.S. Army Corps of Engineers, December 2008. Administrative Record #OE-0679

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. 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. 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.

Burleson Consulting, Inc. 2019a. 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. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW 2870.

Burleson Consulting, Inc. 2019b. 2019 Annual Report: Biological Monitoring for Unit 25 Containment Lines, Unit 31, and BLM Area B Subunit A Containment Lines, Unit 25 and Units 13, 20, and 31 Containment Lines; Units 1 West, 2 West, and 3 West; and Units 4, 11, 12, and Unit 4 South Boundary Road. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW 2885.

Burleson Consulting, Inc. 2021. Annual Report: Biological Monitoring for Range 48; BLM Area B Units B-2A, B-3 West, B-3 East, A Southern Containment Line, B, and C; Units 5A, 9, 23, and 28; Units 2 East and 3 East. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW 2899.

Burleson Consulting, Inc. 2021a. 2020 Annual Report Habitat Restoration. Former Fort Ord, California. Prepared for U.S. Army Corps of Engineers, Sacramento, CA.

Burleson Consulting, Inc. 2022. Annual Report: Biological Monitoring for Units 25, 31, BLM Area B Subunit A Containment Lines; Unit 25 and Units 13, 20, 31 Containment Lines; and Units 6, 7, 10, 1 East, Military Operations Urban Terrain Buffer, and Watkins Gate Burn Area. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW 2922.

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.

ESRI. 2022. ArcGIS Version 10.8.2.

Fiske I, Chandler R. 2011. unmarked: an R package for fitting hierarchical models of wildlife occurrence and abundance. Journal of Statistical Software 43(10): 1-23. URL http://www.jstatsoft.org/v43/i10/.

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.

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

[HLA] Harding Lawson Associates. 1999. 1999 Annual Habitat Monitoring Report, Former Fort Ord, Monterey, California. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW-2234.

[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. 2019. BiodiversityR: Package for Community Ecology and Suitability Analysis. R Package Version 2.12-2. 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.

MacKenzie D I, Nichols J D, Royle J A, Pollock K H, Bailey L L, Hines J E. 2006. Occupancy Estimation and Modeling: Inferring Patterns and Dynamics of Species Occurrence. Elsevier.

[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.

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 Centers for Environmental Information of the National Oceanic and Atmospheric Administration (NCEI NOAA). 2022. 30-Year Normal Precipitation Data for the Monterey Weather Forecast Office. [Internet]. Accessed on January 6, 2022. Available at: https://www.ncei.noaa.gov/access/services/data/v1?dataset=normals-monthly-1991-2020&startDate=0001-01-01&endDate=9996-12-31&stations=USW00023259&format=pdf

Naval Postgraduate School Department of Meteorology. 2022. Monthly Precipitation Summaries for the Monterey Region. [Internet]. Accessed October 26, 2022. Available at: http://met.nps.edu/~ldm/renard_wx/

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. 2022. Vegan: Community Ecology Package. R Package Version 2.6-4. URL http://CRAN.R-project.org/package=vegan

Parsons Inc. 2005. Final 2005 Annual Biological Monitoring Report, Ranges 43–48. Prepared for U.S. Army Corps of Engineers, November 2005. Administrative Record #OE-0577

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

R Core Team. 2021. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

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. 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. 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. 2020. “flora_fire_area” shapefile. Accessed from Fort Ord Data Integration System.

[USACE] United States Army Corps of Engineers. 2020. “flora_pres_burn_area” shapefile. Accessed from Fort Ord Data Integration System.

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

[USDA] U.S. Department of Agriculture, Natural Resources Conservation Service. 2022. Soil Survey Spatial and Tabular Data (SSURGO 2.2). URL https://datagateway.nrcs.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. 2015. Programmatic biological opinion for cleanup and property transfer actions conducted at the former Fort Ord, Monterey County, California (8-8-09-F-74).

[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.

Watts SM, Uhl MM, Maurano SP, Nuccio EE. 2010. Using Small-Scale Studies to Prioritize Threats and Guide Recovery of a Rare Hemiparasitic Plant: *Cordylanthus rigidus* ssp. *Littoralis*. PloS one, 5(1), e8892. https://doi.org/10.1371/journal.pone.0008892.

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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
ACLO	*Acacia longifolia*	Sydney golden wattle	tree
ACME	*Acacia melanoxylon*	blackwood acacia	tree
ACMI	*Achillea millefolium*	common yarrow	perennial herb
ACPA	*Acaena pallida*	pale biddy-biddy	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 brome	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
CAFO2	*Castilleja foliolosa*	Texas Indian paintbrush	perennial herb
CAGL	*Carex globosa*	round fruit sedge	perennial herb
CAKO	*Calamagrostis koelerioides*	fire reedgrass	perennial grass
CAMA	*Calystegia macrostegia*	coast morning-glory	Perennial herb
CAMI	*Camissoniopsis micrantha*	Spencer primrose	annual herb
CAPY	*Carduus pycnocephalus*	Italian thistle	annual herb
CARA	*Cardionema ramosissimum*	sand mat	perennial herb
CARU	*Calamagrostis rubescens*	pinegrass	perennial grass

Table A-1. Species acronyms, Former Fort Ord.

Acronym	Scientific Name	Common Name	Life Form
CASU	*Calystegia subacaulis*	hill morning glory	perennial herb
CATU	*Carex tumulicola*	Foothill sedge	Perennial herb
CAXX1	*Carex* sp.	sedge	perennial herb
CAXX2	*Castilleja* sp.		
CEDE	*Ceanothus dentatus*	dwarf ceanothus	shrub
CEIN	*Ceanothus incanus*	coast whitehorn	shrub
CEME	*Centaurea melitensis*	tocalote	annual herb
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
CRMUM	*Cryptantha muricata* var. *muricate*	showy prickly-nut cryptantha	annual herb
CRSC	*Crocanthemum (Helianthemum) scoparium*	peak rush-rose	subshrub
CRXX	*Cryptantha* sp.		annual herb
DACA	*Danthonia californica*	California oatgrass	Perennial grass
DAPU	*Daucus pusillus*	American wild carrot	annual herb
DECE	*Deschampsia cespitosa*	tufted hairgrass	perennial 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

Table A-1. Species acronyms, Former Fort Ord.

Acronym	Scientific Name	Common Name	Life Form
ERER	*Ericameria ericoides*	mock heather	shrub
ERFA	*Ericameria fasciculata*	Eastwood's goldenbush	shrub
ERMO	*Erodium moschatum*	White-stemmed filaree	annual herb
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
FRCA2	*Fremontodendron californicum*	California flannelbush	shrub
GAAP	*Galium aparine*	goose grass	annual herb
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
GEDI	*Geranium dissectum*	cutleaf geranium	annual 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

Table A-1. Species acronyms, Former Fort Ord.

Acronym	Scientific Name	Common Name	Life Form
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
LYHY	*Lythrum hyssopifolia*	hyssop loosestrife	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
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
PIXX	*Piperia* sp.		
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
POMO	*Polypogon monspeliensis*	rabbitsfoot grass	annual 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

Table A-1. Species acronyms, Former Fort Ord.

Acronym	Scientific Name	Common Name	Life Form
QUWIF	*Quercus wislizeni* var. *frutescens*	chaparral oak	tree
RIMA	*Ribes malvaceum*	Chaparral currant	shrub
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
SOXX	*Solidago* sp.	goldenrod	perennial herb
STPU	*Stipa pulchra*	purple needle grass	perennial grass
STVI	*Stephanomeria virgata*	tall stephanomeria	annual herb
SYALL	*Symphoricarpos albus* var. *laevigatus*	common snowberry	subshrub
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*	smallhead clover	annual herb
TROB	*Tribolium obliterum*	Capetown grass	perennial herb
TRVA	*Trifolium variegatum*	variegated clover	annual herb
TRWI	*Trifolium willdenovii*	tomcat clover	annual herb
URLI	*Uropappus lindleyi*	silver puffs	annual herb
VAOV	*Vaccinium ovatum*	huckleberry	shrub
VISA	*Vicia sativa*	garden vetch	annual herb
VIHI	*Vicia hirsute*	tiny vetch	annual herb
ZEDA	*Zeltnera davyi*	Davy's centuary	annual herb
ZEMU	*Zeltnera muehlenbergii*	Muehlenberg's centaury	annual herb

*Numbered codes correspond with the species acronym codes on the USDA PLANTS Database (USDA NRCS, 2022).

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APPENDIX B

MAPS: HMP ANNUALS GRIDS

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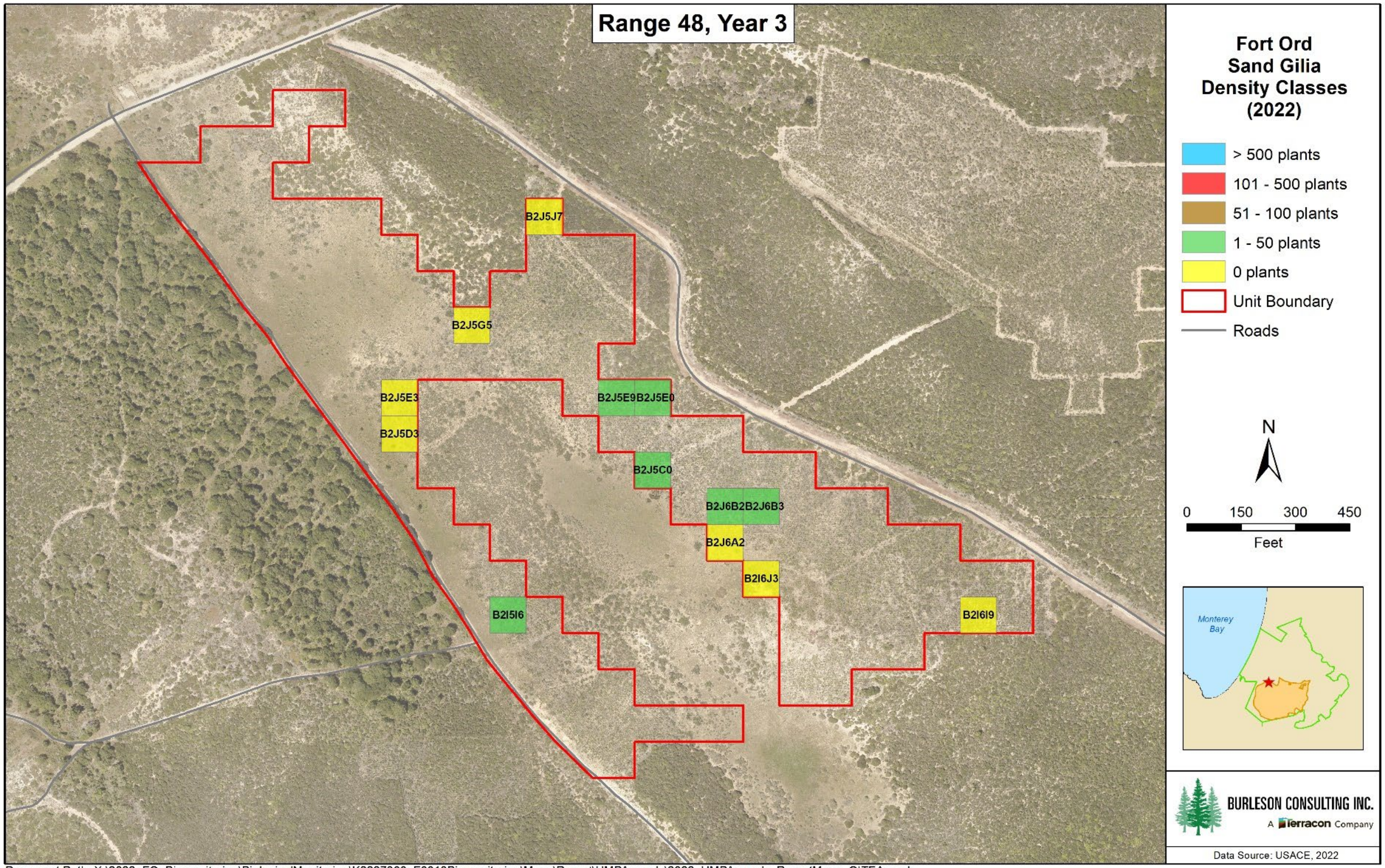

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Figure B-1. Map of Sand Gilia Density; Range 48 (Year 3).

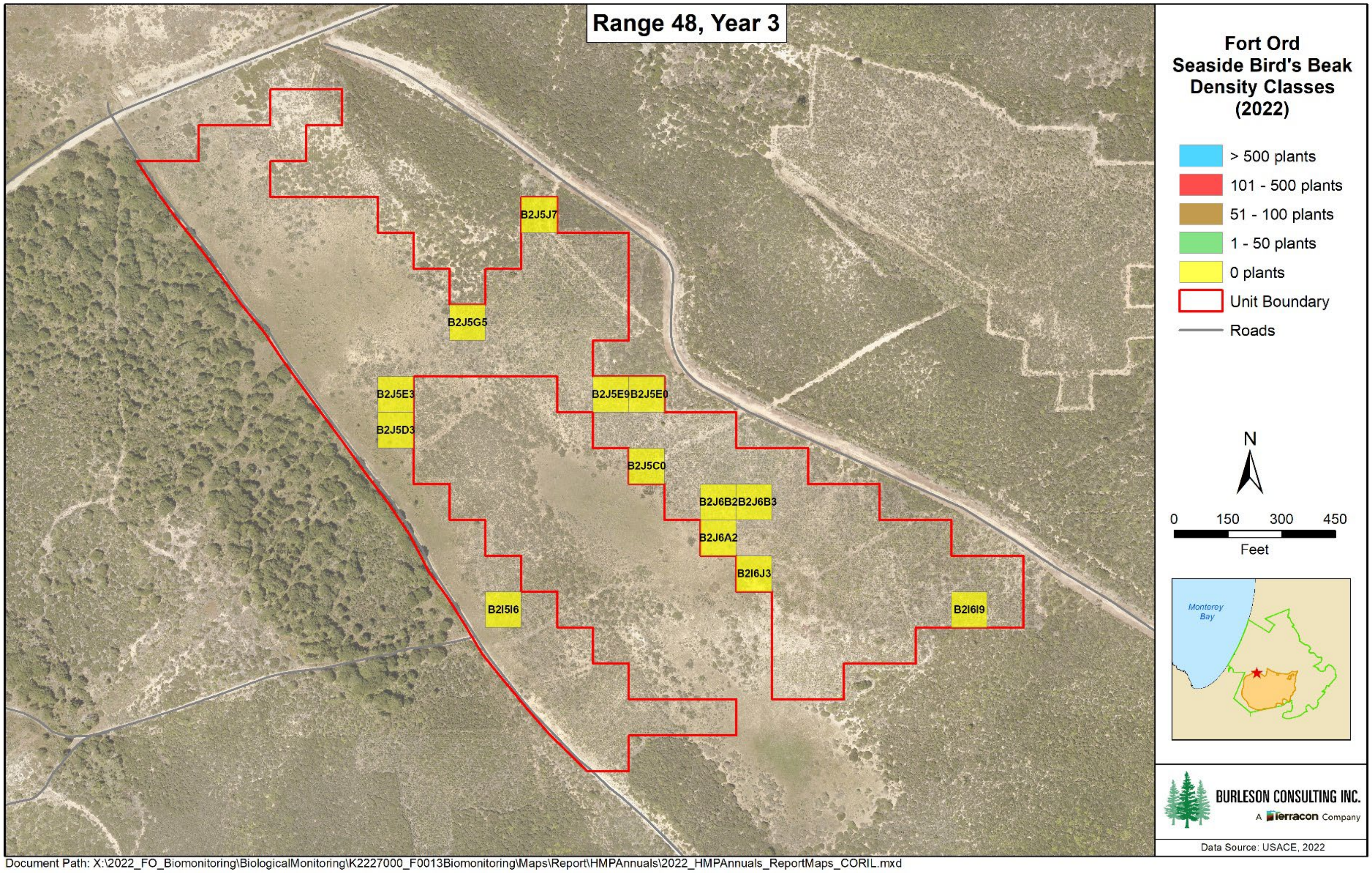

Figure B-2. Map of Seaside Bird's Beak Density; Range 48 (Year 3).

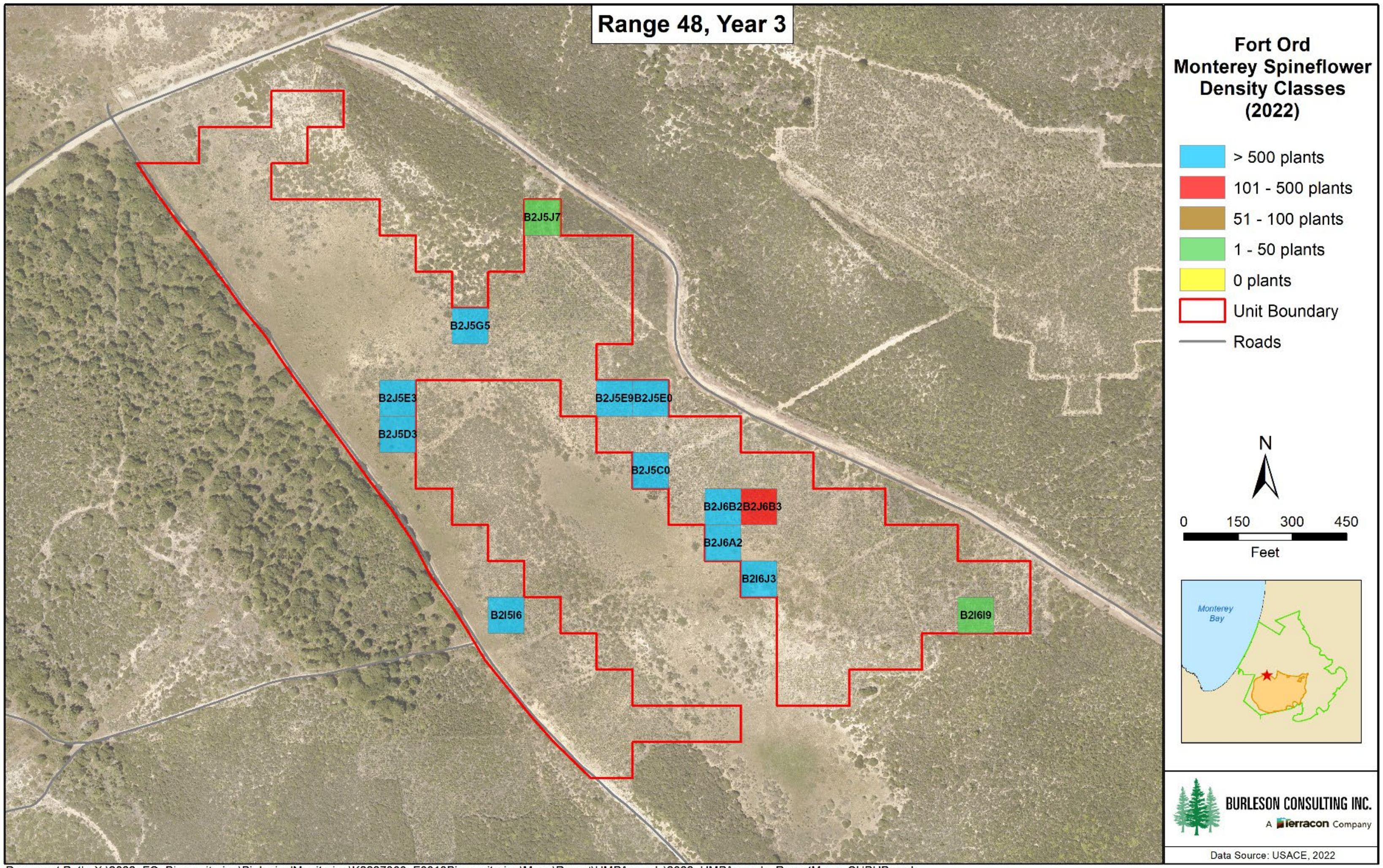

Figure B-3. Map of Monterey Spineflower Density; Range 48 (Year 3).

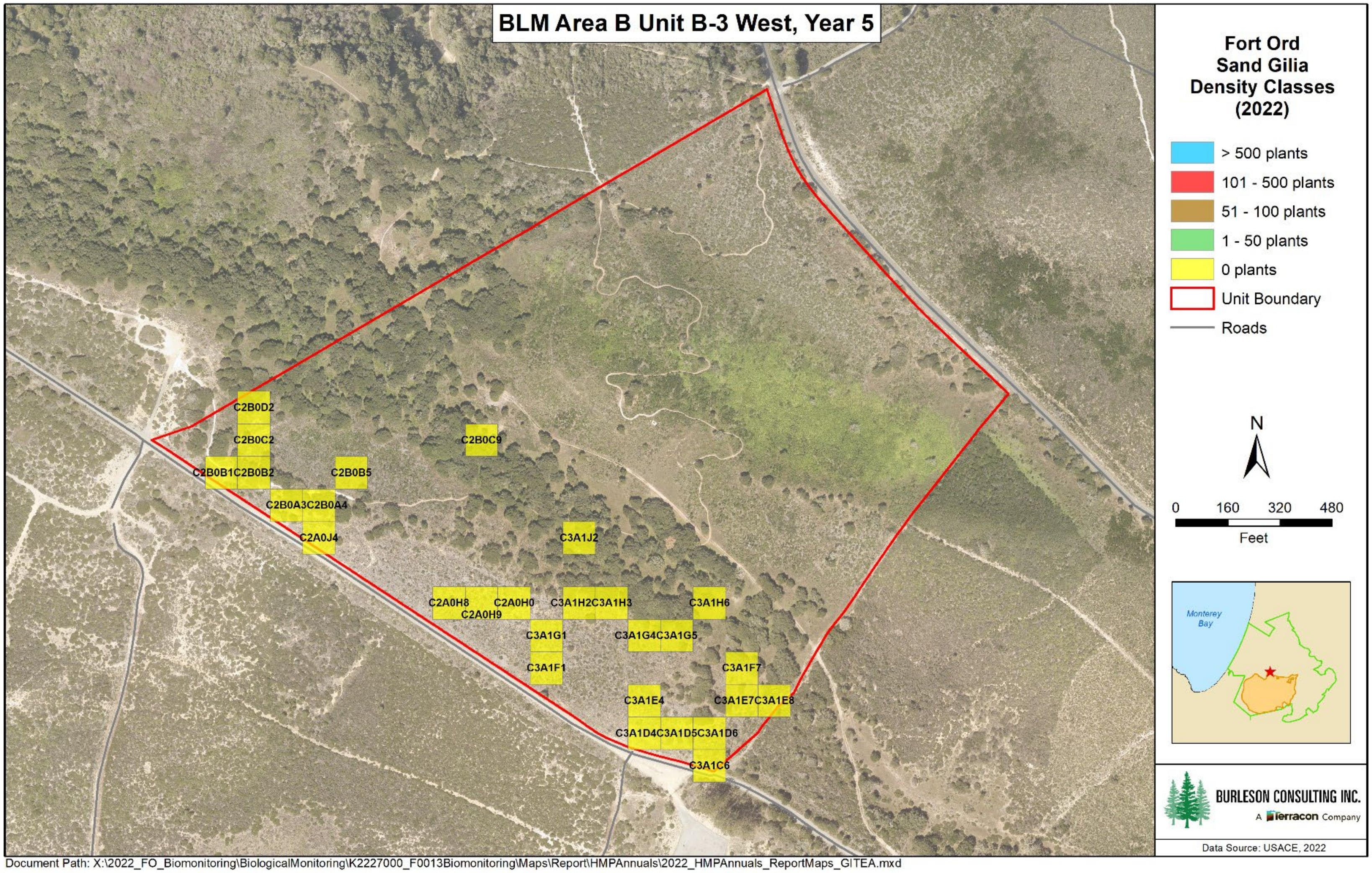

Figure B-4. Map of Sand Gilia Density; BLM Area B Unit B 3 West (Year 5).

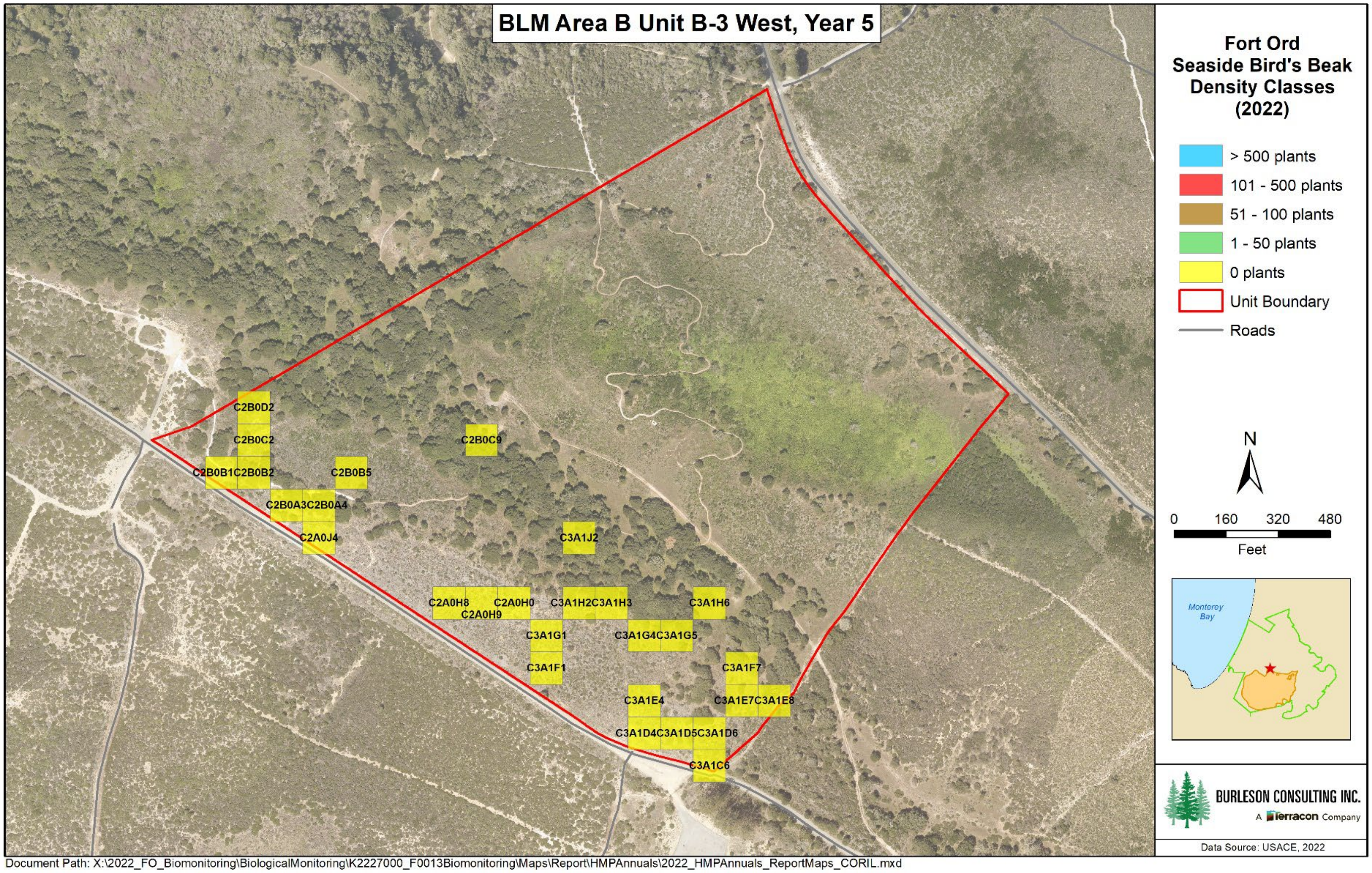

Figure B-5. Map of Seaside Bird's Beak Density; BLM Area B Unit B-3 West (Year 5).

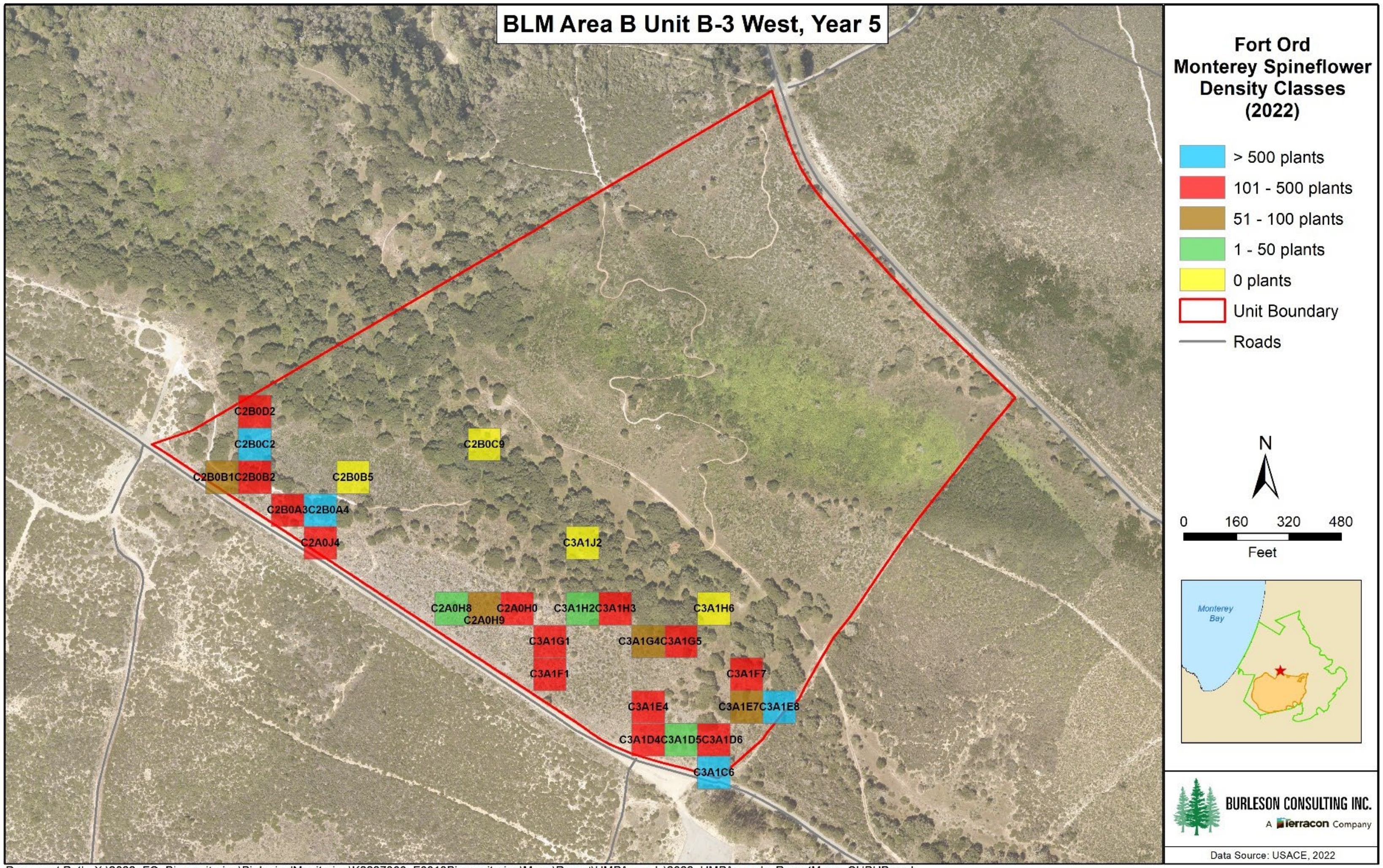

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Figure B-6. Map of Monterey Spineflower Density; BLM Area B Unit B-3 West (Year 5).

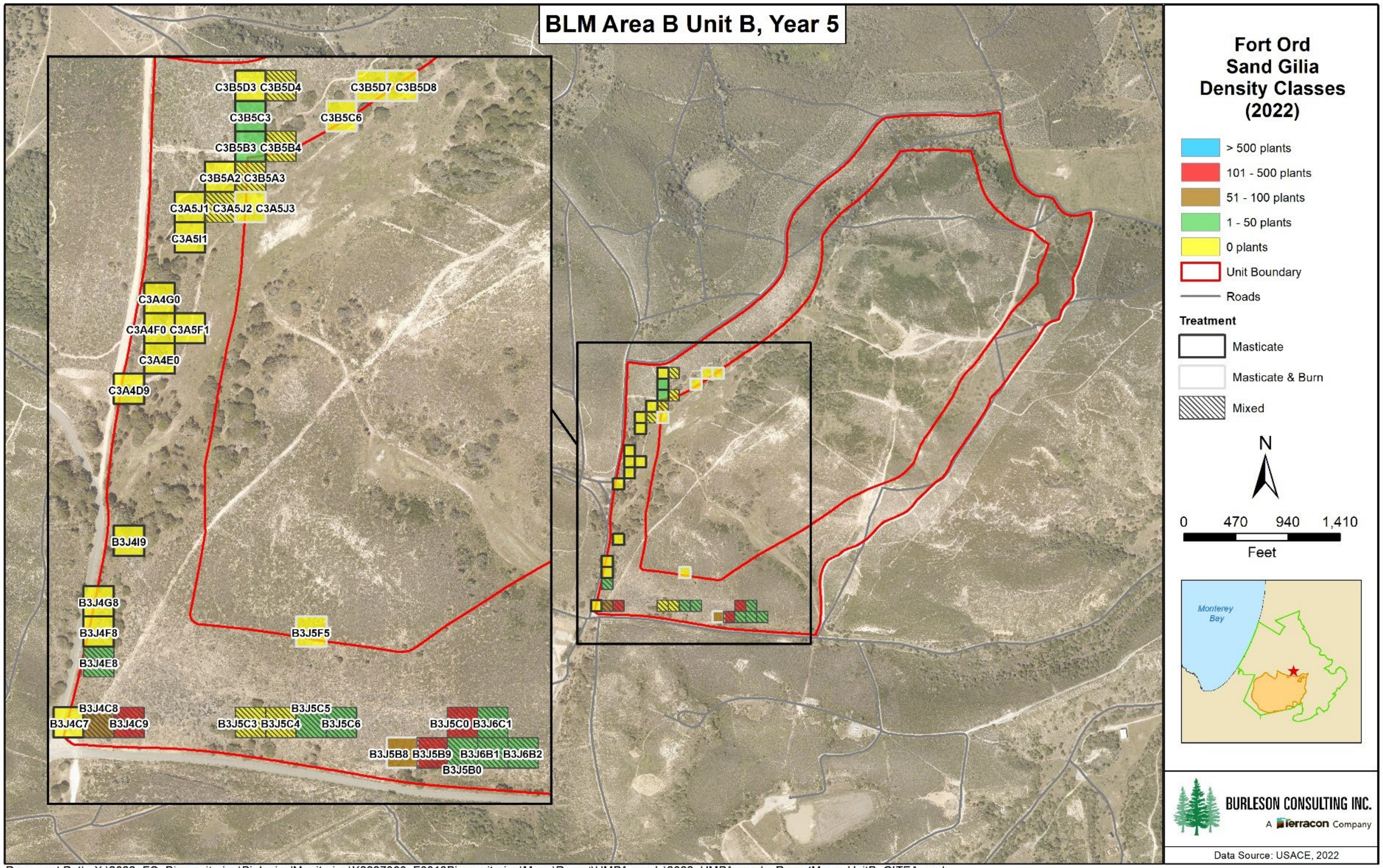

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Figure B-7. Map of Sand Gilia Density; BLM Area B Unit B (Year 5).

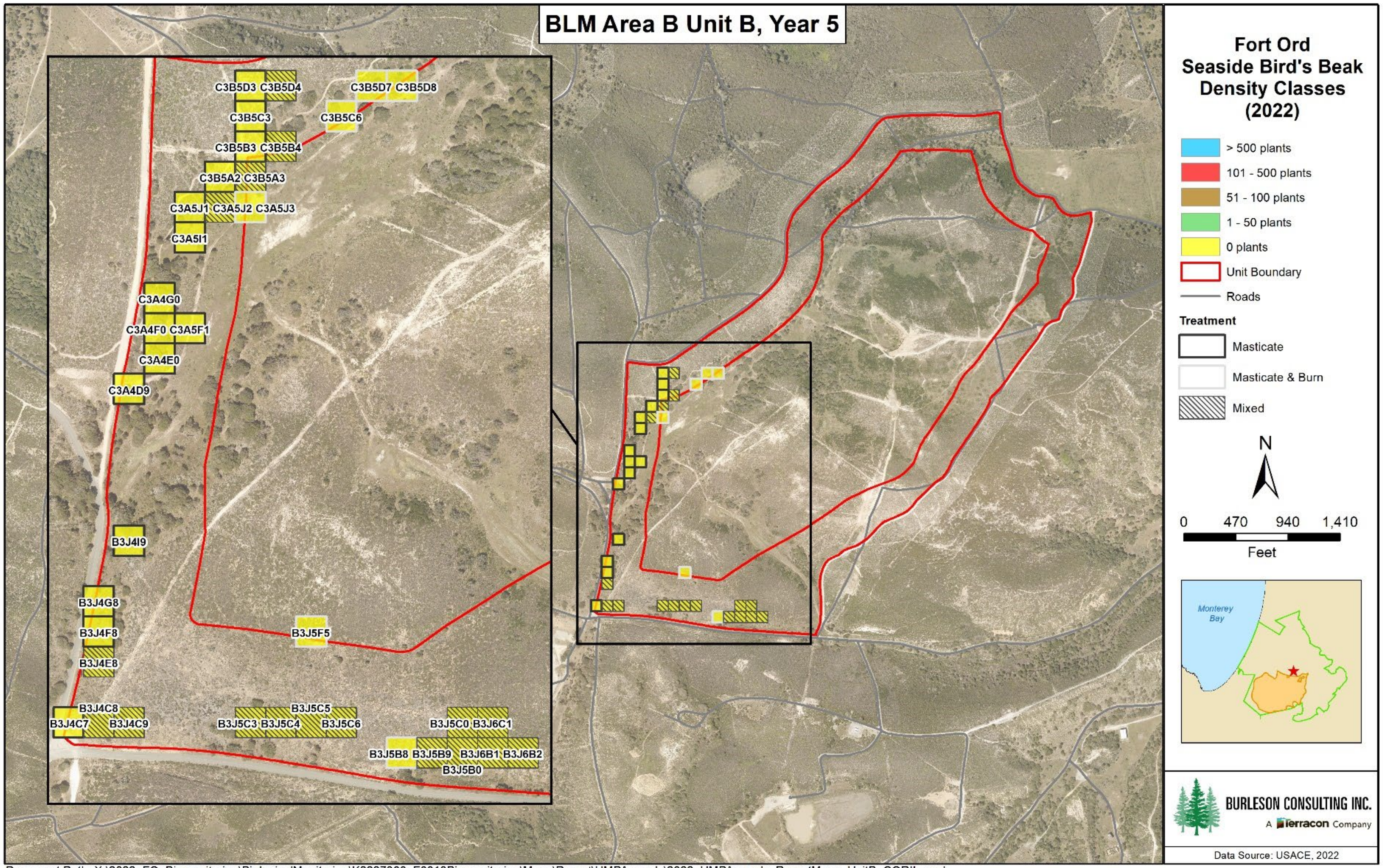

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Figure B-8. Map of Seaside Bird's Beak Density; BLM Area B Unit B (Year 5).

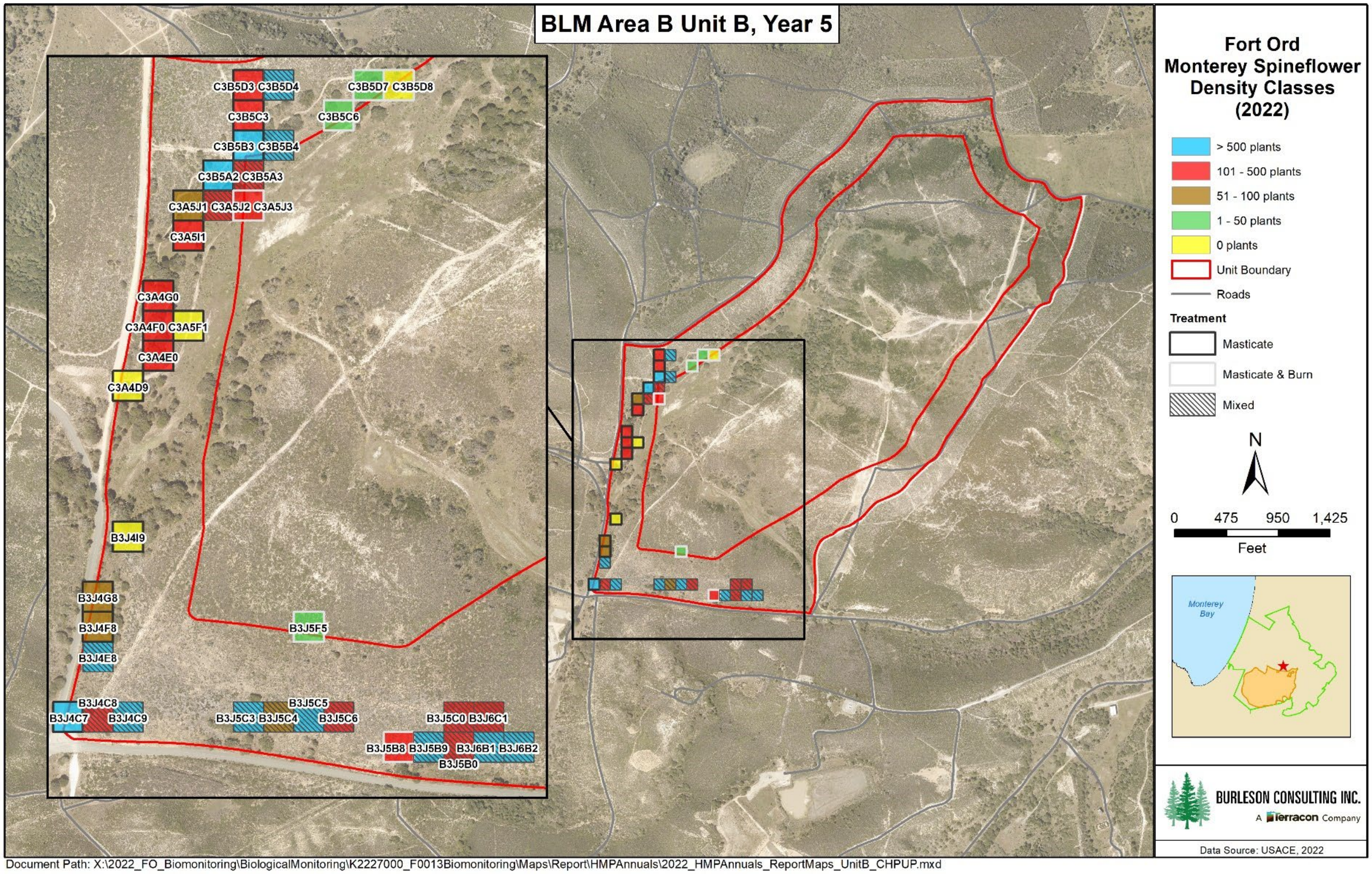

Figure B-9. Map of Monterey Spineflower Density; BLM Area B Unit B (Year 5).

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APPENDIX C

MAPS: HMP SHRUB TRANSECTS

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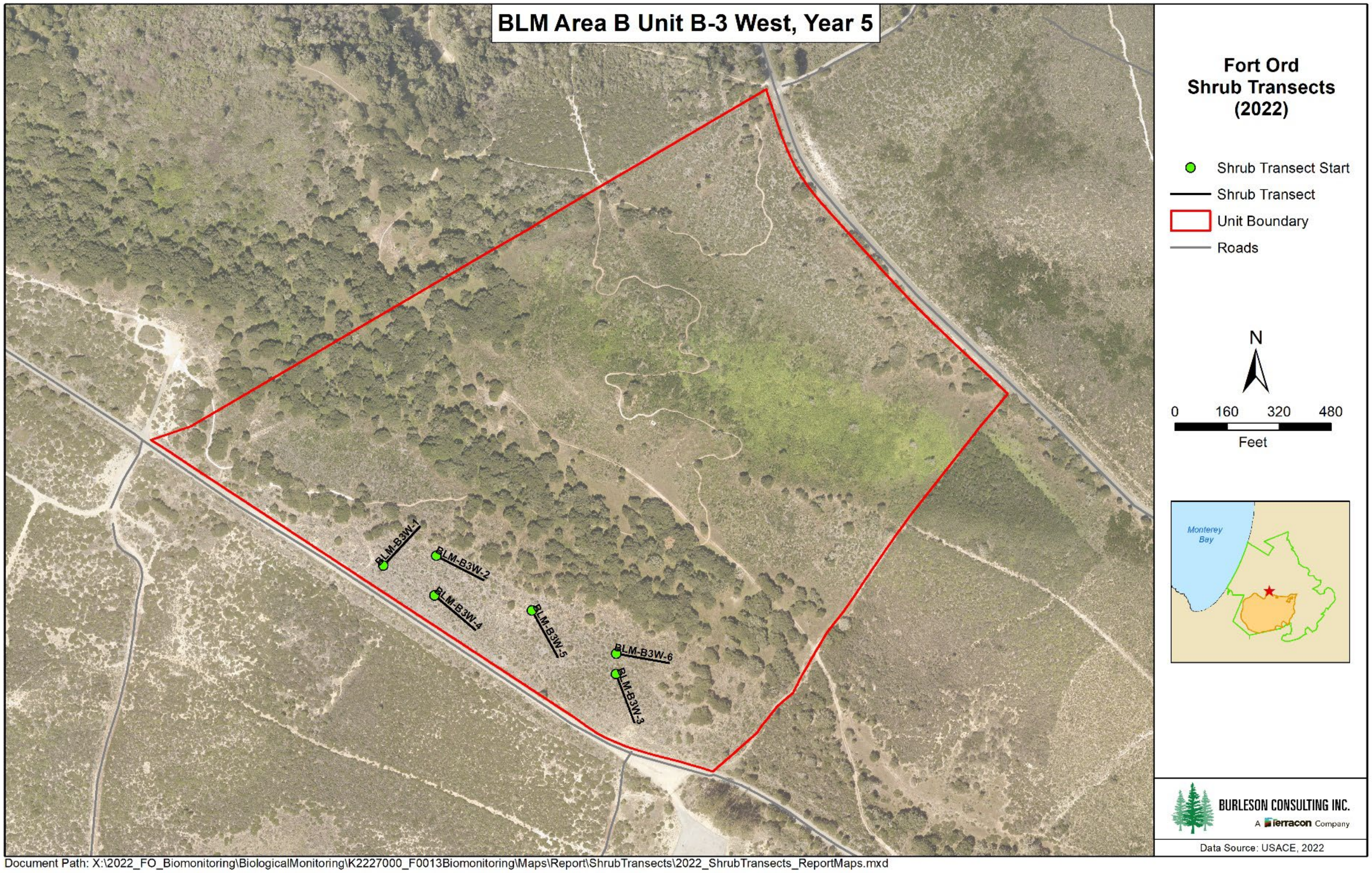

Figure C-1. Map of Shrub Transects; BLM Area B Unit B-3 West (Year 5).

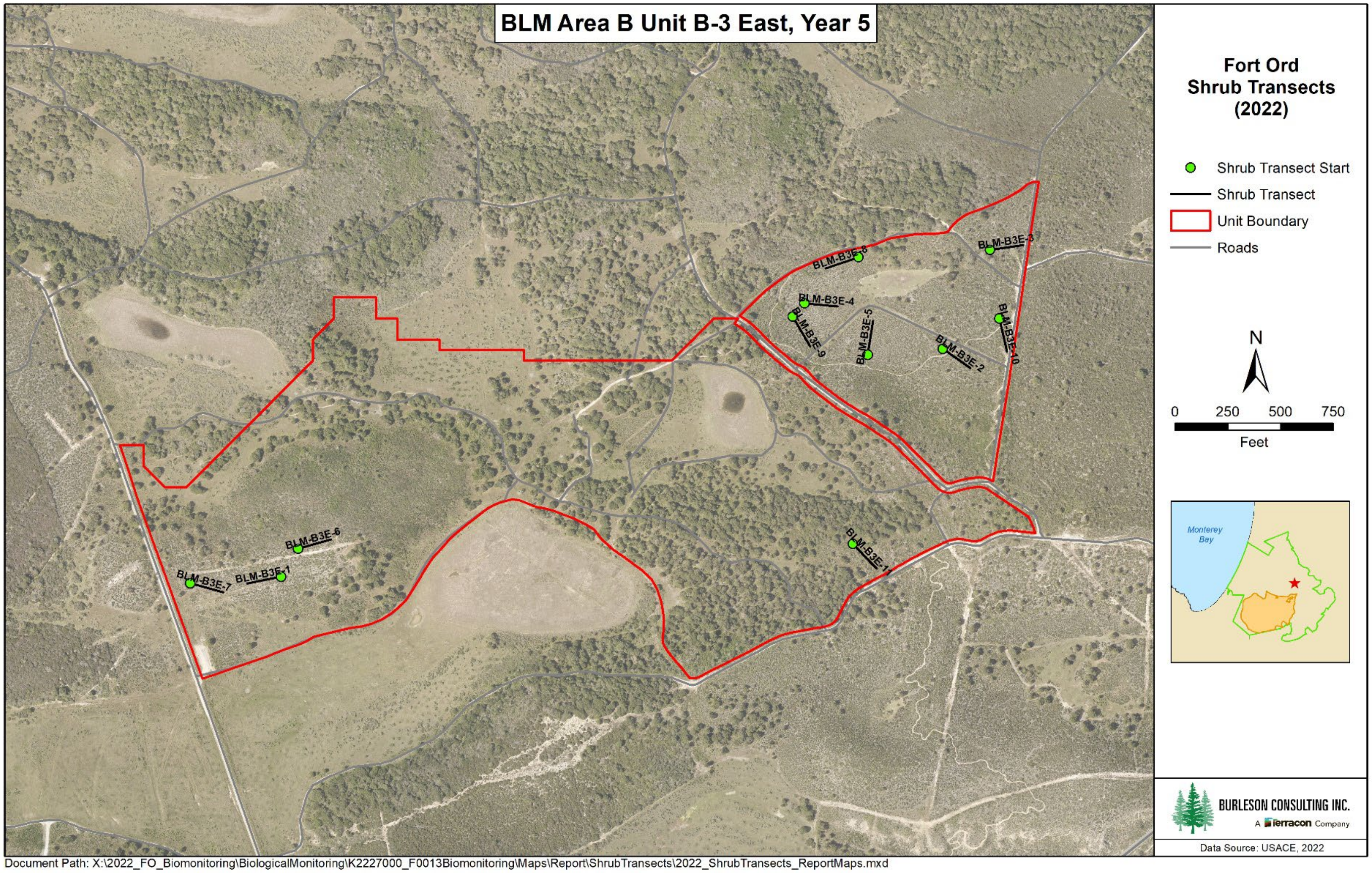

Figure C-2. Map of Shrub Transects; BLM Area B Unit B-3 East (Year 5).

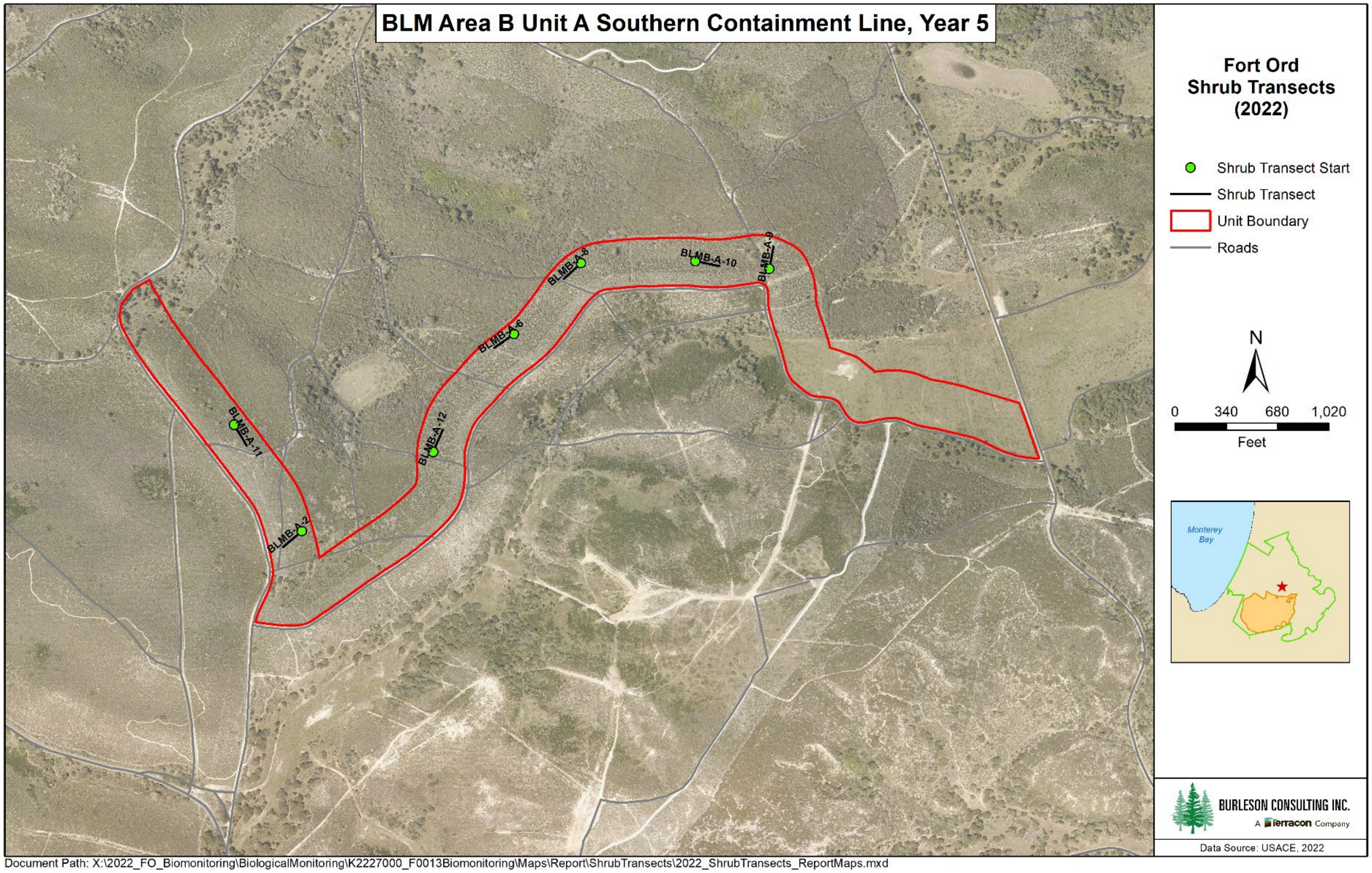

Figure C-3. Map of Shrub Transects; BLM Area B Unit A Southern Containment Line (Year 5).

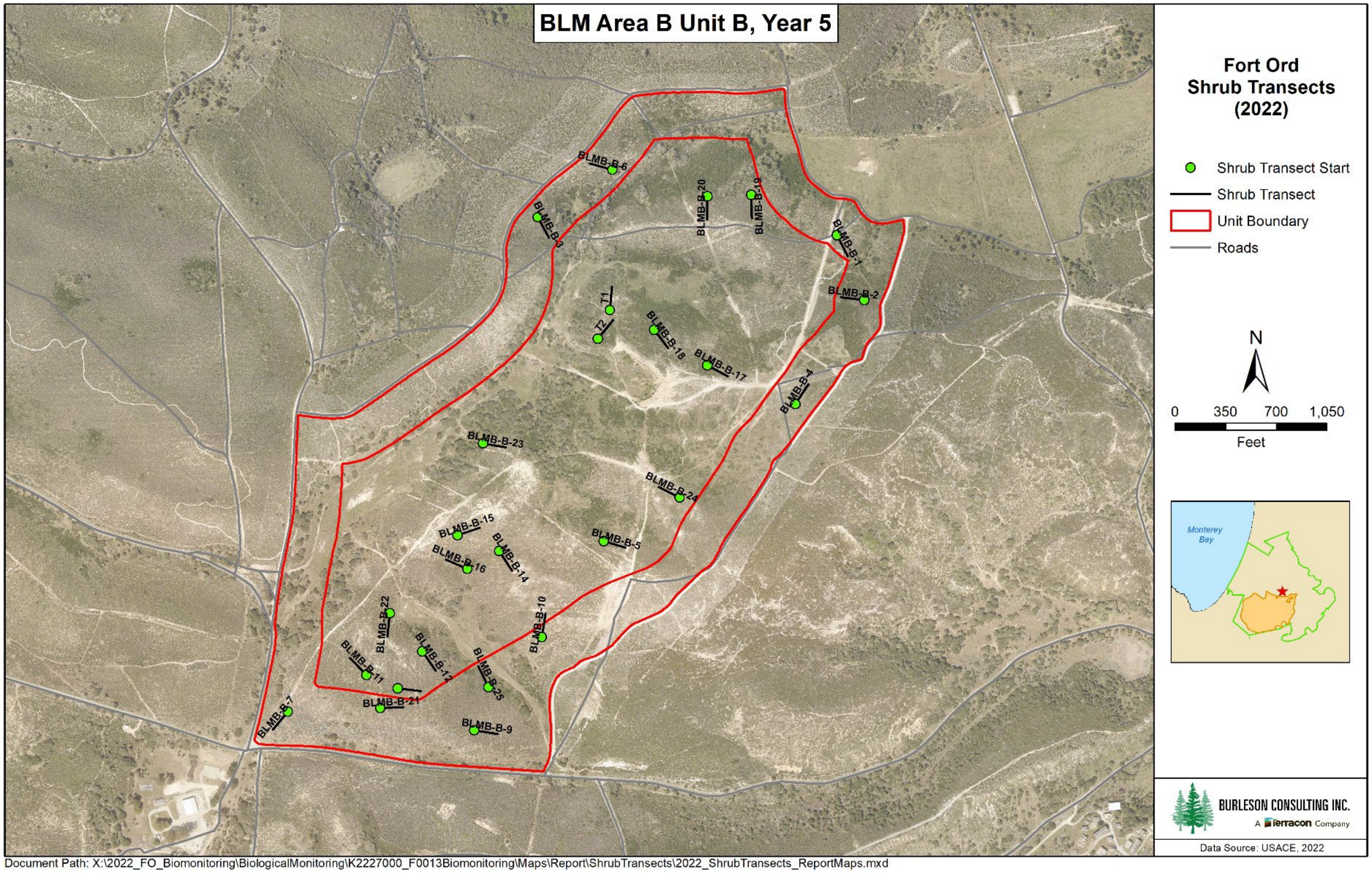

Figure C-4. Map of Shrub Transects; BLM Area B Unit B (Year 5).

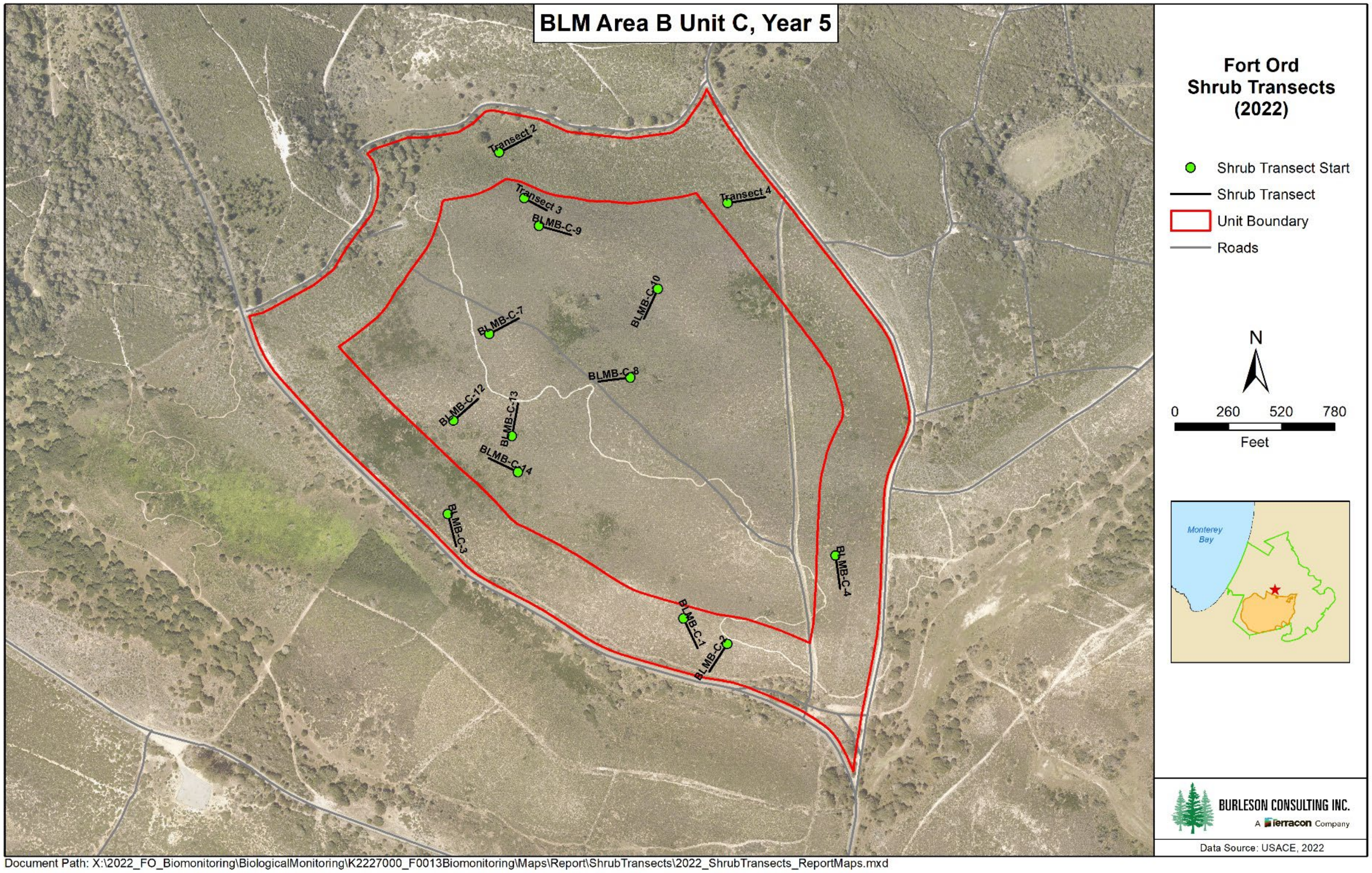

Figure C-5. Map of Shrub Transects; BLM Area B Unit C (Year 5).

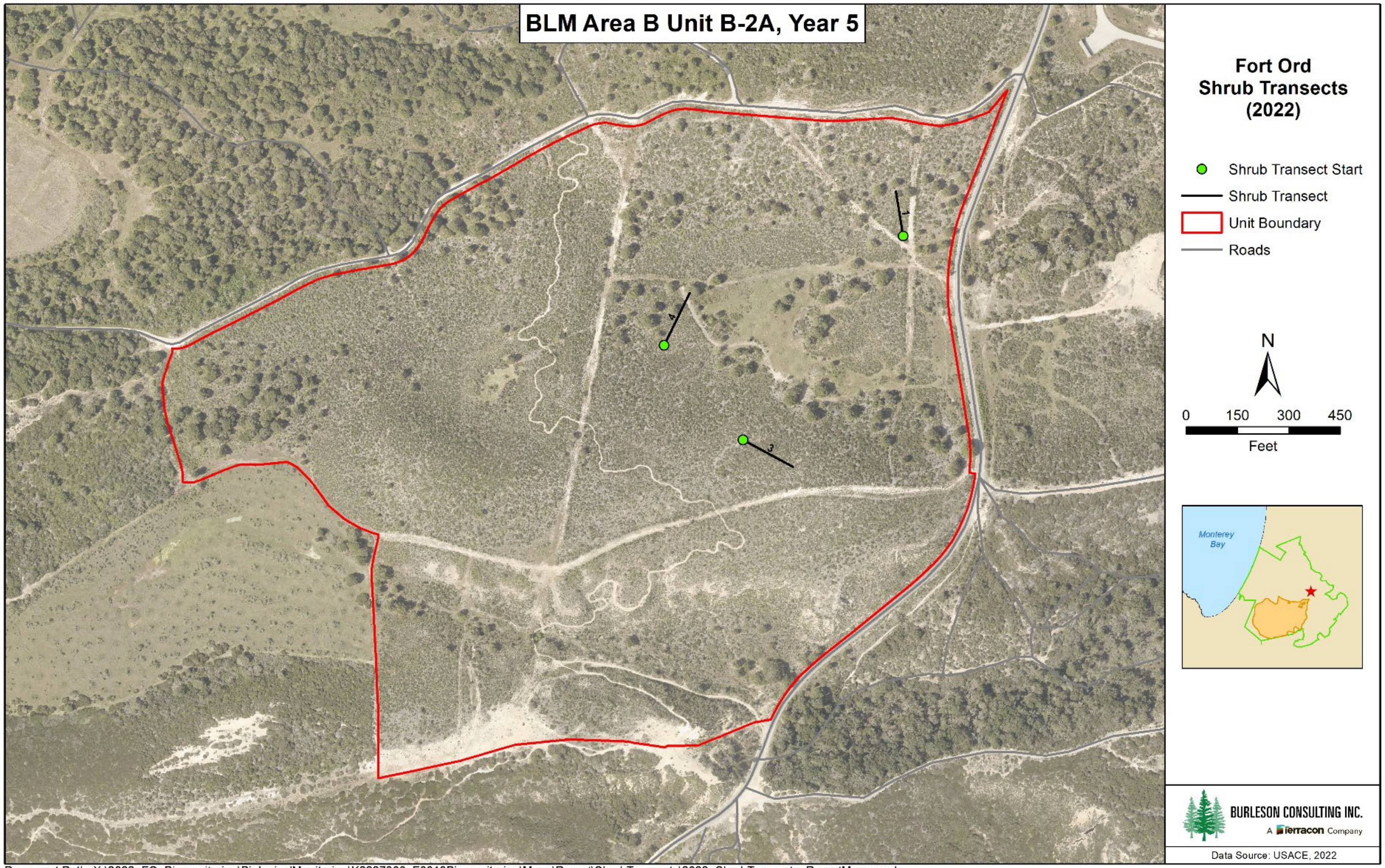

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Figure C-6. Map of Shrub Transects; BLM Area B Unit B-2A (Year 5).

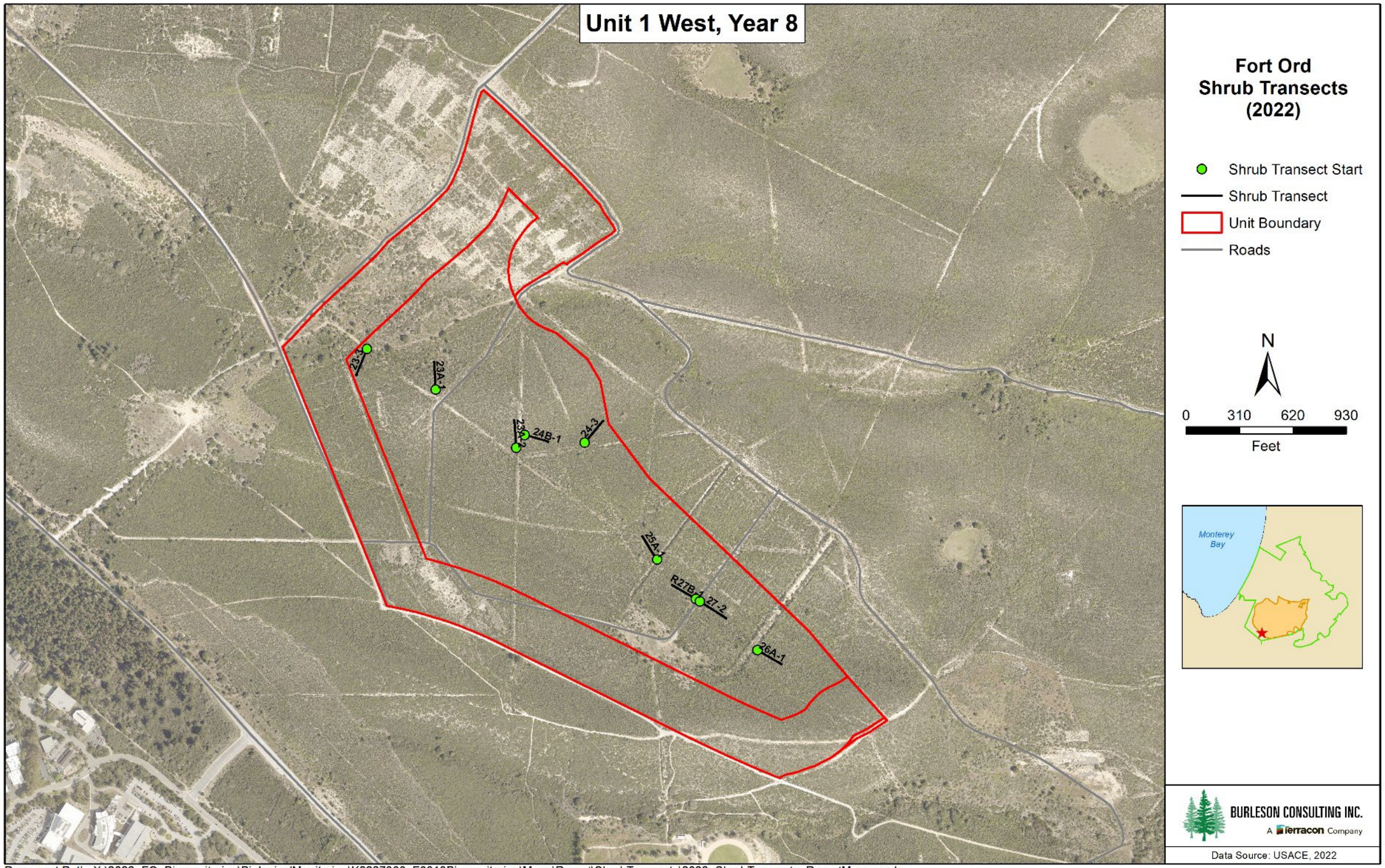

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Figure C-7. Map of Shrub Transects; Unit 1 West (Year 8).

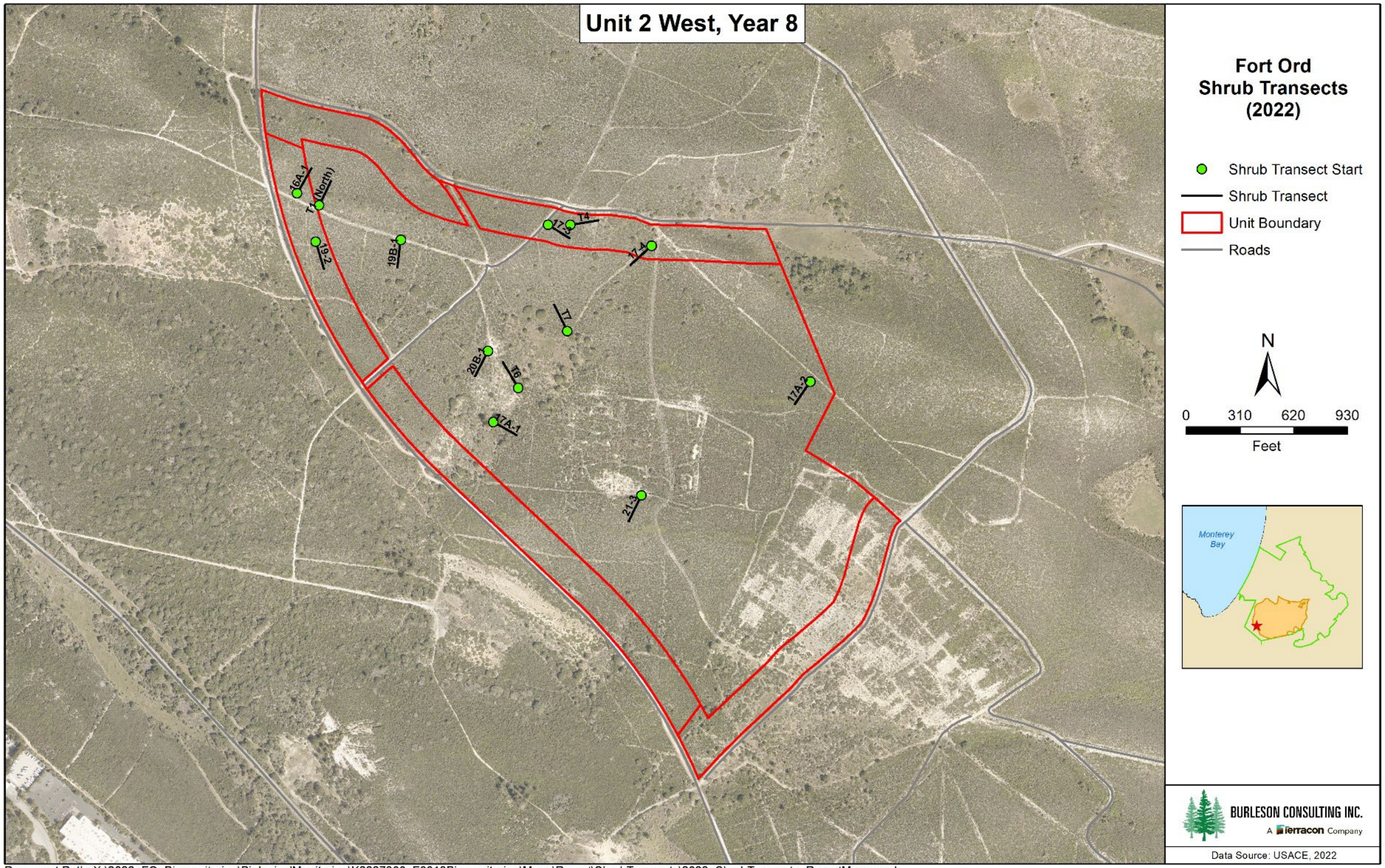

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Figure C-8. Map of Shrub Transects; Unit 2 West (Year 8).

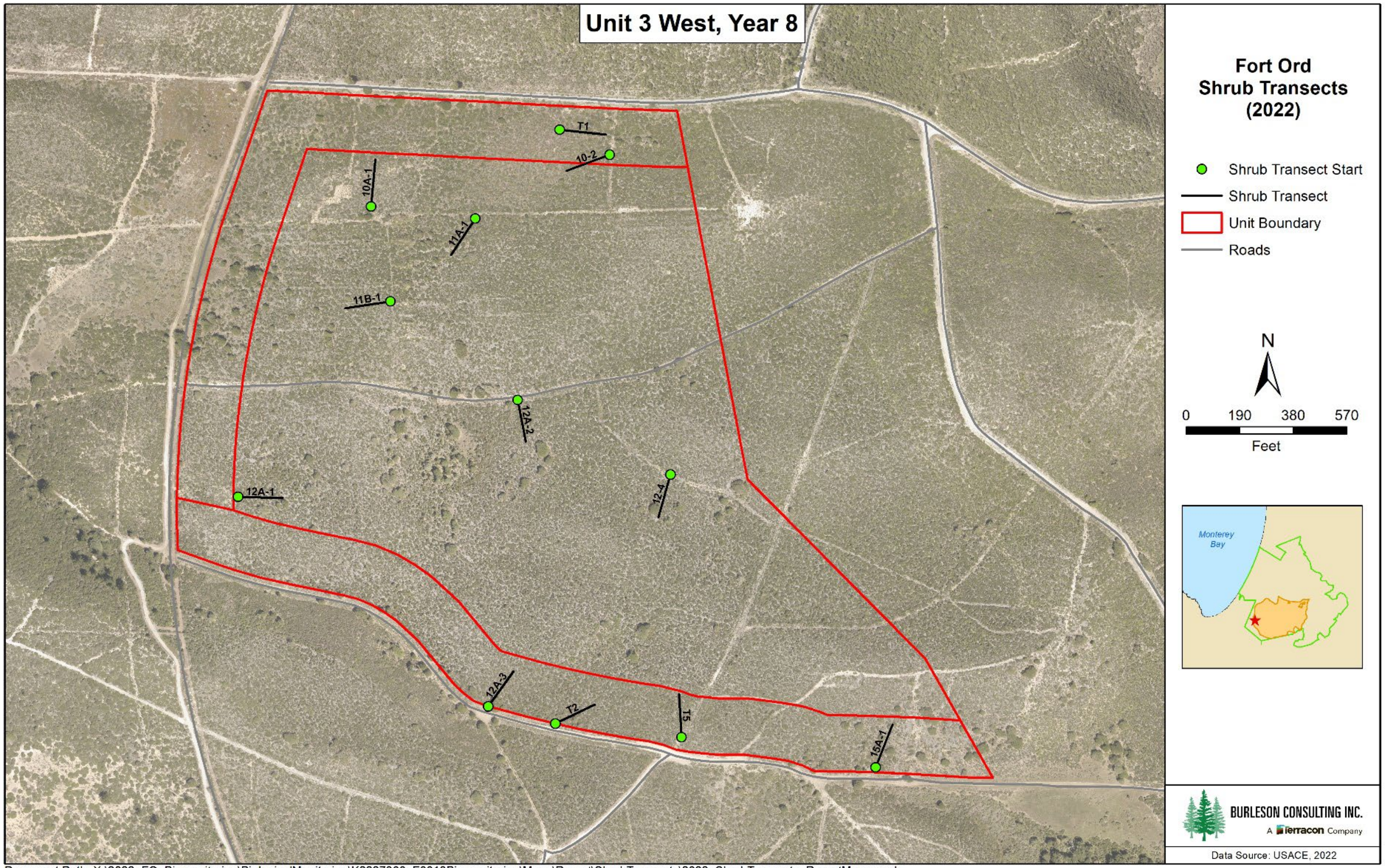

Figure C-9. Map of Shrub Transects; Unit 3 West (Year 8).

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APPENDIX D

MAPS: ANNUAL GRASS DENSITY

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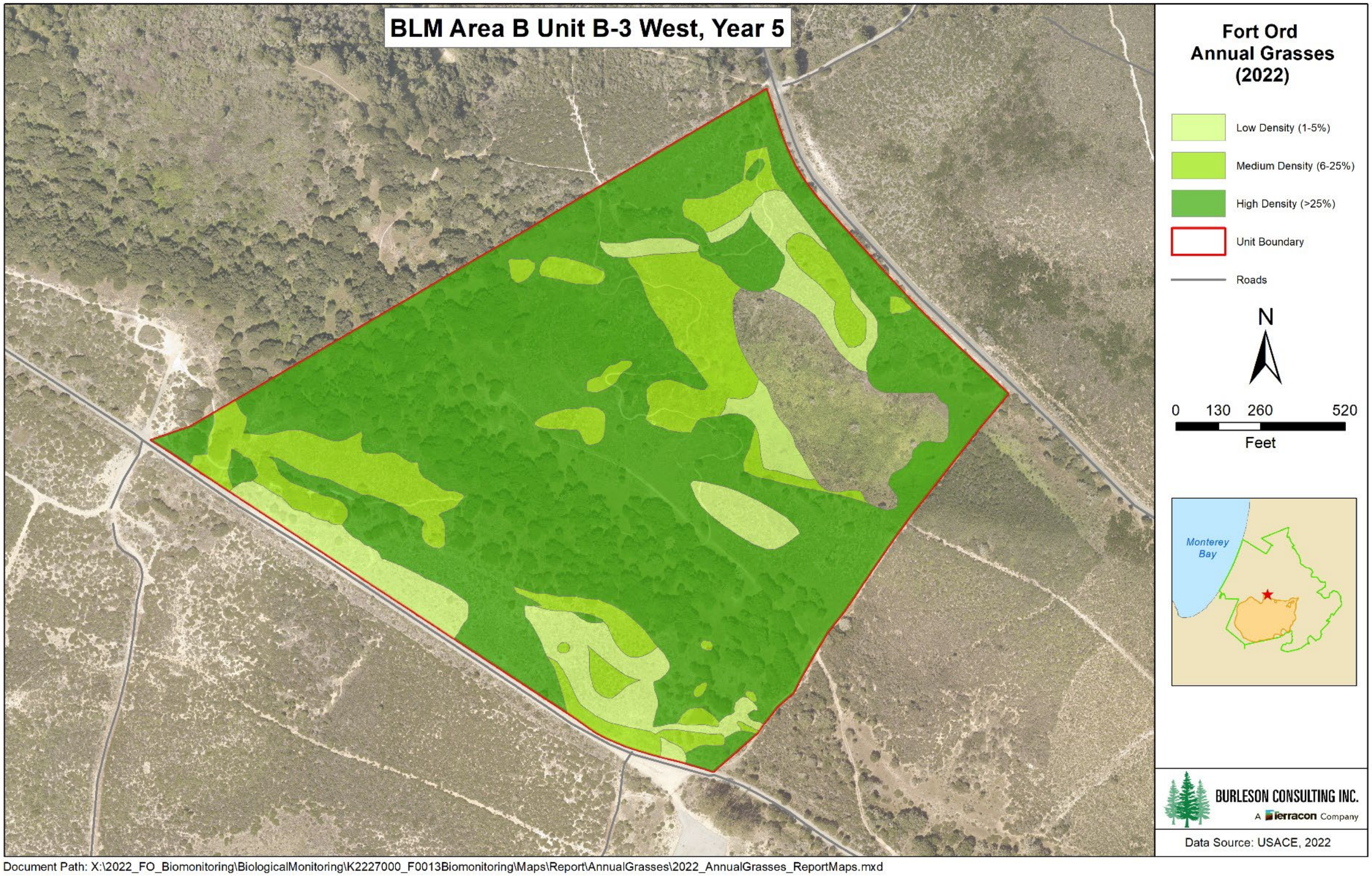

Figure D-1. Map of Annual Grass Density; BLM Area B Unit B-3 West (Year 5).

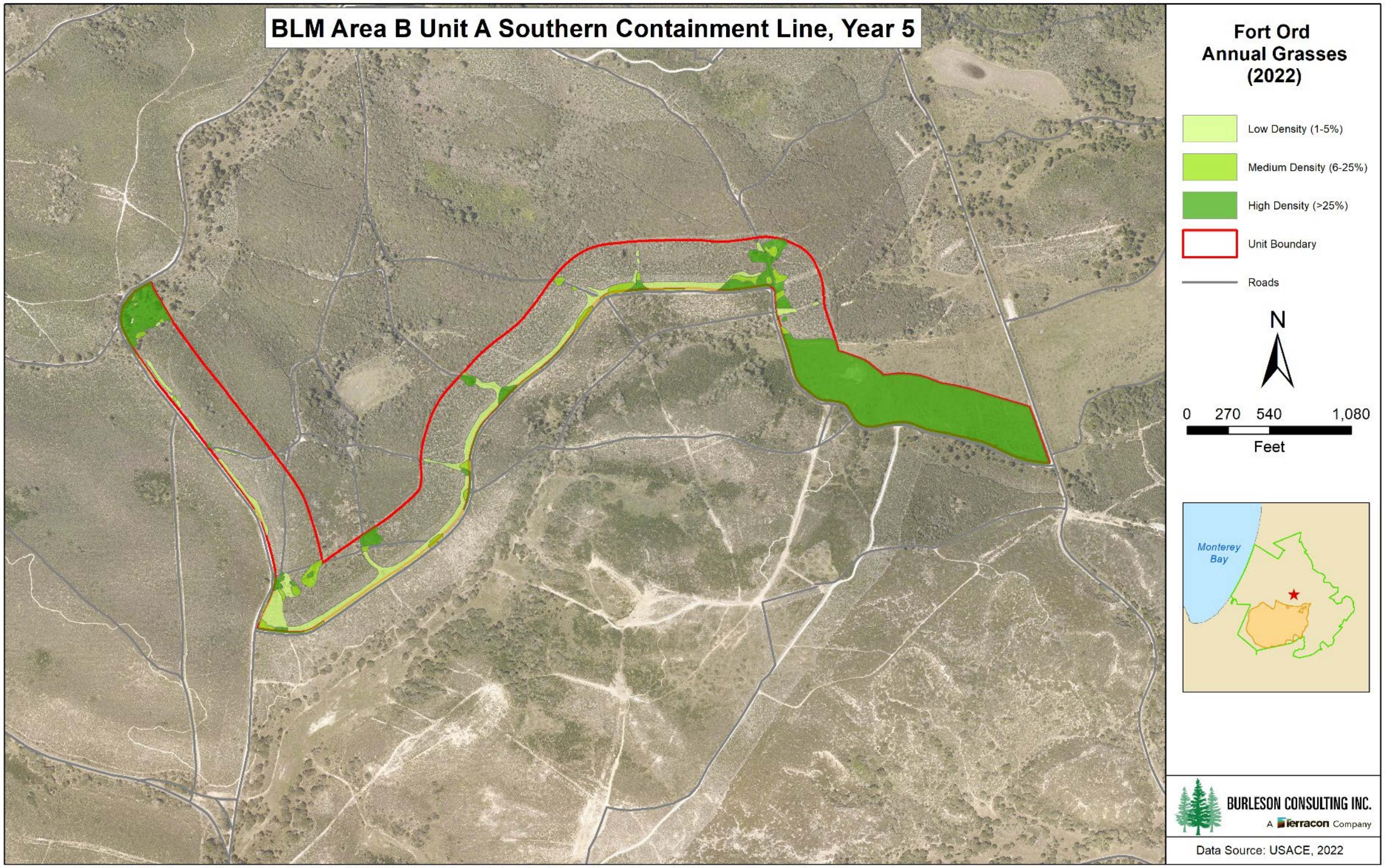

Figure D-2. Map of Annual Grass Density; BLM Area B Unit A Southern Containment Line (Year 5).

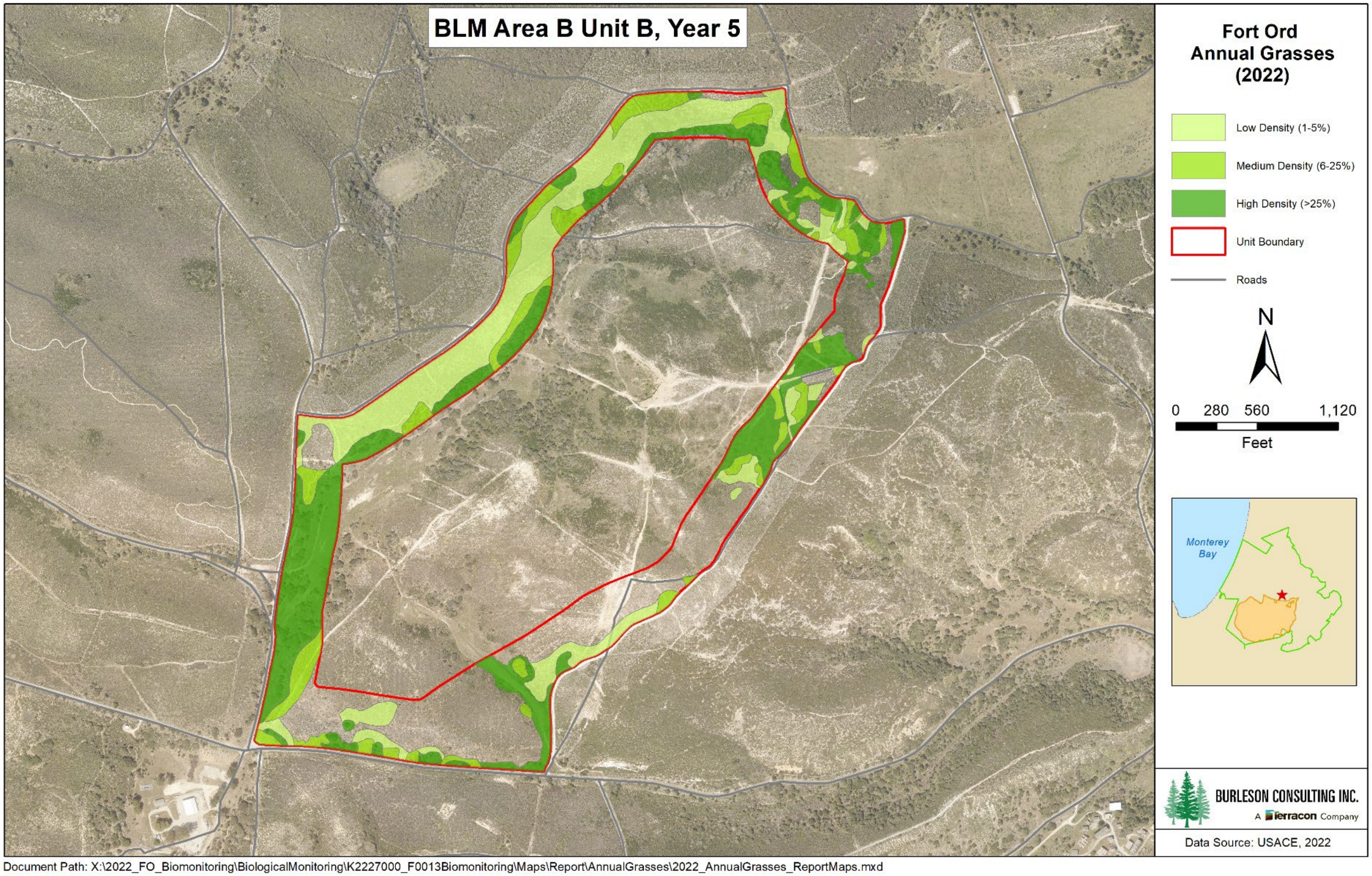

Figure D-3. Map of Annual Grass Density; BLM Area B Unit B (Year 5).

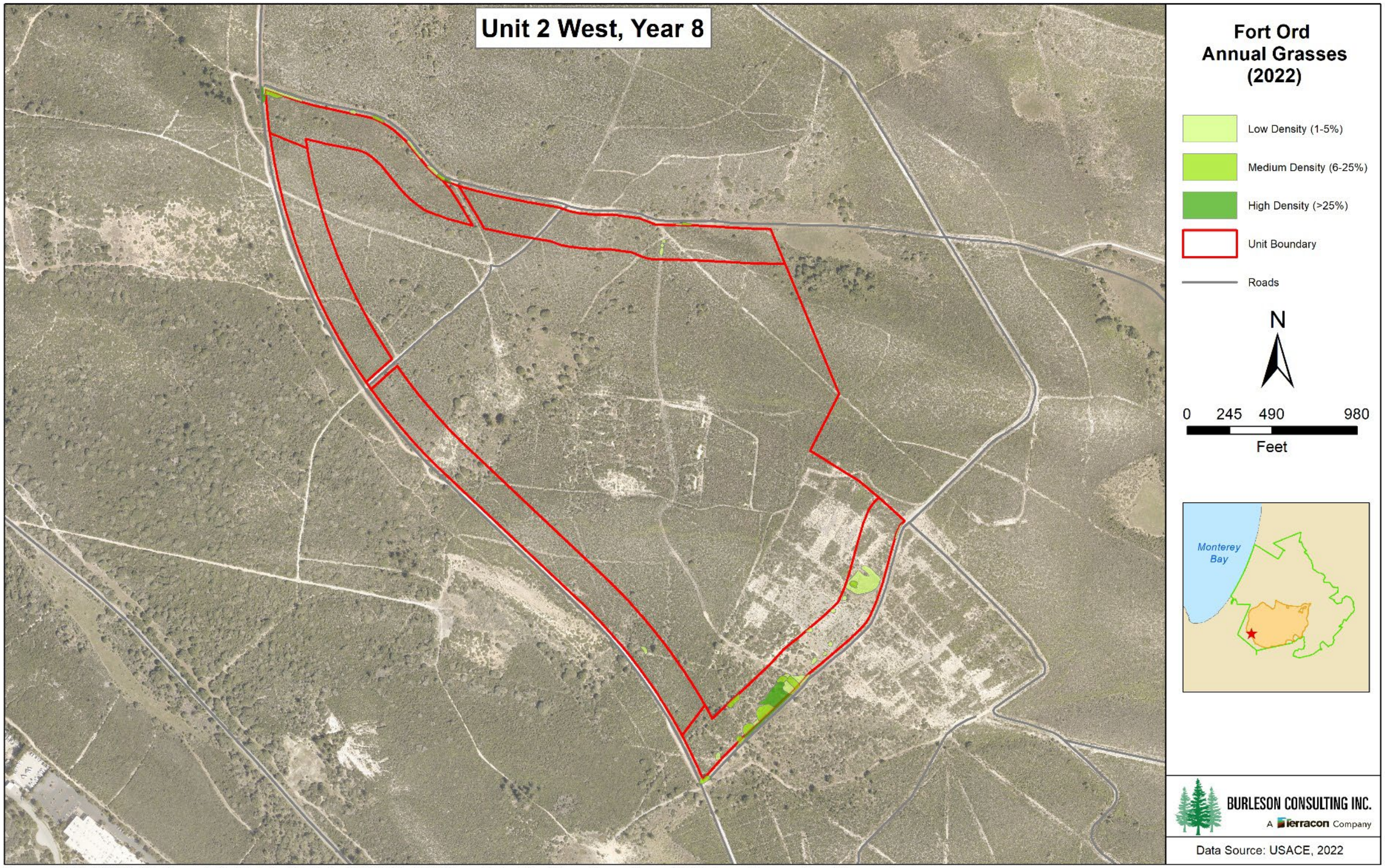

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Figure D-4. Map of Annual Grass Density; Unit 2 West (Year 8).

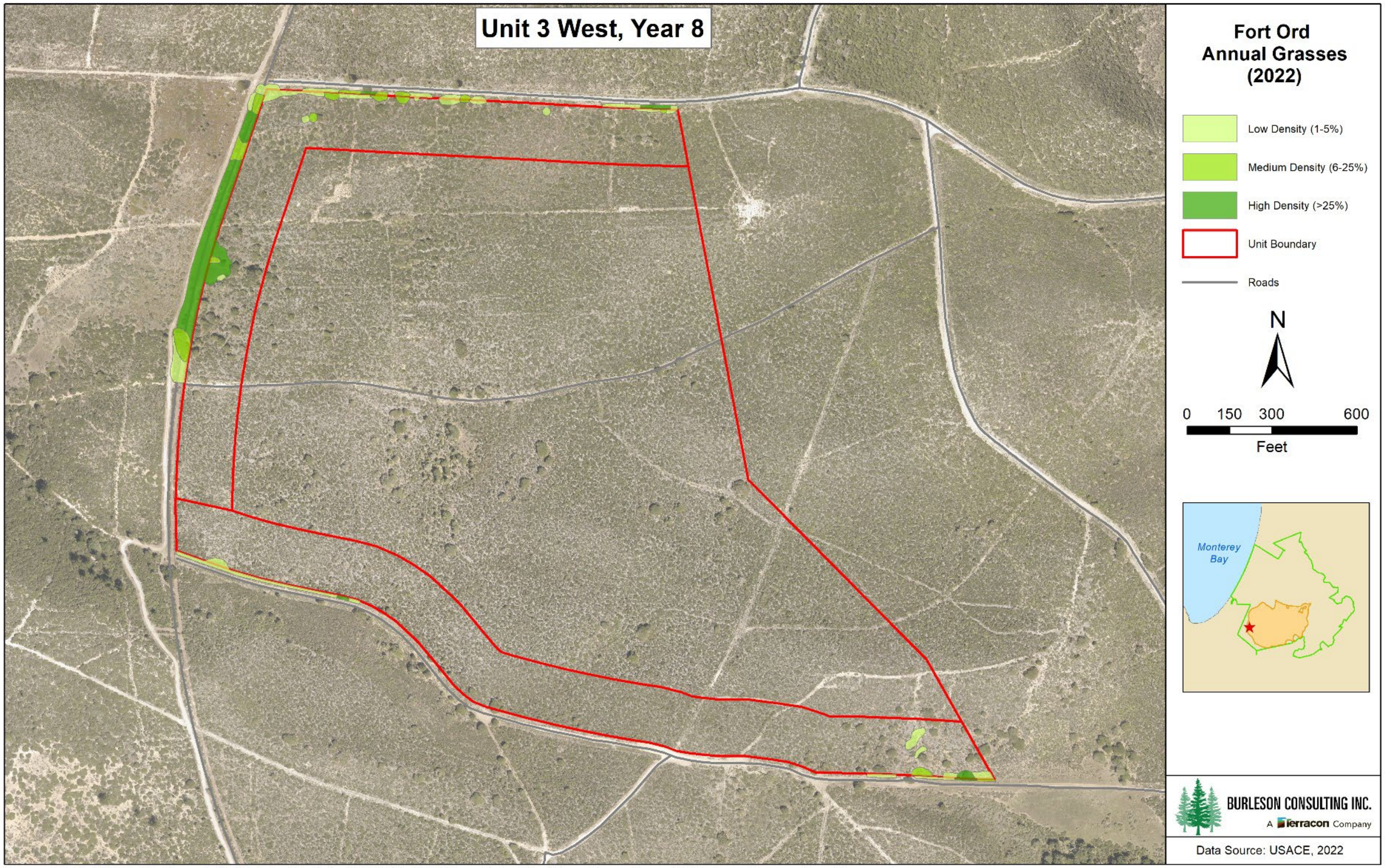

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Figure D-5. Map of Annual Grass Density; Unit 3 West (Year 8).

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APPENDIX E

MAPS: INVASIVE AND RARE SPECIES

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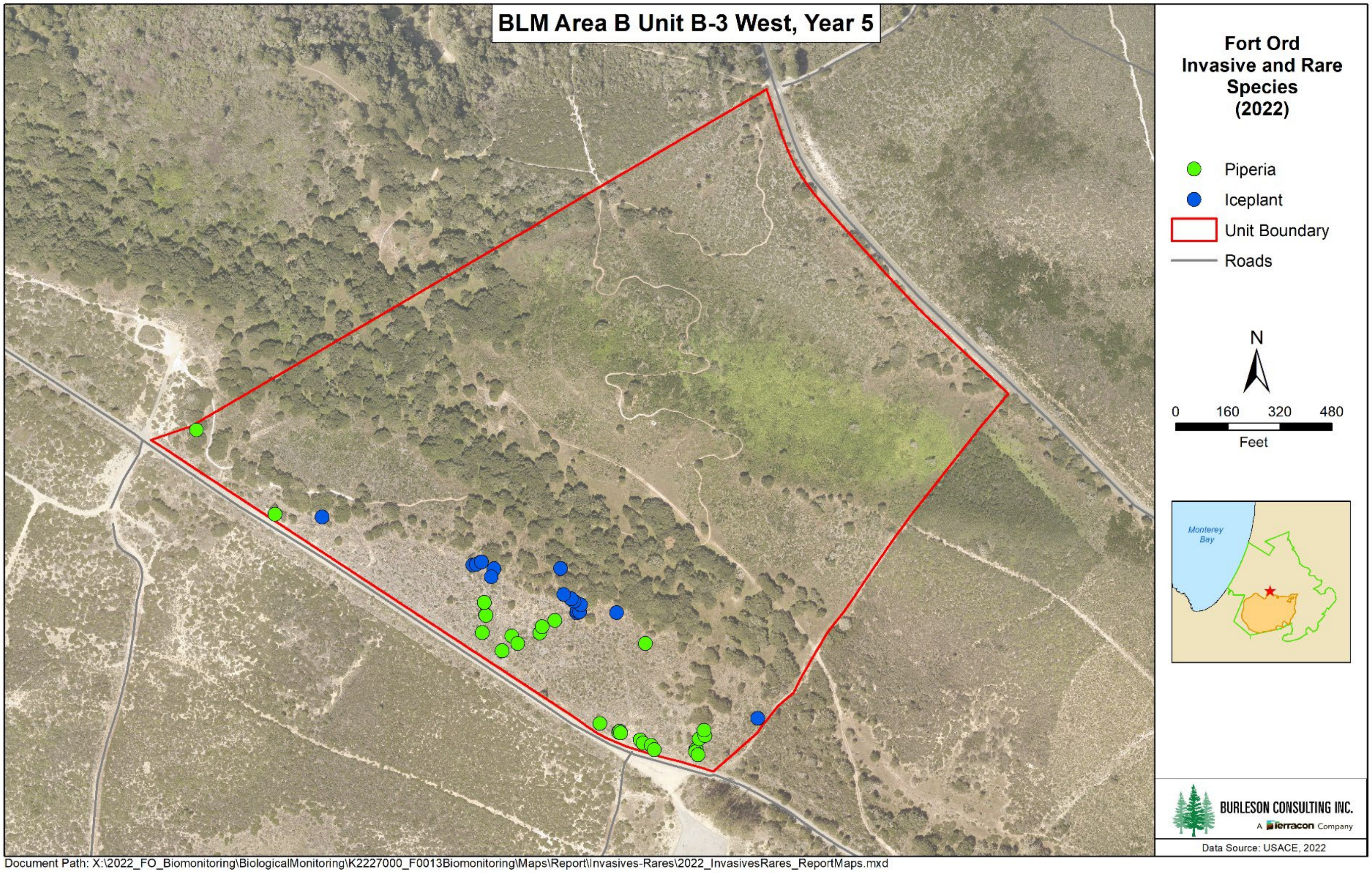

Figure E-1. Map of Invasive and Rare Species; BLM Area B Unit B-3 West (Year 5).

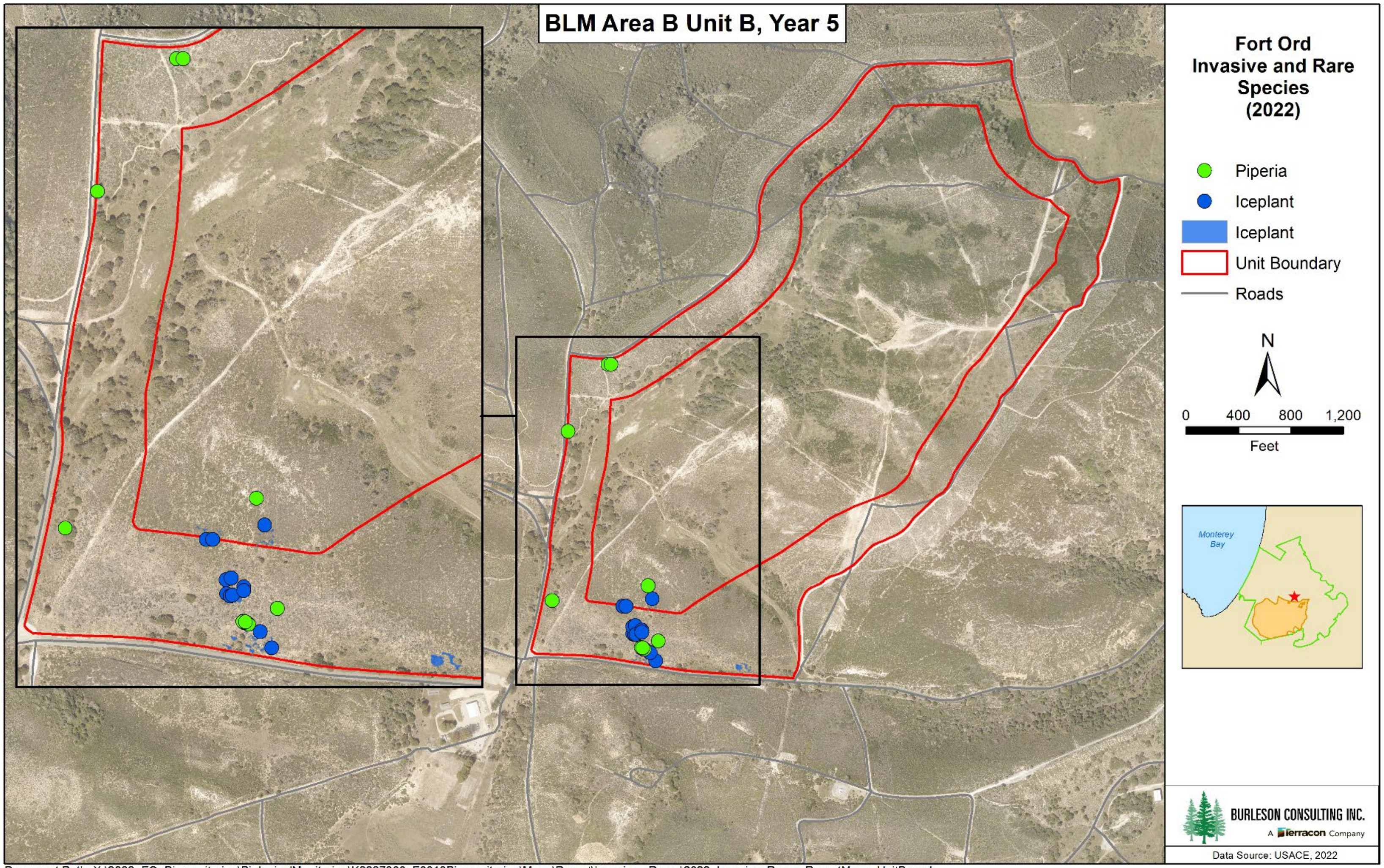

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Figure E-2. Map of Invasive and Rare Species; BLM Area B Unit B (Year 5).

Figure E-3. Map of Invasive and Rare Species; BLM Area B Unit C (Year 5).

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APPENDIX F

SHRUB TRANSECT COVER DATA

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Table F-1. Year 5 Shrub Transects, BLM Area B Unit B-3 West.

		BLM Area B Unit B-3 West					
Code	**Species**	**BLM-B3W-1**	**BLM-B3W-2**	**BLM-B3W-3**	**BLM-B3W-4**	**BLM-B3W-5**	**BLM-B3W-6**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	0.4	2	3.6	1	0.4	6.2
ADFA	*Adenostoma fasciculatum*	10.6	12	2.4	4	12.6	22
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	3.2	0.8	4.4	7.2	2.8	3.8
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	6.6	18.4	11.2	7.8	6	2.6
BAPI	*Baccharis pilularis*	-	-	-	-	-	5.8
CAED	*Carpobrotus edulis*	3.6	0.2	0.4	0.2	-	1.2
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	0
CEDE	*Ceanothus dentatus*	1.2	1	1	0.8	0.4	1.8
CERI	*Ceanothus rigidus*	2.8	2.4	3.2	8.6	2.4	1.6
CETH	*Ceanothus thyrsiflorus*	-	-	-	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	13.8	17.2	16.6	15.8	6.4	7.8
DIAU	*Diplacus aurantiacus*	6	5.6	2.2	0.6	1.2	10
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	3.2	4.2	1	1.4	0.2	1.8
ERER	*Ericameria ericoides*	-	-	0.4	-	-	-
ERFA	*Ericameria fasciculata*	-	-	0.6	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-	-	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	0.2	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	0.8	-	-	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	0.8	0.6	4.2	2.8	3.2	2.4
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	0.8	0.2	-	-	-	-
BG	Bare Ground	54.8	41.8	46.4	54.2	63.8	38.6
HERB	Herbaceous Cover	1.2	2.8	7.2	1.2	6.6	8

Table F-2. Year 5 Shrub Transects, BLM Area B Unit B-3 East.

		BLM Area B Unit B-3 East					
Code	**Species**	**BLM-B3E-1**	**BLM-B3E-10**	**BLM-B3E-11**	**BLM-B3E-2**	**BLM-B3E-3**	**BLM-B3E-4**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	4.4	-	6.8	-	-	-
ADFA	*Adenostoma fasciculatum*	14.6	31.6	29.4	18.8	19.8	40.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	1.8	-	-	-	-	1.4
ARMO	*Arctostaphylos montereyensis*	9.4	0.6	5	-	9.2	1.6
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	26.6	36.2	24.8	10.6	16.2	4.2
BAPI	*Baccharis pilularis*	-	3.2	2	26.8	13	1
CAED	*Carpobrotus edulis*	-	1.6	0.4	1	2.6	-
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	1.8	-	-	-
CERI	*Ceanothus rigidus*	-	1.4	-	0.8	-	-
CETH	*Ceanothus thyrsiflorus*	-	0.6	-	1.8	3.4	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	2.6	0.4	1	-	0.6	-
DIAU	*Diplacus aurantiacus*	-	1	12	0.4	1.8	0.2
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	0.8	2.6	-	-	0.6	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	0.4	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	6.6	5.6	-	-	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	0.4	-	-	-
RIMA	*Ribes malvaceum*	-	0.2	0.2	0.8	-	-
RISP	*Ribes speciosum*	-	-	0.4	0.2	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	5.4	6.8	2.8	-	-	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	10	-	3.8	-
TODI	*Toxicodendron diversilobum*	-	-	5.8	-	1.2	0.2
BG	Bare Ground	40.2	22.8	10.8	34.6	34.6	41.8
HERB	Herbaceous Cover	6.2	7.6	25.6	16.2	7.8	20.8

Table F-2. Year 5 Shrub Transects, BLM Area B Unit B-3 East (cont'd).

		BLM Area B Unit B-3 East				
Code	**Species**	**BLM-B3E-5**	**BLM-B3E-6**	**BLM-B3E-7**	**BLM-B3E-8**	**BLM-B3E-9**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-	-	0.2	-
ADFA	*Adenostoma fasciculatum*	40	4.8	56.2	65.8	34.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	0.8	-	-
ARMO	*Arctostaphylos montereyensis*	0.8	1	-	8.4	0.4
ARPU	*Arctostaphylos pumila*	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	2.4	52.4	7.2	2.2	38
BAPI	*Baccharis pilularis*	1.4	0.2	-	0.2	0.4
CAED	*Carpobrotus edulis*	-	-	-	-	-
CAFO2	*Castilleja foliolosa*	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	-	-
CERI	*Ceanothus rigidus*	-	-	-	-	-
CETH	*Ceanothus thyrsiflorus*	-	2.2	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	2.6	0.6	-	-
DIAU	*Diplacus aurantiacus*	1	-	-	2	5.6
ERCA	*Eriodictyon californicum*	-	4	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	0.2	1.6	-	1.6
ERER	*Ericameria ericoides*	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	0.6	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-
LECA	*Lepechinia calycina*	-	3.8	-	0.6	1
LUCH	*Lupinus chamissonis*	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	0.2	-
RIMA	*Ribes malvaceum*	1.4	-	-	-	0.8
RISP	*Ribes speciosum*	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-
SAME	*Salvia mellifera*	-	3.8	-	1	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	0.4	-
TODI	*Toxicodendron diversilobum*	-	-	0.6	-	-
BG	Bare Ground	36	29.8	25.4	23.2	26
HERB	Herbaceous Cover	29.6	3.6	36.2	13.8	11.6

Table F-3. Year 5 Shrub Transects, BLM Area B Unit A.

		BLM Area B Unit A					
Code	**Species**	**BLMB_A-10**	**BLMB_A-11**	**BLMB_A-12**	**BLMB_A-2**	**BLMB_A-6**	**BLMB_A-8**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-	-	-	-	-
ADFA	*Adenostoma fasciculatum*	1.2	3.8	3.4	9.8	7.6	4.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	0.2	-	-	-	0.2	1
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	1
ARPU	*Arctostaphylos pumila*	-	-	-	5.6	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	70	58.4	61	33.6	60.6	51.4
BAPI	*Baccharis pilularis*	6.4	-	-	-	0.8	-
CAED	*Carpobrotus edulis*	-	0.6	-	-	-	-
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	3	-	1.2	-	-
CERI	*Ceanothus rigidus*	-	-	-	-	-	-
CETH	*Ceanothus thyrsiflorus*	-	-	-	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	0.8	0.8	4.8	-	-
DIAU	*Diplacus aurantiacus*	5.4	0.4	2.2	1.2	-	1.4
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	6.6	-	0.2
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	0.8	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	3.8	-	4.6	-	1.4	0.2
HEAR	*Heteromeles arbutifolia*	3.8	-	-	-	-	-
LECA	*Lepechinia calycina*	-	10.2	3	-	0.2	0.4
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	5.4	-	-	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	-	2	-	6.4	-	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	0.4	-	-	-	-
TODI	*Toxicodendron diversilobum*	4.2	2.8	-	-	-	-
BG	Bare Ground	16.4	29.8	31	34.4	35.6	40.8
HERB	Herbaceous Cover	1.2	-	0.8	1.2	-	1.6

Table F-3. Year 5 Shrub Transects, BLM Area B Unit A (cont'd).

		BLM Area B Unit A
Code	**Species**	**BLMB_A-9**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-
ADFA	*Adenostoma fasciculatum*	4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	2.2
ARMO	*Arctostaphylos montereyensis*	0.8
ARPU	*Arctostaphylos pumila*	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	60.4
BAPI	*Baccharis pilularis*	2.6
CAED	*Carpobrotus edulis*	-
CAFO2	*Castilleja foliolosa*	-
CEDE	*Ceanothus dentatus*	-
CERI	*Ceanothus rigidus*	-
CETH	*Ceanothus thyrsiflorus*	1.6
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	0.8
DIAU	*Diplacus aurantiacus*	4
ERCA	*Eriodictyon californicum*	-
ERCO	*Eriophyllum confertiflorum*	0.2
ERER	*Ericameria ericoides*	-
ERFA	*Ericameria fasciculata*	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-
FRCA2	*Fremontodendron californicum*	-
GAEL	*Garrya elliptica*	-
HEAR	*Heteromeles arbutifolia*	-
LECA	*Lepechinia calycina*	3.4
LUCH	*Lupinus chamissonis*	-
LUXX	*Lupinus* sp.	-
PIRA	*Pinus radiata*	-
PIXX	*Piperia* sp.	-
QUAG	*Quercus agrifolia*	2.8
RIMA	*Ribes malvaceum*	-
RISP	*Ribes speciosum*	-
RUUR	*Rubus ursinus*	-
SAME	*Salvia mellifera*	-
SOUM	*Solanum umbelliferum*	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-
TODI	*Toxicodendron diversilobum*	2.6
BG	Bare Ground	20.8
HERB	Herbaceous Cover	9.2

Table F-4. Year 5 Shrub Transects, BLM Area B Unit B.

		BLM Area B Unit B					
Code	**Species**	**BLMB_B-10**	**BLMB_B-11**	**BLMB_B-12**	**BLMB_B-13**	**BLMB_B-14**	**BLMB_B-15**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	13.8	-	4.4	1.4	20.6	2.2
ADFA	*Adenostoma fasciculatum*	8	-	1.2	-	2.6	0.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	3.4	-	-	9.6	0.8
ARMO	*Arctostaphylos montereyensis*	0.8	-	-	-	-	0.6
ARPU	*Arctostaphylos pumila*	-	0.4	-	1	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	5.2	10.6	31.8	24.2	5.4	24.4
BAPI	*Baccharis pilularis*	0.2	1.8	-	0.8	0.2	-
CAED	*Carpobrotus edulis*	22.4	-	1	2.8	0.6	1.6
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	68.6	13.6	26.2	10.4	15.6
CERI	*Ceanothus rigidus*	7	4	3	9.6	9.8	8
CETH	*Ceanothus thyrsiflorus*	-	-	5.4	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	32.8	9	21.8	14.2	24	34.2
DIAU	*Diplacus aurantiacus*	0.6	1	-	-	-	-
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	2	-	-	1.8	1	1.6
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	1.8	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	0.2	0.4	-	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	2.4	-	-	-	-	5
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-	-	-
BG	Bare Ground	26.4	20.2	34	25.4	25.6	27
HERB	Herbaceous Cover	4.4	-	2.2	10.6	10	2

Table F-4. Year 5 Shrub Transects, BLM Area B Unit B (cont'd).

		BLM Area B Unit B					
Code	**Species**	**BLMB_B-16**	**BLMB_B-17**	**BLMB_B-18**	**BLMB_B-19**	**BLMB_B-20**	**BLMB_B-21**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	0.2	3.6	6	-	-	1
ADFA	*Adenostoma fasciculatum*	12.8	3.2	-	0.8	-	-
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	24.6	6.6	0.8	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	0.2
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	-	2	-	21.2	15.6	12.6
BAPI	*Baccharis pilularis*	1.2	-	4.8	-	-	-
CAED	*Carpobrotus edulis*	2.4	-	0.6	-	3.6	4
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	6.2	-	-	45.6	54	3.6
CERI	*Ceanothus rigidus*	10	11.2	1.8	1.6	5.2	12.2
CETH	*Ceanothus thyrsiflorus*	6.6	26.4	49.2	0.6	2.2	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	1.8	23.6	2.4	7.8	9.8	5
DIAU	*Diplacus aurantiacus*	1.4	-	-	-	-	-
ERCA	*Eriodictyon californicum*	-	5	8.6	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	1.8	1.6	-	-	0.2
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	8.8	10.4	-	1.4	-
GAEL	*Garrya elliptica*	-	-	-	3.6	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	1.4	9.8	3	-	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	0.2
SAME	*Salvia mellifera*	-	-	-	-	0.2	-
SOUM	*Solanum umbelliferum*	-	-	1.2	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	1.8	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	0.2	-	-	-
BG	Bare Ground	29	29.8	24.8	32.6	22.8	52
HERB	Herbaceous Cover	18	0.8	2.6	-	0.4	16.4

Table F-4. Year 5 Shrub Transects, BLM Area B Unit B (cont'd).

		BLM Area B Unit B					
Code	**Species**	**BLMB_B-22**	**BLMB_B-23**	**BLMB_B-24**	**BLMB_B-25**	**T1**	**T2**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	1.8	2.8	7.8	-	16.8	22.4
ADFA	*Adenostoma fasciculatum*	2.4	1.6	9	10.2	10	4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	3.2	1	0.4
ARMO	*Arctostaphylos montereyensis*	-	-	0.2	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	25.2	7.2	7.8	5	4.6	1.8
BAPI	*Baccharis pilularis*	1.2	-	1.4	-	-	7.6
CAED	*Carpobrotus edulis*	2.2	0.6	-	-	3	9.8
CAFO2	*Castilleja foliolosa*	-	-	-	-	0.6	-
CEDE	*Ceanothus dentatus*	10.4	29.8	12.6	26.2	1	-
CERI	*Ceanothus rigidus*	14.4	2	4.8	2	1	0.2
CETH	*Ceanothus thyrsiflorus*	-	4.2	-	26	13	35.2
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	7	18	41.8	1.4	11.4	10.2
DIAU	*Diplacus aurantiacus*	-	-	-	-	2	1.2
ERCA	*Eriodictyon californicum*	-	-	-	-	-	28.2
ERCO	*Eriophyllum confertiflorum*	-	2	3.2	0.2	3.6	0.4
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	0.6
GAEL	*Garrya elliptica*	-	-	-	-	1	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	10	4.8	-	16.4	-	0.2
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	0.6	-	3.8	-	-	0.4
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	12.8	0.4	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-	-	-	-
BG	Bare Ground	34	40.8	24.4	12.2	29	13.2
HERB	Herbaceous Cover	9	1.4	2.2	16.2	18.8	7.8

Table F-4. Year 5 Shrub Transects, BLM Area B Unit B (cont'd).

		BLM Area B Unit B					
Code	**Species**	**BLMB_B-1**	**BLMB_B-2**	**BLMB_B-3**	**BLMB_B-4**	**BLMB_B-5**	**BLMB_B-6**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	0.4	-	-	-	-	-
ADFA	*Adenostoma fasciculatum*	6.4	5.2	-	1.8	-	6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	1.4	2.2	-	4.4	1.8	1.4
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	0.2	1
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	14.6	14.2	11.8	8.8	5.2	48
BAPI	*Baccharis pilularis*	1.4	1	1.8	1	-	-
CAED	*Carpobrotus edulis*	-	1.2	-	-	-	-
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	3	5.2	60	9.4	71.2	-
CERI	*Ceanothus rigidus*	0.4	5.8	12.4	12.6	3.2	-
CETH	*Ceanothus thyrsiflorus*	1.4	37.2	10.4	10	3	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	47.8	7.2	3.2	28.4	7.4	-
DIAU	*Diplacus aurantiacus*	-	-	-	1.2	-	-
ERCA	*Eriodictyon californicum*	-	5.6	-	5.2	-	-
ERCO	*Eriophyllum confertiflorum*	16.4	10.8	-	7.4	-	0.6
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	4	-	-	-	-
GAEL	*Garrya elliptica*	-	4.6	-	-	-	0.2
HEAR	*Heteromeles arbutifolia*	-	-	-	-	1.4	-
LECA	*Lepechinia calycina*	6.2	8.2	0.6	5	0.4	0.4
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	0.2	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	-	1	-	-	-	1.4
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	3.8	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	4	-	-	-
BG	Bare Ground	22.6	16.2	20	19	18.2	44.2
HERB	Herbaceous Cover	2.2	6.4	0.2	2	-	0.6

Table F-4. Year 5 Shrub Transects, BLM Area B Unit B (cont'd).

		BLM Area B Unit B	
Code	**Species**	**BLMB_B-7**	**BLMB_B-9**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	0.4	-
ADFA	*Adenostoma fasciculatum*	2	2
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-
ARMO	*Arctostaphylos montereyensis*	-	-
ARPU	*Arctostaphylos pumila*	3.6	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	13.2	37.6
BAPI	*Baccharis pilularis*	-	0.2
CAED	*Carpobrotus edulis*	-	1.6
CAFO2	*Castilleja foliolosa*	-	-
CEDE	*Ceanothus dentatus*	-	11.2
CERI	*Ceanothus rigidus*	1.4	2.8
CETH	*Ceanothus thyrsiflorus*	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	0.4	9.4
DIAU	*Diplacus aurantiacus*	-	-
ERCA	*Eriodictyon californicum*	-	-
ERCO	*Eriophyllum confertiflorum*	6.4	-
ERER	*Ericameria ericoides*	-	-
ERFA	*Ericameria fasciculata*	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-
FRCA2	*Fremontodendron californicum*	-	-
GAEL	*Garrya elliptica*	-	-
HEAR	*Heteromeles arbutifolia*	-	-
LECA	*Lepechinia calycina*	-	1.2
LUCH	*Lupinus chamissonis*	2.2	-
LUXX	*Lupinus* sp.	-	-
PIRA	*Pinus radiata*	-	-
PIXX	*Piperia* sp.	-	-
QUAG	*Quercus agrifolia*	-	-
RIMA	*Ribes malvaceum*	-	-
RISP	*Ribes speciosum*	-	-
RUUR	*Rubus ursinus*	-	-
SAME	*Salvia mellifera*	-	7
SOUM	*Solanum umbelliferum*	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-
TODI	*Toxicodendron diversilobum*	1.2	-
BG	Bare Ground	65	41.4
HERB	Herbaceous Cover	10.2	-

Table F-5. Year 5 Shrub Transects, BLM Area B Unit C.

		BLM Area B Unit C					
Code	**Species**	**BLMB_C-1**	**BLMB_C-10**	**BLMB_C-12**	**BLMB_C-13**	**BLMB_C-14**	**BLMB_C-2**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	1	-	10	1.2	-	2.2
ADFA	*Adenostoma fasciculatum*	5.8	-	6.4	18.4	3.8	6.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	0.2	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	0.4	-	-
ARPU	*Arctostaphylos pumila*	0.4	-	-	-	-	4
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	13.2	33.6	34.4	14	35.2	3.2
BAPI	*Baccharis pilularis*	-	0.4	-	-	-	-
CAED	*Carpobrotus edulis*	-	-	-	-	0.6	-
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	13.6	15.2	9.8	6.4	4.2	17.4
CERI	*Ceanothus rigidus*	11.2	4	2	5	2.4	7.6
CETH	*Ceanothus thyrsiflorus*	-	0.6	-	1.2	4.2	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	41.6	9.6	31.4	20.6	-	62.6
DIAU	*Diplacus aurantiacus*	-	0.8	-	-	-	-
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	1.8	-	-	-	-	0.8
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	2.6	5	-
HEAR	*Heteromeles arbutifolia*	-	-	-	3.9	10.6	-
LECA	*Lepechinia calycina*	-	11	0.2	1	12.4	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	1	-	0.2	9	-	4.4
SOUM	*Solanum umbelliferum*	-	0.6	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	-	2.4	-
TODI	*Toxicodendron diversilobum*	-	1.8	-	-	-	-
BG	Bare Ground	28.4	26.2	29.6	34.2	30.8	21.8
HERB	Herbaceous Cover	0.32	7.6	0.8	1.6	-	0.6

Table F-5. Year 5 Shrub Transects, BLM Area B Unit C (cont'd).

		BLM Area B Unit C					
Code	**Species**	**BLMB_C-3**	**BLMB_C-4**	**BLMB_C-7**	**BLMB_C-8**	**BLMB_C-9**	**Transect 2**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-	0.4	-	0.4	-
ADFA	*Adenostoma fasciculatum*	0.4	2.4	5.4	1	9	17.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	0.2	-	-	-	-	2
ARMO	*Arctostaphylos montereyensis*	1.6	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	1.2	0.4	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	15	16.6	24.4	11.8	11.8	30.6
BAPI	*Baccharis pilularis*	-	-	-	0.6	0.6	0.4
CAED	*Carpobrotus edulis*	-	-	0.2	-	0.4	-
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	36	26.2	23.4	34	31.8	2.2
CERI	*Ceanothus rigidus*	6	8.8	2.2	-	6	-
CETH	*Ceanothus thyrsiflorus*	17.4	-	-	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	17.4	32.8	43	13.4	54	-
DIAU	*Diplacus aurantiacus*	-	-	-	1.4	0.2	0.8
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	2.2	2.2	-	0.4	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	-	-	-	0.2
HEAR	*Heteromeles arbutifolia*	-	-	-	0.2	0.4	0.6
LECA	*Lepechinia calycina*	1	0.2	3.4	14.2	-	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	1.2	2
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	0.2
SAME	*Salvia mellifera*	5.8	2.8	0.4	-	0.4	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	1	-	26.8
TODI	*Toxicodendron diversilobum*	0.2	-	-	3.6	-	1.8
BG	Bare Ground	20.2	26.2	21.6	28.2	18	27
HERB	Herbaceous Cover	1	2.8	3.2	6.6	2.2	14.4

Table F-5. Year 5 Shrub Transects, BLM Area B Unit C (cont'd).

		BLM Area B Unit C	
Code	**Species**	**Transect 3**	**Transect 4**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-
ADFA	*Adenostoma fasciculatum*	21	5.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	1.6	0.2
ARMO	*Arctostaphylos montereyensis*	-	-
ARPU	*Arctostaphylos pumila*	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	32.8	63.4
BAPI	*Baccharis pilularis*	0.2	3.2
CAED	*Carpobrotus edulis*	-	-
CAFO2	*Castilleja foliolosa*	-	-
CEDE	*Ceanothus dentatus*	2.6	0.4
CERI	*Ceanothus rigidus*	-	0.8
CETH	*Ceanothus thyrsiflorus*	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	-
DIAU	*Diplacus aurantiacus*	0.6	3.4
ERCA	*Eriodictyon californicum*	-	-
ERCO	*Eriophyllum confertiflorum*	-	-
ERER	*Ericameria ericoides*	-	-
ERFA	*Ericameria fasciculata*	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-
FRCA2	*Fremontodendron californicum*	-	-
GAEL	*Garrya elliptica*	-	1.4
HEAR	*Heteromeles arbutifolia*	-	5.4
LECA	*Lepechinia calycina*	-	0.6
LUCH	*Lupinus chamissonis*	-	-
LUXX	*Lupinus* sp.	-	-
PIRA	*Pinus radiata*	-	-
PIXX	*Piperia* sp.	-	-
QUAG	*Quercus agrifolia*	7	-
RIMA	*Ribes malvaceum*	-	-
RISP	*Ribes speciosum*	-	-
RUUR	*Rubus ursinus*	-	-
SAME	*Salvia mellifera*	-	0.2
SOUM	*Solanum umbelliferum*	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	29.2	-
TODI	*Toxicodendron diversilobum*	1.6	2.8
BG	Bare Ground	30.8	21.8
HERB	Herbaceous Cover	7.6	-

Table F-6. Year 5 Shrub Transects, Unit B-2A.

Code	Species	Unit B-2A Transect 1	Unit B-2A Transect 3	Unit B-2A Transect 4
ACGL	*Acmispon glaber* (*Lotus scoparius*)	3	-	-
ADFA	*Adenostoma fasciculatum*	38.6	10.4	54
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	0.6
ARPU	*Arctostaphylos pumila*	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	12.4	54	15
BAPI	*Baccharis pilularis*	-	-	-
CAED	*Carpobrotus edulis*	-	-	-
CAFO2	*Castilleja foliolosa*	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-
CERI	*Ceanothus rigidus*	-	-	0.2
CETH	*Ceanothus thyrsiflorus*	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	-	-
DIAU	*Diplacus aurantiacus*	-	2.2	1.4
ERCA	*Eriodictyon californicum*	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	0.4
ERER	*Ericameria ericoides*	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-
GAEL	*Garrya elliptica*	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-
LECA	*Lepechinia calycina*	-	3.4	-
LUCH	*Lupinus chamissonis*	-	-	-
LUXX	*Lupinus* sp.	-	-	-
PIRA	*Pinus radiata*	-	-	-
PIXX	*Piperia* sp.	-	-	-
QUAG	*Quercus agrifolia*	23.8	-	0.6
RIMA	*Ribes malvaceum*	-	-	-
RISP	*Ribes speciosum*	-	-	0.6
RUUR	*Rubus ursinus*	-	-	-
SAME	*Salvia mellifera*	12.6	-	-
SOUM	*Solanum umbelliferum*	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	1.4
BG	Bare Ground	26.2	32	20.6
HERB	Herbaceous Cover	3	5.6	21.4

Table F-7. Year 8 Shrub Transects, Unit 1 West.

		Unit 1 West					
Code	**Species**	**23-3**	**23A-1**	**23A-2**	**24-3**	**24B-1**	**25A-1**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-	-	-	-	-
ADFA	*Adenostoma fasciculatum*	14.4	9.2	13.8	11.2	19.8	8.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	5.8	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	57.2	47.2	70.2	31.2	63.2	57.4
BAPI	*Baccharis pilularis*	3.6	10.4	3.4	3.2	-	0.6
CAED	*Carpobrotus edulis*	-	-	-	17	-	2
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	5	19	5	0.2	3.6	4.2
CERI	*Ceanothus rigidus*	0.6	1.6	0.6	12.6	3.8	-
CETH	*Ceanothus thyrsiflorus*	-	-	-	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	0.2	-	-	-	1.2
DIAU	*Diplacus aurantiacus*	-	2	-	0.8	-	-
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	1.2	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	1	-	1.8	0.2
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	0.4	0.6	1	4.4	-	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	1	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	9.2	5.6	5.2	20.8	4.8	21.4
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	-	5.8	-
TODI	*Toxicodendron diversilobum*	-	2.4	-	-	-	-
BG	Bare Ground	18	13.8	17.2	20.2	16.4	21.8
HERB	Herbaceous Cover	1.2	0.4	-	-	-	1.2

Table F-7. Year 8 Shrub Transects, Unit 1 West (cont'd).

		Unit 1 West		
Code	**Species**	**26A-1**	**27-2**	**R27B-1**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-	-
ADFA	*Adenostoma fasciculatum*	5.4	20	41.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	37.8	46.8	46.6
BAPI	*Baccharis pilularis*	-	6.2	1
CAED	*Carpobrotus edulis*	1.8	-	-
CAFO2	*Castilleja foliolosa*	-	-	-
CEDE	*Ceanothus dentatus*	0.4	-	0.4
CERI	*Ceanothus rigidus*	1	11.6	20.4
CETH	*Ceanothus thyrsiflorus*	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	-	-
DIAU	*Diplacus aurantiacus*	0.6	0.4	0.6
ERCA	*Eriodictyon californicum*	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-
ERER	*Ericameria ericoides*	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-
GAEL	*Garrya elliptica*	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-
LECA	*Lepechinia calycina*	-	0.2	1
LUCH	*Lupinus chamissonis*	-	-	-
LUXX	*Lupinus* sp.	-	-	-
PIRA	*Pinus radiata*	-	-	-
PIXX	*Piperia* sp.	-	-	-
QUAG	*Quercus agrifolia*	-	-	-
RIMA	*Ribes malvaceum*	-	-	-
RISP	*Ribes speciosum*	-	-	-
RUUR	*Rubus ursinus*	-	-	-
SAME	*Salvia mellifera*	22.6	8.6	9.4
SOUM	*Solanum umbelliferum*	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-
TODI	*Toxicodendron diversilobum*	-	-	-
BG	Bare Ground	35.6	24.9	15.4
HERB	Herbaceous Cover	-	-	-

Table F-8. Year 8 Shrub Transects, Unit 2 West.

		Unit 2 West					
Code	**Species**	**16A-1**	**17-3**	**17-4**	**17A-1**	**17A-2**	**19-2**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	0.2	-	-	-	0.4
ADFA	*Adenostoma fasciculatum*	17.4	8.4	34.8	17.6	7.2	22.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	1.6	-	2.8	-	-	1.2
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	44.6	54.8	59.6	39.8	50.4	45.4
BAPI	*Baccharis pilularis*	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	2.2	-	2.8	8	2.2	2.6
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	4.6	2	2.4	-	14.4	3.4
CERI	*Ceanothus rigidus*	2	3.2	-	1.2	4.6	0.8
CETH	*Ceanothus thyrsiflorus*	-	-	-	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	1.4	-	-	-	-
DIAU	*Diplacus aurantiacus*	1.2	2.2	2.6	-	1.2	0.8
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	0.2	2	-	-	-	-
ERER	*Ericameria ericoides*	-	-	-	0.6	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	0.2	3.4	0.8	19.2	5	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-	4.4	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	34	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	0.6	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	1.2	5.6	-	-	5.6	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	23	0.6	-	1.6	3.8	1.4
BG	Bare Ground	29	25	14.6	8.6	22	31.2
HERB	Herbaceous Cover	0.6	-	-	0.2	-	0.2

Table F-8. Year 8 Shrub Transects, Unit 2 West (cont'd).

		Unit 2 West					
Code	**Species**	**19B-1**	**20B-1**	**21-3**	**T1 (North)**	**T4**	**T6**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	0.6	-	-	-	0.4
ADFA	*Adenostoma fasciculatum*	30.6	22	3.6	26.4	21	-
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	9.6	-	2.8	2.8	20.8
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	38.2	29.8	72.8	35.4	44.6	53
BAPI	*Baccharis pilularis*	-	1.2	-	-	-	-
CAED	*Carpobrotus edulis*	2	2.8	-	4.8	-	-
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	1	6.2	0.2	11.2	1.8	-
CERI	*Ceanothus rigidus*	2.4	4.8	1	4.2	-	-
CETH	*Ceanothus thyrsiflorus*	-	-	-	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	1.2	0.6	0.6	0.8	3.4	-
DIAU	*Diplacus aurantiacus*	11	1	-	-	2.2	0.8
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	0.8	0.6	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	0.6	-	-	-	1.8
HEAR	*Heteromeles arbutifolia*	5.6	1	1.2	-	-	-
LECA	*Lepechinia calycina*	-	-	0.4	-	-	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	0.2	-	-	0.4	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	4.2	4.4	0.2	3.4	-	-
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	-	5.8	-	6.8	1.4	1.4
BG	Bare Ground	15.4	26.2	23	23.4	26.2	25.6
HERB	Herbaceous Cover	2	1.2	-	0.4	3	2.6

Table F-8. Year 8 Shrub Transects, Unit 2 West (cont'd).

		Unit 2 West
Code	**Species**	**T7**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	1.4
ADFA	*Adenostoma fasciculatum*	41.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-
ARMO	*Arctostaphylos montereyensis*	-
ARPU	*Arctostaphylos pumila*	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	26
BAPI	*Baccharis pilularis*	-
CAED	*Carpobrotus edulis*	2.8
CAFO2	*Castilleja foliolosa*	-
CEDE	*Ceanothus dentatus*	-
CERI	*Ceanothus rigidus*	1.6
CETH	*Ceanothus thyrsiflorus*	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-
DIAU	*Diplacus aurantiacus*	5.4
ERCA	*Eriodictyon californicum*	-
ERCO	*Eriophyllum confertiflorum*	-
ERER	*Ericameria ericoides*	-
ERFA	*Ericameria fasciculata*	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-
FRCA2	*Fremontodendron californicum*	-
GAEL	*Garrya elliptica*	0.4
HEAR	*Heteromeles arbutifolia*	-
LECA	*Lepechinia calycina*	-
LUCH	*Lupinus chamissonis*	-
LUXX	*Lupinus* sp.	-
PIRA	*Pinus radiata*	-
PIXX	*Piperia* sp.	-
QUAG	*Quercus agrifolia*	-
RIMA	*Ribes malvaceum*	-
RISP	*Ribes speciosum*	-
RUUR	*Rubus ursinus*	-
SAME	*Salvia mellifera*	7.8
SOUM	*Solanum umbelliferum*	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-
TODI	*Toxicodendron diversilobum*	-
BG	Bare Ground	27.2
HERB	Herbaceous Cover	0.2

Table F-9. Year 8 Shrub Transects, Unit 3 West.

		Unit 3 West					
Code	**Species**	**10-2**	**10A-1**	**11A-1**	**11B-1**	**12-4**	**12A-1**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	7	-	-	-	-
ADFA	*Adenostoma fasciculatum*	45.8	37.4	34	13	22	6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	8	-	0.4	0.4	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	35	6.2	35	46.6	40.6	41
BAPI	*Baccharis pilularis*	-	-	-	-	-	0.4
CAED	*Carpobrotus edulis*	2.4	1.2	-	-	-	-
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	-	2.2	1.2	2.6
CERI	*Ceanothus rigidus*	-	0.2	-	2	-	-
CETH	*Ceanothus thyrsiflorus*	-	-	-	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	2	0.4	2.8	2.2	-
DIAU	*Diplacus aurantiacus*	1	0.8	2.8	0.4	0.2	-
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	1.2	-	2.4	1.6	1.4
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	0.4	1.8	-	2.8
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-	-	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	0.4	-	7.8	-
RIMA	*Ribes malvaceum*	-	-	-	-	0.2	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	-	1.6	-	-	1.6	-
SOUM	*Solanum umbelliferum*	-	-	0.2	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	47.6	-	14	4.2	4.2	0.6
BG	Bare Ground	11.2	38.8	28.4	34.2	27.2	48
HERB	Herbaceous Cover	-	1	-	0.2	0.6	-

Table F-9. Year 8 Shrub Transects, Unit 3 West (cont'd).

		Unit 3 West					
Code	**Species**	**12A-2**	**12A-3**	**15A-1**	**T1**	**T2**	**T5**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-	0.6	-	-	0.4
ADFA	*Adenostoma fasciculatum*	45.2	23.4	33.4	21.2	11.4	18
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	2.2	-	4.2	4.4	-	0.4
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	18.6	50	20.6	51.4	39.8	45.6
BAPI	*Baccharis pilularis*	-	-	-	-	-	-
CAED	*Carpobrotus edulis*	0.2	0.6	1	3.4	-	-
CAFO2	*Castilleja foliolosa*	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	-	1.6	-	-	-	-
CERI	*Ceanothus rigidus*	4.2	4	3	-	3.6	-
CETH	*Ceanothus thyrsiflorus*	-	-	-	-	-	-
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	0.2	0.6	2	1	-	5.2
DIAU	*Diplacus aurantiacus*	0.4	1.6	0.4	2	3.8	5.2
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	0.4	2	2.8	-	-	-
ERER	*Ericameria ericoides*	-	-	-	2.6	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	7.2	7.2	-	-	27.4	4.4
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	-	-	-	-	1.8	-
LUCH	*Lupinus chamissonis*	-	-	-	-	-	-
LUXX	*Lupinus* sp.	-	-	-	-	-	-
PIRA	*Pinus radiata*	-	-	-	-	-	-
PIXX	*Piperia* sp.	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	16.2	19.6	-	-	-
RIMA	*Ribes malvaceum*	-	-	-	-	-	-
RISP	*Ribes speciosum*	-	-	-	-	-	-
RUUR	*Rubus ursinus*	-	-	-	-	-	-
SAME	*Salvia mellifera*	0.8	1.4	-	6	2.8	0.6
SOUM	*Solanum umbelliferum*	-	-	-	-	-	-
SYALL	*Symphoricarpos albus* var. *laevigatus*	-	-	-	-	-	-
TODI	*Toxicodendron diversilobum*	10.2	2.4	3	-	1.2	0.8
BG	Bare Ground	29.2	18	30.8	14.6	25.2	28.2
HERB	Herbaceous Cover	-	-	-	1.8	-	1.4

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APPENDIX G

NON-NATIVE SPECIES

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Table G-1. Non-Native Species Observed During Line Intercept Transect Monitoring in BLM Area B Unit B-3 East.

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silver hair grass	AICA
Avena barbata	slender wild oat	AVBA
Briza maxima	rattlesnake grass	BRMA
Bromus diandrus	ripgut brome	BRDI
Bromus hordeaceus	soft brome	BRHO
Briza minor	small quaking grass	BRMI
Carduus pycnocephalus	Italian thistle	CAPY
Festuca (*Vulpia*) *bromoides*	brome fescue	FEBR
Festuca (*Vulpia*) *myuros*	rattail sixweeks grass	FEMY
Hypochaeris glabra	smooth cat’s ear	HYGL
Hypochaeris radicata	rough cat's-ear	HYRA
Lythrum hyssopifolia	hyssop loosestrife	LYHY
Lysimachia arvensis	scarlet pimpernel	LYAR
Tribolium obliterum	Capetown grass	TROB
Vicia hirsuta	tiny vetch	VIHI

Table G-2. Non-Native Species Observed During Line Intercept Transect Monitoring in BLM Area B Unit B-3 West.

Non-Native Herbaceous Species Name	Common Name	Species Code
Avena barbata	slender wild oat	AVBA
Bromus diandrus	ripgut brome	BRDI
Festuca (*Vulpia*) *bromoides*	brome fescue	FEBR
Festuca (*Vulpia*) *myuros*	rattail sixweeks grass	FEMY
Hypochaeris glabra	smooth cat’s ear	HYGL
Logfia gallica	daggerleaf cottonrose	LOGA
Rumex acetosella	sheep sorrel	RUAC

Table G-3. Non-Native Species Observed During Line Intercept Transect Monitoring in BLM Area B Unit A.

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silver hair grass	AICA
Lysimachia arvensis	scarlet pimpernel	LYAR

Table G-4. Non-Native Species Observed During Line Intercept Transect Monitoring in BLM Area B Unit B.

Non-Native Herbaceous Species Name	Common Name	Species Code
Acaena pallida	Pale biddy-biddy	ACPA
Aira caryophyllea	silver hair grass	AICA
Avena barbata	slender wild oat	AVBA
Briza maxima	rattlesnake grass	BRMA
Briza minor	small quaking grass	BRMI
Bromus diandrus	ripgut brome	BRDI
Bromus hordeaceus	soft brome	BRHO
Erodium cicutarium	red-stemmed filaree	ERCI
Erodium moschatum	White-stemmed filaree	ERMO
Festuca (*Vulpia*) *myuros*	rattail sixweeks grass	FEMY
Geranium dissectum	cutleaf geranium	GEDI
Hypochaeris glabra	smooth cat’s ear	HYGL
Hypochaeris radicata	rough cat’s ear	HYRA
Logfia gallica	daggerleaf cottonrose	LOGA
Lysimachia arvensis	scarlet pimpernel	LYAR
Polypogon monspeliensis	rabbitsfoot grass	POMO
Rumex acetosella	sheep sorrel	RUAC
Senecio glomeratus	cutleaf burnweed	SEGL
Senecio sylvaticus	woodland groundsel	SESY
Tribolium obliterum	Capetown grass	TROB
Vicia sativa	garden vetch	VISA

Table G-5. Non-Native Species Observed During Line Intercept Transect Monitoring in BLM Area B Unit C.

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silver hair grass	AICA
Festuca (*Vulpia*) *myuros*	rattail sixweeks grass	FEMY
Hypochaeris glabra	smooth cat’s ear	HYGL
Hypochaeris radicata	rough cat's-ear	HYRA

Table G-6. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit B-2A.

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silver hair grass	**AICA**
Avena barbata	slender wild oat	**AVBA**
Bromus diandrus	ripgut brome	**BRDI**
Bromus hordeaceus	soft brome	**BRHO**
Festuca (*Vulpia*) *bromoides*	brome fescue	**FEBR**
Festuca (*Vulpia*) *myuros*	rattail sixweeks grass	**FEMY**
Hypochaeris glabra	smooth cat’s ear	**HYGL**
Hypochaeris glabra	daggerleaf cottonrose	**LOGA**

APPENDIX H

MAPS: MACROPLOTS PRESENCE/ABSENCE

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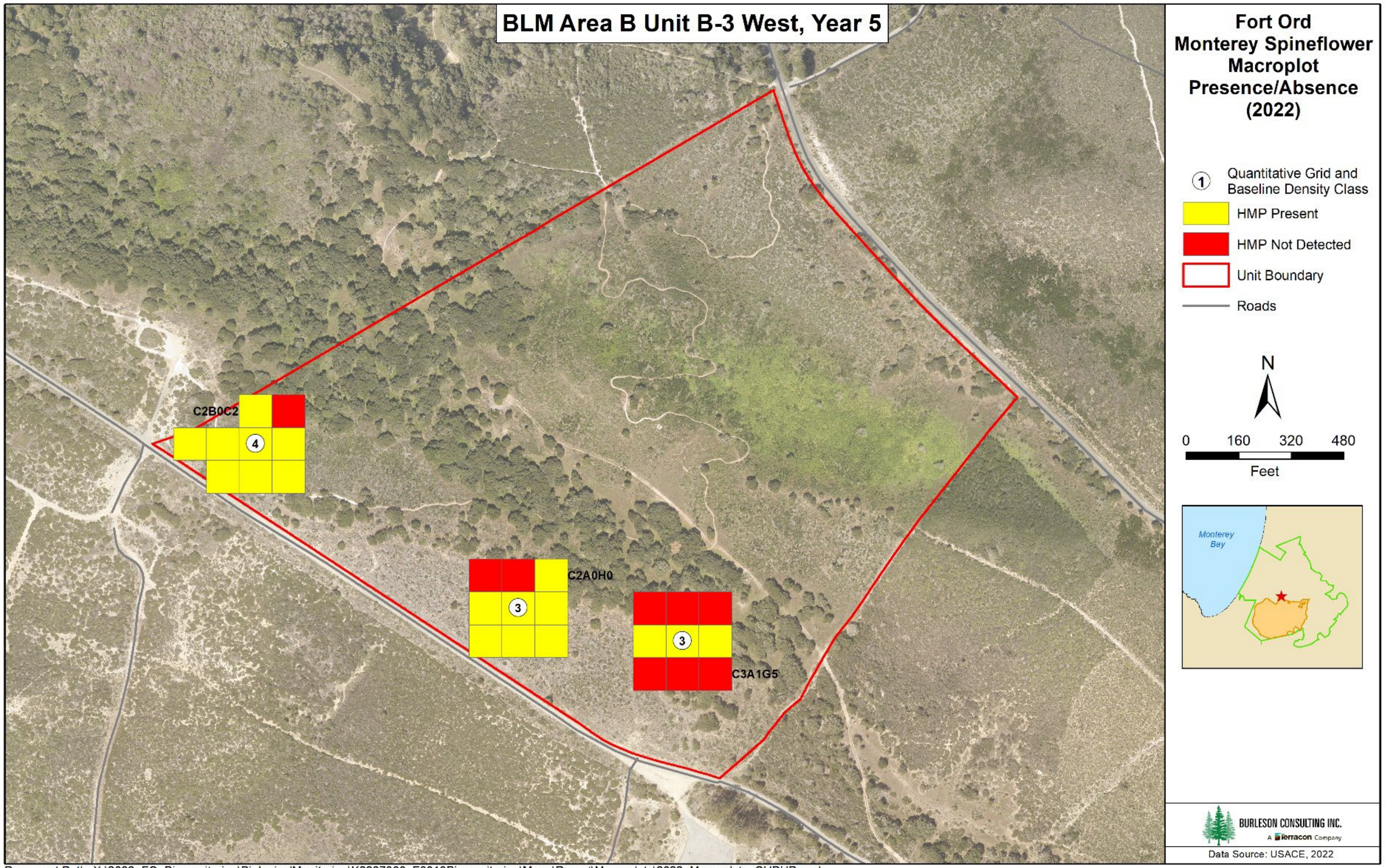

Figure H-1. Map of Monterey Spineflower Macroplot Presence/Absence, BLM Area B-3 West (Year 5).

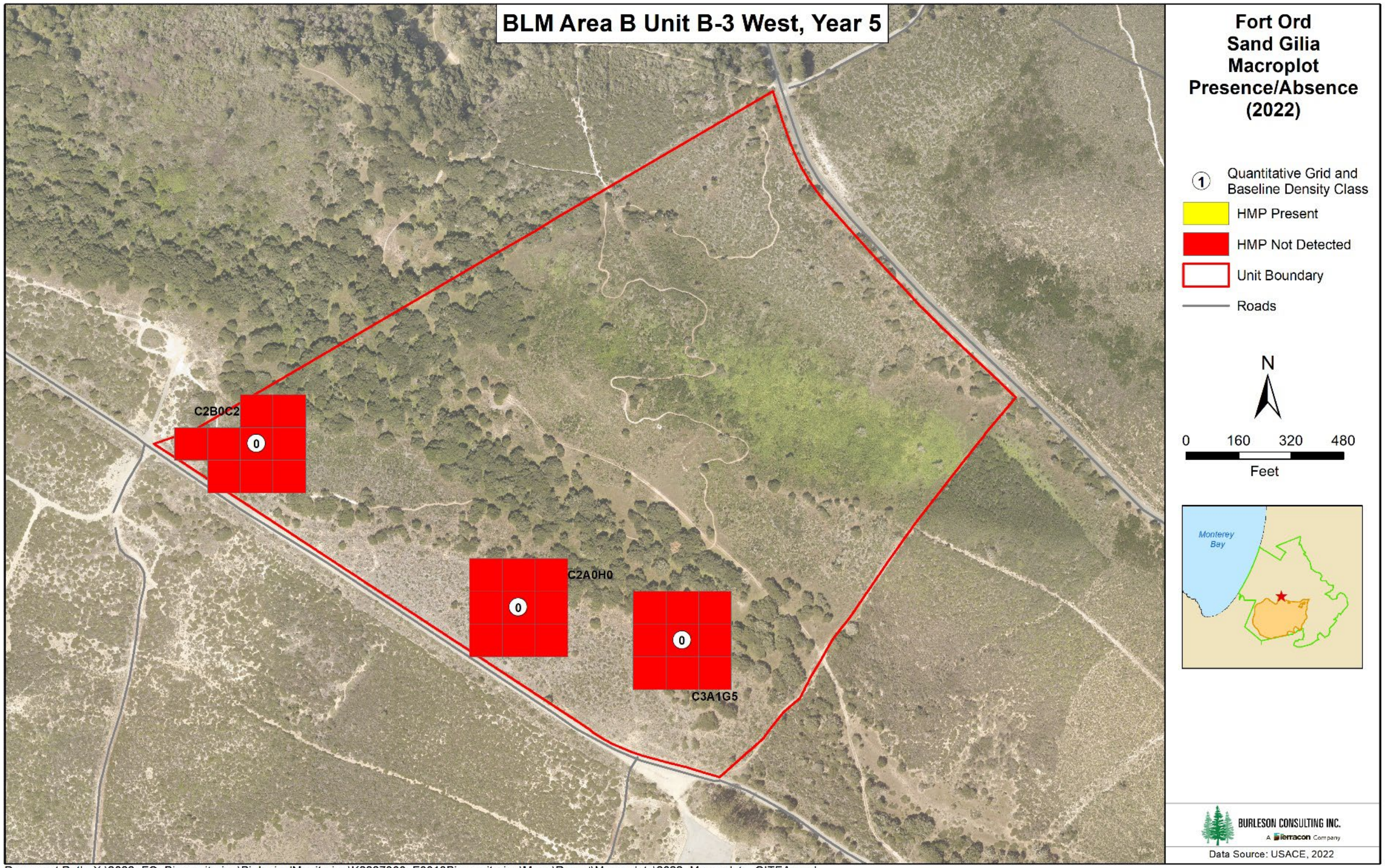

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Figure H-2. Map of Sand Gilia Macroplot Presence/Absence, BLM Area B-3 West (Year 5).

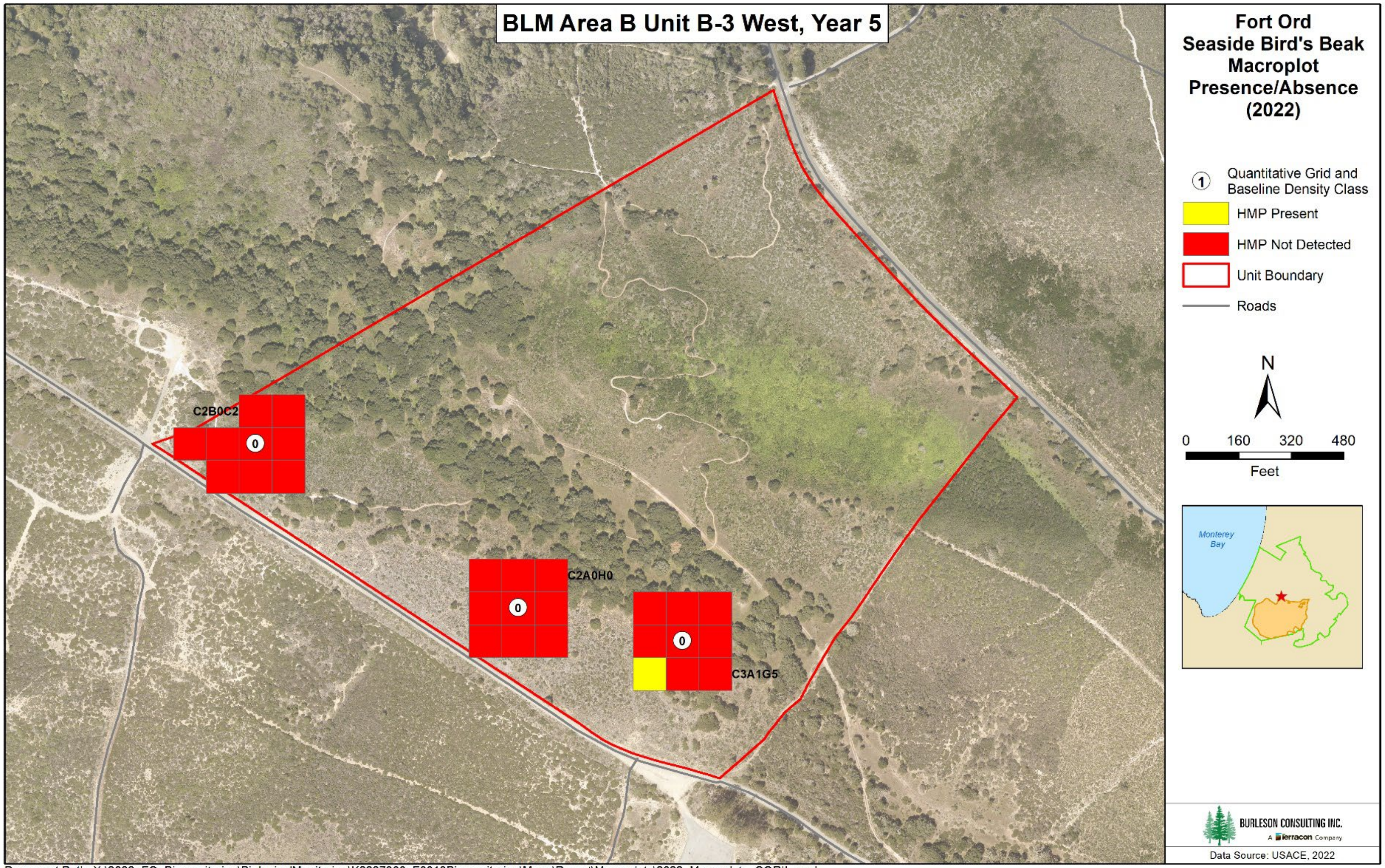

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Figure H-3. Map of Seaside Bird's Beak Macroplot Presence/Absence, BLM Area B-3 West (Year 5).

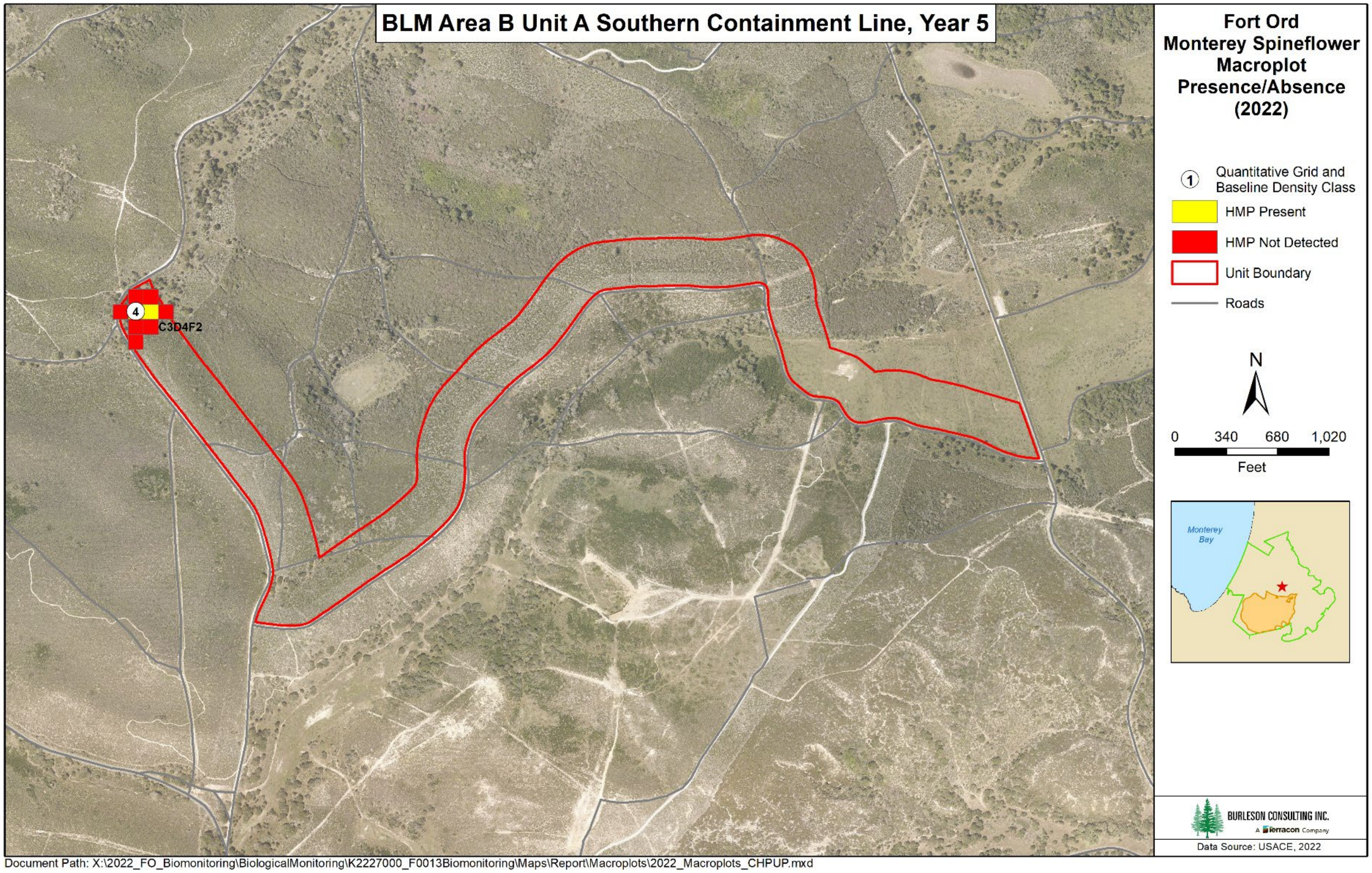

Figure H-4. Map of Monterey Spineflower Macroplot Presence/Absence, BLM Area B Unit A Containment Line (Year 5).

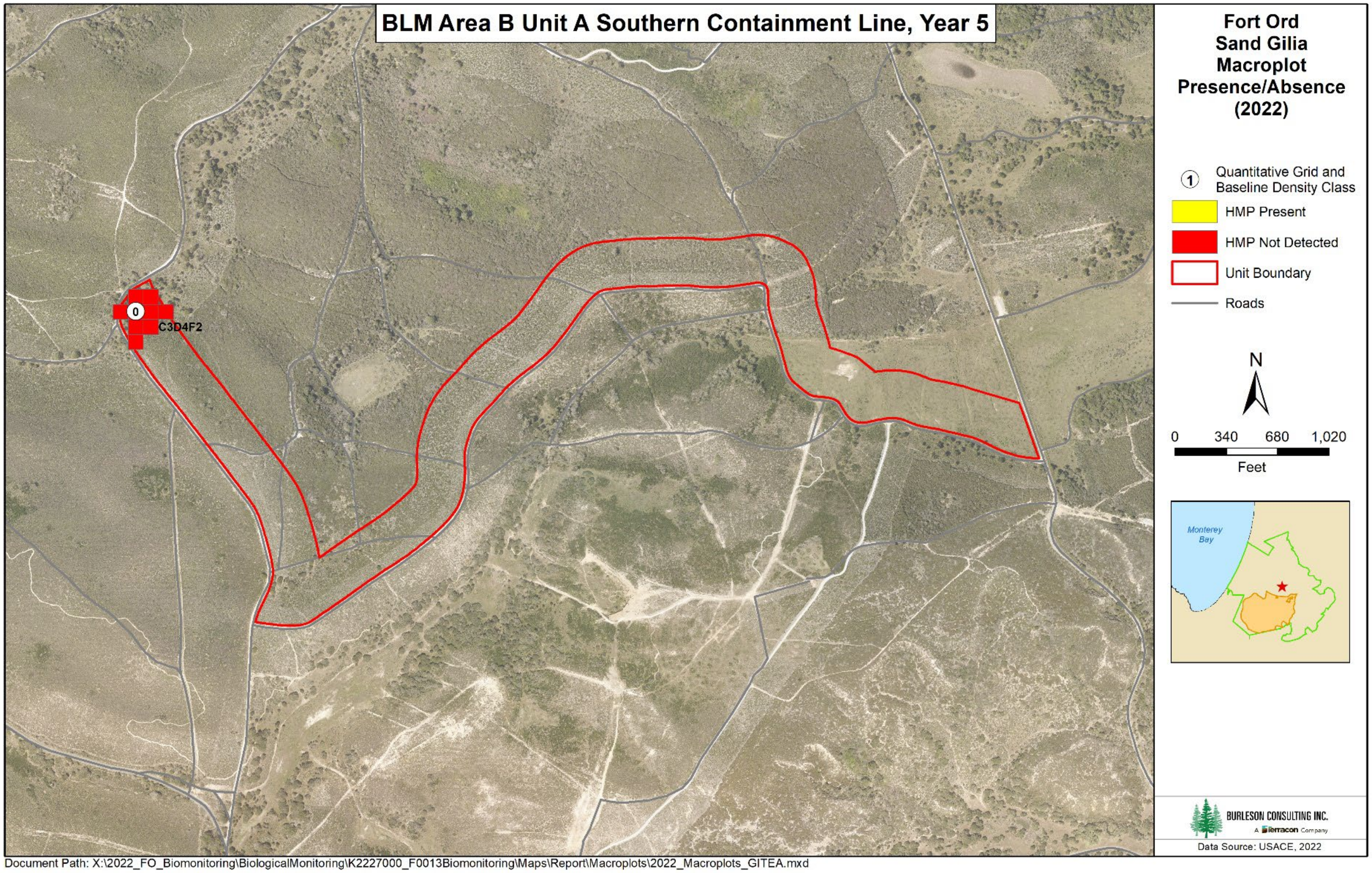

Figure H-5. Map of Sand Gilia Macroplot Presence/Absence, BLM Area B Unit A Containment Line (Year 5).

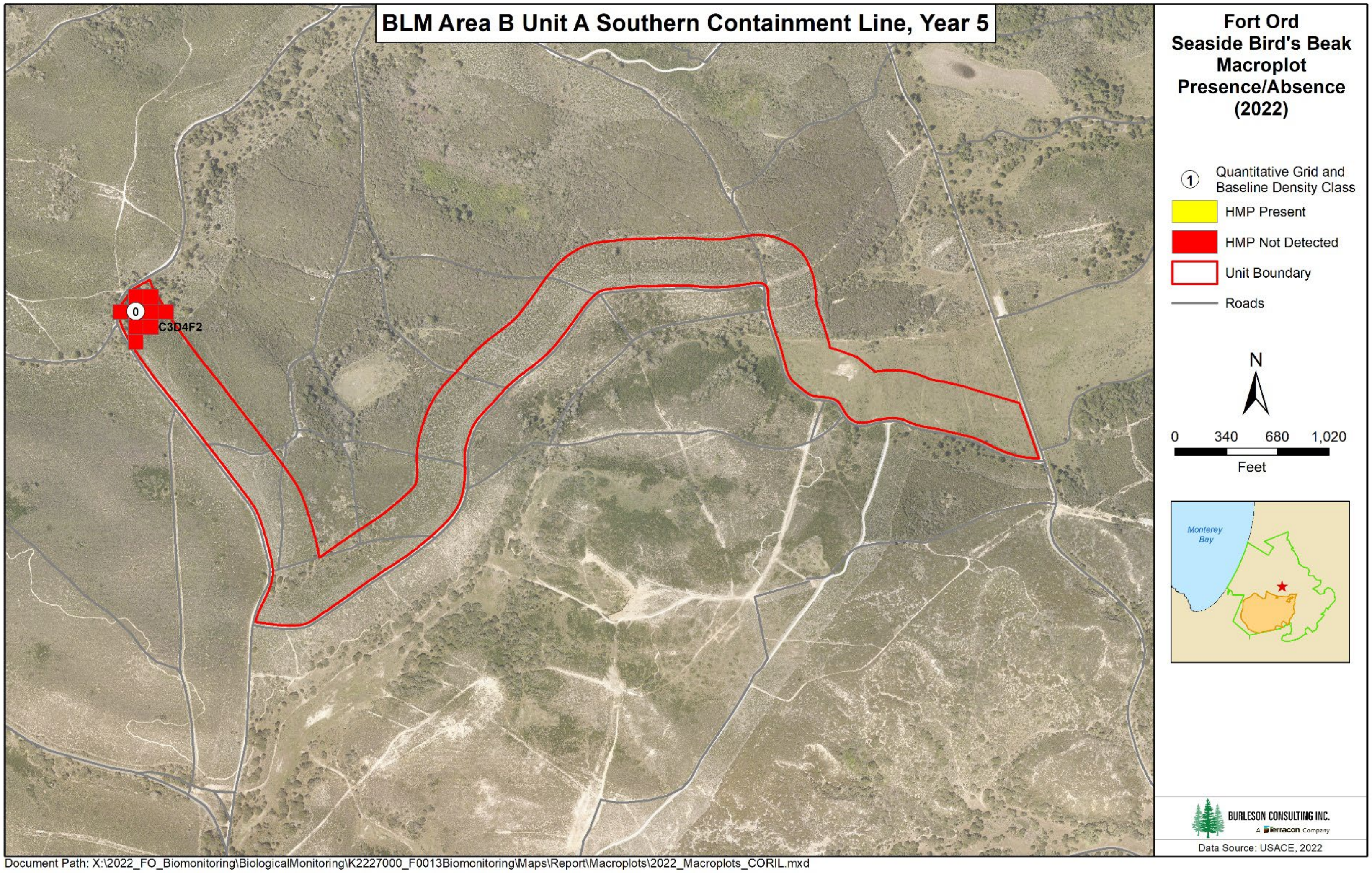

Figure H-6. Map of Seaside Bird's Beak Macroplot Presence/Absence, BLM Area B Unit A Containment Line (Year 5).

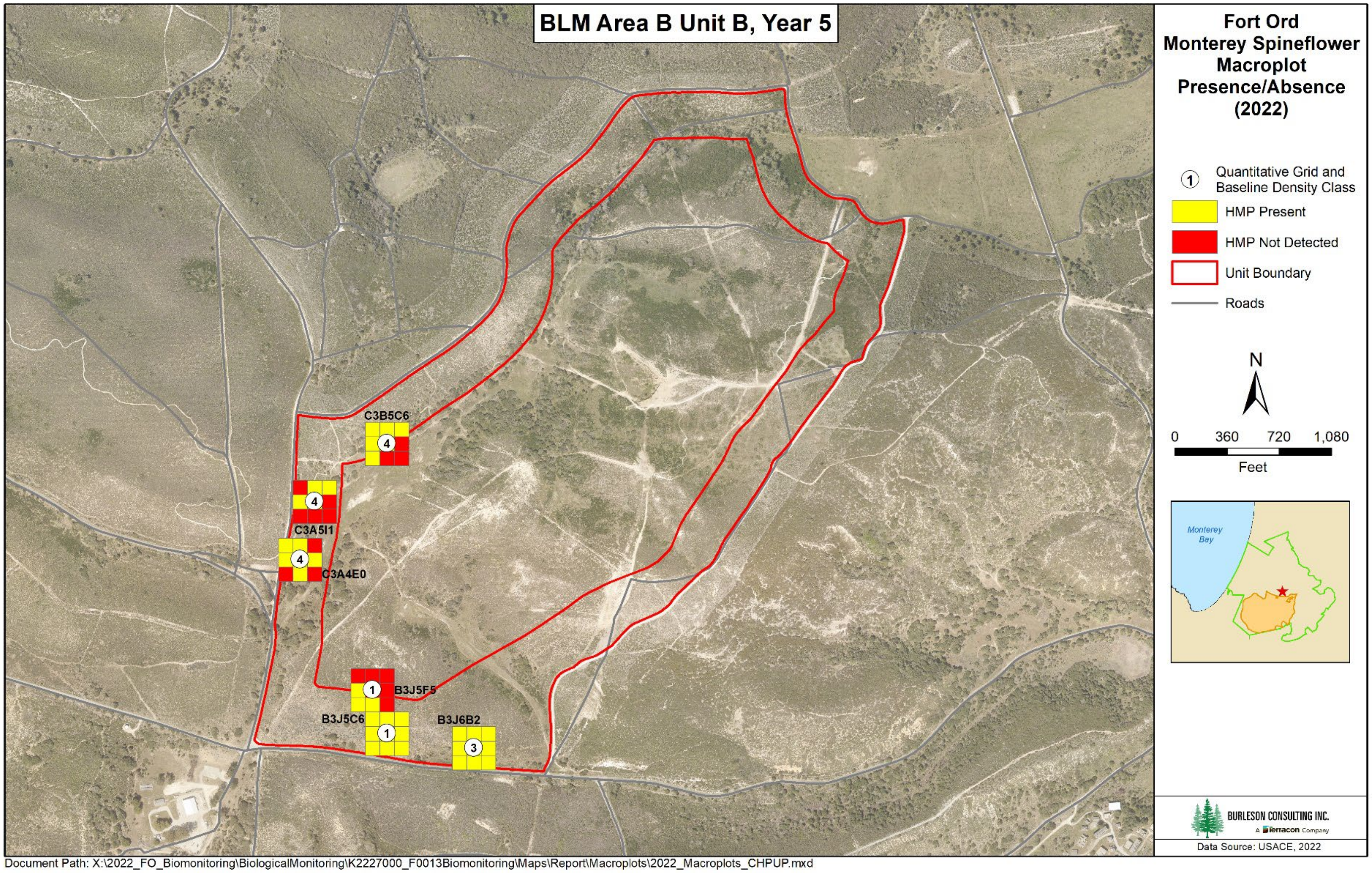

Figure H-7. Map of Monterey Spineflower Macroplot Presence/Absence, BLM Area B Unit B Containment Line (Year 5).

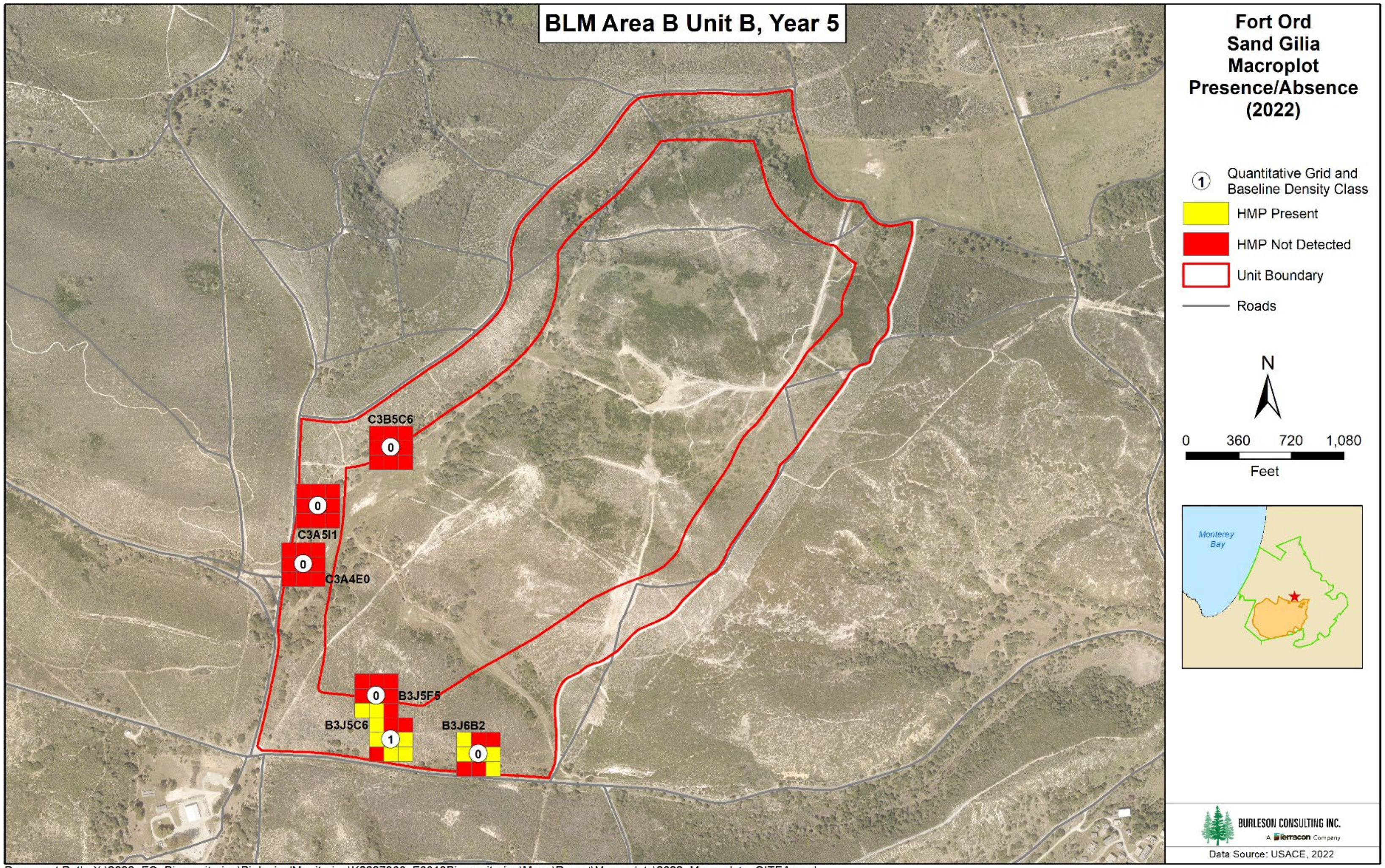

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Figure H-8. Map of Sand Gilia Macroplot Presence/Absence, BLM Area B Unit B Containment Line (Year 5).

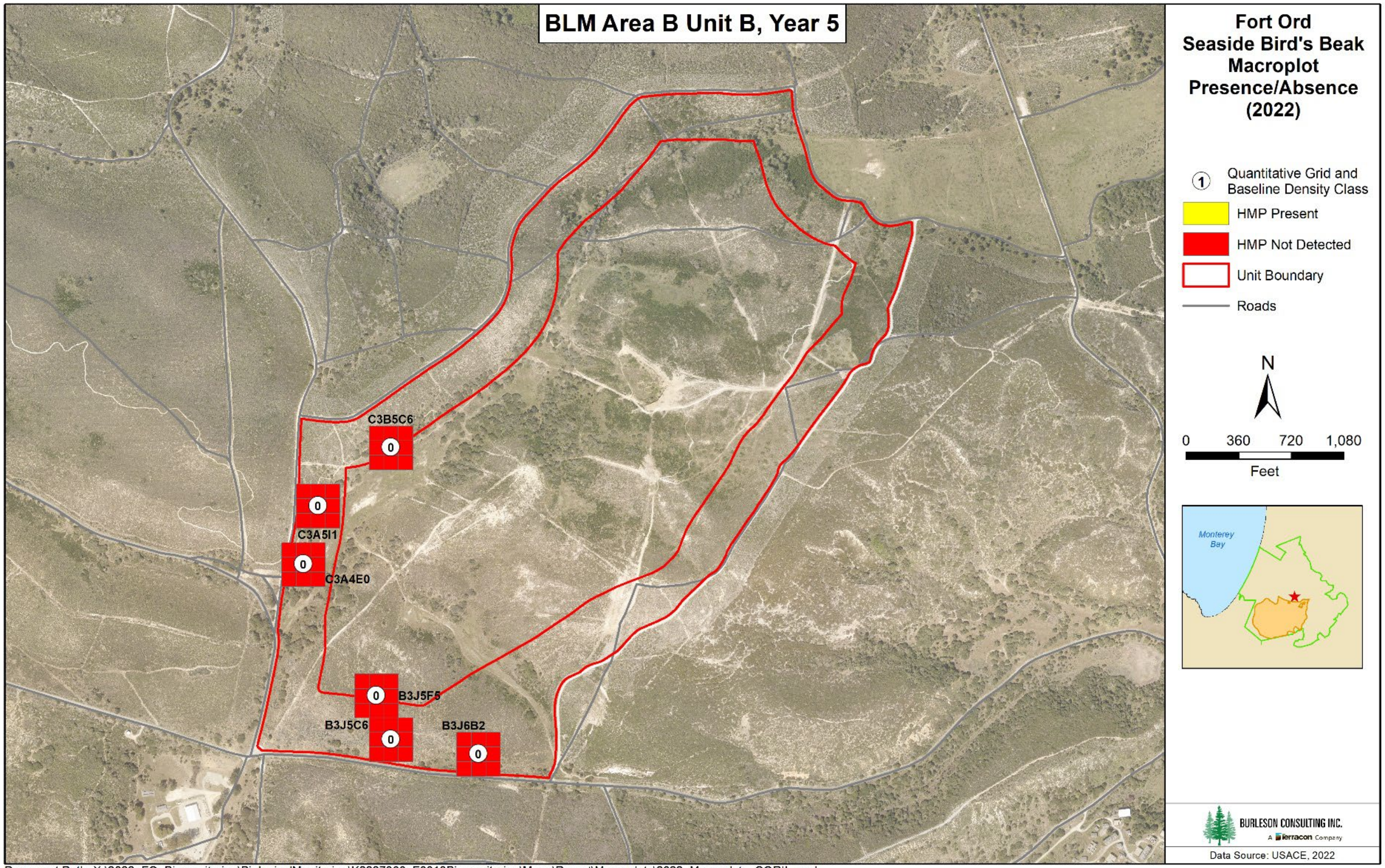

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Figure H-9. Map of Seaside Bird's Beak Macroplot Presence/Absence, BLM Area B Unit B Containment Line (Year 5).