2023 ANNUAL REPORT
BIOLOGICAL MONITORING

for Unit 5; Units 25, 31, and BLM Area B Subunit A Containment Lines; Units 5A, 9, 23, and 28.

CONTRACT NO. W91238-23-D-0009
TASK ORDER W9123823F0032

FORMER FORT ORD

Prepared for:

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Prepared by:

HARRIS ENVIRONMENTAL GROUP INC.

Terracon

March 2024

2023 ANNUAL REPORT
BIOLOGICAL MONITORING
FOR UNIT 5; UNITS 25, 31, AND BLM AREA B SUBUNIT A CONTAINMENT LINES;
UNITS 5A, 9, 23, AND 28.

SUBMITTED TO:

UNITED STATES ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO, CA 95814-2922

SUBMITTED BY:

HARRIS ENVIRONMENTAL GROUP, INC.
650 N. 6TH AVENUE
TUCSON, ARIZONA 85705

PREPARED BY:

JESS SUTTON, MS
SENIOR STAFF SCIENTIST
TERRACON CONSULTANTS, INC.

THOR ANDERSON, MS
SENIOR ECOLOGIST AND PROJECT MANAGER
HARRIS ENVIORNMENTAL GROUP, INC.

FILIPP KASHIRTSEV, MS
BIOLOGIST AND GIS SPECIALIST
HARRIS ENVIRONMENTAL GROUP, INC.

KELSEY HOLLIEN, MS
AQUATIC ECOLOGIST
HARRIS ENVIRONMENTAL GROUP, INC

EMILY POOR
SENIOR STAFF SCIENTIST
TERRACON CONSULTANTS, INC.

PROJECT MANAGER CONTACT DETAILS:
THOR ANDERSON
tanderson@heg-inc.com

CONTENTS

Section **Page**

FIGURES

TABLES

APPENDICES

ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
Army	United States Army
BLM	Bureau of Land Management
Burleson	Burleson Consulting Inc., A Terracon Company
CNPS	California Native Plant Society
cm	centimeter (s)
EcoSystems West	EcoSystems West Consulting Group, Inc.
ft	feet
GIS	Geographic Information System
GPS	Global Positioning System
Harris	Harris Environmental Group Inc.
Harris-Terracon	Harris Environmental Group Inc. and Terracon Consultants Inc. Team
HLA	Harding Lawson Associates
HMP	Habitat Management Plan
HMP annuals	Annual Species of Concern
HMP shrub	Shrub Species of Concern
MACTEC	MACTEC Engineering and Consulting, Inc.
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
NDMC	National Drought Mitigation Center
NPS	Naval Postgraduate School
NMDS	Non-metric Multidimensional Scaling
PERMANOVA	Permutation-Based Multivariate Analysis of Variance
PBO	Programmatic Biological Opinion
Protocol	Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at Former Fort Ord

RAC	Rank Abundance Curve
Revised Protocol	Revisions of Protocol for Conducting Vegetation Monitoring for Compliance with the Installation-Wide Multispecies Habitat Management Plan, Former Fort Ord
Tetra Tech	Tetra Tech Inc.
Terracon	Terracon Consultants Inc. (formerly Burleson Consulting Inc.)
USACE	United States Army Corps of Engineers
USACE-Chenega	United States Army Corps of Engineers and Chenega Reliable Services, LLC Team
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

This page intentionally left blank

1 INTRODUCTION

The United States Army Corps of Engineers (USACE) contracted Harris Environmental Group, Inc. (Harris) and Terracon Consultants Inc. (Terracon) to conduct biological monitoring at former Fort Ord, Monterey County, California (see Figure 1-1 and Figure 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) Unit 5 (Year 1 monitoring); (b) Unit 25 Containment Line, Unit 31 Containment Line, and Bureau of Land Management (BLM) Area B Subunit A Containment Line (Year 5 monitoring); and (c) Units 5A, 9, 23, 23 North, and 28 (Year 8 monitoring). Monitoring was conducted during spring, summer, and fall of 2023 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. Due to a late award of the biological monitoring contract, density monitoring for HMP annual species was conducted by the USACE-Chenega team and Year 5 shrub transects and annual grass density surveys were conducted by the USACE team. The Harris-Terracon team conducted all monitoring in Year 8 Units. Appendices include 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), and non-native species tables (Appendix G).

Baseline monitoring is conducted prior to cleanup activities (e.g., 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. 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, the USFWS concurred with the United States Army's (Army) 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).

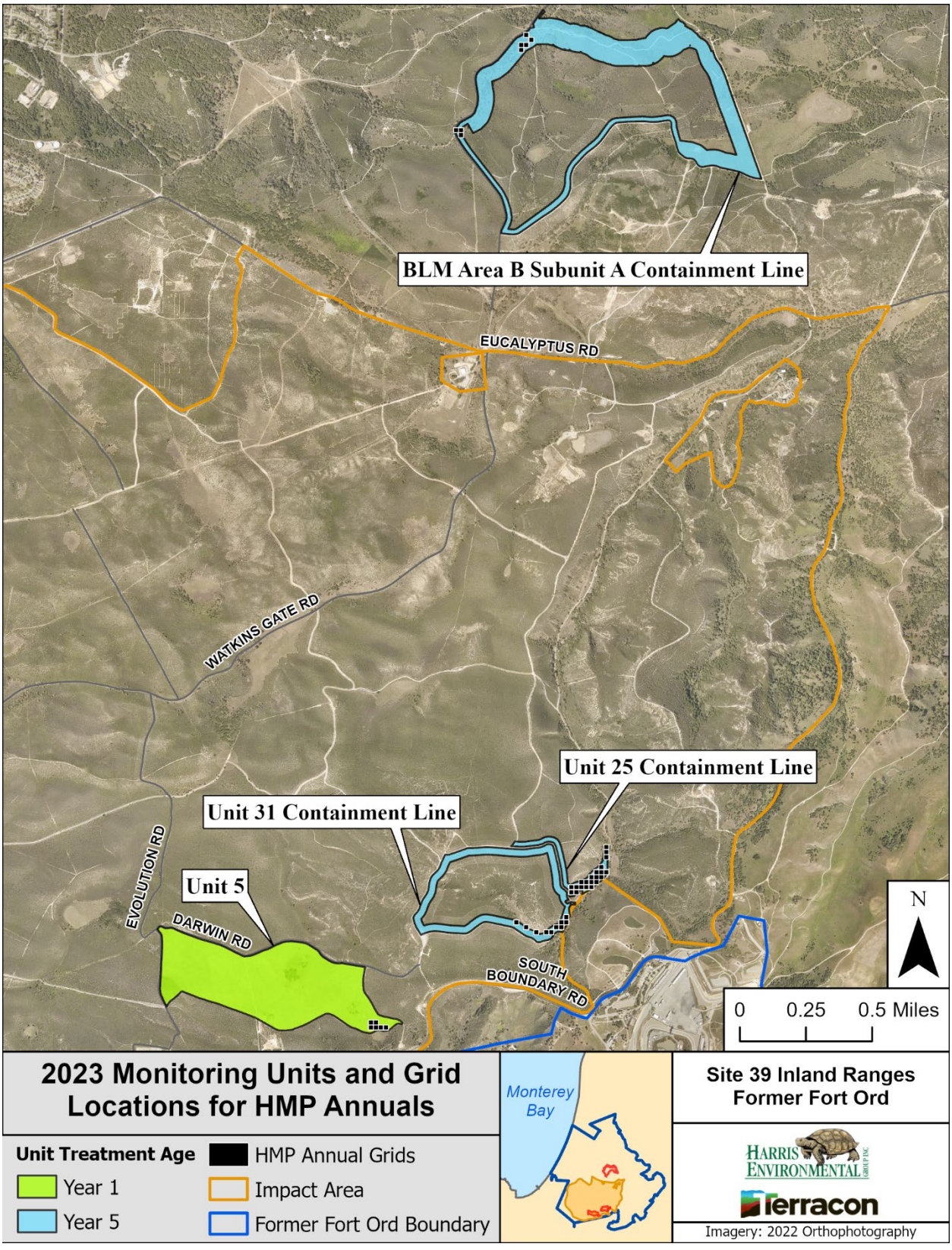


Figure 1-1. Map of Former Fort Ord in Monterey, California, showing locations of Units and grids sampled for HMP annual species in 2023.

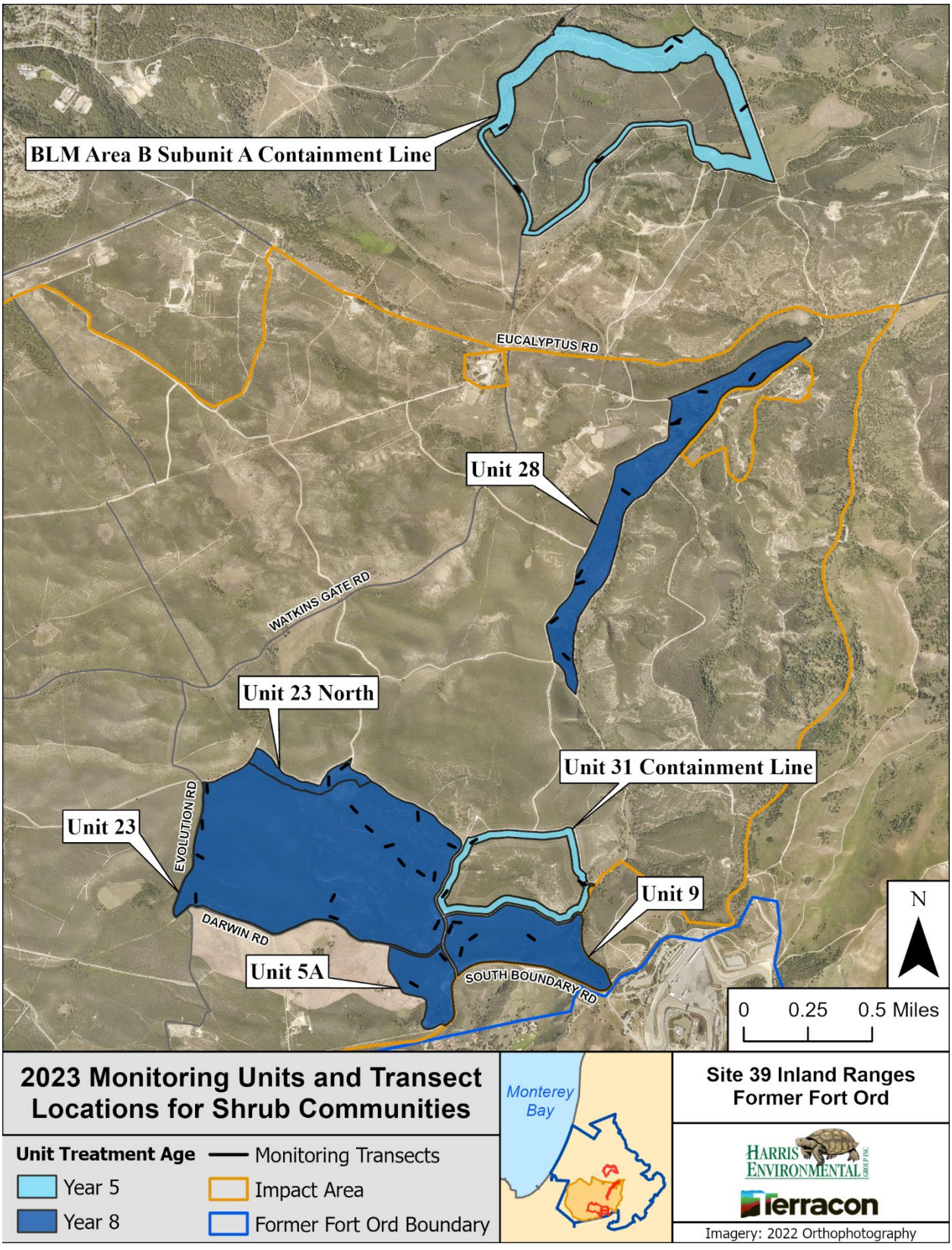


Figure 1-2. Map of Former Fort Ord in Monterey, California, showing locations of Units and transects sampled for shrub community in 2023.

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 releasing nutrients into the soil through biomass combustion and ash deposition and creating more openings for plants to colonize (Potts *et al.*, 2010).

Drought is a substantial factor affecting vegetation composition at former Fort Ord (Burleson, 2022). From 1991 to 2020, the average cumulative precipitation throughout former Fort Ord showed a gradual increase from October through March and generally plateaued at around 40 centimeters (cm) in April. The 2022-2023 water year was well above the 30-year normal; however, the prior two consecutive water years were well below the 30-year normal, resulting in drought conditions (Figure 1-3; NPS, 2023; NCEI NOAA, 2023). According to the United States Drought Monitor, the local region began the 2022-2023 water year in severe drought conditions in October 2022 but was no longer in drought conditions by February 2023 (NDMC *et al.*, 2023). This may have affected the vegetation response of Units that were recovering during this period.

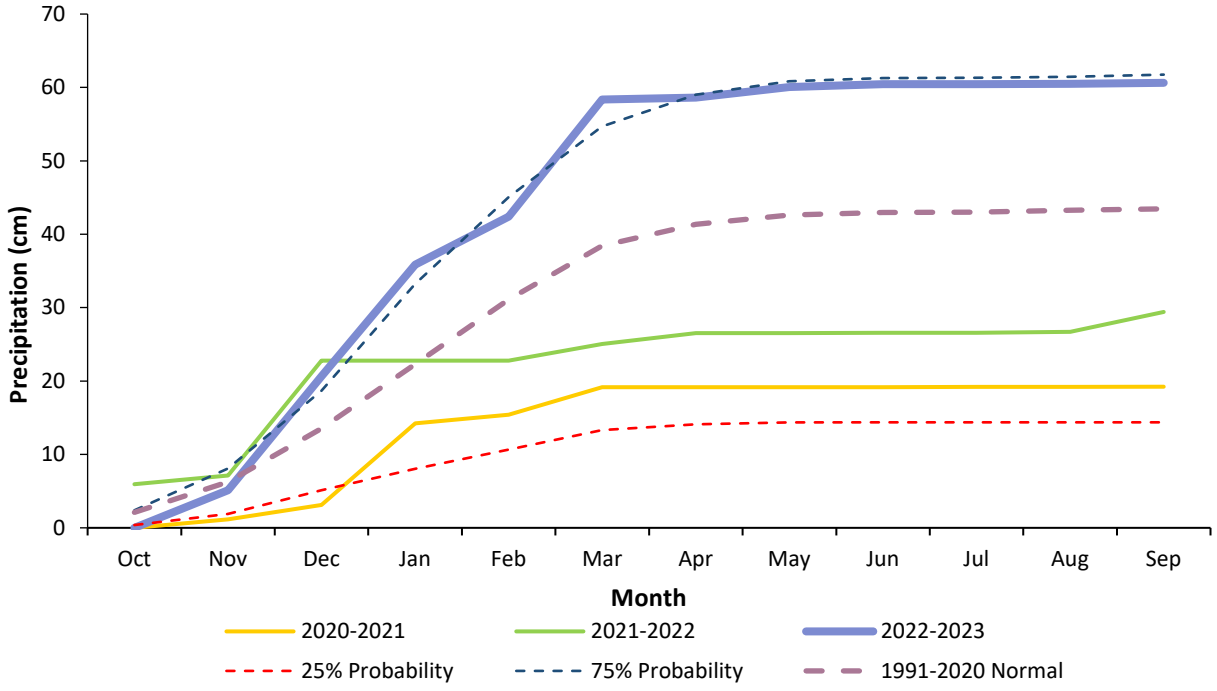


Figure 1-3. Cumulative monthly precipitation for the 2022-2023 water-year compared to the 30-year normal (mean 1991-2020), the 2020-2021 water-year, the 2021-2022 water-year, and the 25% and 75% probabilities (NPS, 2023; NCEI NOAA, 2023).

1.1 Species Included in 2023 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 Yadon'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 2023 are referenced in Table 1-1. Data from previous surveys for HMP annuals and shrub transects were obtained from Geographic Information System (GIS) shapefiles and associated metadata provided by USACE and from results of previous surveys (HLA, 1999 and 2001; MACTEC, 2004; Tetra Tech and EcoSystems West, 2011 – 2015b; Burleson, 2016 – 2023).

When appropriate and available, shrub transect data were transcribed from the electronic versions of previous monitoring reports. In addition to incorporating past shrub transect data into the database, adjustments were made to the "density" class field in the HMP annuals data table to correspond to the density classes defined by Burleson (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 annuals 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 USACE (USACE, 2022).

Table 1-1. Previous Monitoring Surveys at 2023 Study Units on Former Fort Ord.

Survey Year	Survey
2003	MACTEC (2004) performed Baseline surveys in Unit 23 (formerly Range 30A).
2011	Tetra Tech and EcoSystems West (2012) performed Baseline surveys in Units 5A, 9, 23, and 28.
2014	Tetra Tech and EcoSystems West (2015a) performed Baseline surveys on Units 25 and 31 Containment Lines.
2015	Burleson (2016) performed Baseline surveys in Unit 5 and BLM Area B Subunit A Containment Line.
2016	Burleson (2017) performed Year 1 HMP annuals surveys in Units 9, 23 North, and 28.
2017	Burleson (2018) performed Year 1 HMP annuals surveys in Units 25 and 31 Containment Lines.
2018	Burleson (2019) performed Year 1 HMP annuals surveys of the three western grids in BLM Area B Subunit A Containment Line; and Year 3 HMP annuals and shrub transect monitoring of Units 9, 23, 23 North, and 28.
2019	Burleson (2019b) performed Year 1 HMP annual surveys in Units 25, 31, and BLM Area B Subunit A Containment Lines.
2020	Burleson (2021) performed Year 5 HMP annuals surveys in Units 9, 23 North, and 28; and Year 5 shrub transect monitoring of Units 5A, 9, 23, 23 North, and 28.
2021	Burleson (2022) performed Year 3 HMP annual surveys in Units 25, 31 and BLM Area B Subunit A Containment Line; and shrub transects in Units 31 and BLM Area B Subunit A Containment Lines.

2 METHODS

This section describes the standard monitoring methods used during the 2023 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 United States Department of Agriculture (USDA) mapped five soil types occurring in Units monitored in 2023, shown in Table 2-1 (USDA, 2023). Antioch very fine sandy loam with 2 to 9 percent (%) slopes occurs in the BLM Area B Subunit A Containment Line. Arnold loamy sand, 9 to 15% slopes, occurs in Unit 28. Arnold-Santa Ynez complex is a large portion of the munitions remediation area (MRA) and occurs in BLM Area B Subunit A Containment Line, Units 25 and 31 Containment Lines, and Units 5, 5A, 9, 23, 23 North, and 28. Oceano loamy sand with 2 to 15% slopes occur in BLM Area B Subunit A Containment Line. Xerorthents, dissected, occurs in Units 25 and 31 Containment Lines, and Units 9, 23, and 28. However, the soils mapped by the USDA (2023) in the MRA may 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 2023 (USDA, 2023).

Soil Type	Description	Units Where Found
AeC, Antioch very fine sandy loam, 2 to 9% slopes	Very fine loam and sand; moderately well to somewhat poorly drained; derived on level to sloped alluvial fans and terraces	BLM Area B Subunit A Containment Line
AkD, Arnold loamy sand, 9 to 15% slopes, MLRA 15	**Arnold**: Loamy fine sand; somewhat excessively drained; derived from residuum weathered from sandstone	28
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 Subunit A Containment Line, 31 Containment Line, 25 Containment Line, 5, 5A, 9, 23, 23 North, 28
OaD, Oceano loamy sand, 2 to 15% slopes	Loamy sand, sand; deep, excessively drained soils that formed in material weathered from sandy aeolian deposits	BLM Area B Subunit A Containment Line
Xd, Xerorthents, dissected	Loam, clay loam; well drained; derived from mixed unconsolidated alluvium	31 Containment Line, 25 Containment Line, 9, 23, 28

2.2 HMP Annuals Grids Methods

2.2.1 Field Methods

The USACE-Chenega team conducted density monitoring for three HMP annual species (Monterey spineflower, sand gilia, and seaside bird's-beak) during the 2023 monitoring season. These surveys occurred in Unit 5, Units 25 and 31 Containment Lines, and BLM Area B Subunit A Containment Line. 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® GeoExplorer® 6000 GeoXH Global

Positioning System (GPS) unit (10 cm accuracy) and occurrences were noted for comparison with future monitoring efforts. Piperia individuals were recorded to genus due to the difficulty of identifying to species when not in flower. The Army and BLM were informed of these locations for possible avoidance during future remediation work and to allow an Army biologist to return during the appropriate bloom period to identify the species.

The predefined base-wide 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 surveys as occupied by one or more herbaceous HMP species. The monitoring protocol indicates that 20% 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. A Trimble® GeoXH GPS unit was used to locate 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 2023 (Burleson, 2009a; Tetra Tech and EcoSystems West, 2015b). Monitoring for HMP annual species density is conducted at Baseline and follow-up monitoring is conducted at 1, 3, and 5-year intervals following treatment and MEC clearance. For all 2023 HMP annuals density surveys, each 100x100-ft sample grid was 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 treated as any "occupied habitat" or habitat that was suitable for HMP annuals (e.g., bare ground). 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 2023 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), based on experience, 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. Density class 4 was the only class assigned in this manner. The general steps taken by field surveyors when monitoring HMP annual grids were as follows:

- Located grid using Trimble® GeoXH GPS unit.
- Marked the staked corners with flagging tape, or re-staked if necessary.
- Each grid was monitored by one surveyor, starting at one corner and walking the length of the grid and back, maintaining a 2-3 ft buffer from the last lane surveyed.
- 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 Pro (ESRI, 2023). Density classes were 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 Pro (ESRI, 2023; 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.

All Units surveyed in 2023 were masticated only.

2.3 HMP Shrub Transects Methods

2.3.1 Field Methods

The USACE team conducted shrub transect monitoring in maritime chaparral in BLM Area B Subunit A and Unit 31 Containment Lines, and the Harris-Terracon team conducted shrub transect monitoring in maritime chaparral in Units 5A, 9, 23, 23 North, and 28 during the 2023 monitoring season. For previously sampled transects, including follow-up monitoring at 3, 5, and 8 years post-treatment, the surveyors used Avenza Maps with an external Trimble® R1 GNSS receiver (sub-meter accuracy) 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.

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 Avenza Maps with an external Trimble® R1 GNSS 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

Treatment Units were initially separated by the age of treatment at the point when 2023 shrub transect monitoring was conducted (e.g., 5-year-old vs 3-year-old). Within these groups, the Harris-Terracon team 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*. These tests were conducted using the *adonis* function in the vegan package in R Statistical Software (Oksanen, 2021; R Core Team, 2022). The Harris-Terracon team 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), the Harris-Terracon team 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. Vegetation transect data was grouped 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).

Four community metrics were calculated and grouped by *treatment* or *age* within Units to assess community structure. Community metrics calculated were total cover (%), Shannon-Wiener diversity index, species richness, and species evenness index. All community metrics calculations exclude bare ground and herbaceous cover. Total cover is sometimes greater than 100% 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 = $\frac{n_i}{N}$

Species richness is the number of species present, including native and non-native species. 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 calculated using the functions *rowSums*, *diversity*, and *specnumber* in the *vegan* package (Oksanen, 2021). Community metrics data were displayed via scatterplots and the *jitter* function was used to add random noise to better visualize overlapping data points.

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 are 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. Starting with the 2020 Annual Report, less emphasis was placed on *p*-values in comparison to a significance level. This shift is based on a 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 inferences 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, 2022).

2.4 Non-Native Annual Grasses Methods

2.4.1 Field Methods

Non-native annual grasses were mapped within Units 25 and 31 Containment Lines and BLM Area B Subunit A Containment Line, as well as in roadside fuel breaks adjacent to each Unit, during the 2023 monitoring season. 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 Pro. 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 Pro (ESRI, 2023). 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 when encountered incidentally during HMP annuals and annual grass monitoring, or while traversing the Units to reach sampling locations. Emphasis was placed on iceplant (*Carpobrotus edulis*), pampas grass (*Cortaderia* sp.), and French broom (*Genista monspessulana*). Iceplant locations were only recorded when the occurrence was larger than about 100 square feet (ft^2) or in areas clustered with smaller individuals that collectively indicated a recent and/or potentially problematic infestation. Locations were recorded using ArcGIS Field Maps with an external Trimble® R1 GNSS receiver. Due to logistical constraints, GPS locations of incidental findings of invasive species were not recorded in Year 5 Units. However, invasive species cover was recorded when detected along a shrub transect and presence was noted when encountered incidentally near a transect. Invasive species data were collected as planned in Year 8 Units in 2023.

2.5.2 Reporting Methods

Invasive species are presented on maps developed in ArcGIS Pro (ESRI, 2023). These surveys were not intended to be comprehensive. The intent is to document occurrences to support invasive species management through the Service Agreement with the BLM.

This page intentionally left blank

3 YEAR 1 VEGETATION SURVEYS: Unit 5

3.1 Introduction

Year 1 surveys were completed at Unit 5 (Figure 3-1). The area was masticated in 2021 as part of environmental cleanup operations involving MEC removal activities. Baseline surveys were conducted in 2015 for Unit 5 (Burleson, 2016). These surveys included meandering transects to map areas of occurrence of HMP herbaceous species; density monitoring for the HMP annual species sand gilia, seaside bird's-beak, and Monterey spineflower; transects to sample shrub composition in the maritime chaparral; and annual grass monitoring within the planned primary containment line surrounding Unit 5.

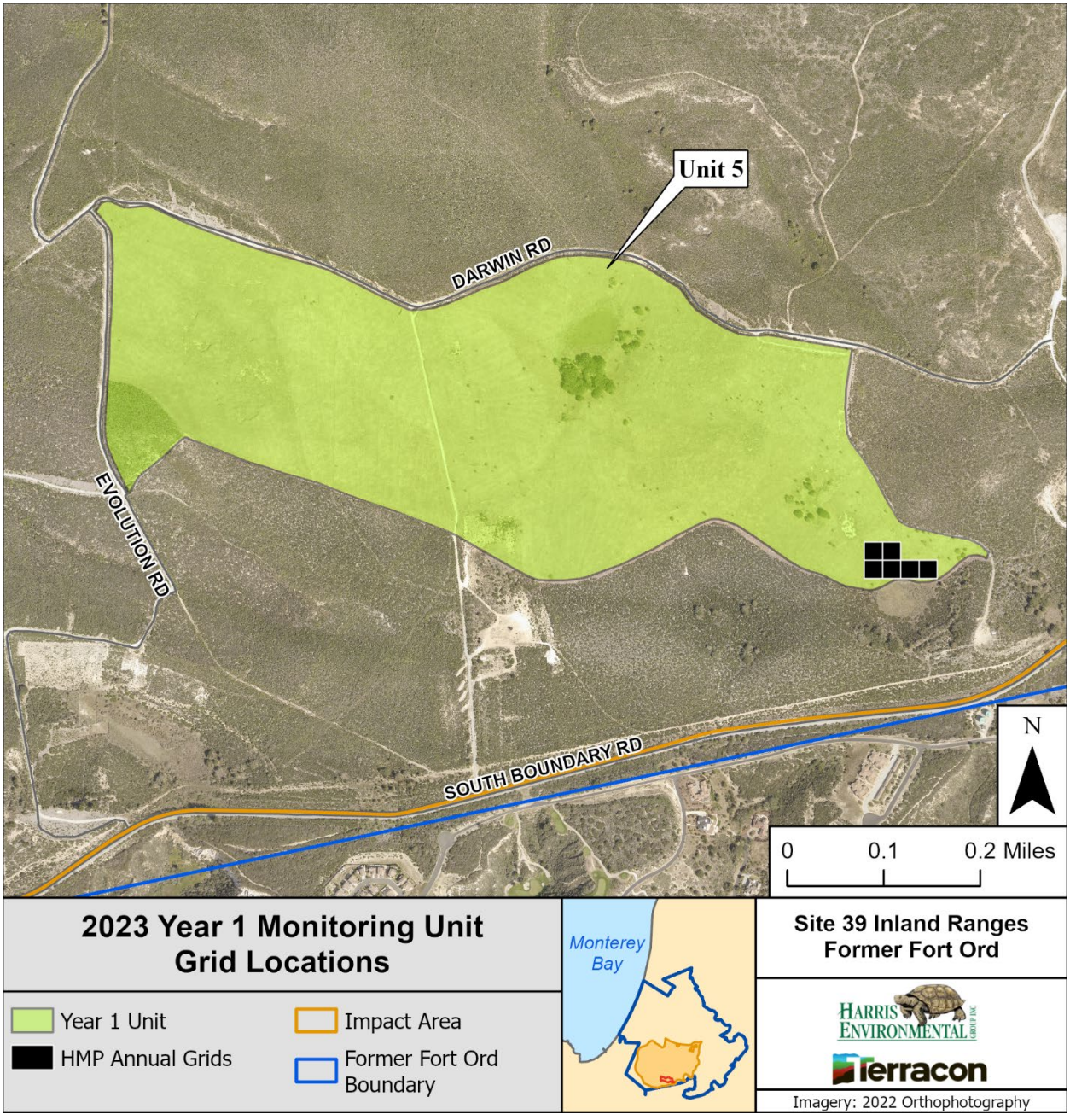


Figure 3-1. Year 1 HMP annuals grids surveyed in 2023.

3.2 Unit 5: Setting

Unit 5 encompasses an area of 130 acres and is located east of Evolution Road and south of Darwin Road in the southern portion of the area of former Fort Ord. In general, Unit 5 has rolling topography and is divided by a prominent east-to-west trending ridge. Baseline surveys were conducted in 2015 and the Unit was masticated in 2021. Prior to mastication, Unit 5 was dominated by mature maritime chaparral vegetation varying considerably in physiognomy and species composition. The majority of chaparral vegetation was very dense, particularly in the south and central portions of the Unit with very limited openings. As in maritime chaparral throughout Fort Ord, shaggy-barked manzanita is the most characteristic dominant, and was generally overwhelmingly dominant. Other characteristic shrubs that were often dominant or co-dominant include chamise, black sage (*Salvia mellifera*), Monterey ceanothus, and poison-oak (*Toxicodendron pubescens*). Pond 21, a vernal pool dominated by a mix of hydrophytic grasses and forbs and known to support federally threatened California tiger salamander (*Ambystoma californiense*), is located in the north central portion of the Unit. A deeply incised and flattened soil remediation and active plant restoration area (Historic Area 29) is located in the south central portion of the Unit. The Unit is bisected by Forrestal Road, but otherwise interior portions of the Unit were largely inaccessible in Baseline conditions.

3.3 Unit 5: Methods

In accordance with methods outlined in the Revised Protocol and Section 2 of this report, the 2023 Year 1 vegetation monitoring surveys in Unit 5 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 May 2, 2023.

3.4 Unit 5: Results and Discussion

Year 1 surveys included 6 HMP monitoring grids in Unit 5 in 2023. Maps of HMP survey grids for Unit 5 are provided in Appendix B (Figures B-1 through B-3).

3.4.1 Sand Gilia

Sand gilia was not observed in Unit 5 in any survey year. Year 1 (2023) surveys remain consistent with Baseline (2015) conditions (Figure 3-2).

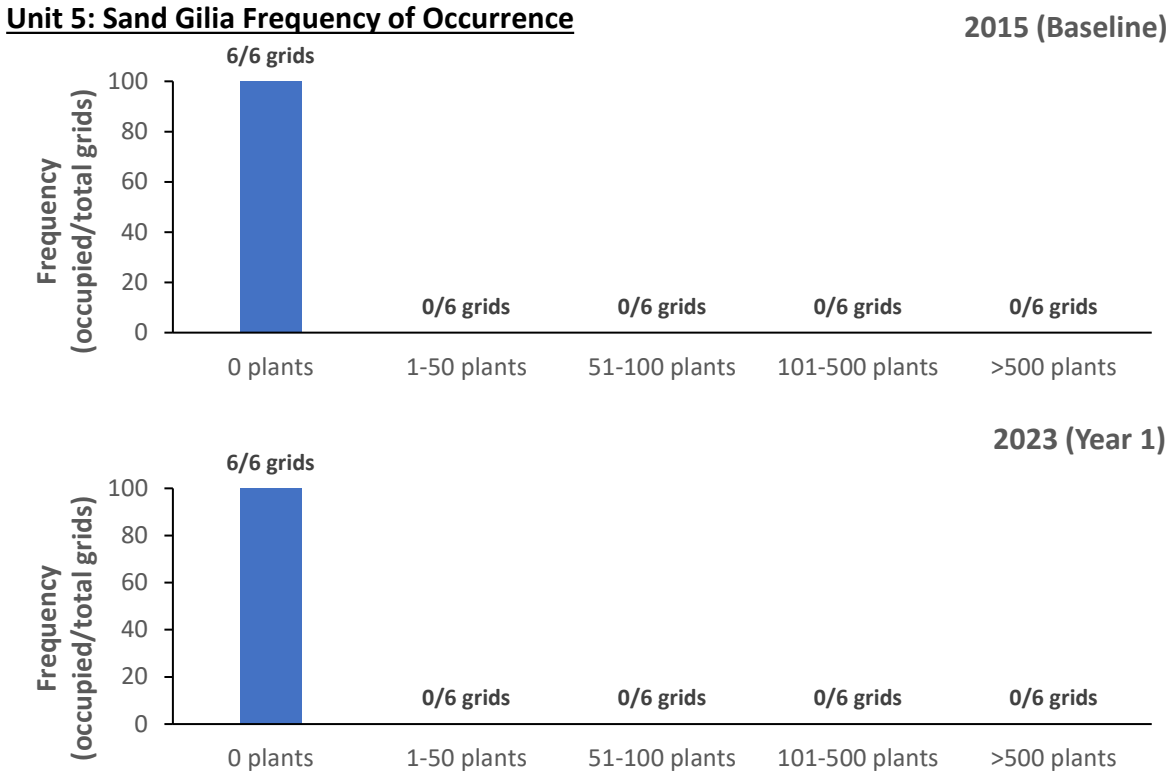


Figure 3-2. Unit 5 sand gilia occurrence in surveyed grids (n=6) for Baseline (2015) and Year 1 (2023).

3.4.2 Seaside Bird's-Beak

Seaside bird's-beak was not observed in Unit 5 in Baseline (2015) or Year 1 (2023) surveys. Year 1 surveys remain consistent with Baseline conditions (Figure 3-3).

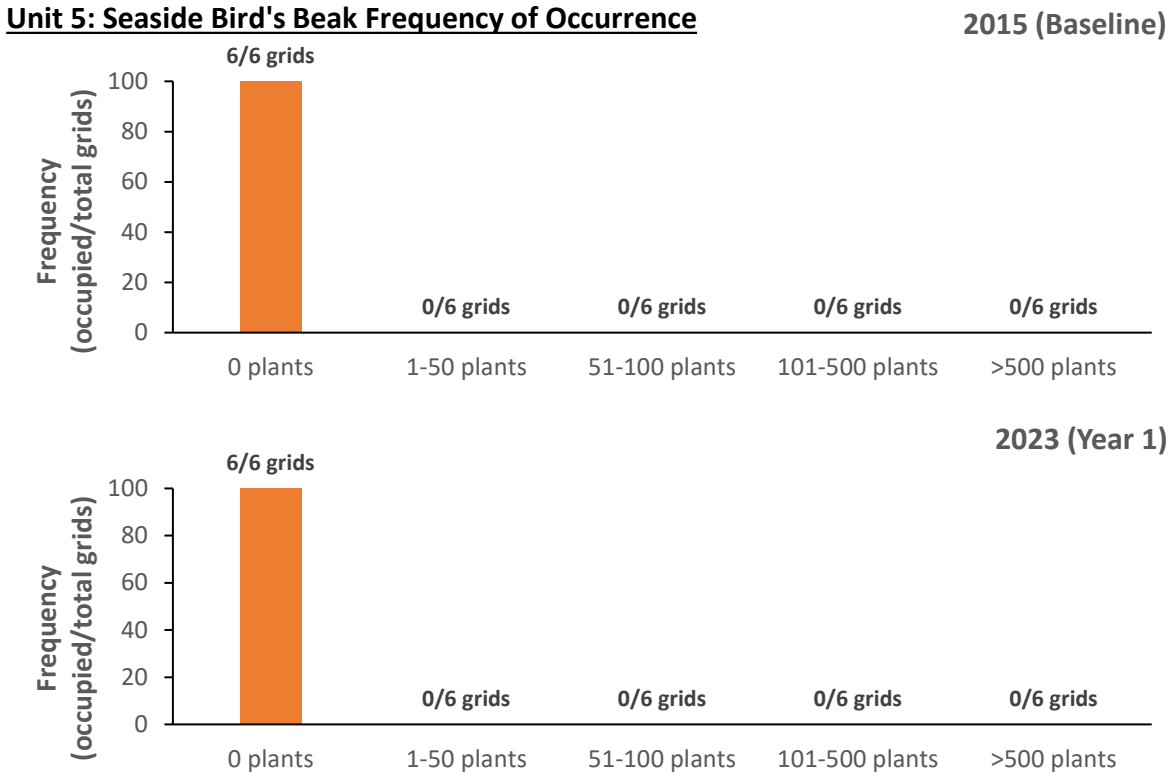


Figure 3-3. Unit 5 seaside bird's beak occurrence in surveyed grids (n=6) for Baseline (2015) and Year 1 (2023).

3.4.3 Monterey Spineflower

Monterey spineflower was observed in Unit 5 in all survey years. In Baseline and Year 1, Monterey spineflower was observed with a frequency of occurrence of 100% (6 of 6 grids) (Figure 3-4; Appendix B, Figure B-3).

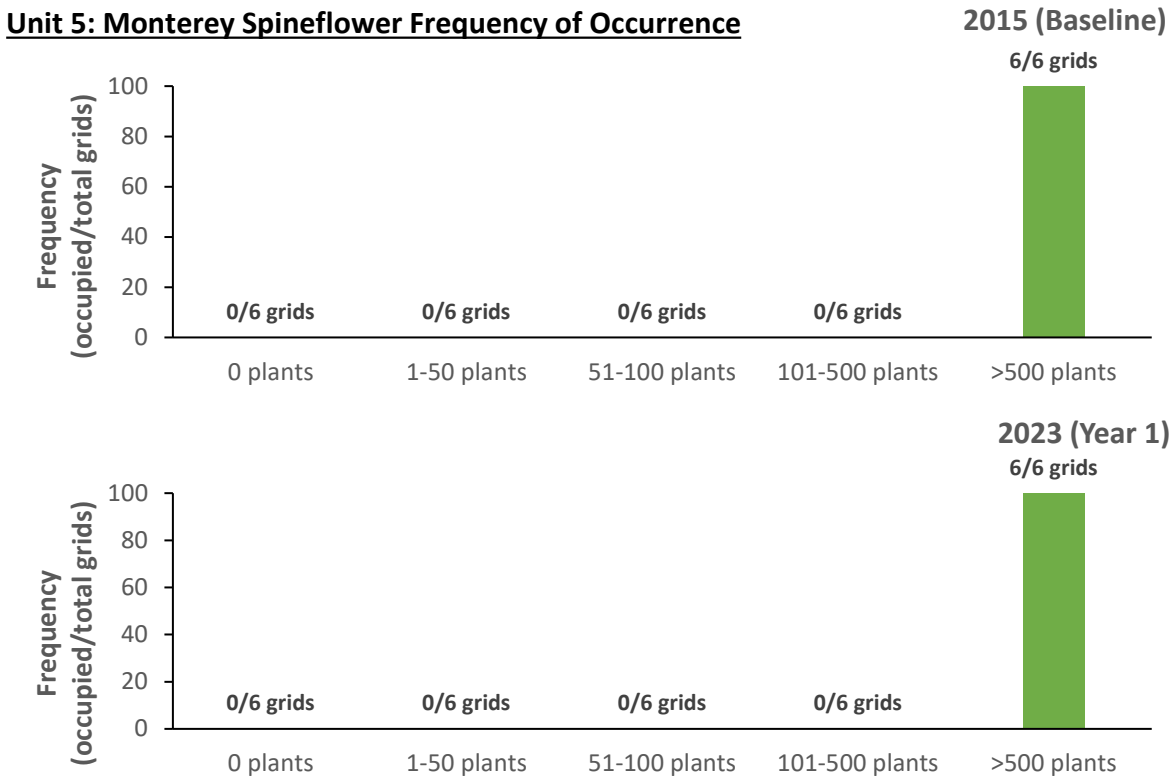


Figure 3-4. Unit 5 Monterey spineflower occurrence in surveyed grids (n=6) for Baseline (2015) and Year 1 (2023).

3.4.4 Yadon's Piperia

No piperia individuals were observed in Unit 5 during Year 1 monitoring.

3.4.5 Effect of Treatment on HMP Density

The differential effects of treatment type on HMP annuals density could not be evaluated in Unit 5 because this area was only masticated, with no prescribed burns.

3.4.6 Invasive and Non-Native Species Monitoring

Invasive and non-native species were not monitored in Unit 5 in 2023.

This page intentionally left blank

4 YEAR 5 VEGETATION SURVEYS: UNITS 25, 31, AND BLM AREA B SUBUNIT A CONTAINMENT LINES

4.1 Introduction

Year 5 Units included Units 25, 31, and BLM Area B Subunit A Containment Lines (Figure 4-1). The Containment Lines of Units 25 and 31 were masticated in 2016, and partially re-masticated in 2018, as part of environmental cleanup operations involving preparations for prescribed burns and MEC removal. The BLM Area B Subunit A Containment Line was masticated in 2017 and partially re-masticated in 2018 in preparation for a prescribed burn.

Baseline surveys occurred in 2014 for Units 25 and 31 Containment Lines, and in 2015 for BLM Area B Subunit A Containment Line (Tetra Tech and EcoSystems West, 2015a; Burleson, 2016). These surveys included meandering transects to map areas of occurrence of HMP herbaceous species; density monitoring for the HMP annual species sand gilia, seaside bird's-beak, and Monterey spineflower; transects to sample shrub composition in the maritime chaparral (for Units 31 and BLM Area B Subunit A Containment Lines); and annual grass monitoring.

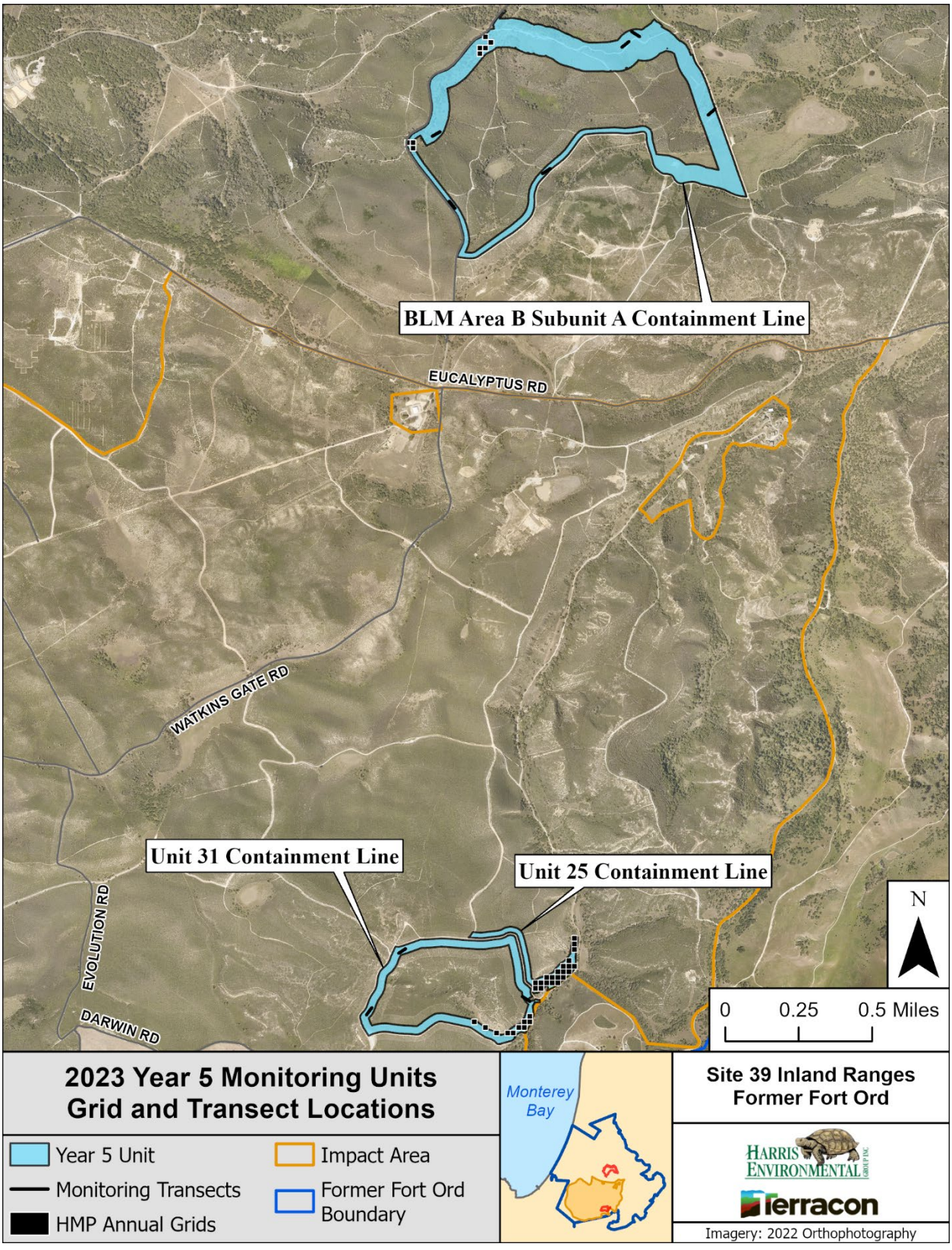


Figure 4-1. BLM Area B Subunit A Containment Line, Unit 25 Containment Line, and Unit 31 Containment Line HMP annuals grids and shrub transects surveyed for Year 5 in 2023.

4.2 Units 25, 31, and BLM Area B Subunit A Containment Lines: Setting

Subunit A is in the northernmost portion of BLM Area B and is bisected by several trails and is bounded by several roads. This area contains a diverse array of maritime chaparral, coast live oak woodland, blue blossom ceanothus (*Ceanothus thyrsiflorus*)-poison oak scrub, native grass prairie, and wet meadow habitats. The BLM Area B Subunit A Containment Line comprises 106 acres. The southern portion of the Containment Line along Watkins Gate Road and West Machine Gun Flats Road encompassing the western group of three survey grids was initially masticated in 2017 and re-masticated in 2018 when the Containment Line around the entire Subunit A was masticated. The portion of the Containment Line encompassing the northern five survey grids was only masticated in 2018. Western grids were surveyed in 2019 as Year 1 post-second mastication and were resurveyed in 2021 as Year 3 post-second mastication (Group 1 grids). The northern five survey grids were surveyed in 2019 as Year 1 post-mastication and were resurveyed in 2021 as Year 3 post-mastication (Group 2 grids).

Unit 25 encompasses an area of 95 acres. The western edge of Unit 25 was masticated in 2015 to prepare Containment Lines for prescribed burns in Units 11 and 12. The remaining vegetation in Unit 25 was masticated in 2016 when the Army made an assessment that a prescribed burn was not feasible due to a significant risk of an escaped wildfire. Unit 25, along with Units 9, 13, 17, 20, and 28, were designated for mastication only, after consultation with USFWS affirmed that it was within the allowed activities described in the PBO (USFWS, 2019). A southeastern portion of the Unit was subsequently re-masticated in 2018 to create a containment line for a prescribed burn of Unit 31. Due to the re-mastication, a portion of the grids were evaluated as Year 1 post-mastication, and a portion of the grids were evaluated as Year 3 post-second mastication in 2019. These grids were surveyed again in 2021 as Year 3 post-second mastication and Year 5 post-mastication. The post-second mastication area of Unit 25 comprises 10 acres, located east of Riso Ridge Road and west of Impossible Canyon Road in the southeast portion of former Fort Ord. Unit 25 has gently rolling topography in the western portion, with a steep, east-facing slope dominated by coast live oak woodland in the eastern portion bordering Impossible Canyon Road. Abandoned roads with varying amounts of vegetative overgrowth cross the Unit along ridgelines providing some degree of unobstructed access to the interior portions of the Unit. Prior to mastication, Unit 25 was dominated by mature maritime chaparral vegetation of the shaggy-barked manzanita association. Non-meadow annual grassland and disturbed areas occur in the southeast portion of the Unit along Impossible Canyon Road. Relatively open chaparral is most extensive on south and east facing slopes in areas that appeared more recently disturbed.

The Unit 31 Containment Line was masticated in 2016 and a portion was re-masticated in 2018 in preparation for prescribed burns. Due to the re-mastication, a portion of the grids (27 acres) were evaluated as Year 1 post-mastication (2017), Year 3 post-mastication (2019), and Year 5 post-mastication (2021); and a portion of the grids (29 acres) were evaluated as Year 1 post-mastication (2017), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and now Year 5 post-second mastication (2023). The remaining 47 acres are within the interior of the Unit and are planned for a prescribed burn without mastication. The Unit is located east of Riso Ridge Road and west of Impossible Canyon Road in the southeast portion of the area of former Fort Ord. Unit 31 is dominated by mature maritime chaparral of the shaggy-barked manzanita association, coast live oak woodland, and disturbed non-native grassland. The Unit is situated as a southeast facing bowl sloping down to a narrow valley that was evidenced to have been heavily used for infantry training when the base was active. The relatively flat valley is bordered by dense coast live oak woodland on a steep north-facing slope immediately to the south and consists of patchy non-native grassland with sparse to locally dense coyote brush (*Baccharis pilularis*).

4.3 Units 25, 31, and BLM Area B Subunit A Containment Lines: Methods

In accordance with methods outlined in the Revised Protocol and Section 2 in this report, the 2023 Year 5 vegetation monitoring surveys in Units 25, 31, and BLM Area B Subunit A Containment Lines 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 May 2, 3, 4, and 5, 2023.

- Repeated sampling of shrub transects that were monitored in 2014, 2015, 2019, and 2021 surveys (Tetra Tech and EcoSystems West, 2015a; Burleson, 2016; Burleson, 2020; Burleson, 2022). This survey effort was conducted at Units 31 and BLM Area B Subunit A Containment Lines to assess shrub species composition of the sensitive maritime chaparral community after treatment. Surveys occurred on June 27, 28, and 29; July 20 and 21; and September 20, 2023

- 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.

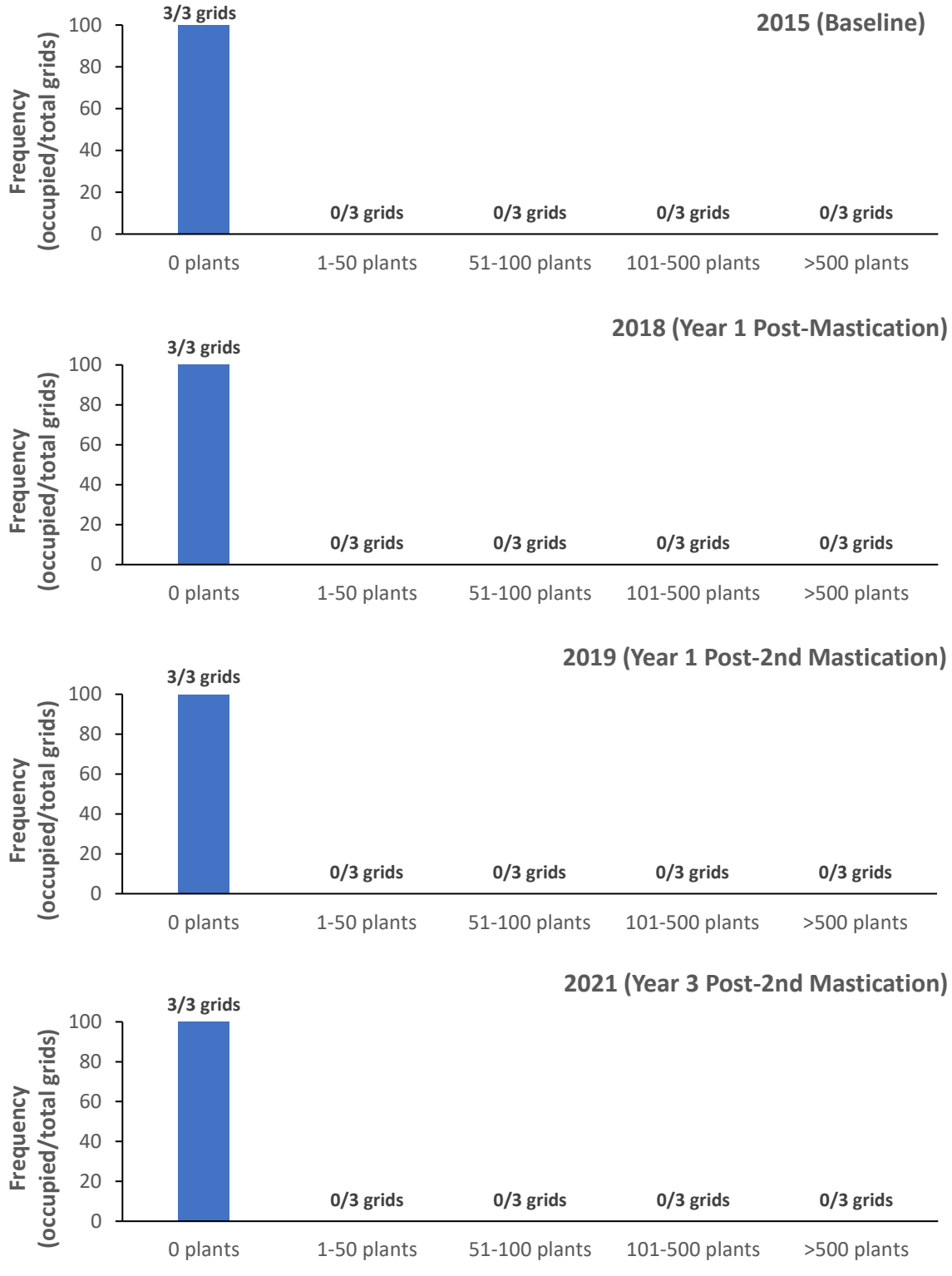
4.4 Units 25, 31, and BLM Area B Subunit A Containment Lines: Results and Discussion

The USACE team surveyed 39 HMP monitoring grids in the Year 5 Units in 2023. Eight grids were surveyed in BLM Area B Subunit A; five of these grids were surveyed post-first mastication (Group 2 grids) and three were surveyed post-second mastication (Group 1 grids). Twenty-one grids were surveyed in the Containment Line of Unit 25 (post-second mastication) and 10 grids were surveyed in the Containment Line of Unit 31. Maps of survey grids for the sampled Units are provided in Appendix B (Figures B-4 through B-12). All HMP grids in these Units were masticated.

4.4.1 Sand Gilia

Sand gilia was observed in Units 25 and 31 Containment Lines in 2023 and was not observed in BLM Area B Subunit A Containment Line in any survey year (Figure 4-2 through Figure 4-5; Appendix B, Figures B-4, B-7, and B-10). Sand gilia was observed in Unit 25 Containment Line in Year 1 (2019) and Year 5 (2023), and in Unit 31 Containment Line in Year 1 (2017, 2019), Year 3 (2021), and Year 5 (2023) surveys. In Unit 25 Containment Line, sand gilia was found at a frequency of occurrence of approximately 10% (2 of 21 grids) during Year 1 (2019 post-second mastication) surveys and approximately 5% (1 of 21 grids) during Year 5 (2023) surveys. In Unit 31 Containment Line, sand gilia was found at a frequency of occurrence of 0% (0 of 10 grids) in 2014, 40% (4 of 10 grids) in 2017 post-mastication, 30% (3 of 10 grids) in 2019 post-second mastication, and 20% (2 of 10 grids) in 2021 and 2023 post-second mastication.

BLM Area B, Subunit A Containment Line: Sand Gilia Frequency of Occurrence



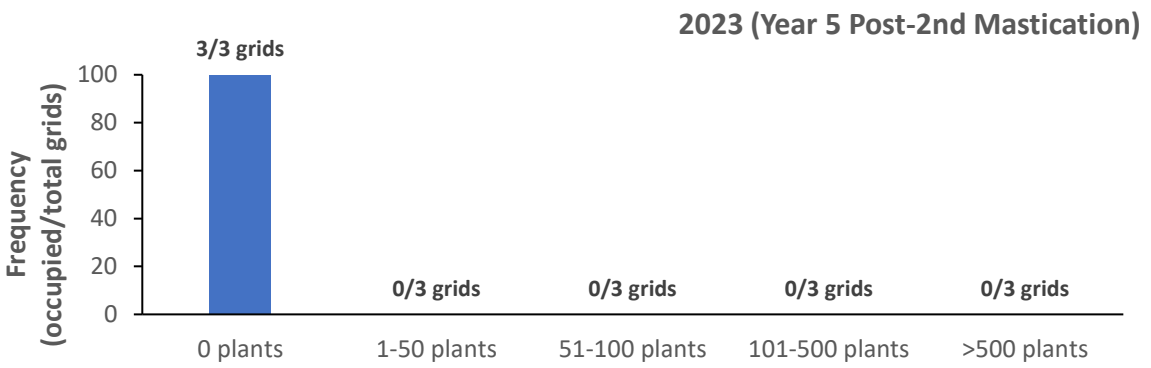


Figure 4-2. BLM Area B Subunit A Containment Line sand gilia occurrence in surveyed Group 1 Grids (n=3) for Baseline (2015), Year 1 post-mastication (2018), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and Year 5 post-second mastication (2023).

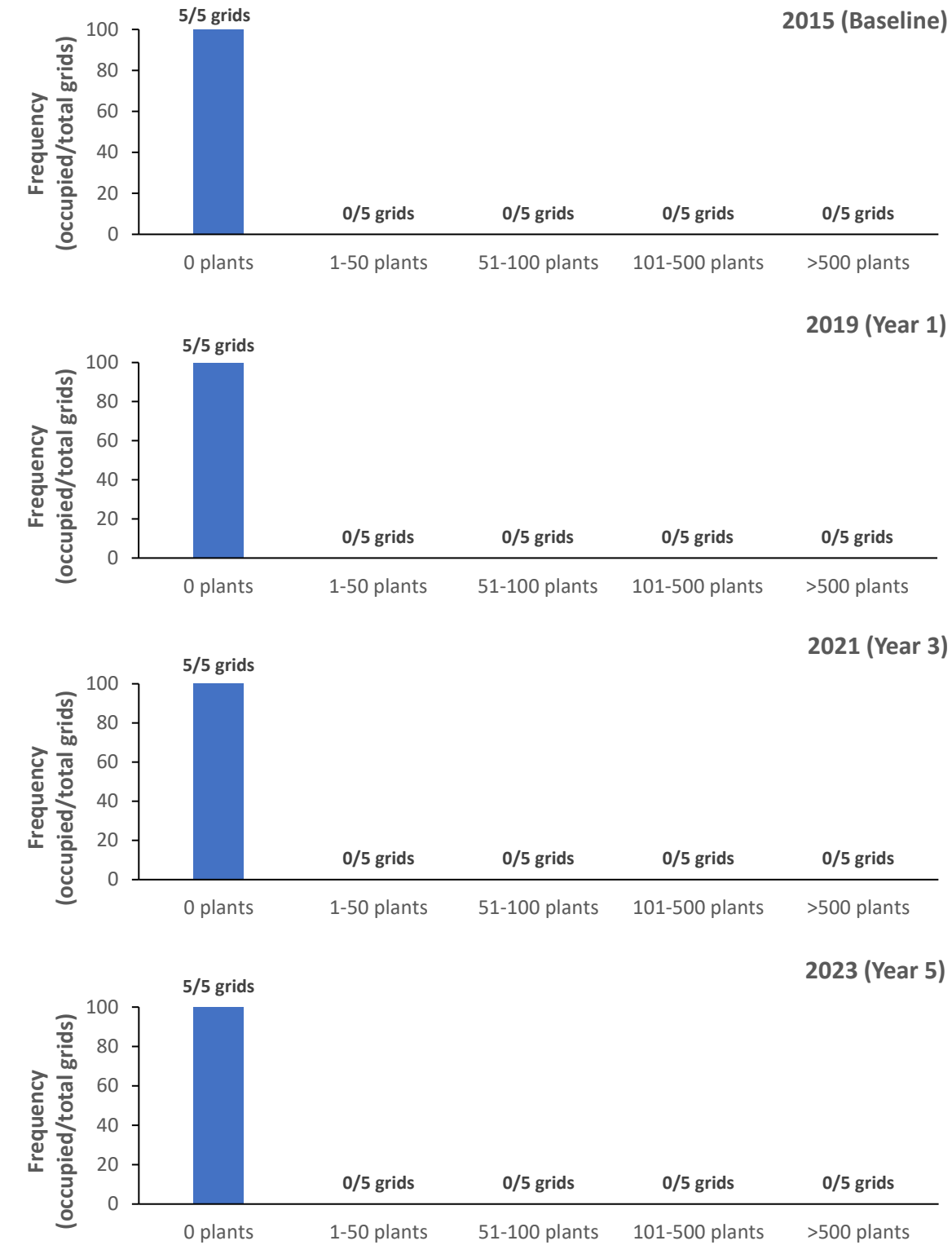
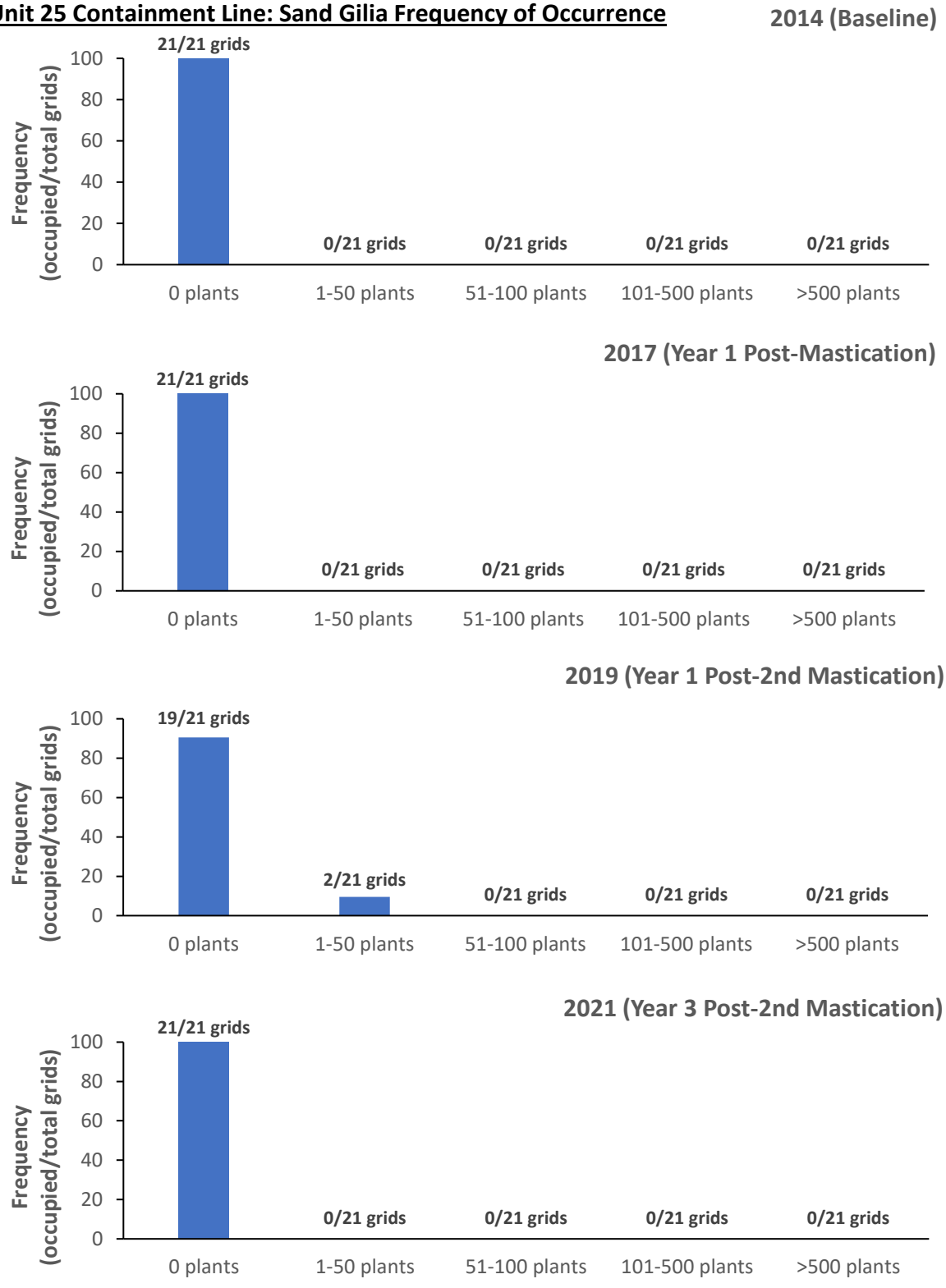


Figure 4-3. BLM Area B Subunit A Containment Line sand gilia occurrence in surveyed Group 2 Grids (n=5) for Baseline (2015), Year 1 (2019), Year 3 (2021), and Year 5 (2023).

Unit 25 Containment Line: Sand Gilia Frequency of Occurrence



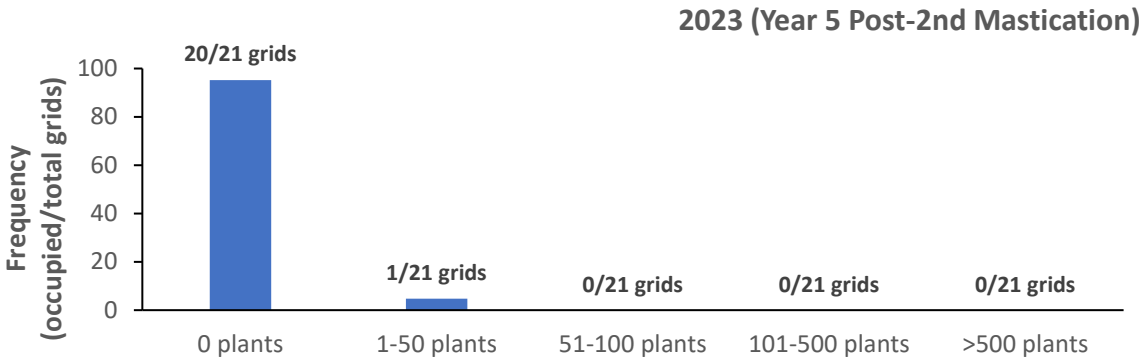
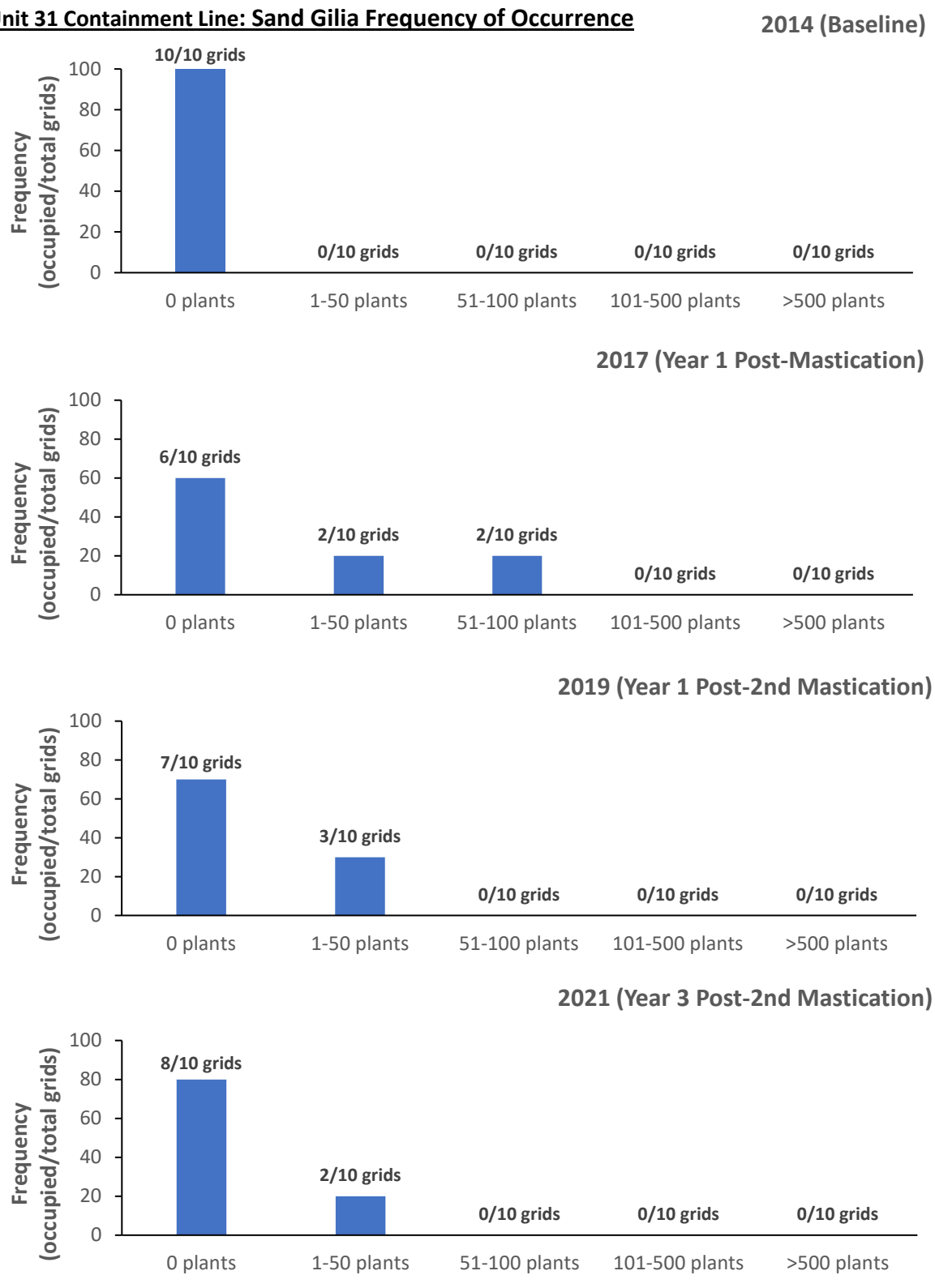


Figure 4-4. Unit 25 Containment Line sand gilia occurrence in surveyed grids (n=21) for Baseline (2014), Year 1 post-mastication (2017), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and Year 5 post-second mastication (2023).

Unit 31 Containment Line: Sand Gilia Frequency of Occurrence



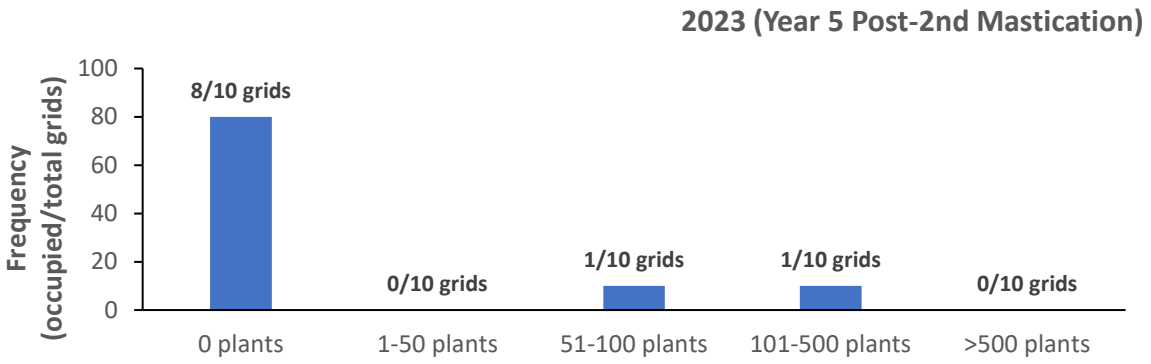
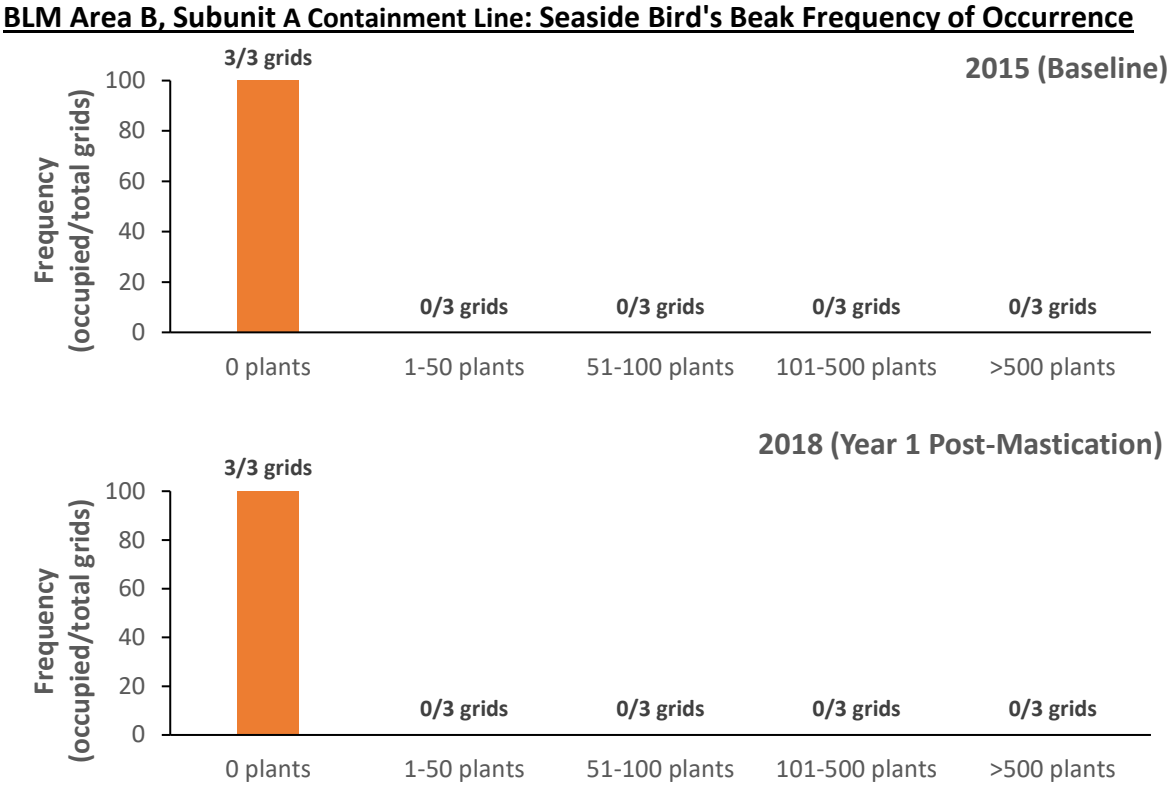


Figure 4-5. Unit 31 Containment Line sand gilia occurrence in surveyed grids (n=10) for Baseline (2014), Year 1 post-mastication (2017), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and Year 5 post-second mastication (2023).

4.4.2 Seaside Bird's-Beak

Seaside bird's beak was not observed in any of the Year 5 Units in 2023. Throughout all survey years, this species was only found in Unit 25 Containment Line with a frequency of occurrence of approximately 5% (1 of 21 grids) during Year 1 Post-Mastication (2017) and Year 1 Post-Second Mastication (2019) surveys (Figure 4-6 through Figure 4-9; Appendix B, Figures B-5, B-8, and B-11).



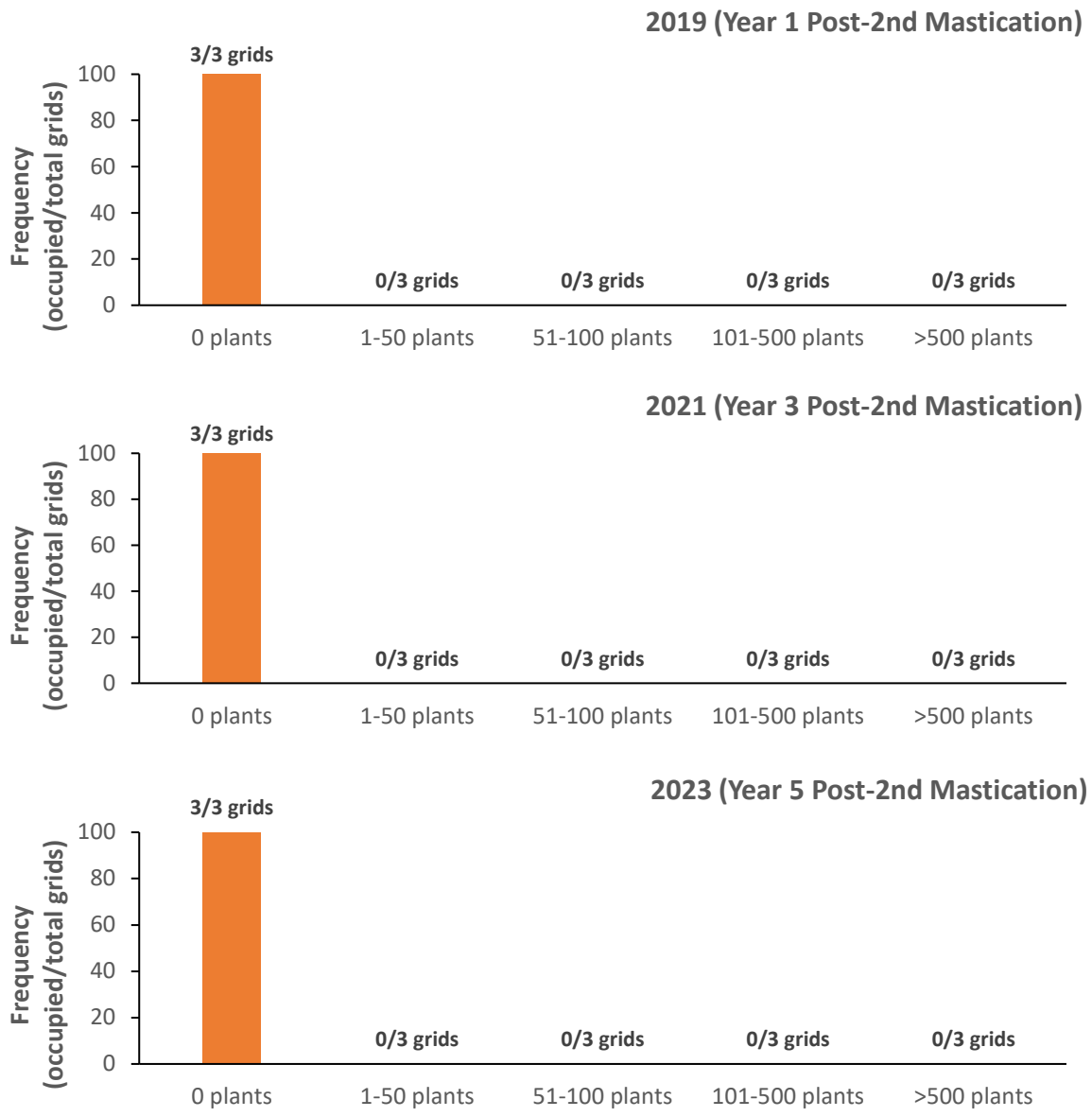


Figure 4-6. BLM Area B Subunit A Containment Line seaside bird's beak occurrence in surveyed Group 1 Grids (n=3) for Baseline (2015), Year 1 post-mastication (2018), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and Year 5 post-second mastication (2023).

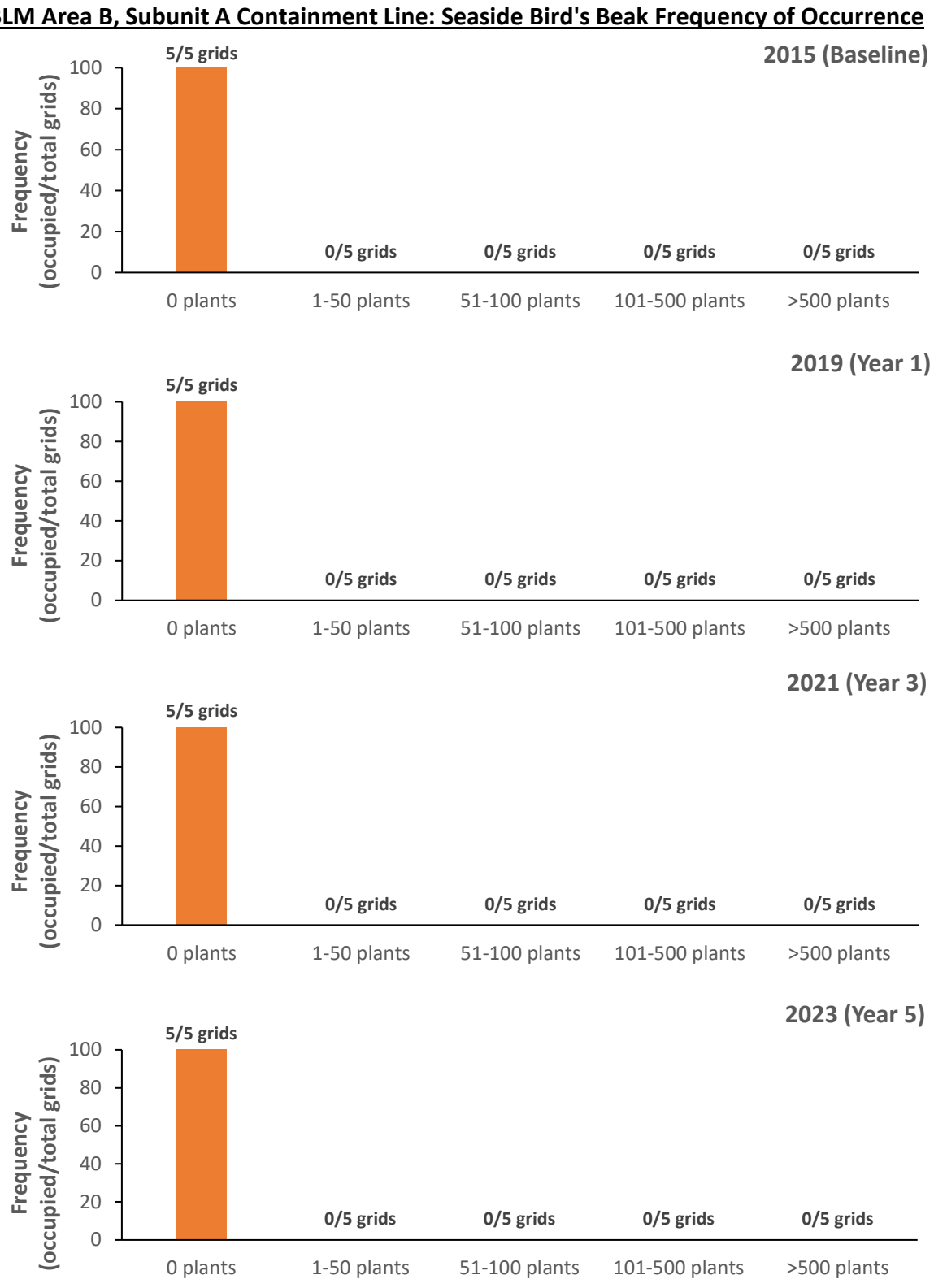
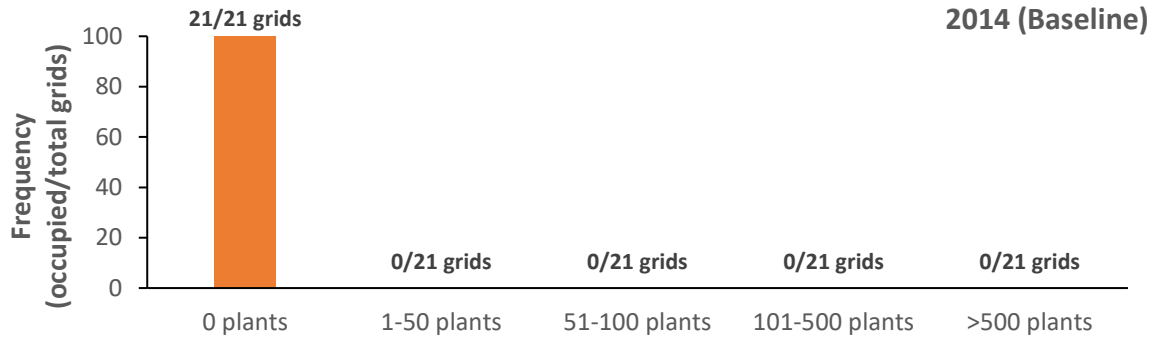
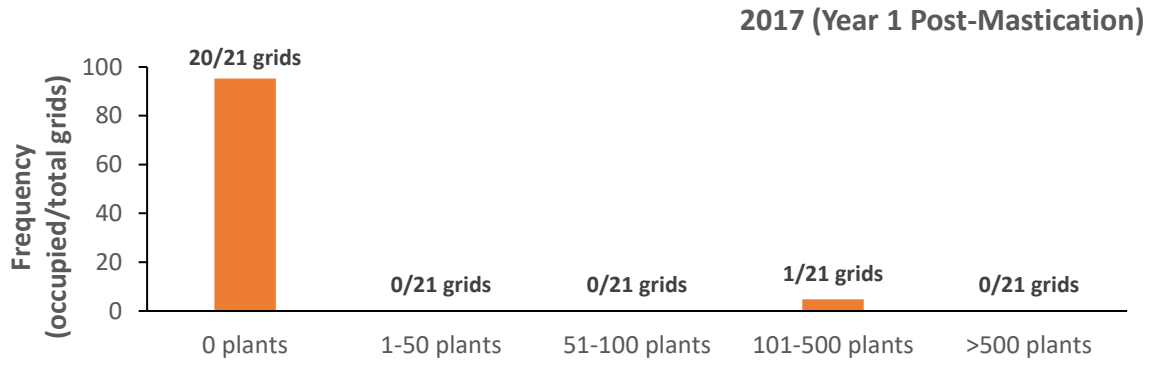
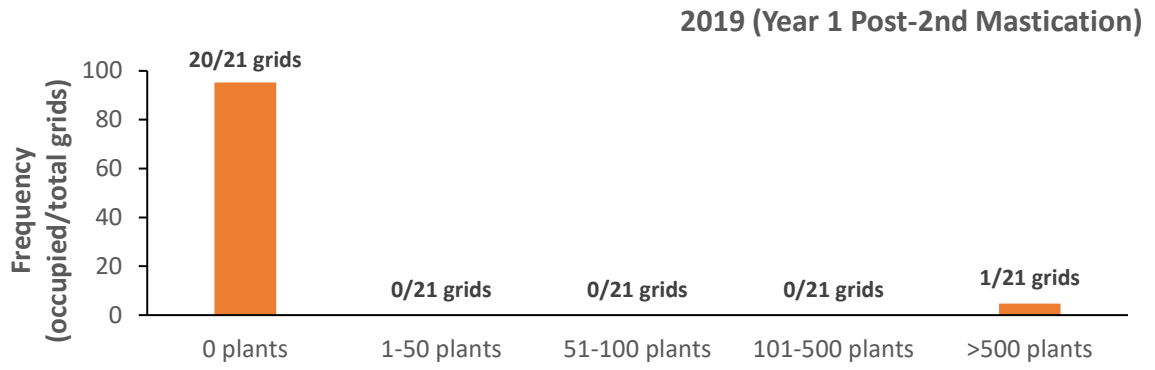


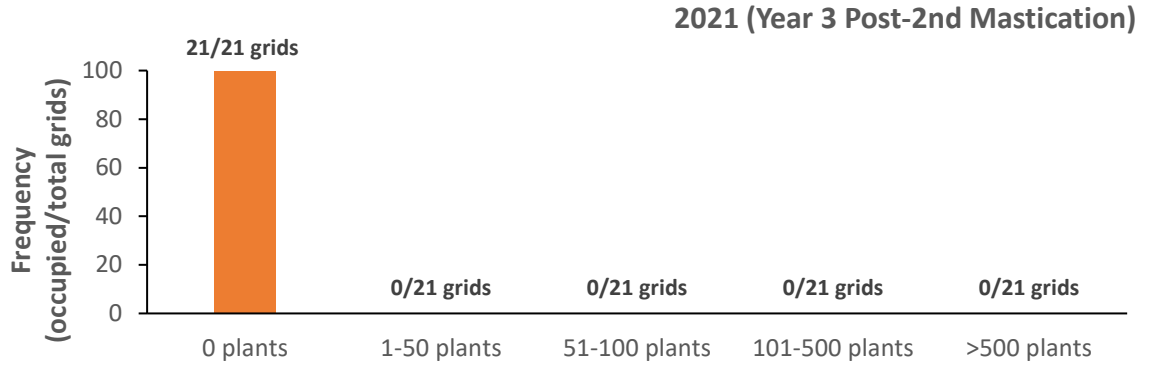
Figure 4-7. BLM Area B Subunit A Containment Line seaside bird's beak occurrence in surveyed Group 2 Grids (n=5) for Baseline (2015), Year 1 (2019), Year 3 (2021), and Year 5 (2023).

Unit 25 Containment Line: Seaside Bird's Beak Frequency of Occurrence









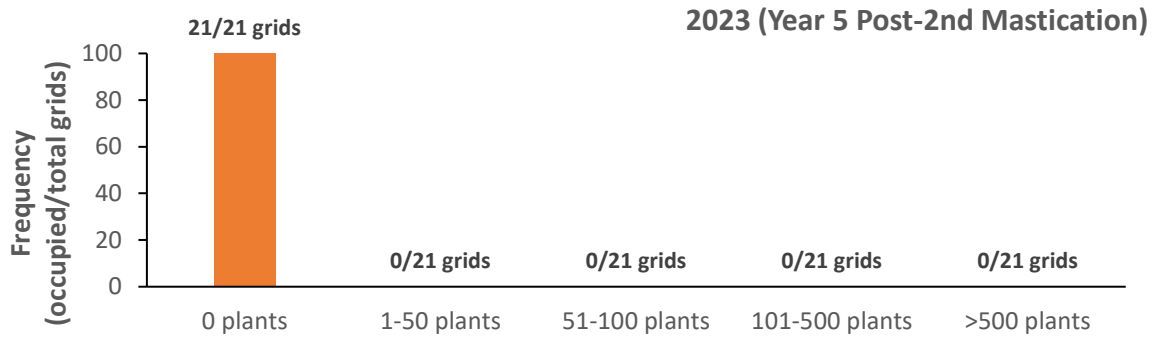
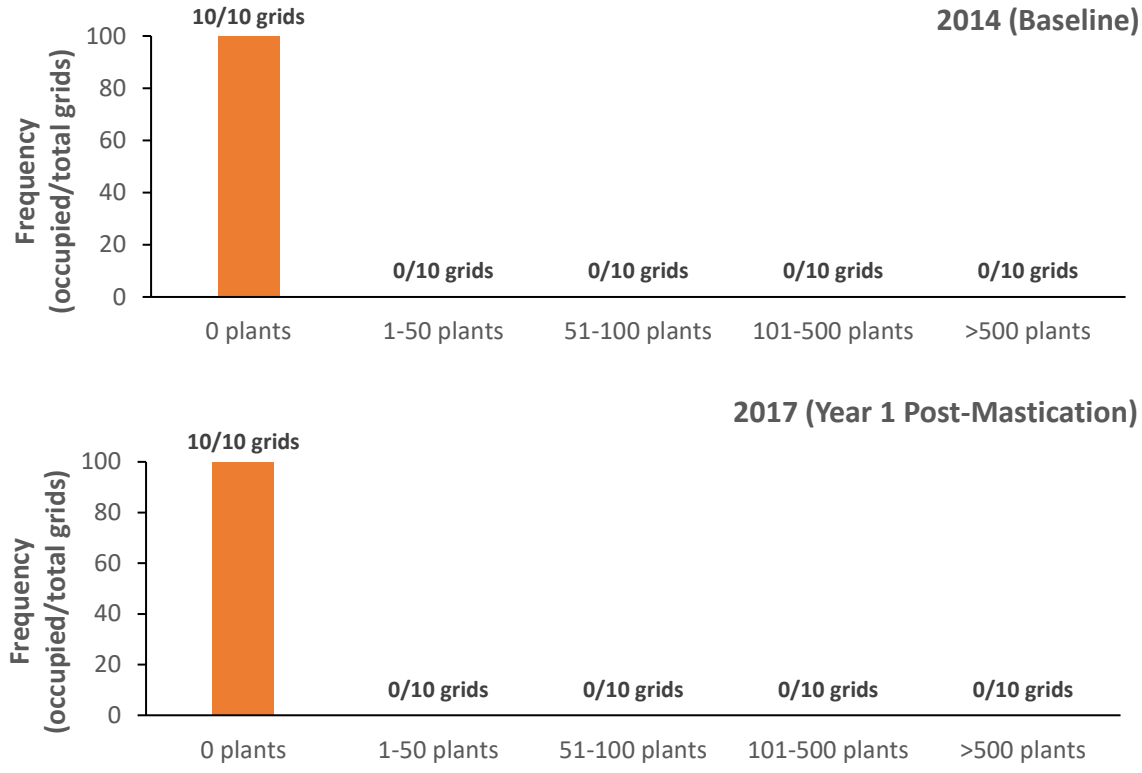


Figure 4-8. Unit 25 Containment Line seaside bird's beak occurrence in surveyed grids (n=21) for Baseline (2014), Year 1 post-mastication (2017), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and Year 5 post-second mastication (2023).

Unit 31 Containment Line: Seaside Bird's Beak Frequency of Occurrence



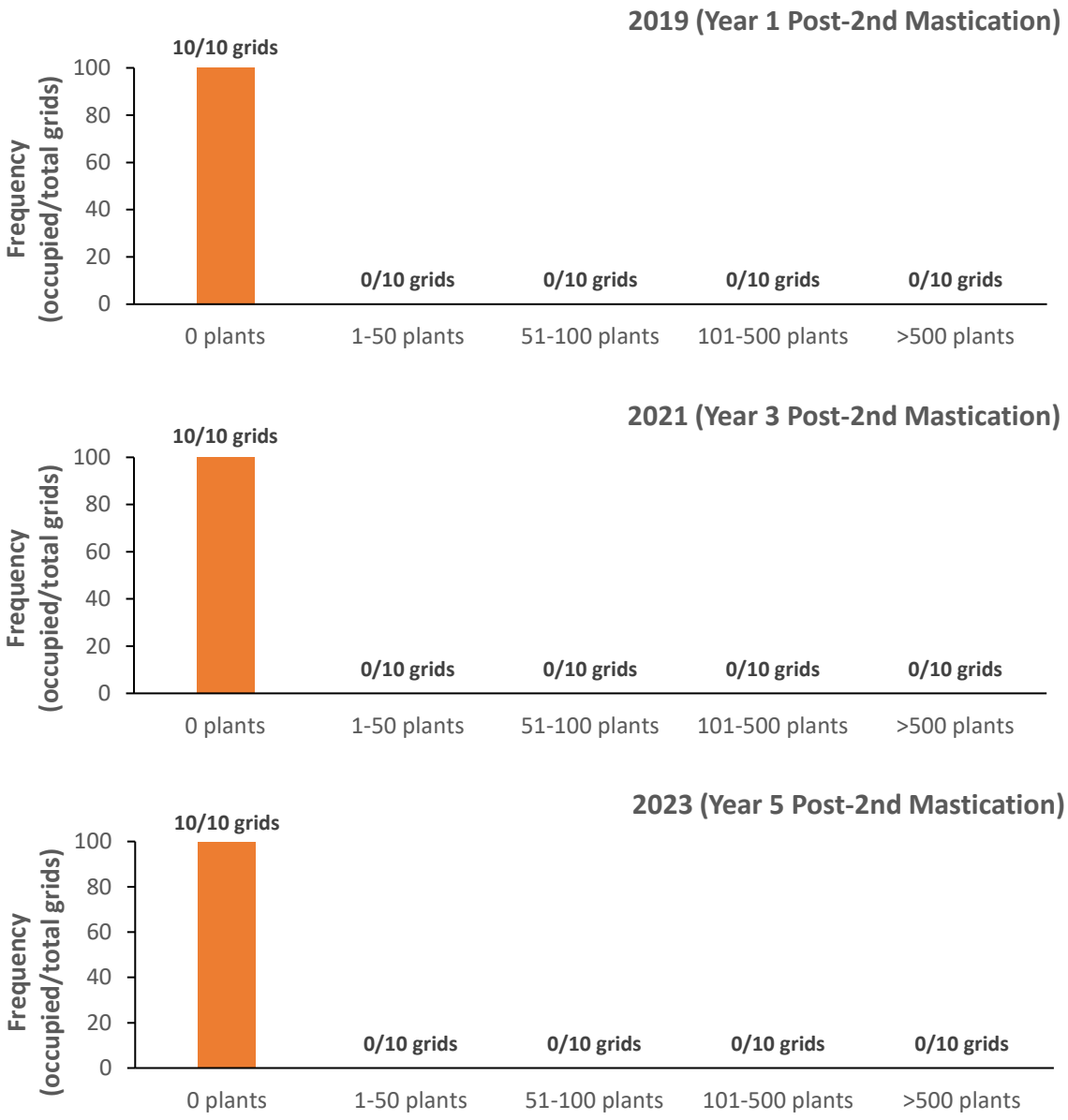
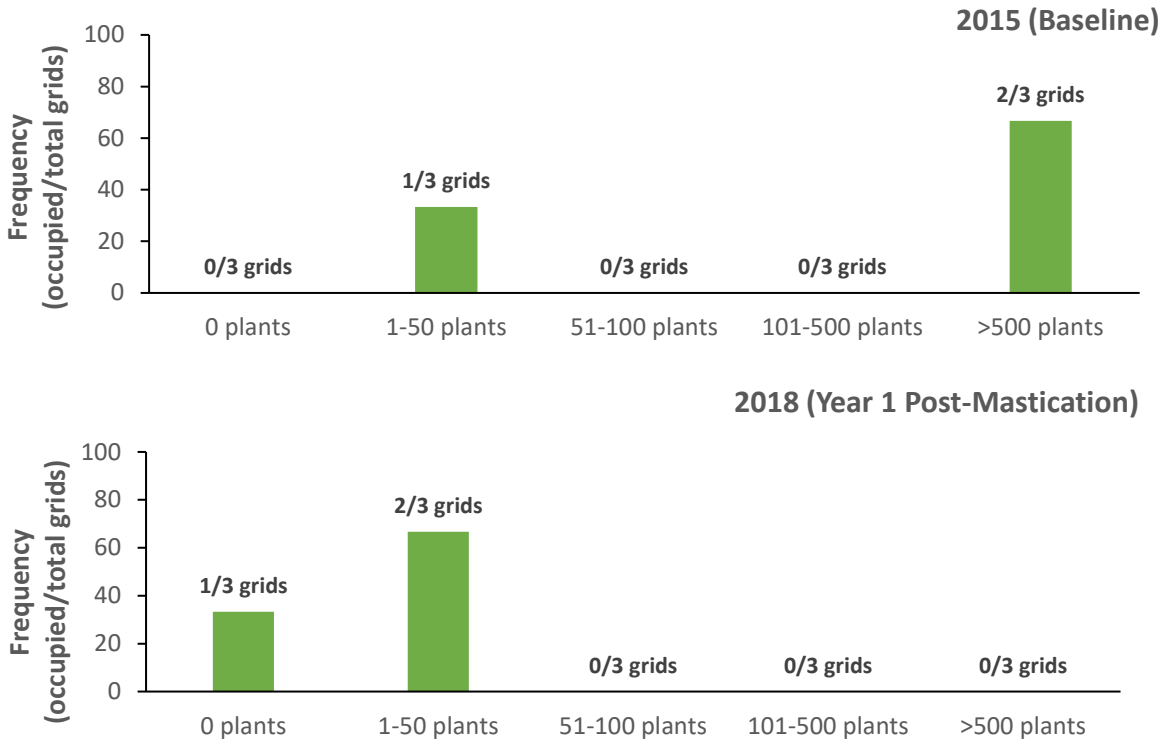


Figure 4-9. Unit 31 Containment Line seaside bird's beak occurrence in surveyed grids (n=10) for Baseline (2014), Year 1 post-mastication (2017), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and Year 5 post-second mastication (2023).

4.4.3 Monterey Spineflower

Monterey spineflower was present in all Year 5 Units except for BLM Area B Subunit A Group 1 grids (Figure 4-10 through Figure 4-13; Appendix B, Figures B-6, B-9, and B-12). The frequency of occurrence in BLM Area B Subunit A Containment Line was 100% in 2015 for both Group 1 (3 of 3 grids) and Group 2 (5 of 5 grids). In Group 1 grids, frequency of occurrence was 67% (2 of 3 grids) in 2018 (post-mastication) and 2019 (post-second mastication), 33% (1 of 3 grids) in 2021 and decreased to 0% in 2023. In Group 2 grids, frequency of occurrence was 100% (5 of 5 grids) in 2015 and 2019, 80% (4 of 5 grids) in 2021 and increased back to 100% in 2023. Frequency of occurrence of Monterey spineflower in Unit 25 Containment Line was 100% in Baseline, approximately 95% (20 of 21 grids) in 2017 (post-mastication), 86% (18 of 21 grids) in 2019 (post-second mastication), 90% (19 of 21 grids) in 2021, and 95% (20 of 21 grids) in 2023. Frequency of occurrence of Monterey spineflower in Unit 31 Containment Line was 100% in 2014, 2017, and 2019, and decreased to 90% (9 of 10 grids) frequency of occurrence in 2021 and 2023.

BLM Area B, Subunit A Containment Line: Monterey Spineflower Frequency of Occurrence



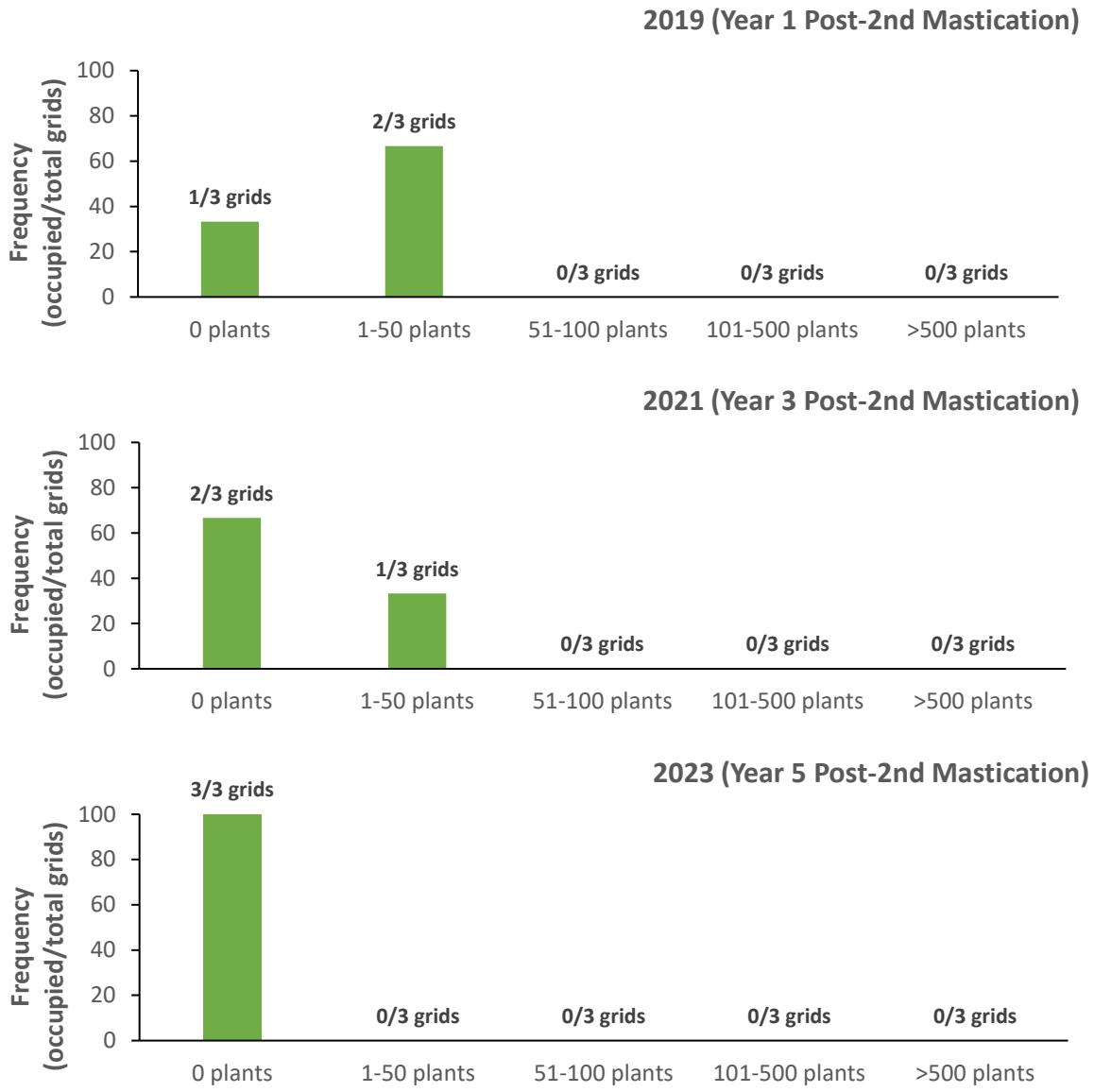


Figure 4-10. BLM Area B Subunit A Containment Line Monterey spineflower occurrence in Group 1 Grids (n=3) for Baseline (2015), Year 1 post-mastication (2018), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and Year 5 post-second mastication.

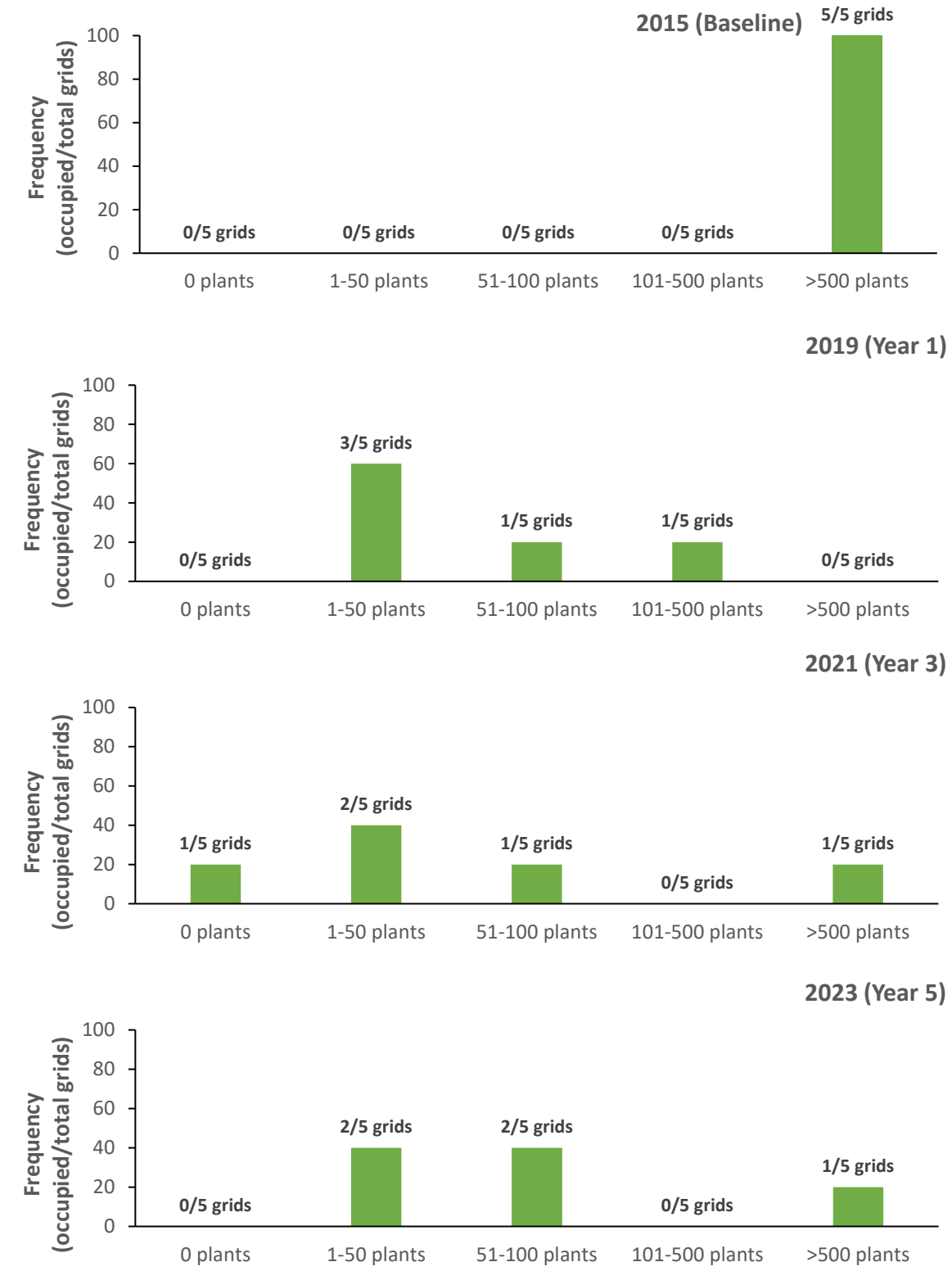
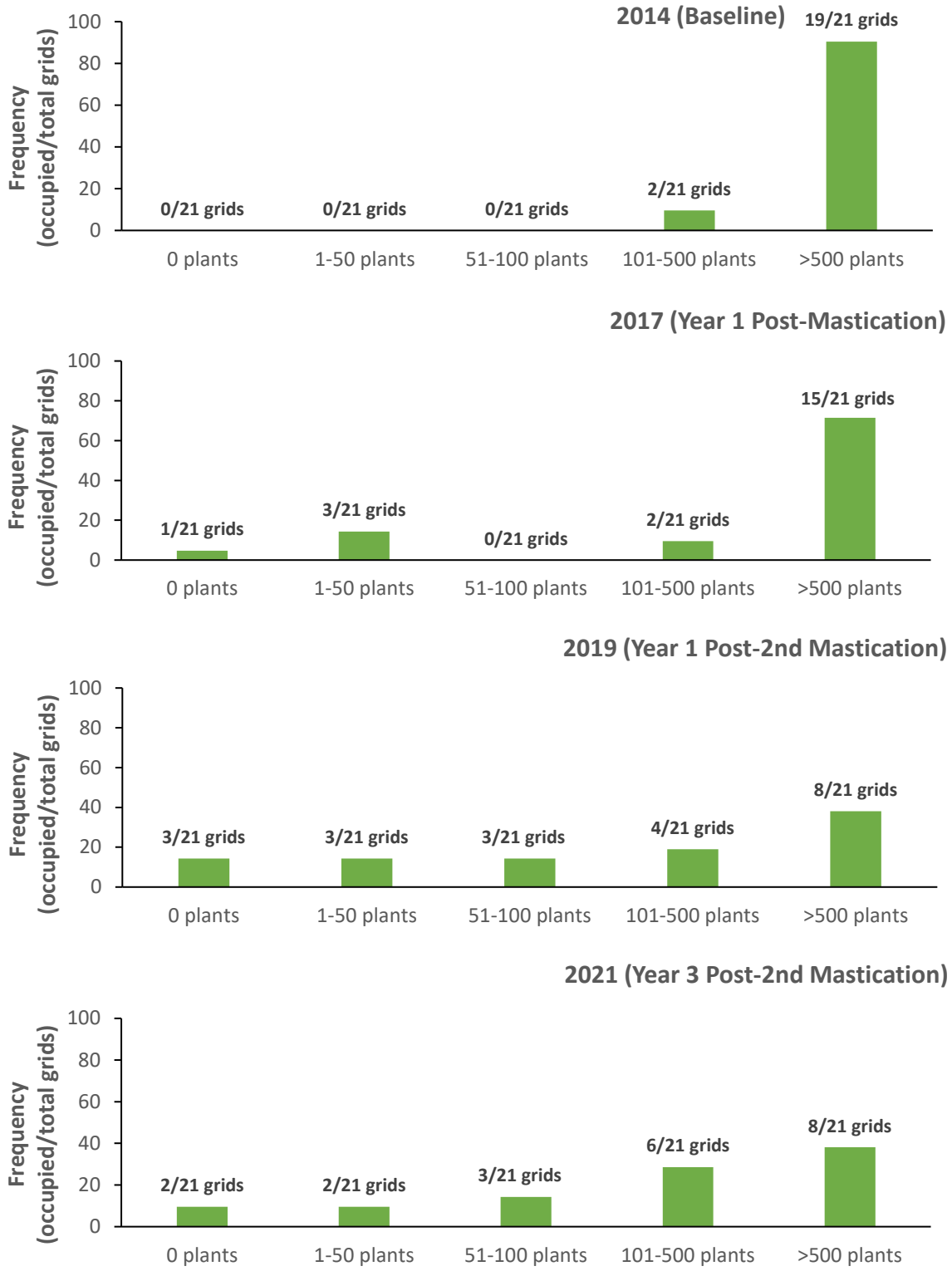


Figure 4-11. BLM Area B Subunit A Containment Line Monterey spineflower occurrence in Group 2 Grids (n=5) for Baseline (2015), Year 1 (2019), Year 3 (2021), and Year 5 (2023).

Unit 25 Containment Line: Monterey Spineflower Frequency of Occurrence



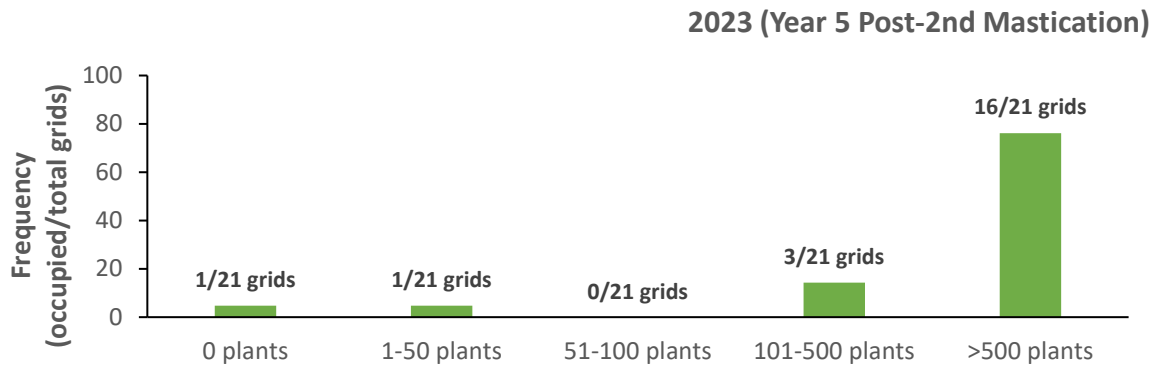
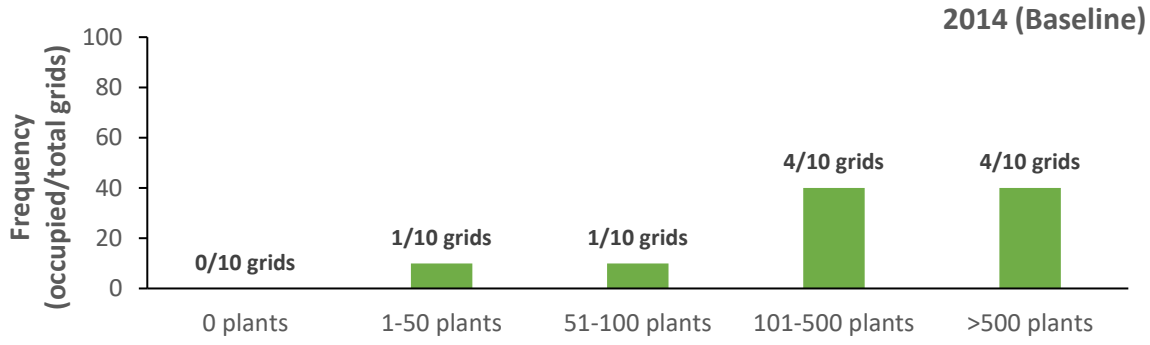
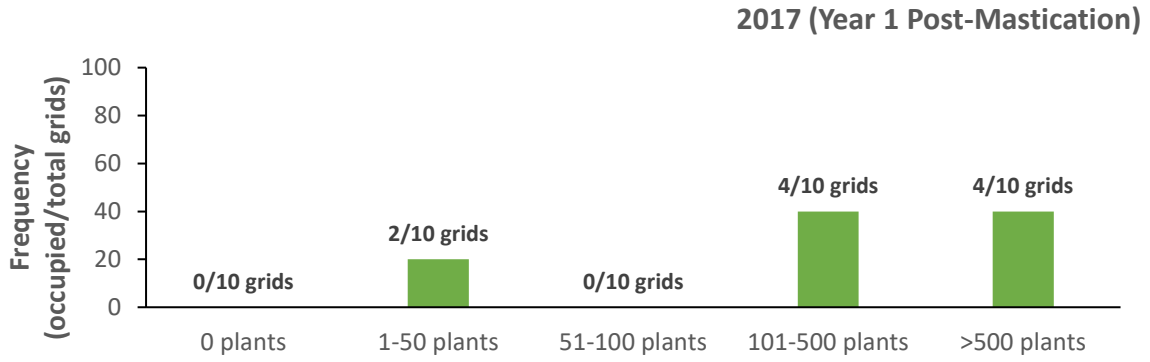


Figure 4-12. Unit 25 Containment Line Monterey spineflower occurrence in surveyed grids (n=21) for Baseline (2014), Year 1 post-mastication (2017), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and Year 5 post-second mastication (2023).

Unit 31 Containment Line: Monterey Spineflower Frequency of Occurrence





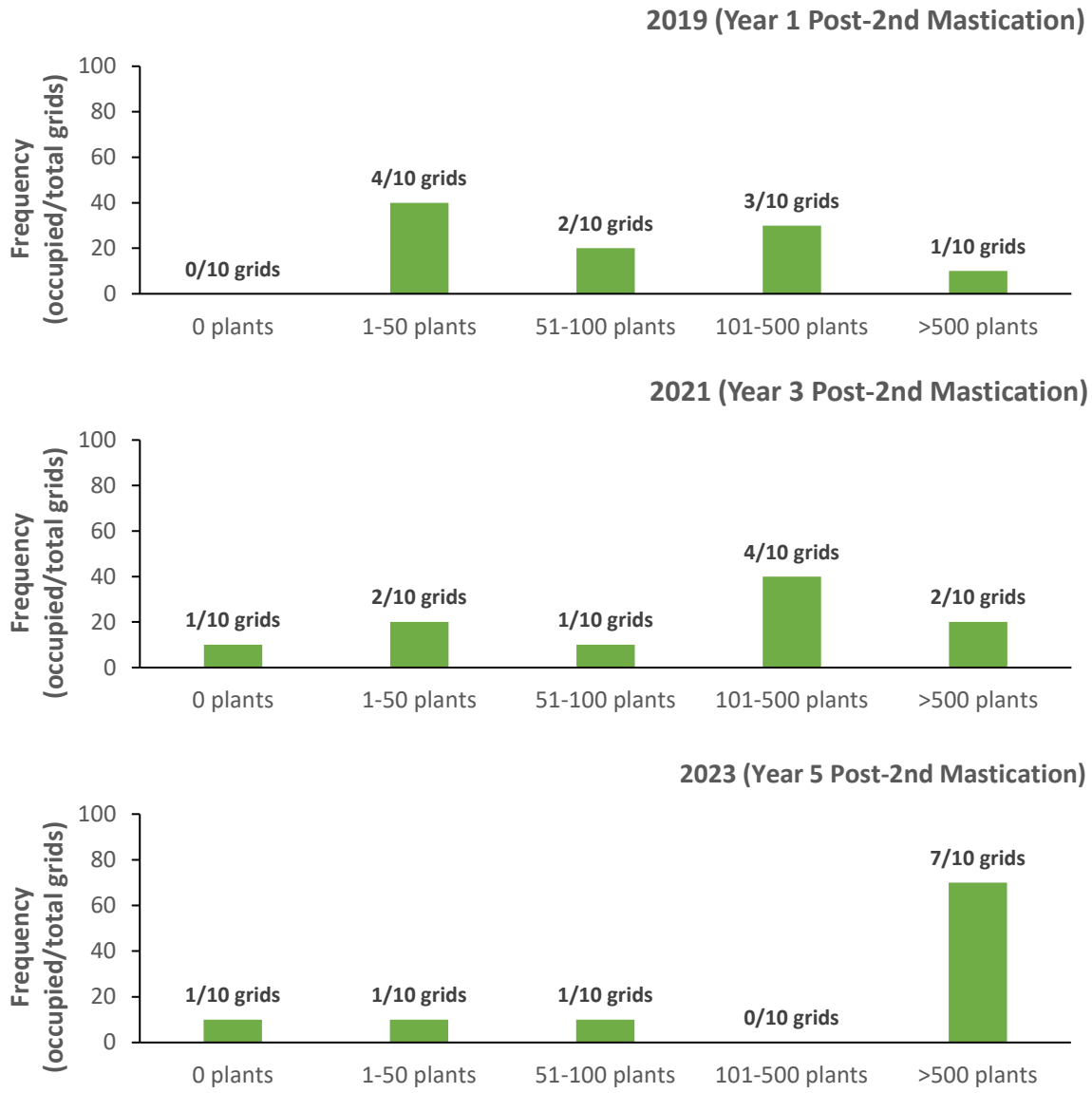


Figure 4-13. Unit 31 Containment Line Monterey spineflower occurrence in surveyed grids (n=10) for Baseline (2014), Year 1 post-mastication (2017), Year 1 post-second mastication (2019), Year 3 post-second mastication (2021), and Year 5 post-second mastication (2023).

4.4.4 Yadon's Piperia

Two piperia individuals were observed in the western portion of Unit 31 Containment Line during 2023 (Year 5) surveys (Appendix E, Figure E-1). Piperia was not observed in Unit 25 Containment Line or BLM Area B Subunit A Containment Line. 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 differential effects of treatment type on HMP annuals density was not evaluated in Year 3; Units were only masticated, with no prescribed burns.

4.4.6 Shrub Transect Monitoring

Shrub transects were sampled in BLM Area B Subunit A Containment Line (n = 6) and Unit 31 Containment Line (n = 3) in 2023 (Appendix C; Figures C-1 and C-2). Two of the six transects in BLM Area B Subunit A Containment Line were re-masticated in 2018, following initial mastication in 2017, and therefore represent two different treatment types. For the purposes of this report, all six transects are analyzed as a single unit and referred to collectively as BLM Area B Subunit A Containment Line. Baseline transects were collected in 2015 for BLM Area B Subunit A Containment Line and in 2014 for Unit 31 Containment Line (Burleson, 2016).

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 Year 5 Units. Unit did not appear to influence any community structure parameters, whereas age of the Unit (Baseline vs. Year 5) appeared to influence all community structure parameters. There was no evidence that interactions between Unit and age factors contributed to differences seen in community structure (Table 4-1).

Table 4-1. Mixed-design ANOVA Results for BLM Area B Subunit A and Unit 31 Containment Lines.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*P*	*F*	*p*	*F*	*p*	*F*	*p*
Unit	0.0171	0.8997	0.2348	0.6428	4.159	0.0808	2.415	0.1641
Age	18.95	1.040E-04	21.21	5.796E-05	5.370	0.0186	13.36	5.685E-04
Unit*Age	0.1631	0.8511	1.365	0.2873	2.354	0.1314	1.018	0.3866

Shrub cover decreased between Baseline and Year 3 in all Year 5 Units but began recovering between Year 3 and Year 5 surveys ($C_{BLMB\_A,\ Year\ 0}$ = 109%, $C_{BLMB\_A,\ Year\ 3}$ = 72%, $C_{BLMB\_A,\ Year\ 5}$ = 74%; $C_{U31,\ Year\ 0}$ = 110%, $C_{U31,\ Year\ 3}$ = 69%, $C_{U31,\ Year\ 5}$ = 79%).

Species diversity in Year 5 Units generally increased between Baseline and Year 5 surveys (Figure 4-14 and Figure 4-15). BLM Area B Subunit A Containment Line diversity increased from Baseline (*H* = 0.88) to Year 3 (*H* = 1.3) and remained stable in Year 5. Unit 31 Containment Line species diversity increased from Baseline (*H* = 1.2) to Year 3 (*H* = 1.6), and decreased slightly from Year 3 to Year 5 (*H* = 1.4).

Species richness increased in all Year 5 Units between Baseline and Year 5 (Figure 4-14 and Figure 4-15). BLM Area B Subunit A Containment Line species richness increased from Baseline (*S* = 5.8) to Year 3 (*S* = 9.8) and decreased slightly from Year 3 to Year 5 (*S* = 8.7). Unit 31 Containment Line species richness increased from Baseline (*S* = 7.0) to Year 3 (*S* = 9.3) and remained stable in Year 5.

Species evenness in Year 5 Units generally increased or remained stable between Baseline and Year 5 (Figure 4-14 and Figure 4-15). BLM Area B Subunit A Containment Line evenness increased from Baseline (*J* = 0.50) to Year 3 (*J* = 0.59) and Year 5 (*J* = 0.63). Unit 31 Containment Line species evenness increased from Baseline (*J* = 0.62) to Year 3 (*J* = 0.72), and decreased from Year 3 to Year 5 (*J* = 0.64).

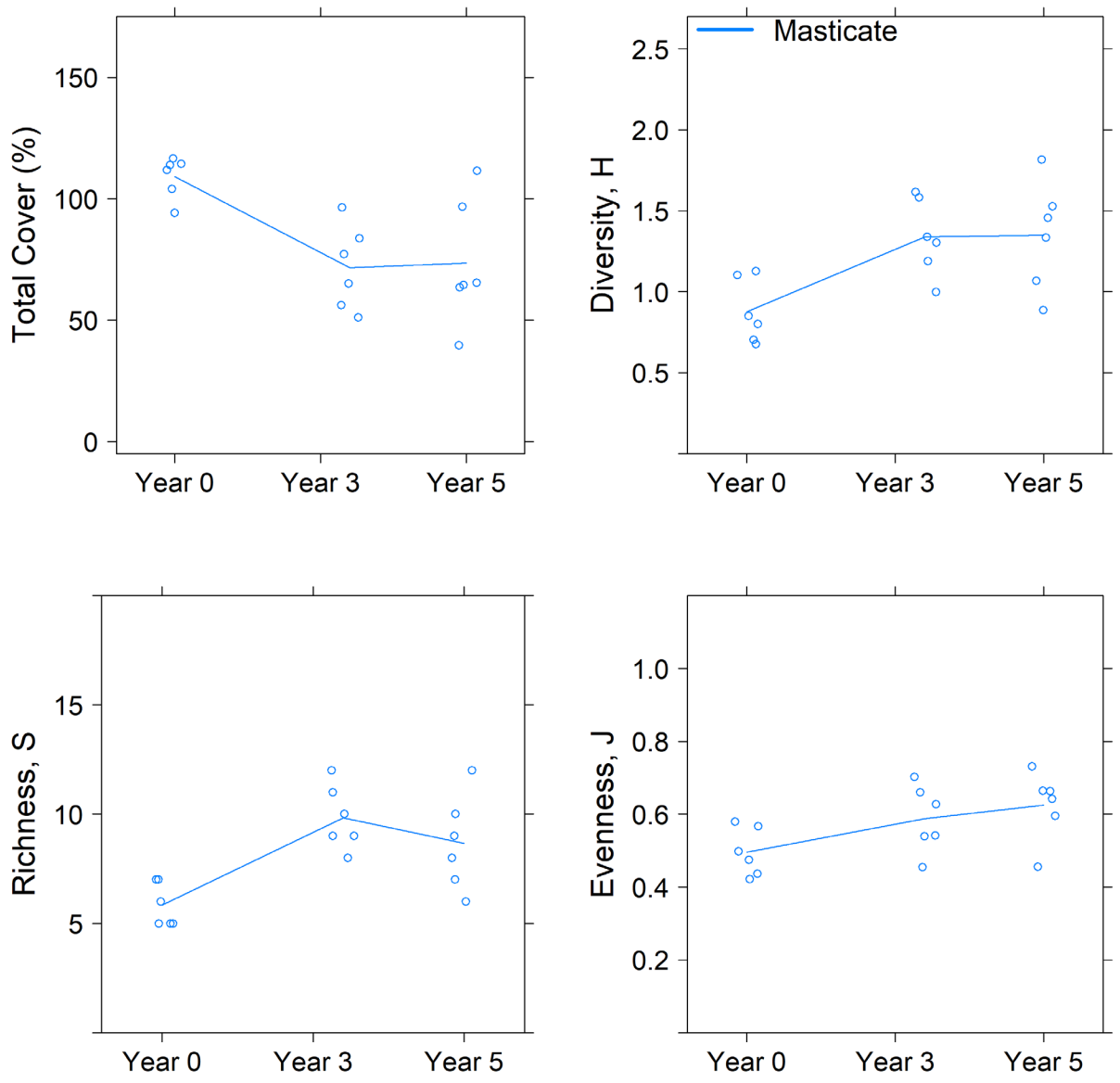


Figure 4-14. BLM Area B Subunit A Containment Line community structure from Baseline (2015) to five years after mastication (2023). Six masticated transects were analyzed in BLM Area B Subunit A Containment Line.

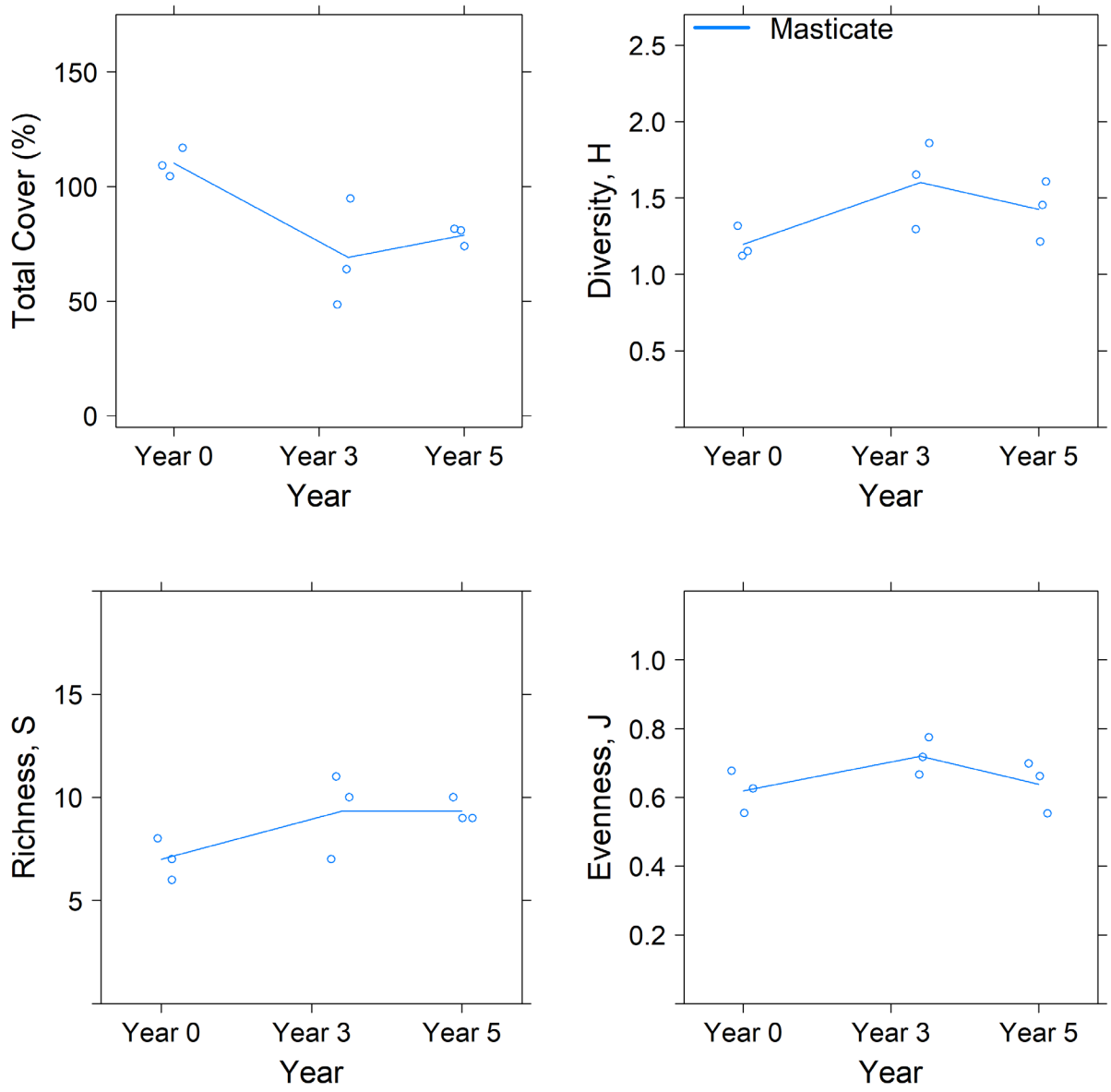


Figure 4-15. Unit 31 Containment Line community structure from Baseline (2014) to five years after mastication (2023). Three masticated transects were analyzed in Unit 31 Containment Line.

Mixed-design ANOVAs were conducted to examine the effects of Unit and age on mean percent bare ground and herbaceous cover. There was no evidence that Unit affected bare ground or herbaceous cover, nor that an interaction between Unit and age may contribute to the observed variation in bare ground cover and herbaceous cover. However, there was statistical evidence that age of the Unit (Baseline vs. Year 5) influenced bare ground and herbaceous cover (Table 4-2).

Table 4-2. Mixed-design ANOVA Results for BLM Area B Subunits A and Unit 31 Containment Lines Bare Ground and Herbaceous Cover.

Factor	Bare Ground		Herbaceous Cover	
	F	***p***	***F***	***p***
Unit	0.3879	0.5532	0.8554	0.3858
Age	7.992	0.0048	11.19	0.0012
Unit*Age	1.272	0.3109	1.515	0.2537

The pattern by which bare ground and herbaceous cover changed over time differed between the Year 5 Units (Figures 4-16 and 4-17). Bare ground in BLM Area B Subunit A Containment Line increased over time from Baseline to Year 5; whereas bare ground in Unit 31 Containment Line increased from Baseline to Year 3 then decreased by roughly half in Year 5. Conversely, herbaceous cover in BLM Area B Subunit Containment Line increased from Baseline to Year 3 then decreased by roughly half in Year 5; and herbaceous cover in Unit 31 Containment Line increased over time from Baseline to Year 5 (Table 4-3).

Table 4-3. Average Percent of Bare Ground and Herbaceous Cover in BLM Area B Subunit A and Unit 31 Containment Lines.

Cover Type % (Year)	BLM Area B Subunit A Containment Line	Unit 31 Containment Line
Bare ground (Baseline)	5.5%	8.7%
Bare ground (Year 3)	29%	30%
Bare ground (Year 5)	31%	16%
Herbaceous (Baseline)	0.5%	0.1%
Herbaceous (Year 3)	13%	14%
Herbaceous (Year 5)	5.9%	15%

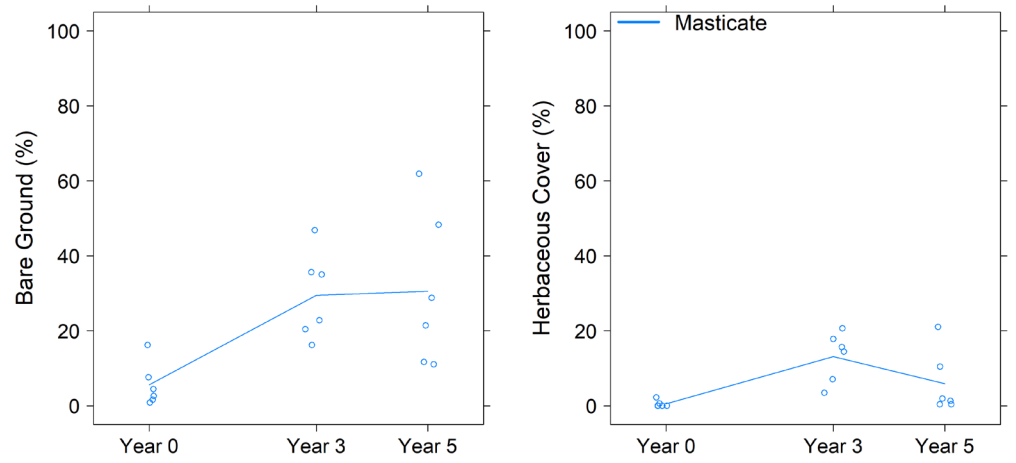


Figure 4-16. BLM Area B Subunit A Containment Line bare ground and herbaceous cover between Baseline (2015) and Year 5 (2023). Six masticated transects were analyzed in BLM Area B Subunit A Containment Line.

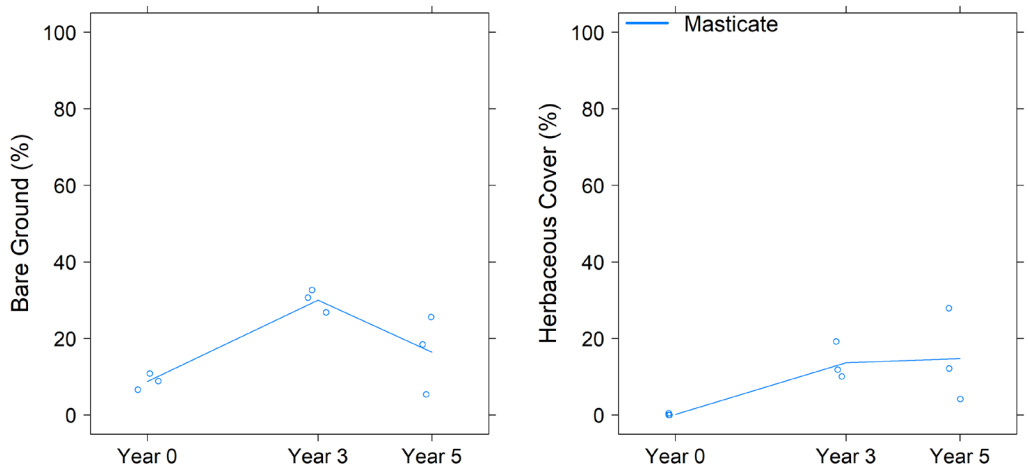


Figure 4-17. Unit 31 Containment Line bare ground and herbaceous cover between Baseline (2014) and Year 5 (2023). Three masticated transects were analyzed in Unit 31 Containment Line.

PERMANOVAs were conducted to examine differences in community composition among age and Units. The results suggest that overall variation in community composition was influenced by both Unit and age. There was no evidence that an interaction between Unit and age affected community composition (Table 4-4). This suggests that community composition may vary through time and across Units. Rank abundance curves illustrate species richness and evenness in each Unit between Baseline and Year 3 surveys (Figure 4-18 and Figure 4-19).

Table 4-4. Two-way PERMANOVA Results for BLM Area B Subunit A and Unit 31 Containment Lines Community Compositions, based on Bray-Curtis Distance Matrices.

Factor	*F*	*p*
Age	4.192	0.0005
Unit	4.672	0.0025
Age*Unit	0.6914	0.7261

Community composition differed between Year 5 Units over time. The Units generally responded similarly over time with respect to richness and evenness, where richness typically increased over time and evenness generally remained stable or increased between years.

Both Year 5 Units were consistently dominated by shaggy-barked manzanita and chamise across all survey years (Figure 4-18 and Figure 4-19). Shaggy-barked manzanita was the dominant species in BLM Area B Subunit A Containment Line in all three survey years ($C_{BLMB\_A,\ Year\ 0}$ = 76%, $C_{BLMB\_A,\ Year\ 3}$ = 44%, $C_{BLMB\_A,\ Year\ 5}$ = 41%), followed by chamise ($C_{BLMB\_A,\ Year\ 0}$ = 11%, $C_{BLMB\_A,\ Year\ 3}$ = 8.4%, $C_{BLMB\_A,\ Year\ 5}$ = 8.7%). Pitcher sage (*Lepechinia calycina*) was not present in Baseline but grew in abundance to become the third most dominant species in BLM Area B Subunit A Containment Line ($C_{BLMB\_A,\ Year\ 5}$ = 4.7%), followed by Hooker's manzanita ($C_{BLMB\_A,\ Year\ 5}$ = 4.3%), which was present in all years. In Unit 31 Containment Line, shaggy-barked manzanita was the dominant species, followed by chamise; shaggy-barked manzanita cover was 60% in Baseline, 29% in Year 3, and 35% in Year 5, while chamise cover was 30% in Baseline, 17% in Year 3, and 22% in Year 5. Dwarf ceanothus (*Ceanothus dentatus*) has grown in abundance since Baseline surveys to become the third most dominant species in Unit 31 Containment Line in Year 5 ($C_{U31,\ Year\ 0}$ = 0.1%, $C_{U31,\ Year\ 3}$ = 2.9%, $C_{U31,\ Year\ 5}$ = 7.5%).

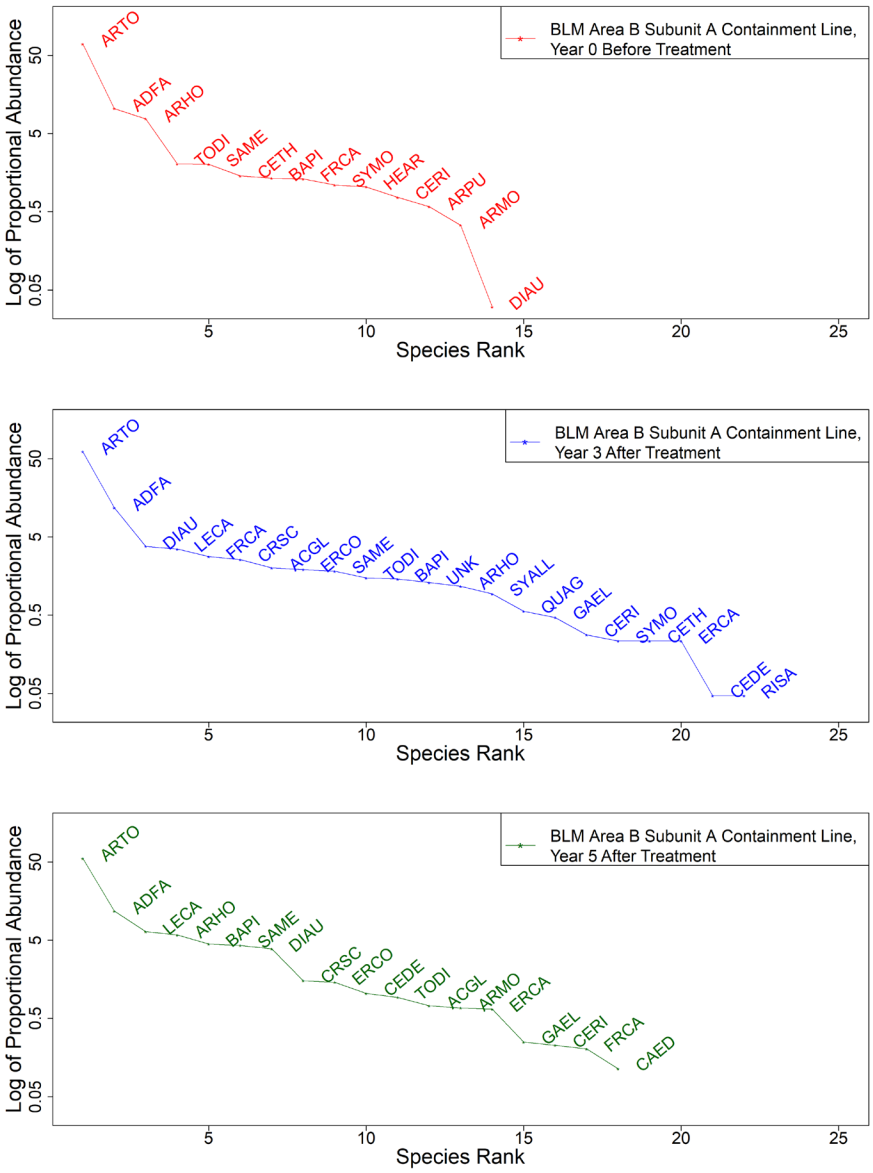


Figure 4-18. BLM Area B Subunit A Containment Line rank abundance curves between Baseline (2015) and Year 5 (2023). New species present in Year 5 surveys compared to Baseline include pitcher sage, peak rush-rose (*Crocanthemum scoparium*), golden yarrow (*Eriophyllum confertiflorum*), dwarf ceanothus, deerweed (*Acmispon glaber*), yerba santa (*Eriodictyon californicum*), coast silk tassel (*Garrya elliptica*), and iceplant. Species present in Baseline surveys, but absent in Year 5 include sandmat manzanita, blue blossom, toyon (*Heteromeles arbutifolia*), and creeping snowberry (*Symphoricarpos mollis*). Six masticated transects were analyzed in BLM Area B Subunit A Containment Line. Y-axis is in log_{10} scale.

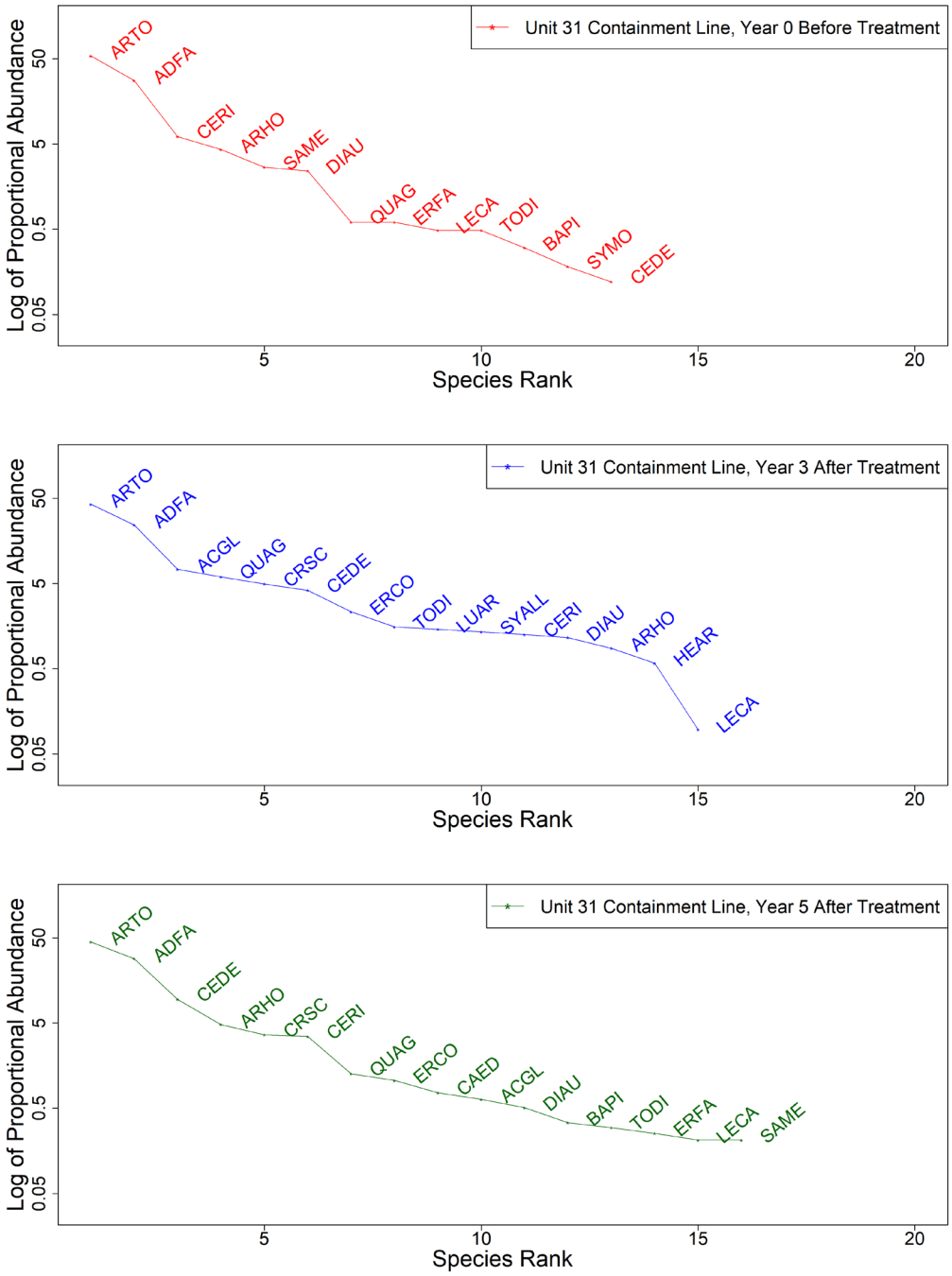


Figure 4-19. Unit 31 Containment Line rank abundance curves between Baseline (2014) and Year 5 (2023). New species present in Year 5 surveys compared to Baseline include peak rush-rose, golden yarrow, iceplant, and deerweed. One species present in Baseline surveys but absent in Year 5 was creeping snowberry. Three masticated transects were analyzed in Unit 31 Containment Line. Y-axis is in log_{10} scale.

HMP shrub species observed in BLM Area B Subunit A Containment Line in Baseline were sandmat manzanita, Monterey ceanothus, Toro manzanita, and Hooker's manzanita (Figure 4-20). Sandmat manzanita and Toro manzanita were not observed in 2021 after mastication; however, Toro manzanita returned in Year 5 (0.50% cover) while sandmat manzanita did not. Monterey ceanothus and Hooker's manzanita were present in all years, recovering at 20% and 51% of Baseline conditions in Year 5, respectively. Toro manzanita had the fastest rate of recovery in BLM Area B Subunit A Containment Line, followed by Hooker's manzanita. HMP shrub species observed in Unit 31 Containment Line in Baseline were Monterey ceanothus, Hooker's manzanita, and Eastwood's goldenbush (Figure 4-21). Monterey ceanothus and Hooker's manzanita both decreased from Baseline to Year 3 ($C_{U31\ CERI,\ Baseline}$ = 6.7%, $C_{U31\ CERI,\ Year\ 3}$ = 0.87%; $C_{U31\ ARHO,\ Baseline}$ = 4.7%, $C_{U31\ ARHO,\ Year\ 3}$ = 0.60%); and started to recover in Year 5 ($C_{U31\ CERI,\ Year\ 5}$ = 2.7%, $C_{U31\ ARHO,\ Year\ 5}$ = 3.8%). Eastwood's goldenbush was not observed in Year 3 but returned in Year 5 (0.21% cover). Hooker's manzanita had the fastest rate of recovery in Unit 31 Containment Line, followed by Monterey ceanothus.

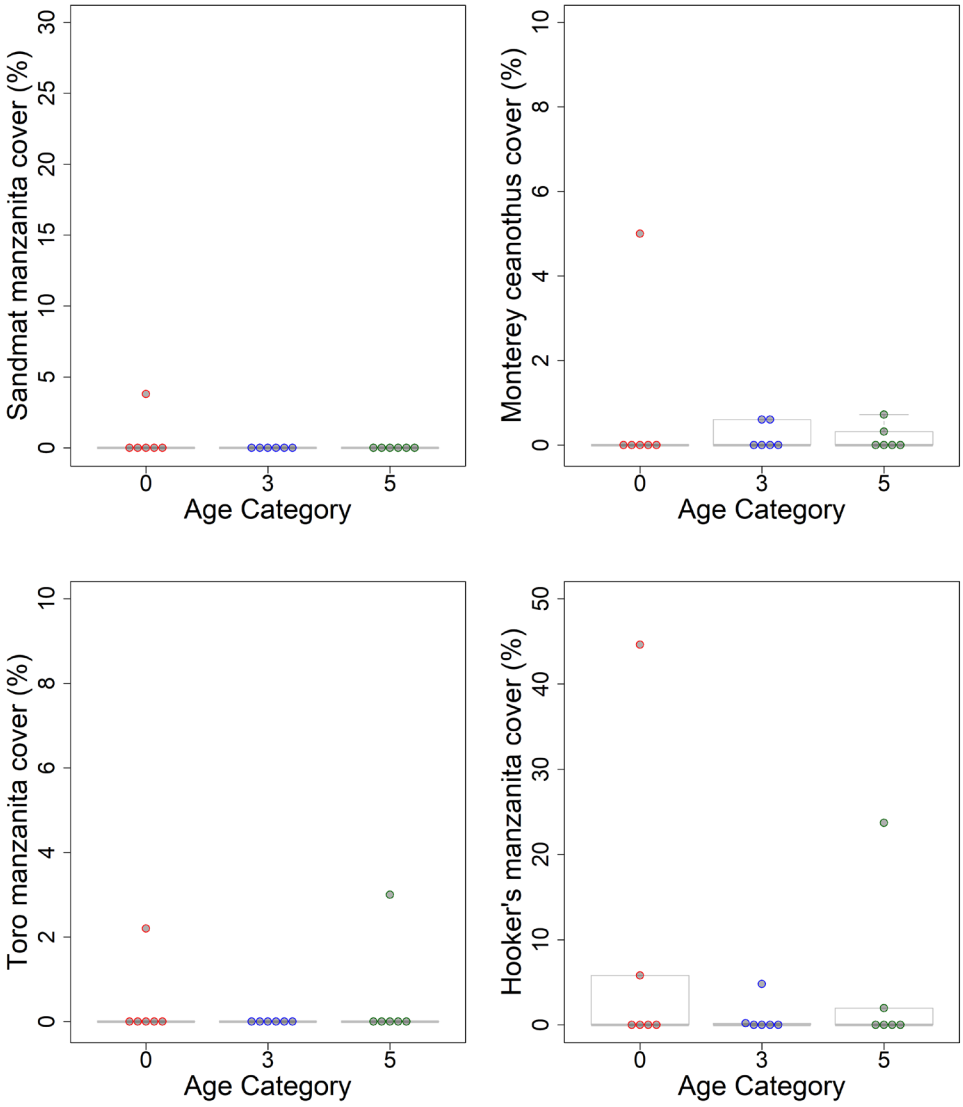


Figure 4-20. BLM Area B Subunit A Containment Line HMP shrub species cover between Baseline (2015) and Year 5 (2023). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median; the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Six masticated transects were analyzed in BLM Area B Subunit A Containment Line. Scales not equivalent.

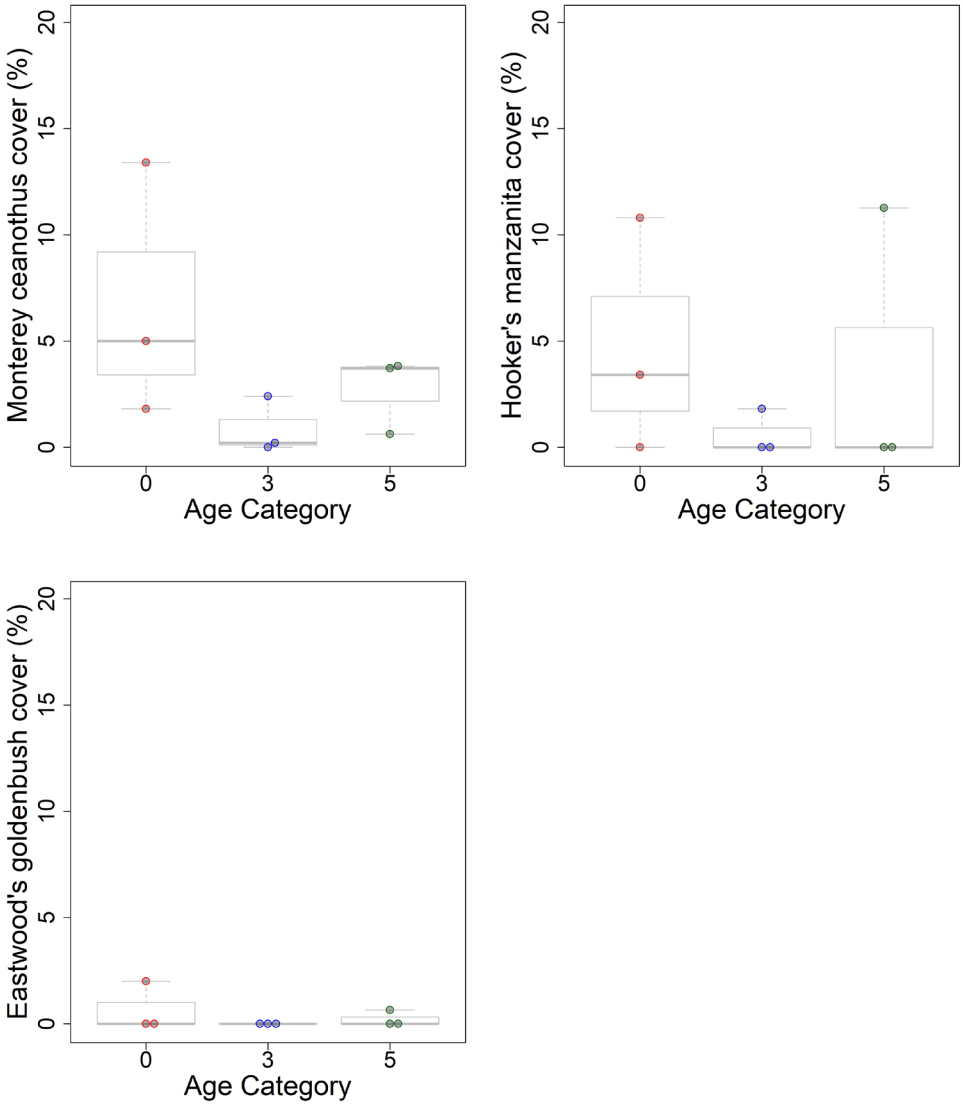


Figure 4-21. Unit 31 Containment Line HMP shrub species cover between Baseline (2014) and Year 5 (2023). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the upper (3rd) and lower (1st) quartile, respectively. Three transects were analyzed in Unit 31 Containment Line.

NMDS ordinations for Year 5 Units illustrate that community compositions in Year 5 are on trajectory toward Baseline compositions (Figure 4-22 and Figure 4-23). 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. Community composition in BLM Area B Subunit A Containment Line diverged from Baseline composition in Year 3; the size and location of the ellipse shifted in Year 5, showing marginal progress toward Baseline composition. The differences in community composition between the masticated (n=4) and re-masticated (n=2) transects in BLM Area B Subunit A Containment Line could be influencing the ellipse locations in Figure 4-22. Community composition of Unit 31 Containment Line diverged from Baseline composition in Year 3; the Year 5 ellipse then shifted back toward the Baseline ellipse, implying that community composition is more similar to Baseline in Year 5 than in Year 3.

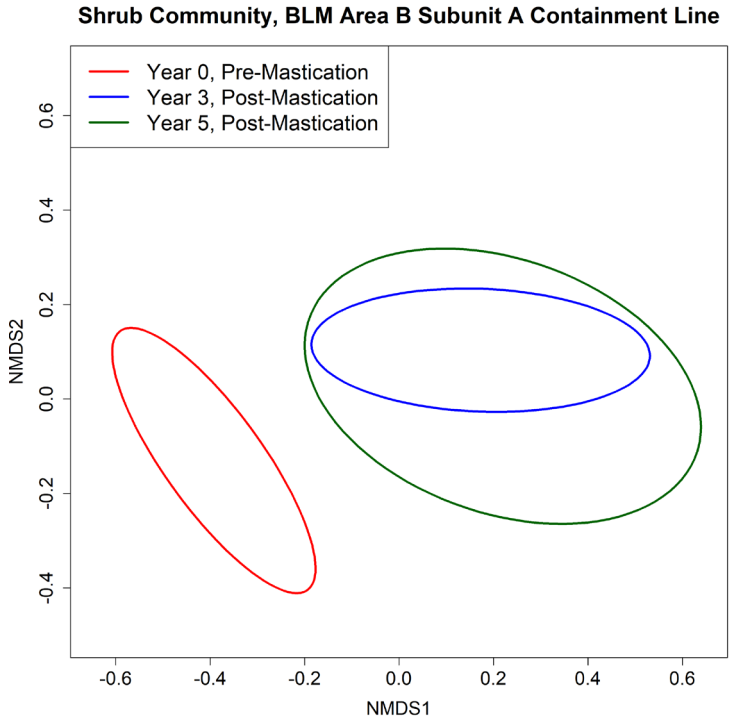


Figure 4-22. NMDS ordination plot showing BLM Area B Subunit A Containment Line community composition changes between Baseline (2015), Year 3 surveys (2021), and Year 5 surveys (2023). Six masticated transects were analyzed in BLM Area B Subunit A Containment Line.

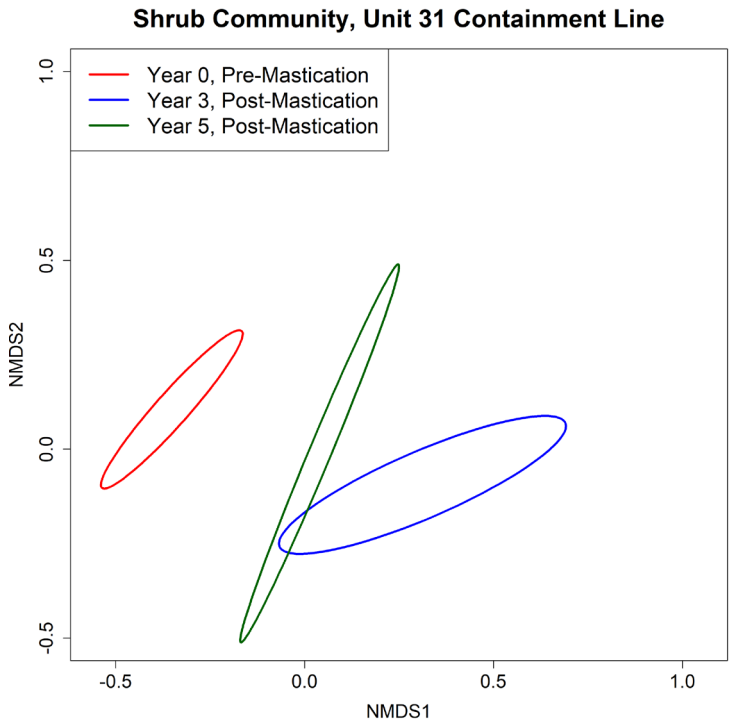


Figure 4-23. NMDS ordination plot showing Unit 31 Containment Line community composition changes between Baseline (2014), Year 3 surveys (2021), and Year 5 surveys (2023). Three masticated transects were analyzed in Unit 31 Containment Line.

4.4.7 Annual Grass Monitoring

Non-native annual grassland cover was surveyed and mapped for BLM Area B Subunit A, Unit 31, and Unit 25 Containment Lines in 2023. Non-native annual grass cover increased between Baseline and Year 5 and also increased between Year 3 and Year 5 for all Units (Appendix D, Figures D-1 through D-3). Estimated areas occupied by each density class in 2023 are summarized in Table 4-5. Density class 3 (>25% cover) had the largest areal extent in BLM Area B Subunit A and Unit 25 Containment Lines, and density class 1 (1-5%) had the largest areal extent in Unit 31 Containment Line. In 2023, density class 3 contained an area of 45.3 acres in BLM Area B Subunit A Containment Line and 4.71 acres in Unit 25 Containment Line; density class 1 contained an area of 18.40 acres in Unit 31 Containment Line.

Table 4-5. Estimated Area Occupied by Annual Grasses in BLM Area B Subunit A Containment Line and Units 25 and 31 Containment Lines Between Baseline (2015 and 2014, respectively) and Year 5 (2023).

Cover Class	Baseline (acres)	Year 1 (acres)	Year 3 (acres)	Year 5 (acres)
BLM Area B Subunit A Containment Line				
1 (Low) = 1 – 5%	22.12	3.38	23.73	32.86
2 (Medium) = 6 – 25%	4.76	2.35	31.83	28.74
3 (High) = > 25%	17.05	19.73	41.19	45.26
Total Acreage	**43.93**	**25.46**	**96.75**	**106.86**
Unit 31 Containment Line				
1 (Low) = 1 – 5%	1.68	4.06	5.74	18.40
2 (Medium) = 6 – 25%	1.38	10.65	6.55	5.49
3 (High) = > 25%	1.42	13.91	15.22	4.90
Total Acreage	**4.48**	**28.62**	**27.51**	**28.79**
Unit 25 Containment Line				
1 (Low) = 1 – 5%	0.63	2.41	2.70	3.06
2 (Medium) = 6 – 25%	0.50	0.38	0.46	2.16
3 (High) = > 25%	3.80	6.41	6.32	4.71
Total Acreage	**4.93**	**9.20**	**9.48**	**9.93**

4.4.8 Invasive and Non-Native Species Monitoring

Of the target invasive species, iceplant was observed in BLM Area B Subunit A and Unit 31 Containment Lines. However, due to logistical constraints when surveying Year 5 Units, invasive species cover was only recorded when detected along a shrub transect and presence of invasive species was noted when encountered incidentally near a transect. Minor occurrences of non-native herbaceous cover were observed during transect monitoring in all Year 5 Units (Appendix G, Tables G-1 and G-2).

5 YEAR 8 VEGETATION SURVEYS: UNITS 5A, 9, 23, 23 North, and 28

5.1 Introduction

Year 5 Units included the entirety of Units 5A, 9, 23, 23 North, and 28 (Figure 5-1). These Units were masticated in 2015. Unit 23 North was initially masticated in 2011 to support a planned prescribed burn of Units 11 and 12 and re-masticated in 2015 to create a containment line for a planned prescribed burn of Units 11 and 12. The remaining part of Unit 23 was masticated in 2015 to support MEC cleanup. Baseline monitoring for Units 5A, 9, and 28 was conducted in 2011 and included meandering transect surveys to map areas of occurrence of HMP herbaceous species; density monitoring for the HMP annual species sand gilia, seaside bird's-beak, and Monterey spineflower; transect surveys to sample shrub composition in the maritime chaparral; and annual grass monitoring (Tetra Tech and EcoSystems West, 2012). Baseline monitoring for shrubs and HMP annual species sand gilia, seaside bird's-beak, and Monterey spineflower was conducted in Unit 23 in 2003, and additional Baseline HMP annual density monitoring in Unit 23 North was conducted in 2011 (MACTEC, 2004; Tetra Tech and EcoSystems West, 2012).

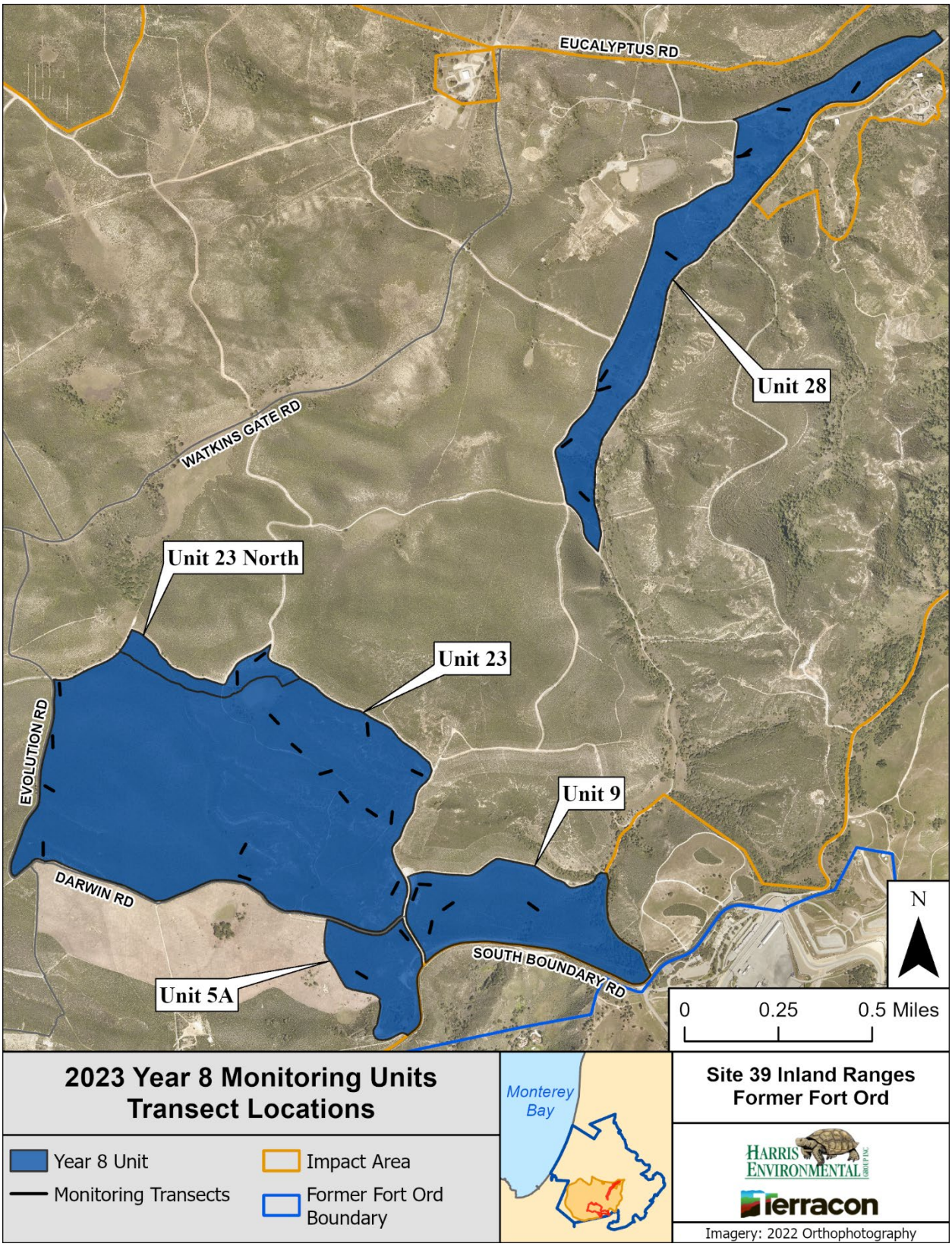


Figure 5-1. Units 5A, 9, 23, 23 North, and 28 HMP shrub transects surveyed for Year 8 in 2023.

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

Unit 5A encompasses an area of 33 acres (Figure 5-1). The Unit is located south of Darwin Road and is bordered by South Boundary Road to the east and south. Unit 5A is contiguous with Unit 5 to the west. The terrain is mostly gently rolling to moderately steep. In pre-treatment condition, Unit 5A was dominated by mature maritime chaparral vegetation varying considerably in physiognomy and species composition (Tetra Tech and EcoSystems West, 2012). Most of the chaparral vegetation was very dense, particularly in the south and central portions of the Unit with limited clearings. The chaparral shrubs ranged in height from low (3-4 ft) to tall (12-15 ft), and shrub density ranged from relatively open, to essentially 100% areal cover. As in maritime chaparral throughout Fort Ord, shaggy-barked manzanita is the most characteristic dominant, and is overwhelmingly dominant where the shrub cover is tall and dense. Other characteristic shrubs that are dominant or co-dominant include chamise, black sage, and Monterey ceanothus.

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

Unit 23 and Unit 23 North encompass areas of 343 acres and 10 acres, respectively (Figure 5-1). These Units are located near the southern end of former Fort Ord. The terrain is gently rolling to locally steep. In pre-treatment condition, these Units were vegetated primarily with mature maritime chaparral largely dominated by shaggy-barked manzanita. Pond 54, a vernal pool containing emergent vegetation and known to support California tiger salamander, is in the northeastern corner of Unit 23, near the intersection of Nowhere Road and Orion Road.

Unit 28 encompasses an area of 105 acres (Figure 5-1). This long narrow Unit is delineated by a portion of Impossible Canyon as well as portions of the adjacent southeast-facing slopes of Riso Ridge and Tongue (Dallas) Ridge. The terrain is gently rolling to very steep. In pre-treatment condition, Unit 28 was vegetated primarily with mature maritime chaparral, but also included numerous areas of coast live oak woodland of various patch sizes. Toro manzanita is prevalent in this Unit and individual shrubs were flagged to be omitted from fall 2015 mastication efforts throughout the Unit. Localized erosion areas also occurred in this Unit. Part of the northern end of Unit 28 was burned in an accidental brush fire in 2003.

Collectively, these Units have rolling to steep topography. Arnold-Santa Ynez complex soil type is mapped in Units 5A, 9, 23, 23 North, and 28 (USDA, 2023). Xerorthents dissected area was mapped along the eastern edges of Units 9 and 23 and throughout Unit 28. The distribution of soils in the Year 8 survey areas and characteristics of these soils are presented in Table 2-1.

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

In accordance with methods outlined in the Revised Protocol (Tetra Tech and EcoSystems West, 2015b) and Section 2 of this report, the 2023 Year 8 follow-up monitoring in Units 5A, 9, 23, 23 North, and 28 consisted of the following activities:

- Repeated sampling of transects that were monitored in 2003, 2011, 2018, and 2020 surveys (MACTEC, 2004; Tetra Tech and EcoSystems West, 2012; Burleson, 2019a; Burleson, 2021). This survey effort was conducted to assess shrub species composition of the sensitive maritime chaparral community after treatment. Surveys occurred on September 18, 19, 20, 21, 25, 26, 27, and 28; and October 3, 4, and 5, 2023.

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

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

A total of 33 shrub transects were monitored in Year 8 Units, with 2 in Unit 5A, 5 in Unit 9, 15 in Unit 23, 2 in Unit 23 North, and 9 in Unit 28. Maps of monitored transects are provided in Appendix C.

5.4.1 Yadon's Piperia

Piperia was observed within Unit 23 and Unit 28 during 2023 (Year 8) surveys (Appendix E, Figures E-4 and E-5). Eighteen piperia individuals were observed in Unit 23; 16 in the eastern portion, 1 in the northeastern portion, and 1 in the southeastern portion of Unit 23. One piperia individual was observed in the southwestern area of Unit 28. Piperia was not observed in Units 5A, 9, or 23 North. Due to the timing of monitoring, these individuals were not in flower and could not be identified to their specific taxon.

5.4.2 Shrub Transect Monitoring

Shrub transects were sampled in Units 5A (*n*=2), 9 (*n*=5), 23 (*n*=15), 23 North (*n*=2), and 28 (*n*=9) in 2023 (Appendix C, Figures C-3 through C-6). For the purposes of this report, Unit 23 and 23 North are analyzed as a single unit and referred to collectively as Unit 23. Baseline transects were collected in 2011 for Units 5A, 9, and 28, and in 2003 for Unit 23 (Tetra Tech and EcoSystems West, 2011; MACTEC, 2004).

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 were conducted to examine the effects of Unit and age on mean percent cover, species richness, species evenness, and species diversity for Year 8 Units. Unit did not appear to influence any community structure parameters, whereas age of the Unit (Baseline vs. Year 8) appeared to influence mean percent cover, species richness, and species diversity (Table 5-1). However, there was evidence of an interaction between age and Unit on total cover, indicating that the inherent relationship between age and Unit may mask the true effects of these factors separately.

Table 5-1. Mixed-design ANOVA Results for Units 5A, 9, 23, and 28.

Factor	Total Mean Cover		Species Richness		Species Evenness		Species Diversity	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Unit	0.4687	0.7064	1.412	0.2592	2.499	0.0793	2.317	0.0964
Age	60.13	3.798E-21	10.18	8.168E-06	1.012	0.3916	6.218	7.079E-04
Unit*Age	2.051	0.0428	1.196	0.3078	0.9490	0.4877	1.087	0.3810

Mean shrub cover in all Year 8 Units responded similarly to mastication between Baseline and Year 8 (Figures 5-2, 5-3, 5-4, and 5-5). Mean cover decreased for all Year 8 Units between Baseline ($C_{5A,\ Baseline}$ = 135%; $C_{9,\ Baseline}$ = 113%; $C_{23,\ Baseline}$ = 108%; $C_{28,\ Baseline}$ = 107%) and Year 3 ($C_{5A,\ Year\ 3}$ = 73%; $C_{9,\ Year\ 3}$ = 75%; $C_{23,\ Year\ 3}$ = 78%; $C_{28,\ Year\ 3}$ = 70%). All Units began increasing in Year 5 and continued to increase in Year 8 ($C_{5A,\ Year\ 8}$ = 98%; $C_{9,\ Year\ 8}$ = 97%; $C_{23,\ Year\ 8}$ = 96%; $C_{28,\ Year\ 8}$ = 93%).

Species richness in Year 8 Units responded variably to mastication (Figures 5-2, 5-3, 5-4, and 5-5). Species richness in Units 9, 23, and 28 generally increased from Baseline ($S_{9,\ Baseline}$ = 5.2; $S_{23,\ Baseline}$ = 7.1; $S_{28,\ Baseline}$ = 6.2) to Year 3 ($S_{9,\ Year\ 3}$ = 8.8; $S_{23,\ Year\ 3}$ = 10.1; $S_{28,\ Year\ 3}$ = 9.0), remained relatively stable in Year 5, and decreased in Year 8 ($S_{9,\ Year\ 8}$ = 8.0; $S_{23,\ Year\ 8}$ = 8.8; $S_{28,\ Year\ 8}$ = 8.9). Unit 5A decreased from Baseline ($S_{5A,\ Baseline}$ = 8.0) to Year 3 ($S_{5A,\ Year\ 3}$ = 7.5), increased in Year 5 ($S_{5A,\ Year\ 5}$ = 8.0), then decreased again in Year 8 ($S_{5A,\ Year\ 8}$ = 6.0).

Species diversity between Year 8 Units generally responded differently over time (Figures 5-2, 5-3, 5-4, and 5-5). Units 9, 23, and 28 species diversity increased from Baseline ($H_{9,\ Baseline}$ = 0.91, $H_{23,\ Baseline}$ = 1.3, $H_{28,\ Baseline}$ = 1.2) to Year 3 ($H_{9,\ Year\ 3}$ = 1.2, $H_{23,\ Year\ 3}$ = 1.6, $H_{28,\ Year\ 3}$ = 1.5), either increased slightly or remained stable in Year 5, and decreased slightly in Year 8 ($H_{9,\ Year\ 8}$ = 1.2, $H_{23,\ Year\ 8}$ = 1.3, $H_{28,\ Year\ 8}$ = 1.2). Species diversity in Unit 5A remained relatively stable over the years, with a slight decrease from Baseline ($H_{5A,\ Baseline}$ = 1.5) to Year 8 ($H_{5A,\ Year\ 8}$ = 1.3).

Species evenness in Year 8 Units responded variably to mastication but remained relatively stable between years (Figures 5-2, 5-3, 5-4, and 5-5). Units 23 and 28 increased slightly from Baseline ($J_{23,\ Baseline}$ = 0.67, $J_{28,\ Baseline}$ = 0.65) to Year 3 ($J_{23,\ Year\ 3}$ = 0.69, $J_{28,\ Year\ 3}$ = 0.71), decreased or remained stable in Year 5 ($J_{23,\ Year\ 5}$ = 0.69, $J_{28,\ Year\ 5}$ = 0.66), and decreased in Year 8 ($J_{23,\ Year\ 8}$ = 0.62, $J_{28,\ Year\ 8}$ = 0.57). Unit 5A decreased from Baseline ($J_{5A,\ Baseline}$ = 0.77) to Year 3 ($J_{5A,\ Year\ 3}$ = 0.71), decreased by 0.02 in Year 5, and increased again in Year 8 ($J_{5A,\ Year\ 8}$ = 0.73). Species evenness in Unit 9 remained relatively stable over the years at 0.56 in Baseline and Year 8, with a minor decrease in Year 3 ($J_{9,\ Year\ 3}$ = 0.54) and minor increase in Year 5 ($J_{9,\ Year\ 5}$ = 0.59).

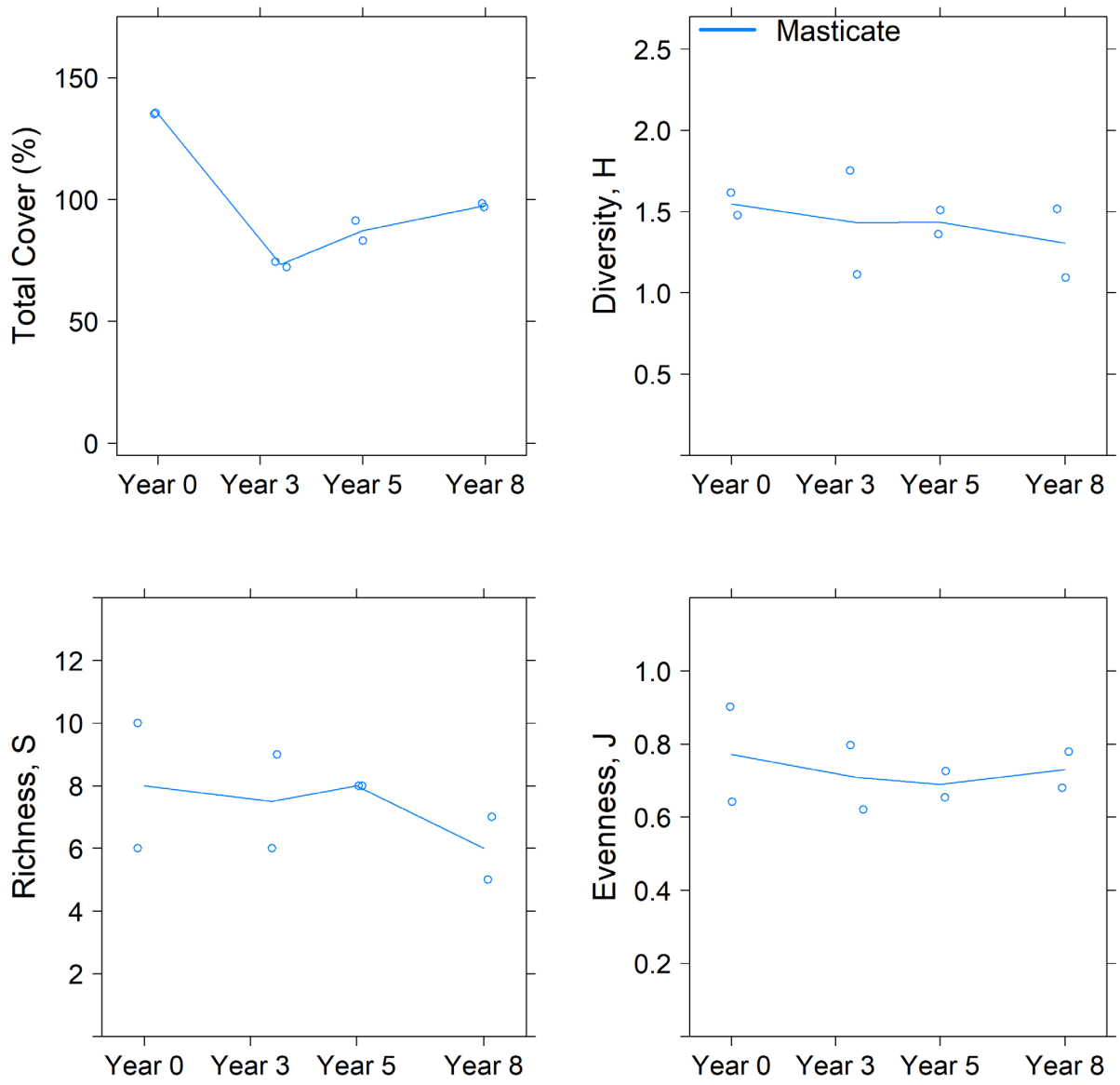


Figure 5-2. Unit 5A community structure from Baseline (2011) to eight years after mastication (2023). Two masticated transects were analyzed in Unit 5A.

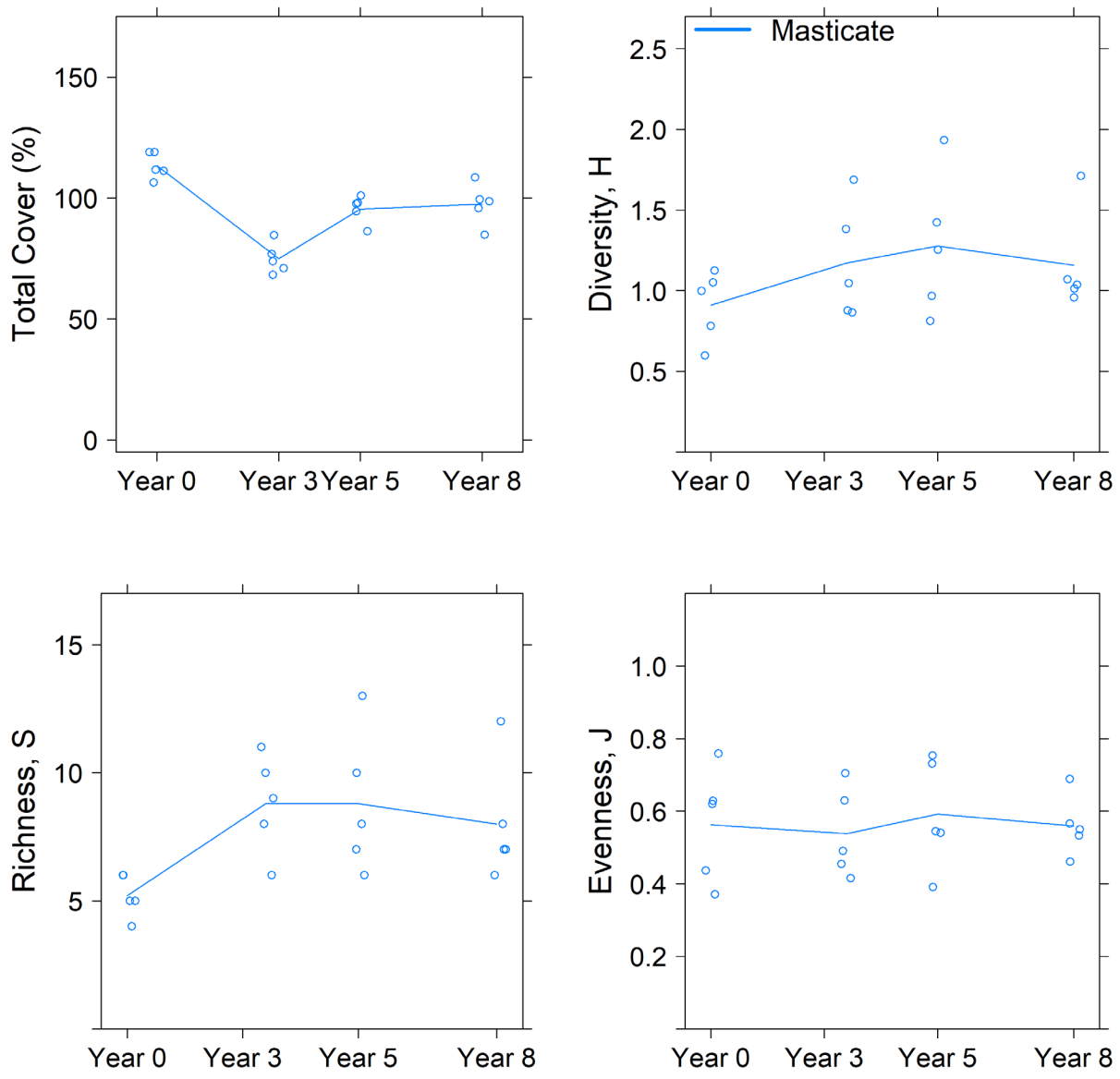


Figure 5-3. Unit 9 community structure from Baseline (2011) to eight years after mastication (2023). Five masticated transects were analyzed in Unit 9.

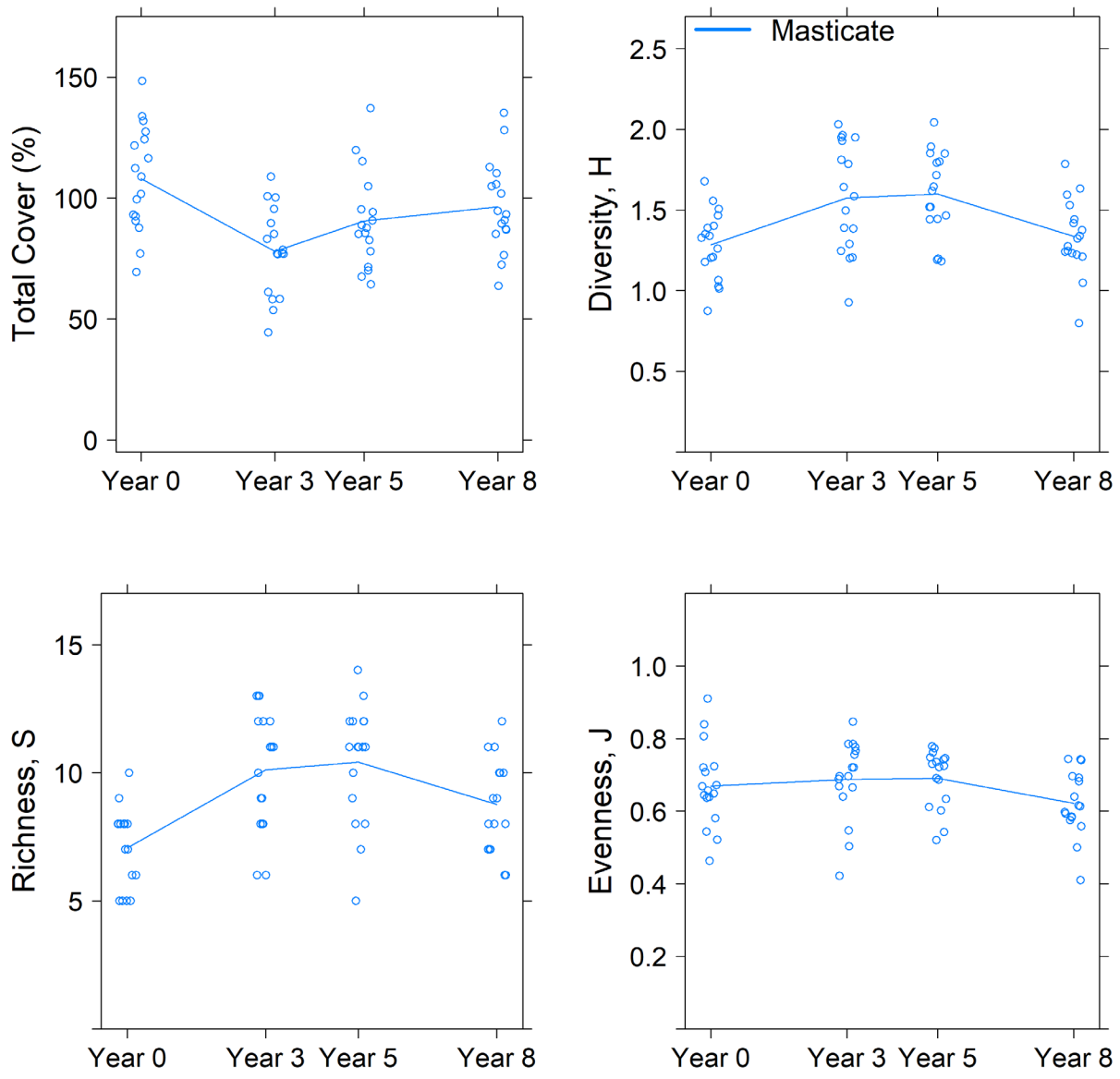


Figure 5-4. Unit 23 community structure from Baseline (2003) to eight years after mastication (2023). Seventeen masticated transects were analyzed in Unit 23.

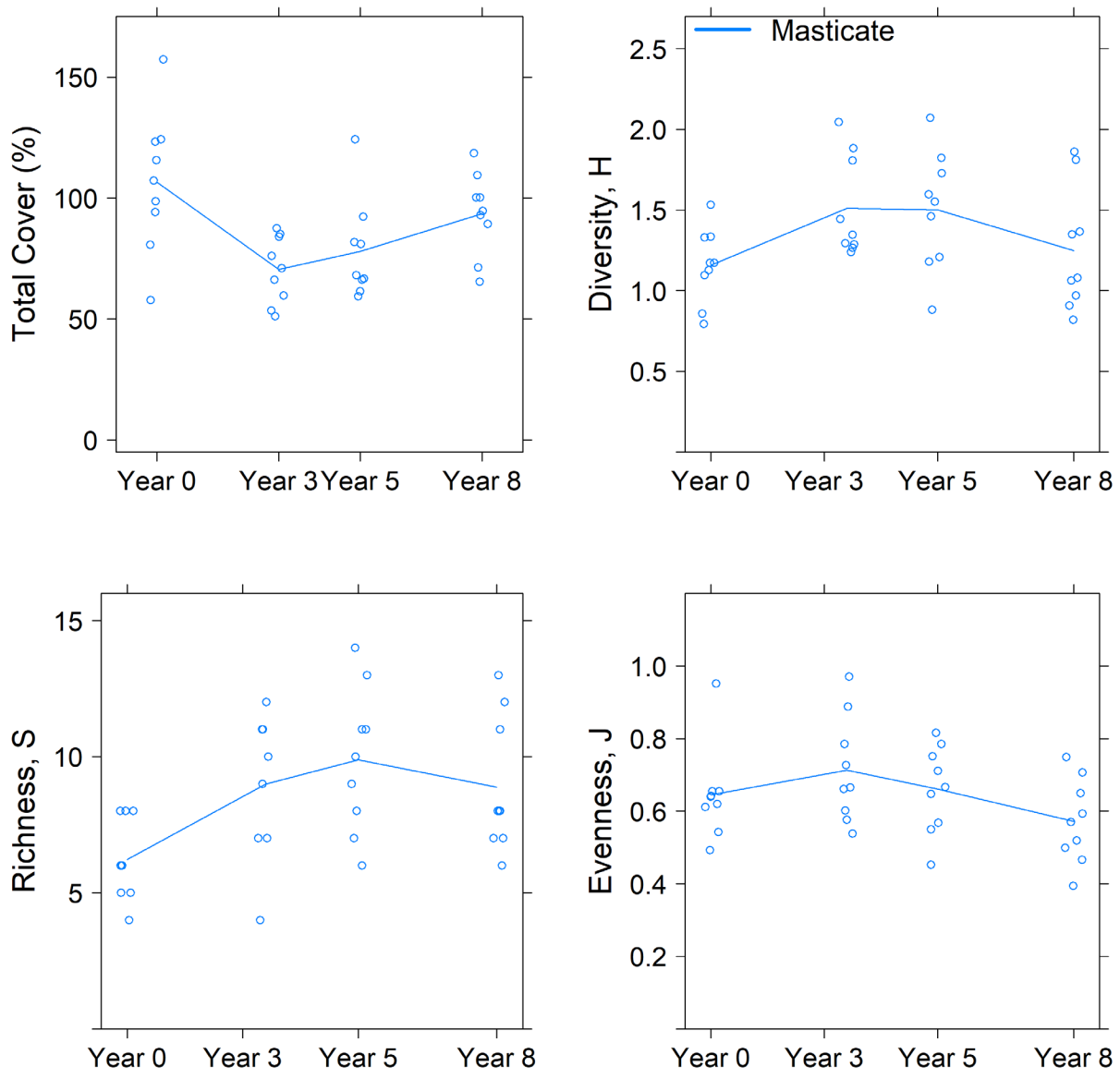


Figure 5-5. Unit 28 community structure from Baseline (2011) to eight years after mastication (2023). Nine masticated transects were analyzed in Unit 28.

Mixed-design ANOVAs were conducted to examine the effect of Unit and age on mean percent bare ground and mean percent herbaceous cover (Table 5-2). In Year 8 Units, age appeared to influence bare ground and herbaceous cover while Unit did not appear to influence either factor. There was also evidence of an interaction between Unit and age influencing bare ground; this indicates that the inherent relationship between Unit and age may be masking effects of these factors individually on differences in bare ground between Units and through time.

Table 5-2. Mixed-design ANOVA Results for Units 5A, 9, 23, and 28 Bare Ground and Herbaceous Cover.

Factor	Bare Ground		Herbaceous Cover	
	F	***p***	***F***	***p***
Unit	1.065	0.3793	1.934	0.1462
Age	40.87	1.413E-16	3.742	0.0375
Unit*Age	2.302	0.0227	1.271	0.2914

The pattern by which bare ground and herbaceous cover changed over time was similar in all Year 8 Units (Figures 5-6, 5-7, 5-8, and 5-9). Bare ground cover increased in all Year 8 Units between Baseline and Year 3, then gradually decreased in Year 5 and Year 8. All Year 8 Units increased in herbaceous cover between Baseline and Year 3; Unit 5A and Unit 9 then gradually decreased between Year 3 and Year 8, while Unit 23 and Unit 28 increased from Year 3 to Year 5, then decreased in Year 8 (Table 5-3).

Table 5-3. Average Percent of Bare Ground and Herbaceous Cover in Units 5A, 9, 23, and 28.

Cover Type % (Year)	Unit 5A	Unit 9	Unit 23	Unit 28
Bare ground (Baseline)	1.2%	3.2%	15%	13%
Bare ground (Year 3)	37%	31%	28%	34%
Bare ground (Year 5)	24%	19%	21%	25%
Bare ground (Year 8)	18%	17%	18%	19%
Herbaceous (Baseline)	0.0%	0.0%	1.9%	4.1%
Herbaceous (Year 3)	3.6%	3.2%	13%	9.5%
Herbaceous (Year 5)	0.8%	1.0%	15%	14%
Herbaceous (Year 8)	0.7%	0.6%	9.6%	5.6%

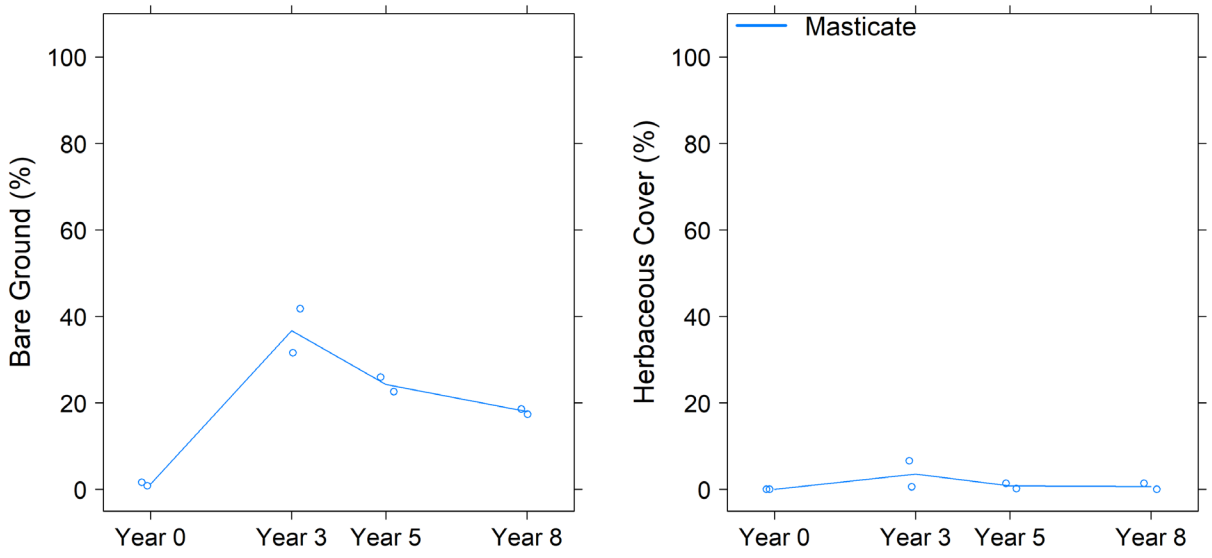


Figure 5-6. Unit 5A bare ground and herbaceous cover between Baseline (2011), Year 3 (2018), Year 5 (2020), and Year 8 (2023). Two masticated transects were analyzed in Unit 5A.

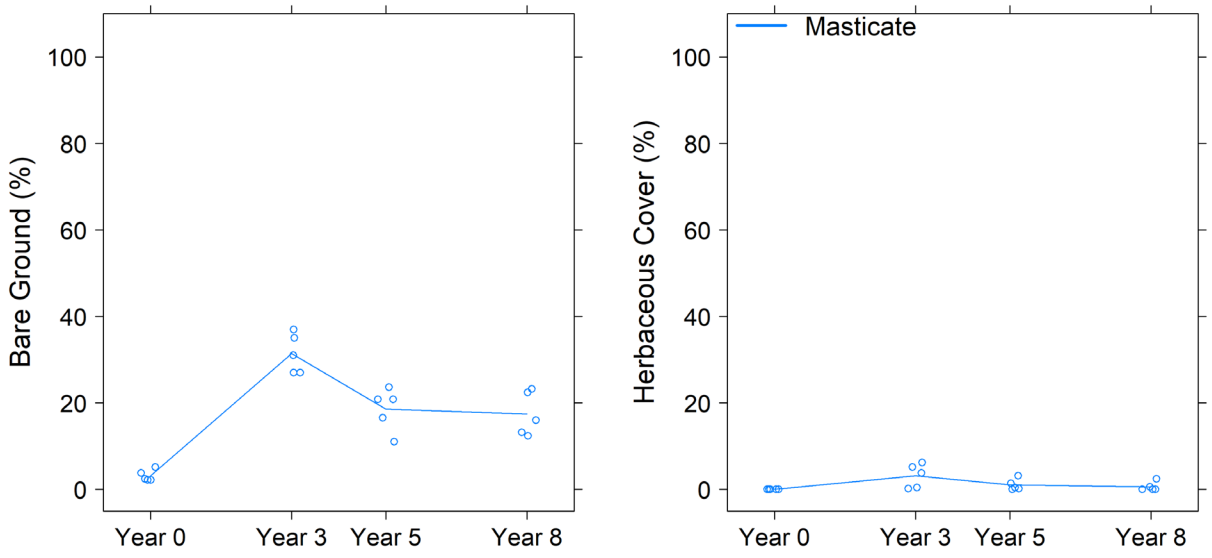


Figure 5-7. Unit 9 bare ground and herbaceous cover between Baseline (2011), Year 3 (2018), Year 5 (2020), and Year 8 (2023). Five masticated transects were analyzed in Unit 9.

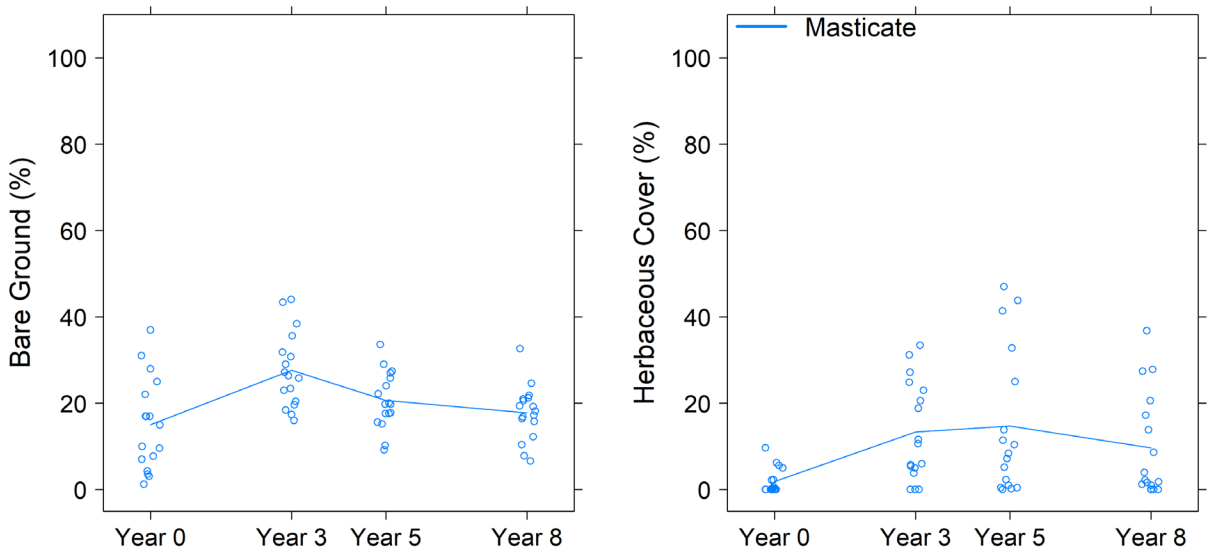


Figure 5-8. Unit 23 bare ground and herbaceous cover between Baseline (2003), Year 3 (2018), Year 5 (2020), and Year 8 (2023). Seventeen masticated transects were analyzed in Unit 23.

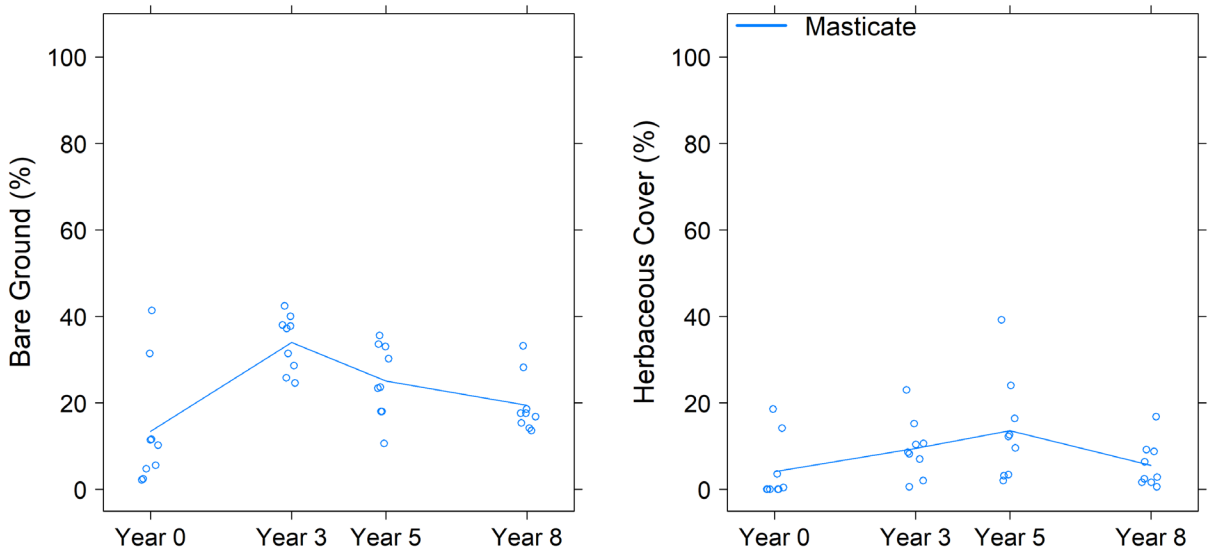


Figure 5-9. Unit 28 bare ground and herbaceous cover between Baseline (2011), Year 3 (2018), Year 5 (2020), and Year 8 (2023). Nine masticated transects were analyzed in Unit 28.

PERMANOVAs were conducted to examine the effect of Unit and age on community composition in Year 8 Units. Community structure appeared to be influenced by age and by Unit. This indicates that the types and abundance of species present within each Unit were different from year to year. 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 5A, 9, 23, and 28 Community Compositions, based on Bray-Curtis Distance Matrices.

Factor	*F*	*p*
Age	7.182	0.0001
Unit	8.352	0.0001
Unit*Age	0.5084	0.9976

Rank abundance curves illustrate that community composition of Year 8 Units generally responded similarly to treatment over time (Figures 5-10, 5-11, 5-12, and 5-13). All Year 8 Units were either dominated by shaggy-barked manzanita or co-dominated by shaggy-barked manzanita and chamise in all years. Unit 23 was dominated by shaggy-barked manzanita in Baseline (47%), then shifted to being co-dominated by shaggy-barked manzanita and chamise in Year 3 ($C_{23\ ARTO}$ = 22%, $C_{23\ ADFA}$ = 28%), Year 5 ($C_{23\ ARTO}$ = 27%, $C_{23\ ADFA}$ = 31%), and Year 8 ($C_{23\ ARTO}$ = 36%, $C_{23\ ADFA}$ = 38%). Unit 28 was also dominated by shaggy-barked manzanita in Baseline (50%), then shifted to being co-dominant with chamise in Year 3 ($C_{28\ ARTO}$ = 21%, $C_{28\ ADFA}$ = 18%), Year 5 ($C_{28\ ARTO}$ = 27%, $C_{28\ ADFA}$ = 24%), and Year 8 ($C_{28\ ARTO}$ = 37%, $C_{28\ ADFA}$ = 32%). Units 5A and 9 were dominated by shaggy-barked manzanita in all years. Additionally, richness generally tended to increase between Baseline and Year 8 and evenness remained relatively stable over time.

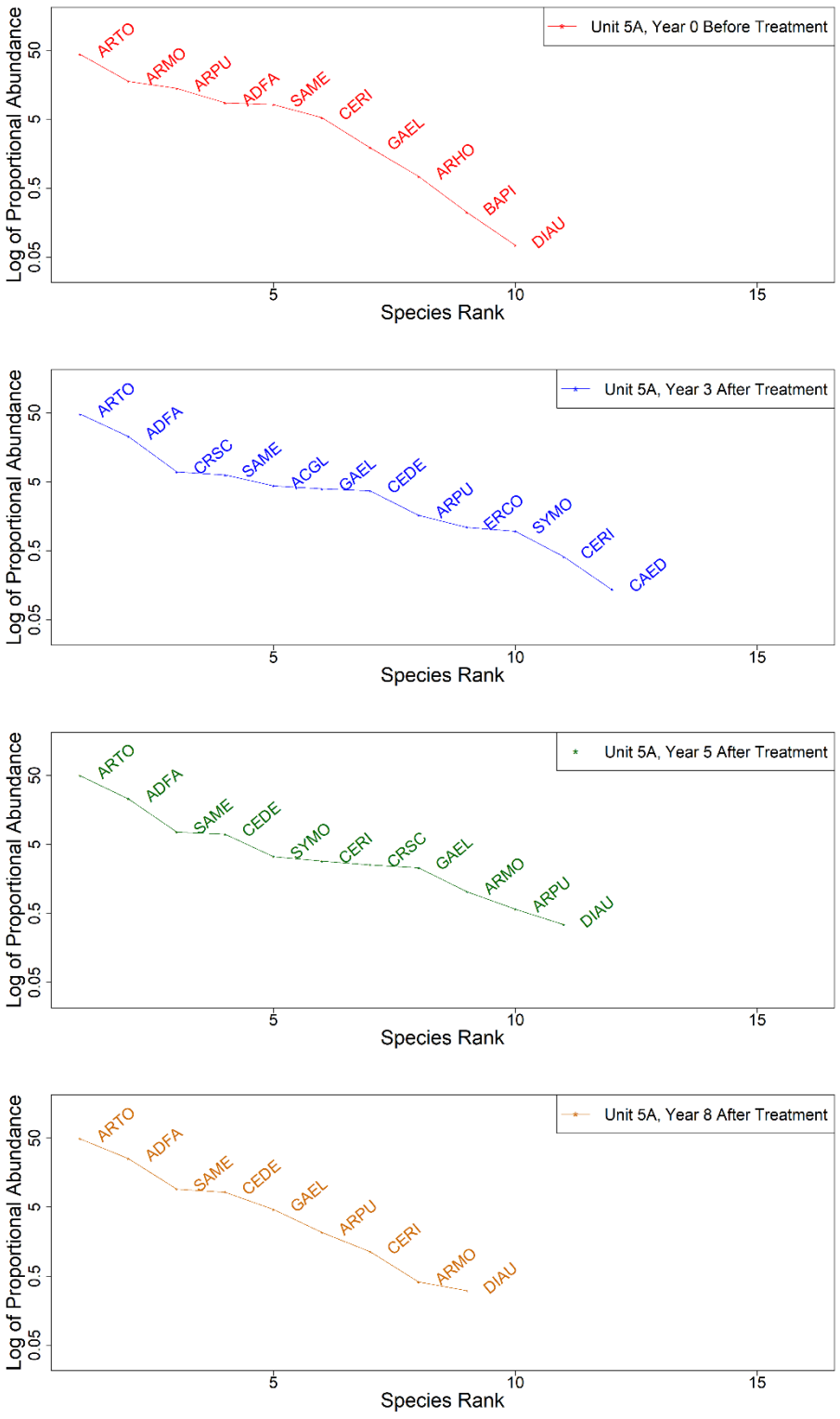


Figure 5-10. Unit 5A rank abundance curves between Baseline (2011) and Year 8 (2023). One species present in Year 8 surveys compared to Baseline was dwarf ceanothus. Species present in Baseline surveys, but absent in Year 8 include Hooker's manzanita and coyote brush. Two masticated transects were analyzed in Unit 5A. Y-axis is in log_{10} scale.

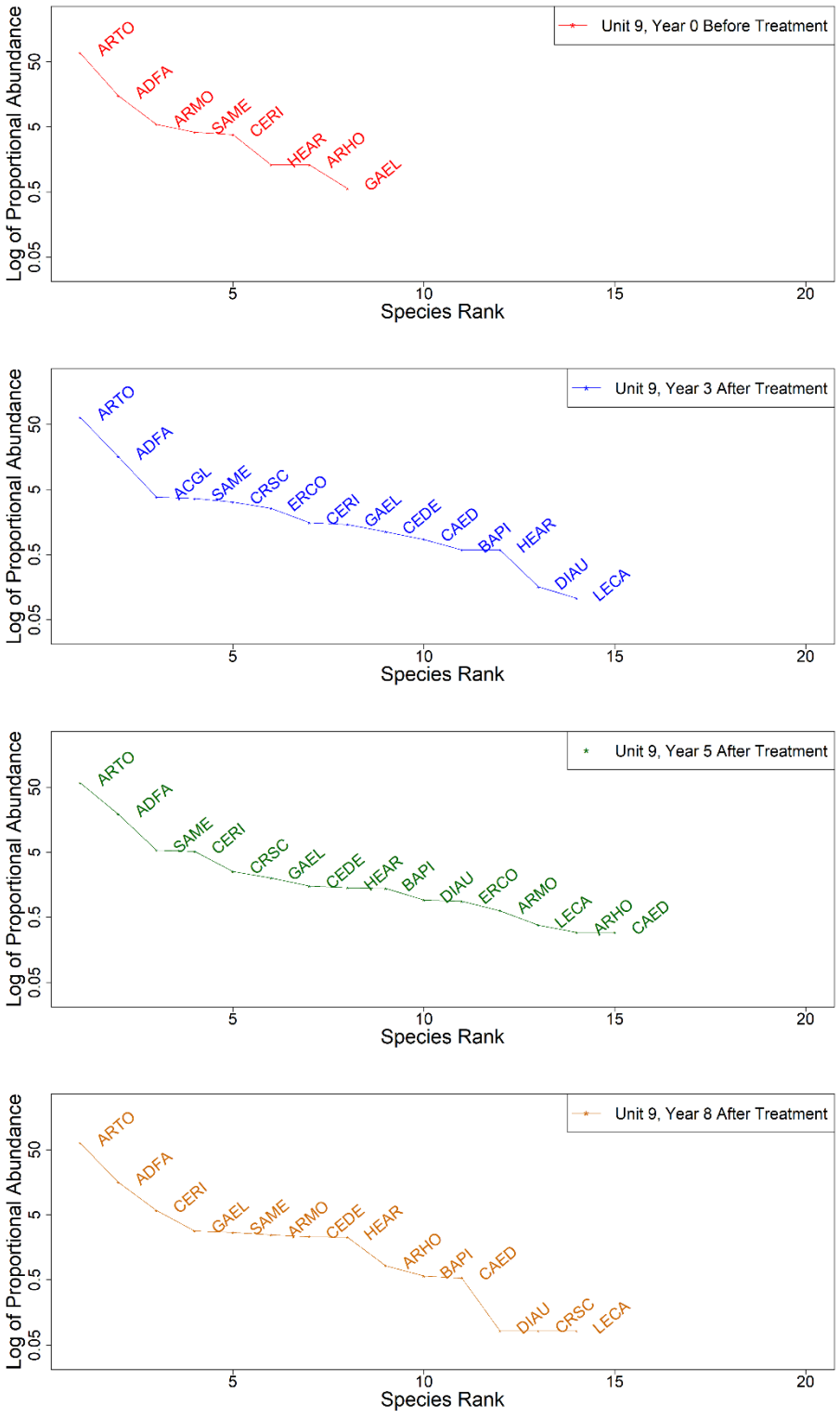


Figure 5-11. Unit 9 rank abundance curves between Baseline (2011) and Year 8 (2023). New species present in Year 8 surveys compared to Baseline include coyote brush, iceplant, dwarf ceanothus, peak rush-rose, sticky monkeyflower (*Diplacus aurantiacus*), and pitcher sage. There were no species present in Baseline surveys that were absent in Year 8. Five masticated transects were analyzed in Unit 9. Y-axis is log_{10} scale.

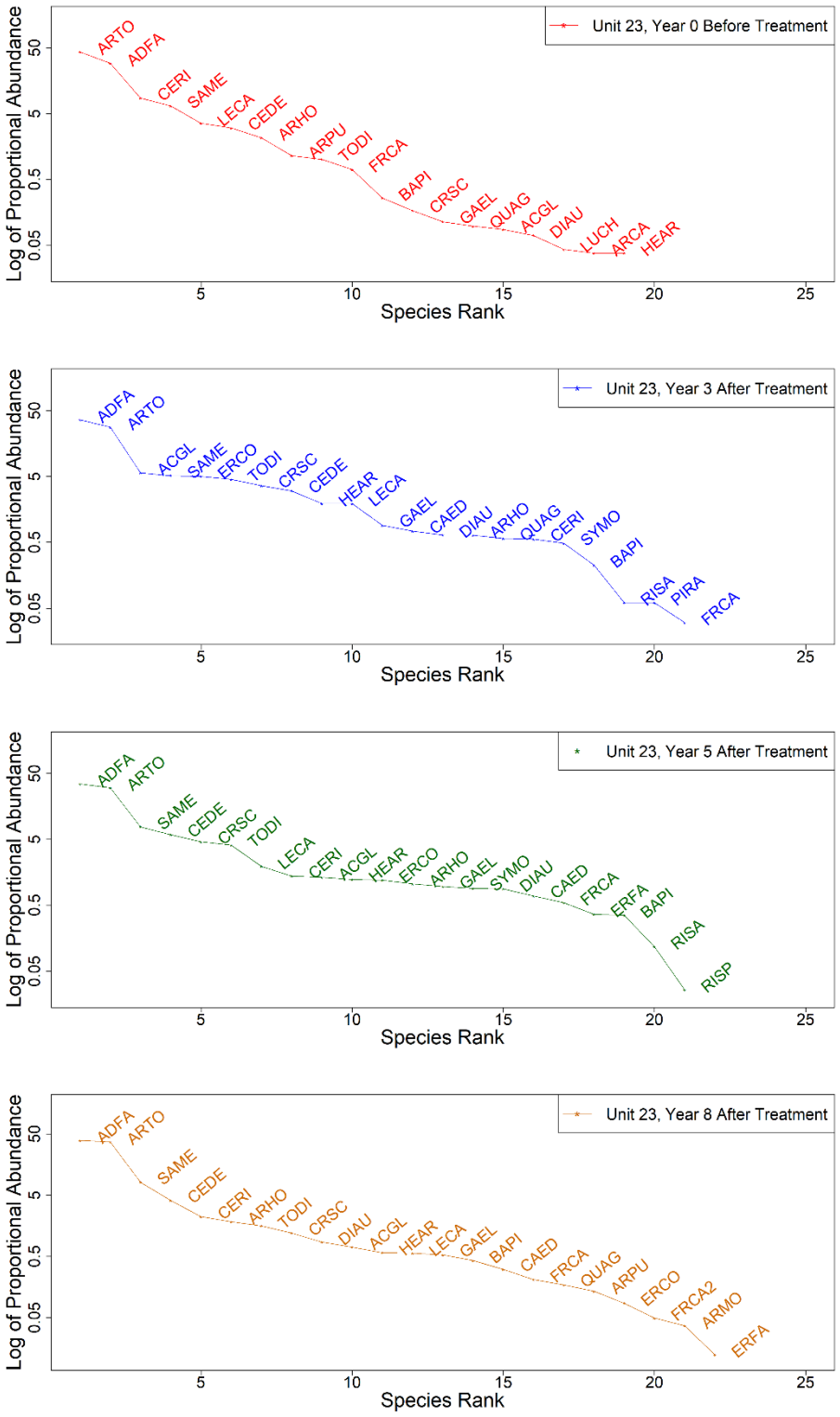


Figure 5-12. Unit 23 rank abundance curves between Baseline (2003) and Year 8 (2023). New species present in Year 8 surveys compared to Baseline include Toro manzanita, iceplant, golden yarrow, Eastwood's goldenbush, and California flannelbush (*Fremontodendron californicum*). Species present in Baseline surveys, but absent in Year 8 include California sagebrush (*Artemisia californica*) and silver beach lupine (*Lupinus chamissonis*). Seventeen masticated transects were analyzed in Unit 23. Y-axis is log_{10} scale.

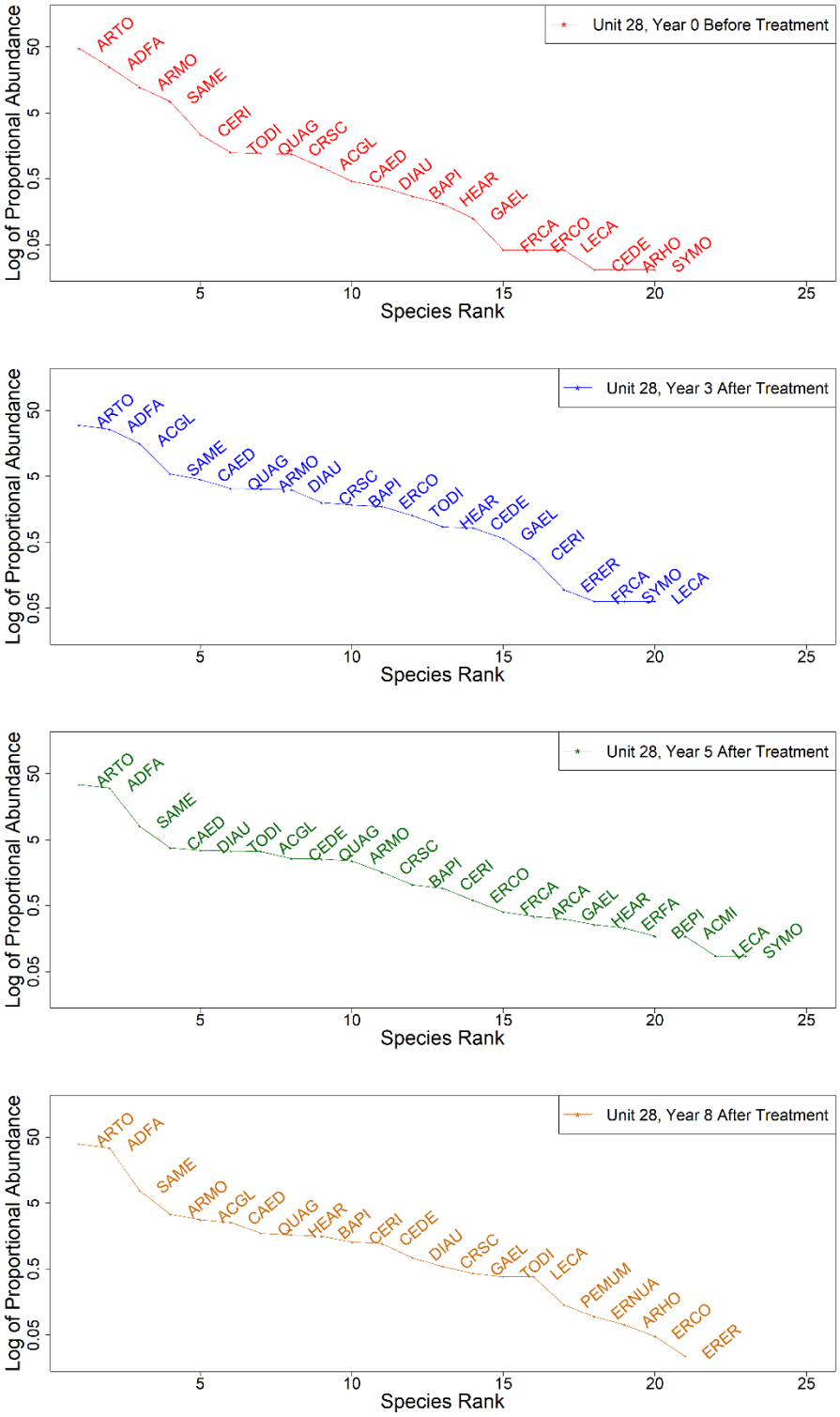


Figure 5-13. Unit 28 rank abundance curves between Baseline (2011) and Year 8 (2023). New species present in Year 8 surveys compared to Baseline include mock heather (*Ericameria ericoides*), ear-shaped wild buckwheat (*Eriogonum nudum* var. *auriculatum*), and bird's foot fern (*Pellaea mucronata* var. *mucronata*). Species present in Baseline surveys, but absent in Year 8 include California coffeeberry (*Frangula californica*) and creeping snowberry. Nine masticated transects were analyzed in Unit 28. Y-axis is log_{10} scale.

Generally, HMP shrub species that were present in Year 8 Units in Baseline persisted in Year 8, with the exception of Hooker's manzanita in Unit 5A (Figures 5-14, 5-15, 5-16, and 5-17). Hooker's manzanita, Monterey ceanothus, and Toro manzanita were present in Baseline in all Year 8 Units, and sandmat manzanita was also present in Unit 5A and Unit 23. Monterey ceanothus tended to recover at the fastest rate, followed by Hooker's manzanita and Toro manzanita.

Monterey ceanothus was present in all years in Year 8 Units, recovering at nearly 50% of Baseline conditions in Unit 28 and exceeding Baseline conditions in Unit 9; this species is experiencing a slower rate of recovery in Units 5A and 23 (15% and 23%, respectively). Toro manzanita was present in Baseline in Units 5A, 9, and 28; it has recovered to only 2% of Baseline conditions in Unit 5A but has recovered to 25% and 39% of Baseline conditions in Units 28 and 9, respectively. Hooker's manzanita was present in small quantities in Baseline in all Year 8 Units. In Unit 28, Hooker's manzanita was not observed in Years 3 and 5, but recovered in Year 8 ($C_{28\ ARHO,\ Baseline}$ = 0.02%, $C_{28\ ARHO,\ Year\ 8}$ = 0.07%); the species has also recovered to 53% and 77% of Baseline conditions in Units 9 and 23, respectively. However, Unit 5A had 1.0% cover of Hooker's manzanita in Baseline and the species did not return in any of the subsequent years. Sandmat manzanita was only present in Unit 5A and Unit 23, where it recovered at 11% and 10% of Baseline conditions in Year 8, respectively. Lastly, Eastwood's goldenbush was not present in Baseline in any Units but was observed in Year 5 ($C_{23\ ERFA}$ = 0.33%) and Year 8 ($C_{23\ ERFA}$ = 0.01% cover) in Unit 23 and in Year 5 ($C_{28\ ERFA}$ = 0.18% cover) in Unit 28.

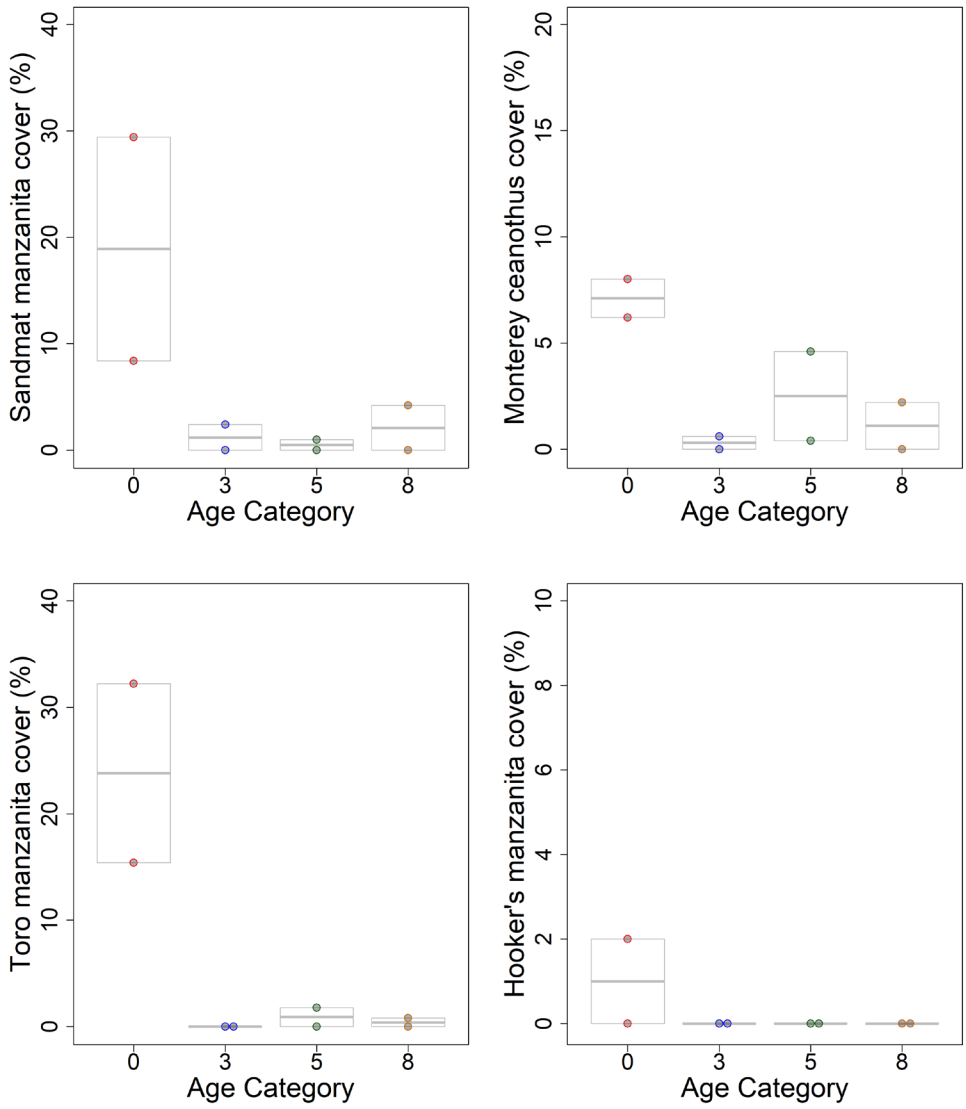


Figure 5-14. Unit 5A HMP shrub species cover between Baseline (2011) and Year 8 (2023). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Two masticated transects were analyzed in Unit 5A. Scales not equivalent.

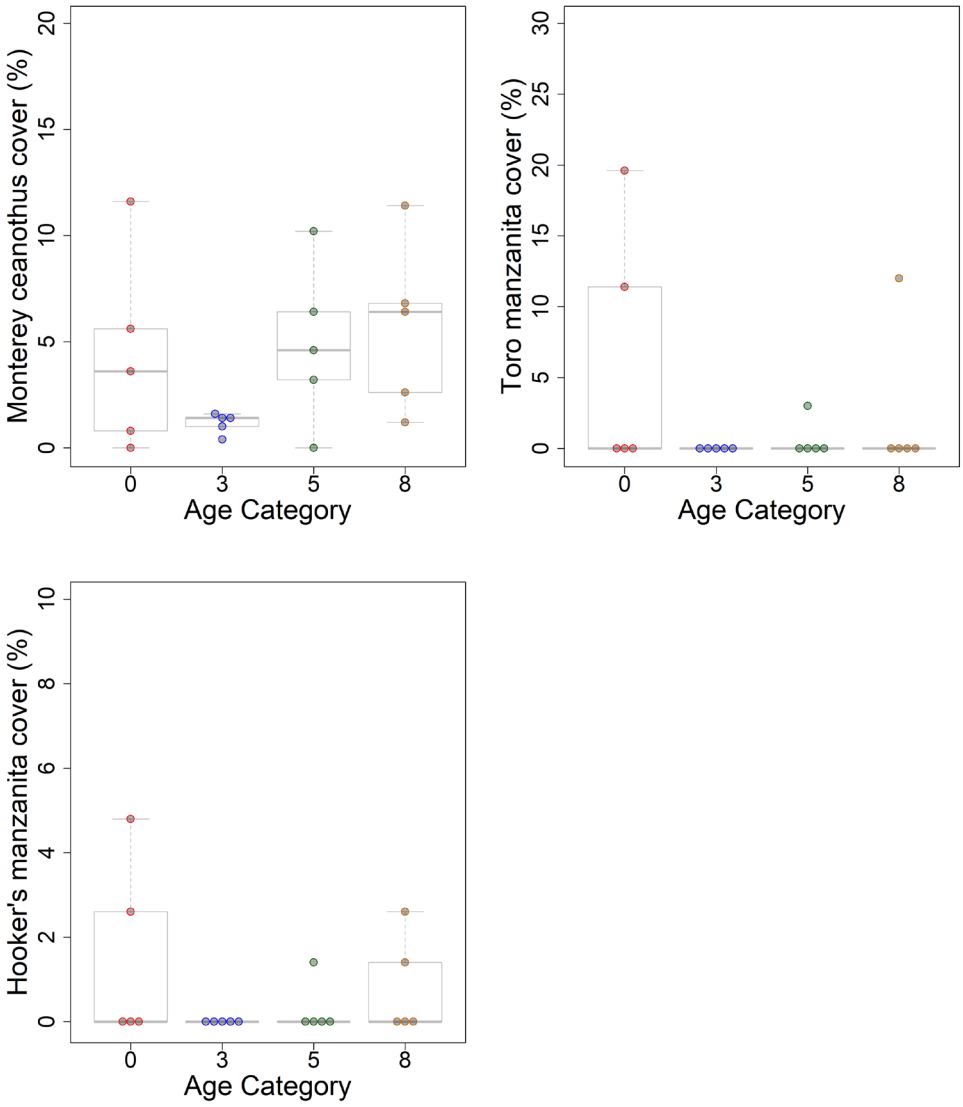


Figure 5-15. Unit 9 HMP shrub species cover between Baseline (2011) and Year 8 (2023). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Five masticated transects were analyzed in Unit 9. Scales not equivalent.

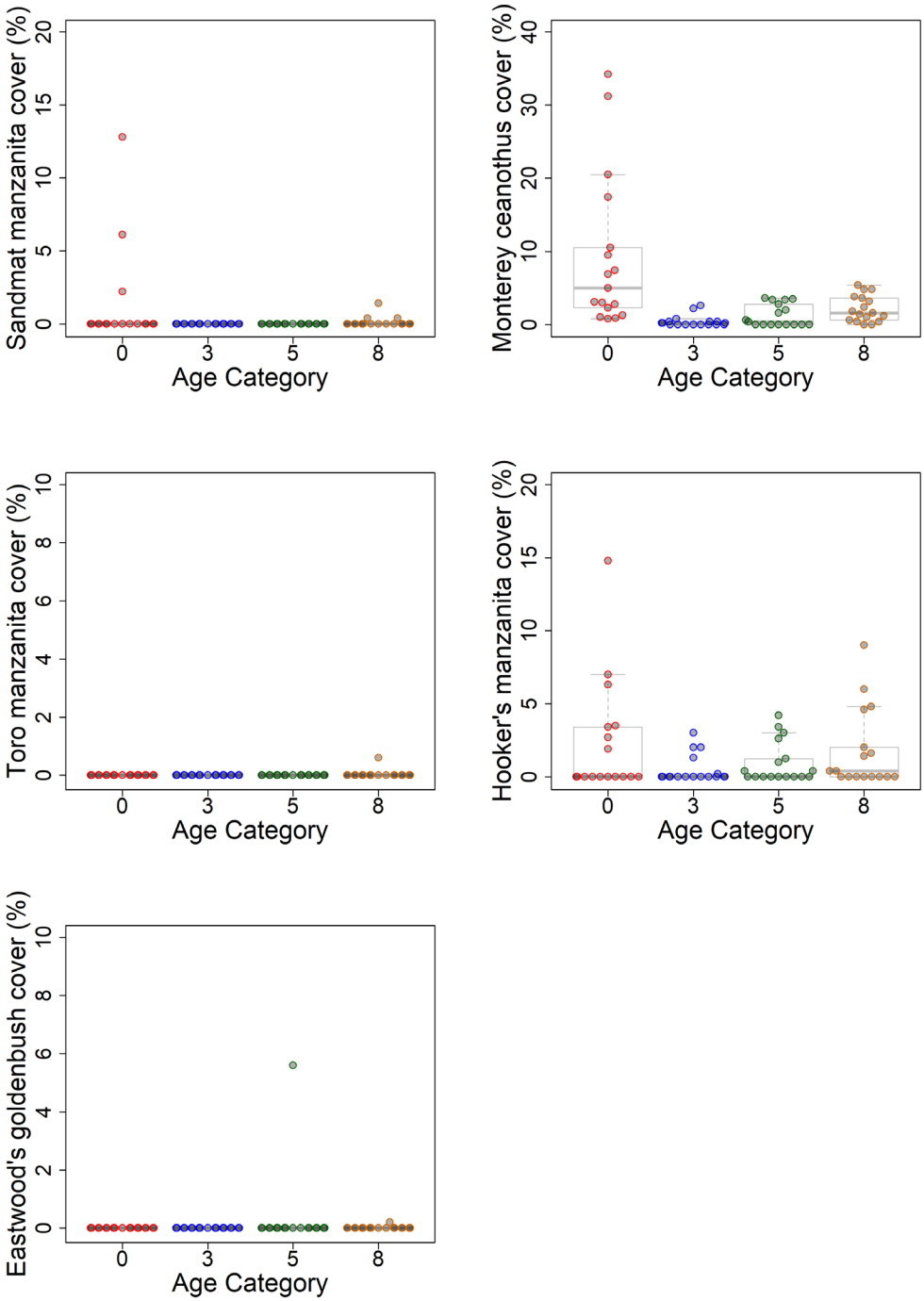


Figure 5-16. Unit 23 HMP shrub species cover between Baseline (2003) and Year 8 (2023). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Seventeen masticated transects were analyzed in Unit 23. Scales not equivalent.

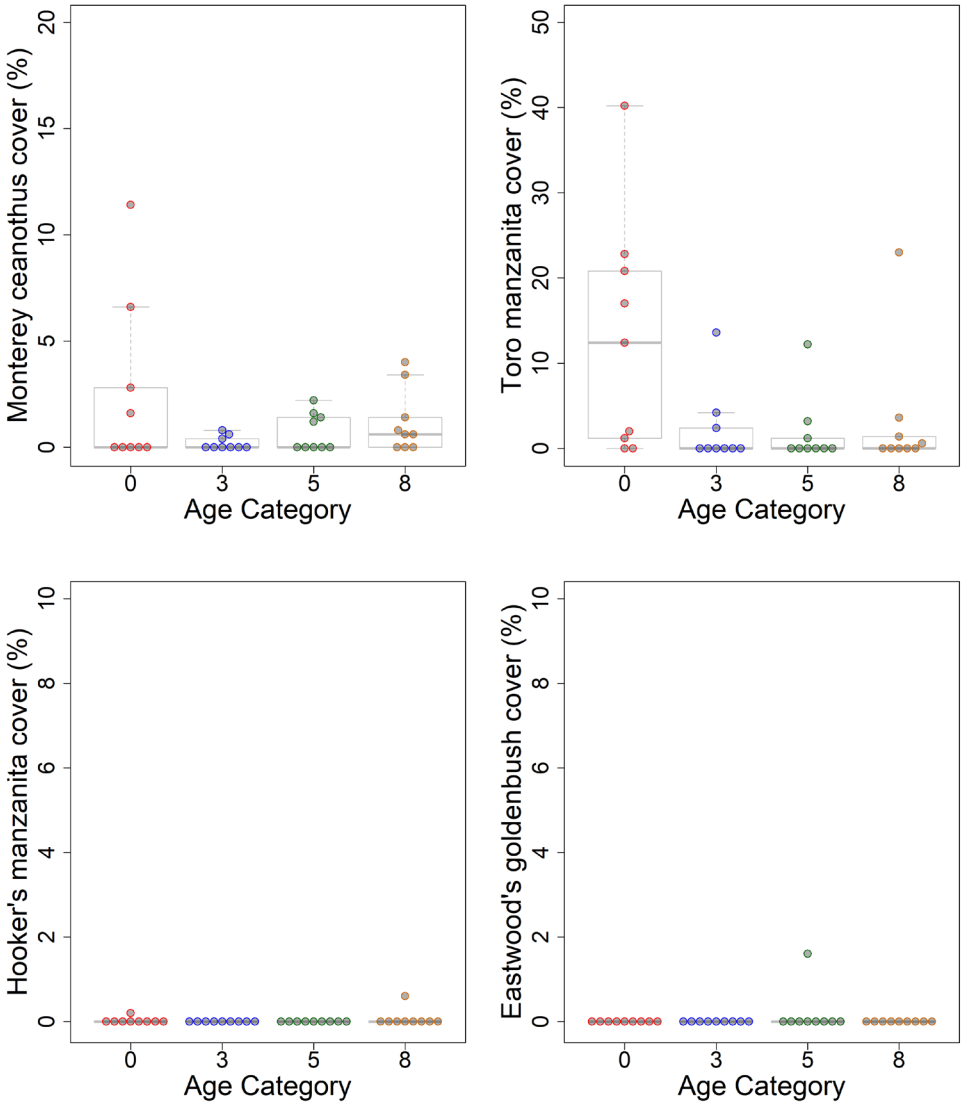


Figure 5-17. Unit 28 HMP shrub species cover between Baseline (2011) and Year 8 (2023). The colored dots represent the percent cover of the respective species for each transect within an age category. The thick grey line in the box represents the median, the top and bottom edges of the central box represent the upper (3rd) and lower (1st) quartile, respectively. Nine masticated transects were analyzed in Unit 28. Scales not equivalent.

NMDS ordinations for Year 8 Units illustrate that community compositions in Year 8 are on trajectory toward Baseline compositions (Figures 5-18, 5-19, and 5-20). 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.

In Unit 5A, there were an insufficient number of transects (two transects for each age category) to conduct an NMDS ordination or a Wilcoxon signed-rank test and an ordination plot is not provided. To examine changes in community composition in Unit 5A, community statistics (total cover, diversity, species richness, and species evenness) for individual transects were evaluated over time. Along transect 5A-1 in Unit 5A, total cover decreased from 135% in Baseline (2011) to 74% in Year 3 (2018) before increasing to 83% and 97% in Year 5 (2020) and 8 (2023), respectively. Species diversity fluctuated over the years, decreasing from Baseline to Year 3, increasing in Year 5, and decreasing in Year 8 ($H_{5A\text{-}1,\ Baseline}$ = 1.5, $H_{5A\text{-}1,\ Year\ 3}$ = 1.1, $H_{5A\text{-}1,\ Year\ 5}$ = 1.4, $H_{5A\text{-}1,\ Year\ 8}$ = 1.1). Species evenness remained relatively stable from Baseline through Year 8 ($J_{5A\text{-}1,\ Baseline}$ = 0.64, $J_{5A\text{-}1,\ Year\ 3}$ = 0.62, $J_{5A\text{-}1,\ Year\ 5}$ = 0.65, $J_{5A\text{-}1,\ Year\ 8}$ = 0.68). Species richness decreased from 10 to 6 species between Baseline and Year 3, then increased to 8 species in Year 5 and decreased to 5 species in Year 8.

Along transect 5A-2 in Unit 5A, total cover decreased from 135% in Baseline to 72% in Year 3 before increasing to 91% and 98% in Years 5 and 8, respectively. Species diversity increased from 1.6 in Baseline to 1.8 in Year 3, then remained stable at 1.5 in Years 5 and 8. Species evenness decreased gradually from 0.90 in Baseline to 0.78 in Year 8. Species richness increased from 6 to 9 species between Baseline and Year 3, then steadily decreased to 8 and 7 species in Years 5 and 8, respectively.

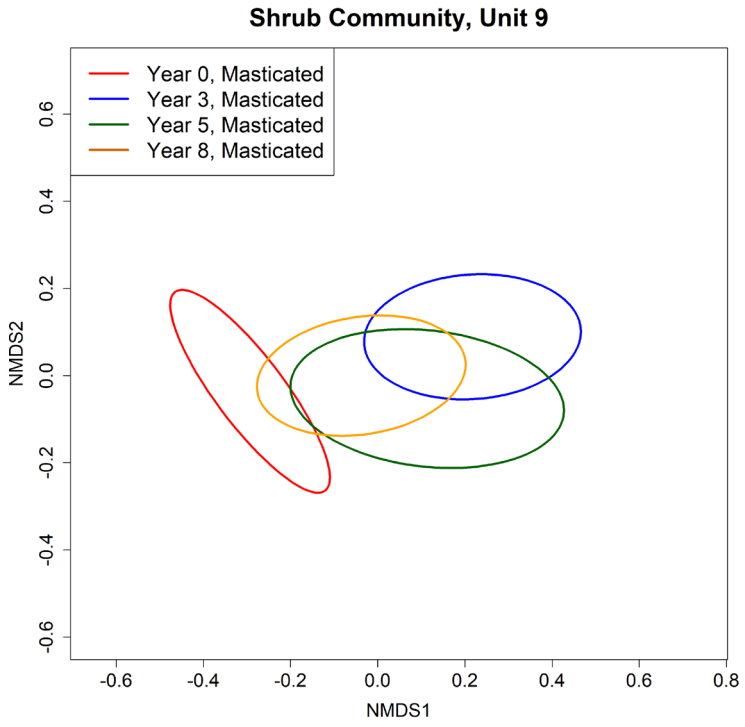


Figure 5-18. NMDS ordination plot showing Unit 9 community composition changes between Baseline (2011), Year 3 (2018), Year 5 (2020), and Year 8 (2023). Five masticated transects were analyzed in Unit 9.

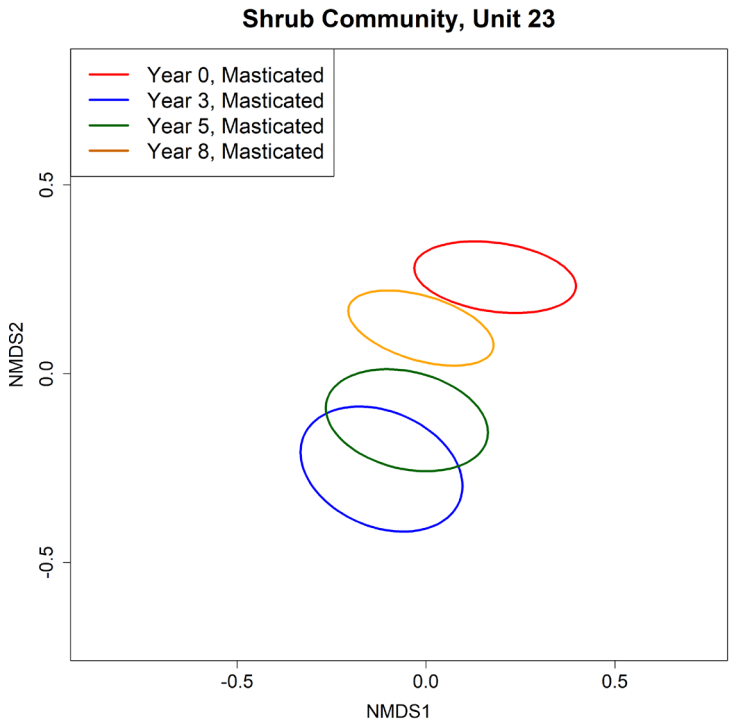


Figure 5-19. NMDS ordination plot showing Unit 23 community composition changes between Baseline (2003), Year 3 (2018), Year 5 Surveys (2020), and Year 8 (2023). Seventeen masticated transects were analyzed in Unit 23.

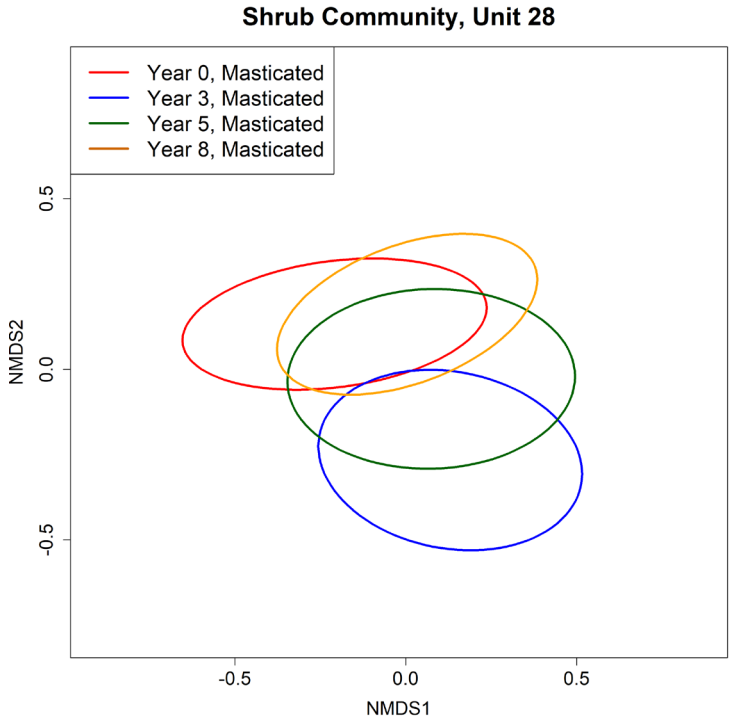


Figure 5-20. NMDS ordination plot Showing Unit 28 community composition changes between Baseline (2011), Year 3 (2018), Year 5 (2020), and Year 8 (2023). Nine masticated transects were analyzed in Unit 28.

5.4.3 Invasive and Non-Native Species Monitoring

Of the target invasive species, pampas grass was observed in Units 5A and 9, and iceplant was observed in Unit 28, while French broom was not observed in any unit. One patch of pampas grass was observed in Unit 5A and one patch was observed in the northwest portion of Unit 9. One patch of iceplant was observed in the southern half of Unit 28, spanning roughly 14 x 20 ft. Additionally, one acacia grove was observed in the northern half of Unit 28 (Appendix E, Figures E-2 through E-5). Minor occurrences of non-native herbaceous cover were observed in Unit 23 and Unit 28 during transect monitoring (Appendix G, Tables G-3 and G-4).

This page intentionally left blank

6 CONCLUSIONS

6.1 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 2023, comparison to Baseline was conducted for all age classes. Treatment-related effects were not assessed in any of the Units surveyed in 2023 due to utilization of only one treatment (mastication).

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.

6.1.1 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 6-1. The only criterion that could not be assessed was comparison of the percentage of bare ground relative to Baseline conditions for Unit 5 and Unit 25 because no shrub transect surveys were required in these Units in Year 1 monitoring.

Ninety-four percent of HMP annuals success criteria were met for the 2023 survey year (Table 6-1). The HMP annual success criterion requires that frequency of occurrence is at least 90% of the Baseline frequency in any post-treatment year. The only criteria not met was Monterey spineflower in the Group 1 grids of BLM Area B Subunit A Containment Line (Year 5). These three grids have shown a steady decline since Baseline frequency, starting at 100% in Baseline and decreasing to 67% in Year 1, 33% in Year 3, and 0% in Year 5. This could be due to the high annual grass density in these grids, minimizing the amount of habitat available for Monterey spineflower (Appendix D, Figure D-1).

Table 6-1. Evaluation of Success Criteria for HMP Annuals.

Year Class	Units	Criterion	Baseline	2023	Pass/Fail
Year 1	Unit 5	Frequency of sand gilia > 90% of Baseline frequency	$f_{Unit\ 5}$ = 0.00	$f_{Unit\ 5}$ = 0.00	Pass
		Frequency of seaside bird's-beak > 90% of Baseline frequency	$f_{Unit\ 5}$ = 0.00	$f_{Unit\ 5}$ = 0.00	Pass
		Frequency of Monterey spineflower > 90% of Baseline frequency	$f_{Unit\ 5}$ = 1.00	$f_{Unit\ 5}$ = 1.00	Pass

		Bare ground > Baseline condition	$f_{Unit\ 5}$ = N/A	$f_{Unit\ 5}$ = N/A	N/A*
Year 5	BLM Area B Subunit A Containment Line, Unit 25 Containment Line, Unit 31 Containment Line	Frequency of sand gilia > 90% of Baseline frequency	$f_{Unit\ 25\ Contain}$ = 0.00 $f_{Unit\ 31\ Contain}$ = 0.00 $f_{Subunit\ A,\ Group\ 1}$ = 0.00 $f_{Subunit\ A,\ Group\ 2}$ = 0.00	$f_{Unit\ 25\ Contain}$ = 0.05 $f_{Unit\ 31\ Contain}$ = 0.20 $f_{Subunit\ A,\ Group\ 1}$ = 0.00 $f_{Subunit\ A,\ Group\ 2}$ = 0.00	Pass Pass Pass Pass
		Frequency of seaside bird's-beak > 90% of Baseline frequency	$f_{Unit\ 25\ Contain}$ = 0.00 $f_{Unit\ 31\ Contain}$ = 0.00 $f_{Subunit\ A,\ Group\ 1}$ = 0.00 $f_{Subunit\ A,\ Group\ 2}$ = 0.00	$f_{Unit\ 25\ Contain}$ = 0.00 $f_{Unit\ 31\ Contain}$ = 0.00 $f_{Subunit\ A,\ Group\ 1}$ = 0.00 $f_{Subunit\ A,\ Group\ 2}$ = 0.00	Pass Pass Pass Pass
		Frequency of Monterey spineflower > 90% of Baseline frequency	$f_{Unit\ 25\ Contain}$ = 1.0 $f_{Unit\ 31\ Contain}$ = 1.0 $f_{Subunit\ A,\ Group\ 1}$ = 1.0 $f_{Subunit\ A,\ Group\ 2}$ = 1.0	$f_{Unit\ 25\ Contain}$ = 0.95 $f_{Unit\ 31\ Contain}$ = 0.90 $f_{Subunit\ A,\ Group\ 1}$ = 0.00 $f_{Subunit\ A,\ Group\ 2}$ = 1.0	Pass Pass Fail Pass
		Bare ground > Baseline condition	$c_{Unit\ 25\ Contain}$ = N/A $c_{Unit\ 31\ Contain}$ = 8.7% $c_{Subunit\ A\ Contain}$ = 5.5%	$c_{Unit\ 25\ Contain}$ = N/A $c_{Unit\ 31\ Contain}$ = 16% $c_{Subunit\ A\ Contain}$ = 31%	N/A* Pass Pass

*Bare ground criterion could not be assessed because shrub transect monitoring was not conducted in this Unit in 2023.

6.2 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 responses to treatment were not assessed since all 2023 survey Units received only mastication with no prescribed burning.

HMP shrub species in Year 8 Units, which included sandmat manzanita, Monterey ceanothus, Hooker's manzanita, and Toro manzanita, generally persisted in Year 8 (see Figures 5-14, 5-15, 5-16, and 5-17). Monterey ceanothus tended to have the fastest recovery rate of the four species, followed by Hooker's manzanita and Toro manzanita.

6.2.1 Shrub Community Success Criteria

The Revised Protocol identified success criteria for recovery of the shrub community in Years 3 and 5. In 2023, no shrub transect surveys occurred in Year 3 Units. Community compositions in Year 5 Units have shown recovery in Years 3 and 5 (Figure 4-22 and Figure 4-23) and have therefore met the Year 5 success criterion (Table 6-2).

Table 6-2. Evaluation of Success Criteria for Shrub Communities in Year 5.

Year Class	Units	Criterion	Rationale	Pass/Fail
Year 5	BLM Area B Subunit A Containment Line, Unit 31 Containment Line	Observation of community recovery	Figures 4-22 and 4-23	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 6-3.

All but two specified criteria were met in Year 8:

1) The shaggy-barked manzanita dominated Baseline transects in Unit 5A were observed as having less than 70% of the Baseline frequency of Monterey ceanothus by Year 8 (50%),

2) the maximum invasive plant cover along Unit 28 transects was greater than 10% cover in Year 8 (11.6%).

Monterey ceanothus cover in Unit 5A in Year 8 was less than the required 70% of the Baseline frequency; however, because the sample size was small in this Unit (n=2), the change of occupancy on one transect represents a substantial change in percent cover. Invasive plant cover in Unit 28 was 1.6% greater than the 10% threshold to meet the Year 8 success criteria. However, overall community compositions in Year 8 Units continue to move toward Baseline conditions (see Figures 5-18, 5-19, and 5-20). 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 5A, 9, 23/23 North, and 28, they will be removed from the monitoring schedule.

Table 6-3. Evaluation of Success Criteria for Dominant Chaparral Shrub Associations on Fort Ord in Year 8 Units Monitored in 2023 (Units 5A, 9, 23, and 28).

Plant Association	Criterion	Unit	Baseline value	Year 8 value	P/F
A – ARTO dominated	Average cover of ARTO > 30% of Baseline cover	5A	59%	48%	Pass
		9	78%	62%	Pass
		23	53%	39%	Pass
		28	65%	49%	Pass
	Frequency of dwarf ceanothus > 70% Baseline frequency	5A	0.00	0.50	Pass
		9	0.00	0.80	Pass
		23	0.38	0.69	Pass
		28	0.17	1.0	Pass
	Frequency of Monterey ceanothus >70% Baseline frequency	5A	1.0	0.50	Fail
		9	0.80	1.0	Pass
		23	1.0	0.85	Pass
		28	0.67	0.83	Pass
B – ADFA dominated	Average cover of ADFA > 30% of Baseline cover	5A	N/A	N/A	N/A*
		9	N/A	N/A	N/A*
		23	51%	51%	Pass
		28	42%	43%	Pass
	Frequency of dwarf ceanothus > 70% Baseline frequency	5A	N/A	N/A	N/A*
		9	N/A	N/A	N/A*
		23	0.25	0.50	Pass
		28	0.00	0.33	Pass
	Frequency of Monterey ceanothus >70% Baseline frequency	5A	N/A	N/A	N/A*
		9	N/A	N/A	N/A*
		23	1.0	1.0	Pass

		28	0.00	0.33	Pass
C/D – ARPU dominated	Frequency of ARPU > 70% of Baseline frequency	5A	N/A	N/A	N/A*
		9	N/A	N/A	N/A*
		23	N/A	N/A	N/A*
		28	N/A	N/A	N/A*
	Frequency of dwarf ceanothus > 70% Baseline frequency	5A	N/A	N/A	N/A*
		9	N/A	N/A	N/A*
		23	N/A	N/A	N/A*
		28	N/A	N/A	N/A*
	Frequency of Monterey ceanothus >70% Baseline frequency	5A	N/A	N/A	N/A*
		9	N/A	N/A	N/A*
		23	N/A	N/A	N/A*
		28	N/A	N/A	N/A*
Bare Ground	Bare ground > 90% of Baseline cover	5A	1.2%	18%	Pass
		9	3.2%	17%	Pass
		23	15%	18%	Pass
		28	13%	20%	Pass
Invasive plants	Invasive plants <10% cover per transect	5A	0.0%	0.0%	Pass
		9	0.0%	2.6%	Pass
		23	0.0%	2.4% (max)	Pass
		28	4.4%	12% (max)	Fail

*Criterion could not be assessed because no transects in this Unit were classified as having this shrub association.

6.3 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 2023 (Appendix D). High annual grass density was present in all cleared fuel break areas; 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 4-4).

Response of annual grasses varied between age classes and Units. The cover of annual grasses in all Year 5 Units (Units 25, 31, and BLM Area B Subunit A Containment Lines) increased between Baseline and Year 3 by at least 92% and then increased marginally (at least 5%) between Years 3 and 5 (Table 4-4). BLM Area B Subunit A Containment Line had the greatest area occupied by annual grasses, increasing by 143% from Baseline to Year 5. This high density could be one of the contributing factors to the disappearance of Monterey spineflower from the Group 1 grids in this Unit. As shrubs continue to mature in these Units, annual grass density is expected to decrease. Annual grass cover was not monitored in Year 8 Units.

7 REFERENCES

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

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

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., A Terracon Company. 2021. 2020 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., A Terracon Company. 2022. 2021 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.

Burleson Consulting Inc., A Terracon Company. 2023. 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. Prepared for U.S. Army Corps of Engineers, Sacramento, CA. Administrative Record #BW 2940.

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

ESRI. 2023. ArcGIS Pro Version 3.1.3.

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.

Kindt R. 2019. BiodiversityR: Package for Community Ecology and Suitability Analysis. R Package Version 2.12-2. Available at: https://cran.r-project.org/web/packages/BiodiversityR/index.html

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

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

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

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). 2023. 30-Year Normal Precipitation Data for the Monterey Weather Forecast Office. [Internet]. Accessed on November 8, 2023. 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

[NDMC] National Drought Mitigation Center, USDA, NOAA. 2023. U.S. Drought Monitor – Monthly Precipitation Summaries for the Monterey Region. [Internet]. Accessed November 16, 2023. Available at: https://droughtmonitor.unl.edu/

[NPS] Naval Postgraduate School Department of Meteorology. 2023. Monthly Precipitation Summaries for the Monterey Region. [Internet]. Accessed November 8, 2023. 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. Available at: http://CRAN.R-project.org/package=vegan

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

Potts JB, Marino E, Stephens SL. 2010. Chaparral shrub recovery after fuel reduction: a comparison of prescribed fire and mastication techniques. Plant Ecology 210:303-315.

R Core Team. 2022. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. Available at: 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. 2012. 2011 Biological Monitoring Report for Units 11, 12, MOUT, 28, 9, 4, 5a; a portion of Unit 23 and Watkins Gate Burn Area; Units 15, 21, 32, and 34; South Boundary Road Unit; Units 18 and 22; and MRS 16 Former Fort Ord. Prepared for U.S. Army Corps of Engineers, Sacramento, CA.

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

Tetra Tech, Inc., and EcoSystems West Consulting Group. 2015a. 2014 Biological Monitoring Report for Units 25 and 31; Units 06, 07, 10, 33 WGBA and MOUT; Units 04, 11, 12 and 23N; Units 14 and 19; and MRS-16, Former Fort Ord. Prepared for the U.S. Army Corps of Engineers, Sacramento, CA.

Tetra Tech, Inc., and EcoSystems West Consulting Group. 2015b. Revisions of Protocol for Conducting Vegetation Monitoring for Compliance with the Installation-Wide Multispecies Habitat Management

Plan, Former Fort Ord, Monterey, California. Prepared for the U.S. USACE Corps of Engineers, Sacramento, CA.

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

[USACE] United States Army Corps of Engineers. 2022. "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. Available at: http://plants.usda.gov

[USDA] U.S. Department of Agriculture, Natural Resources Conservation Service. 2023. Soil Survey Spatial and Tabular Data (SSURGO 2.2). Available at: https://datagateway.nrcs.usda.gov/

[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). Available at: http://docs.fortordcleanup.com/ar_pdfs/AR-BW-2747A/

[USFWS] U.S. Fish and Wildlife Service. 2019. Changes to Vegetation Clearance Activities Under the Programmatic Biological Opinion for Cleanup and Property Transfer Actions Conducted at the Former Fort Ord, Monterey, California (2017-F-0094) (#BW-2747A.2). Available at: https://docs.fortordcleanup.com/ar_pdfs/AR-BW-2747A.2/

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

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.

APPENDIX A

SPECIES ACRYONYMS

This page intentionally left blank

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

Acronym	Scientific Name	Common Name	Life Form
ACAMA	*Acmispon americanus var. americanus*	Spanish clover	annual herb
ACGL	*Acmispon glaber (Lotus scoparius)*	deerweed	subshrub
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
AGPA	*Agrostis pallens*	leafy bent grass	perennial grass
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*	Toro 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
CASU	*Calystegia subacaulis*	hill morning glory	perennial herb

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

Acronym	Scientific Name	Common Name	Life Form
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. *muricata*	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
ERER	*Ericameria ericoides*	mock heather	shrub
ERFA	*Ericameria fasciculata*	Eastwood’s goldenbush	shrub
ERMO	*Erodium moschatum*	white-stemmed filaree	annual herb

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

Acronym	Scientific Name	Common Name	Life Form
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
JUBU	*Juncus bufonius*	common toad rush	annual 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?)*	valley lessingia	annual herb
LOGA	*Logfia (Filago) gallica*	daggerleaf cottonrose	annual herb
LOMA	*Lomatium* sp.		perennial herb
LOPA	*Lomatium parvifolium*	small-leaved lomatium	perennial herb
LUAL	*Lupinus albifrons* (var. *albifrons?)*	silver bush lupine	shrub
LUAR	*Lupinus arboreus*	yellow bush lupine	shrub
LUBI	*Lupinus bicolor*	miniature lupine	annual herb
LUCH	*Lupinus chamissonis*	silver beach lupine	shrub
LUCO	*Lupinus concinnus*	bajada lupine	annual herb
LUNA	*Lupinus nanus*	sky lupine	annual herb

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

Acronym	Scientific Name	Common Name	Life Form
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
MUMA	*Muilla maritima*	common muilla	perennial 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
PEGA	*Perideridia gairdneri*	Gairdner's yampah	perennial 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
QUWIF	*Quercus wislizeni* var. *frutescens*	chaparral oak	tree
RIMA	*Ribes malvaceum*	chaparral currant	shrub

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

Acronym	Scientific Name	Common Name	Life Form
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
TOFR	*Toxicoscordion fremontii*	Fremont's star lily	perennial herb
TOMI	*Toxicoscordion micranthum*	small flowered star lily	perennial herb
TRAN	*Trifolium angustifolium*	narrow-leaved clover	annual 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).

This page intentionally left blank

APPENDIX B

MAPS: HMP ANNUALS GRIDS

This page intentionally left blank

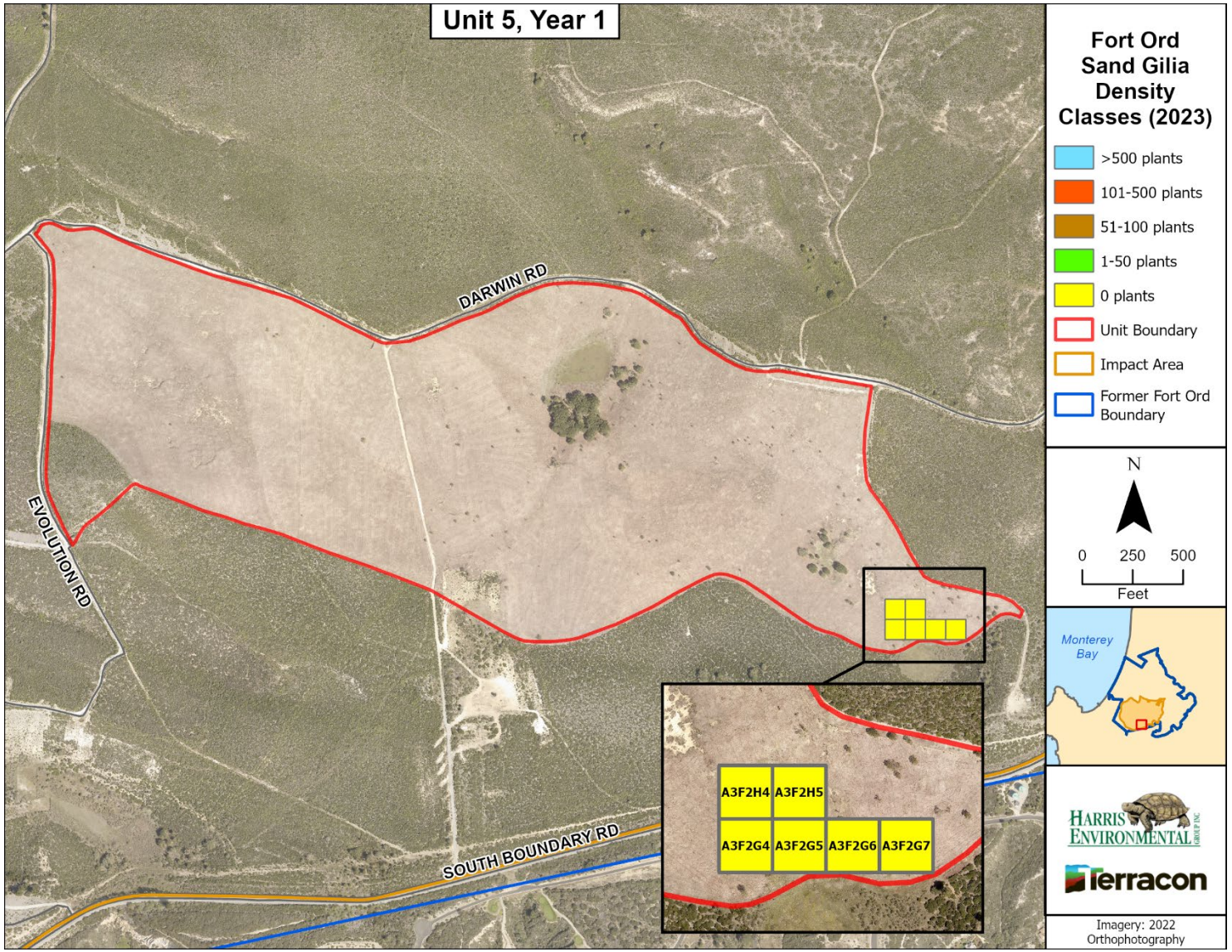


Figure B-1. Map of sand gilia density; Unit 5 (Year 1).

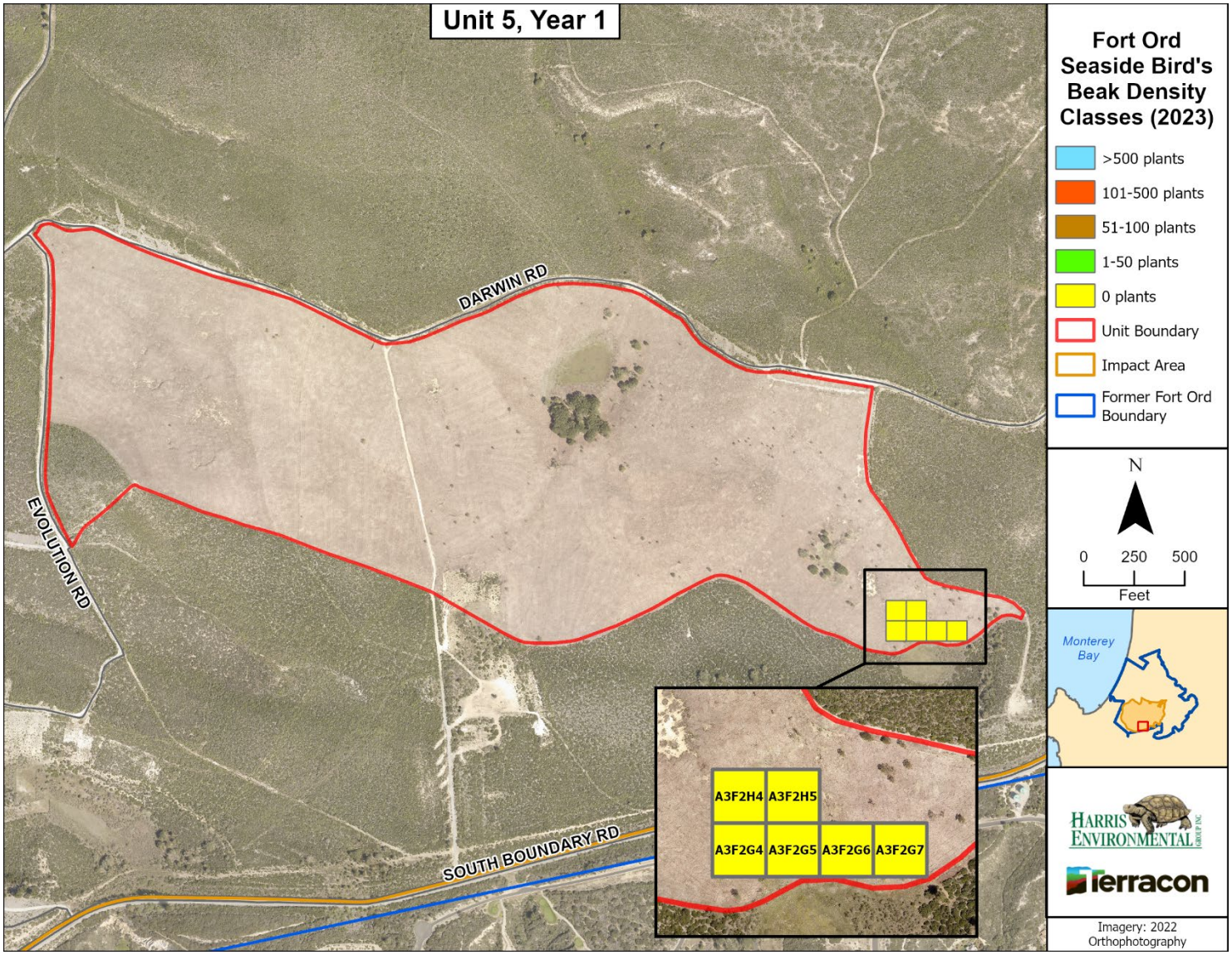


Figure B-2. Map of seaside bird's beak density; Unit 5 (Year 1).

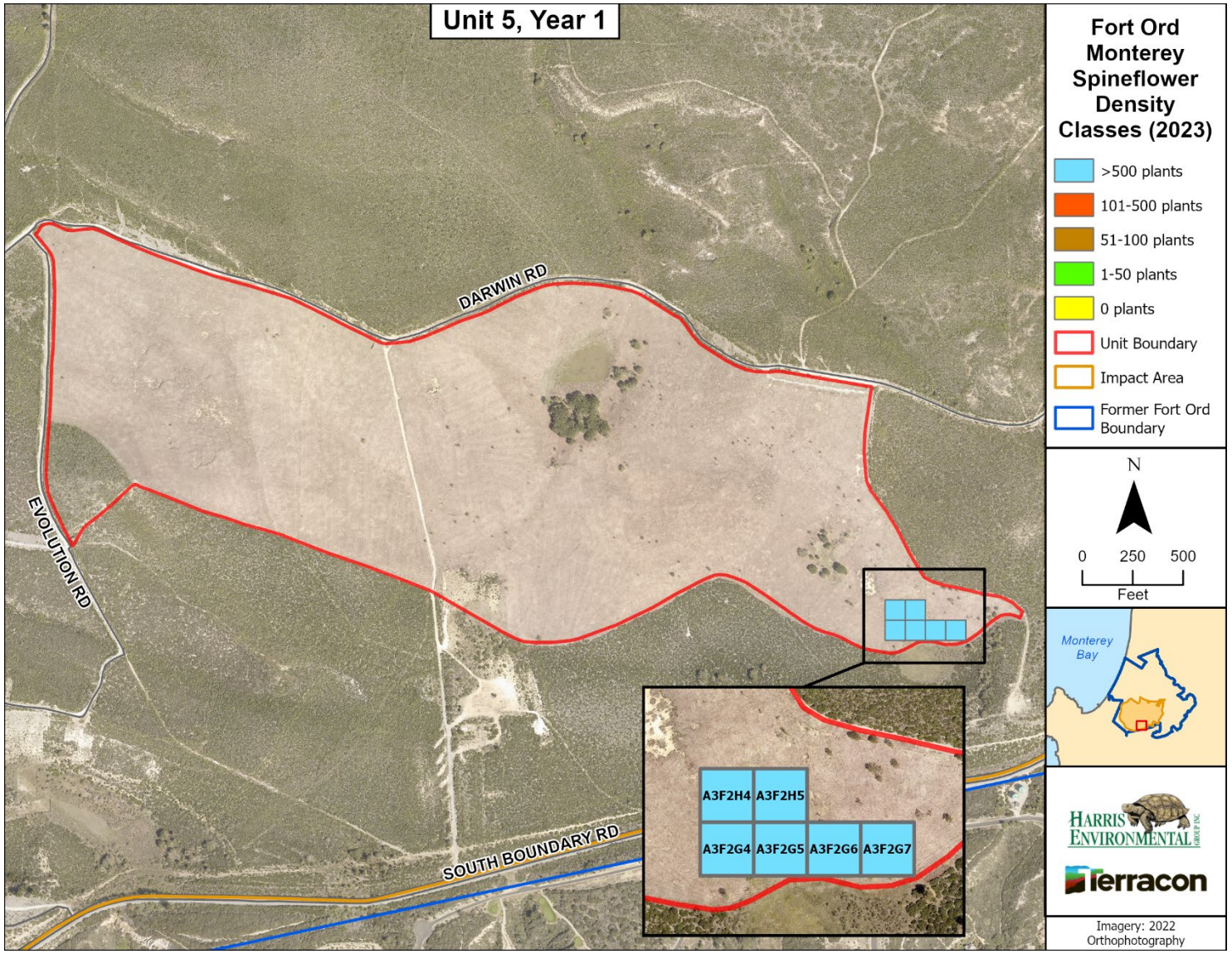


Figure B-3. Map of Monterey spineflower density; Unit 5 (Year 1).

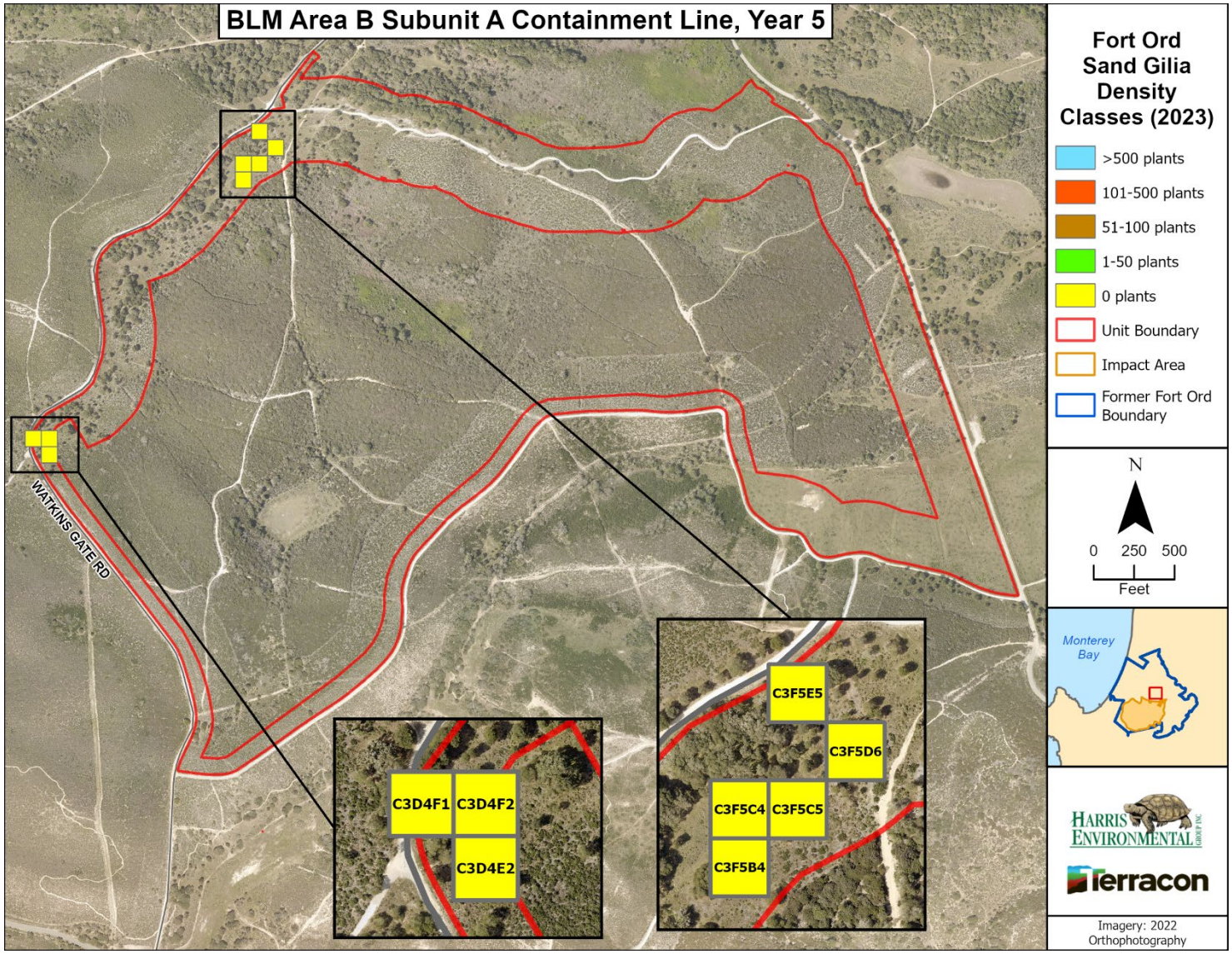


Figure B-4. Map of sand gilia density; BLM Area B Subunit A Containment Line (Year 5).

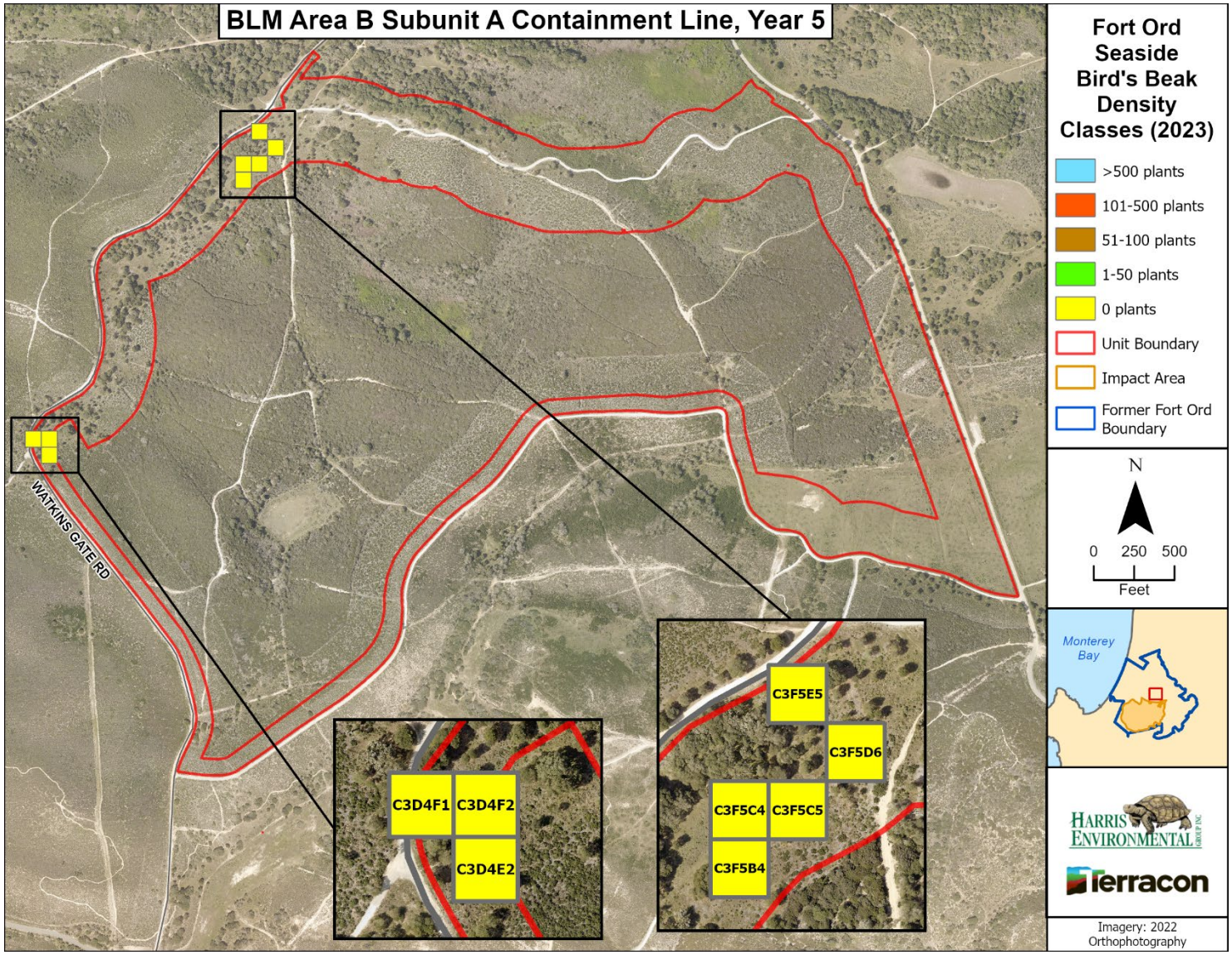


Figure B-5. Map of seaside bird's beak density; BLM Area B Subunit A Containment Line (Year 5).

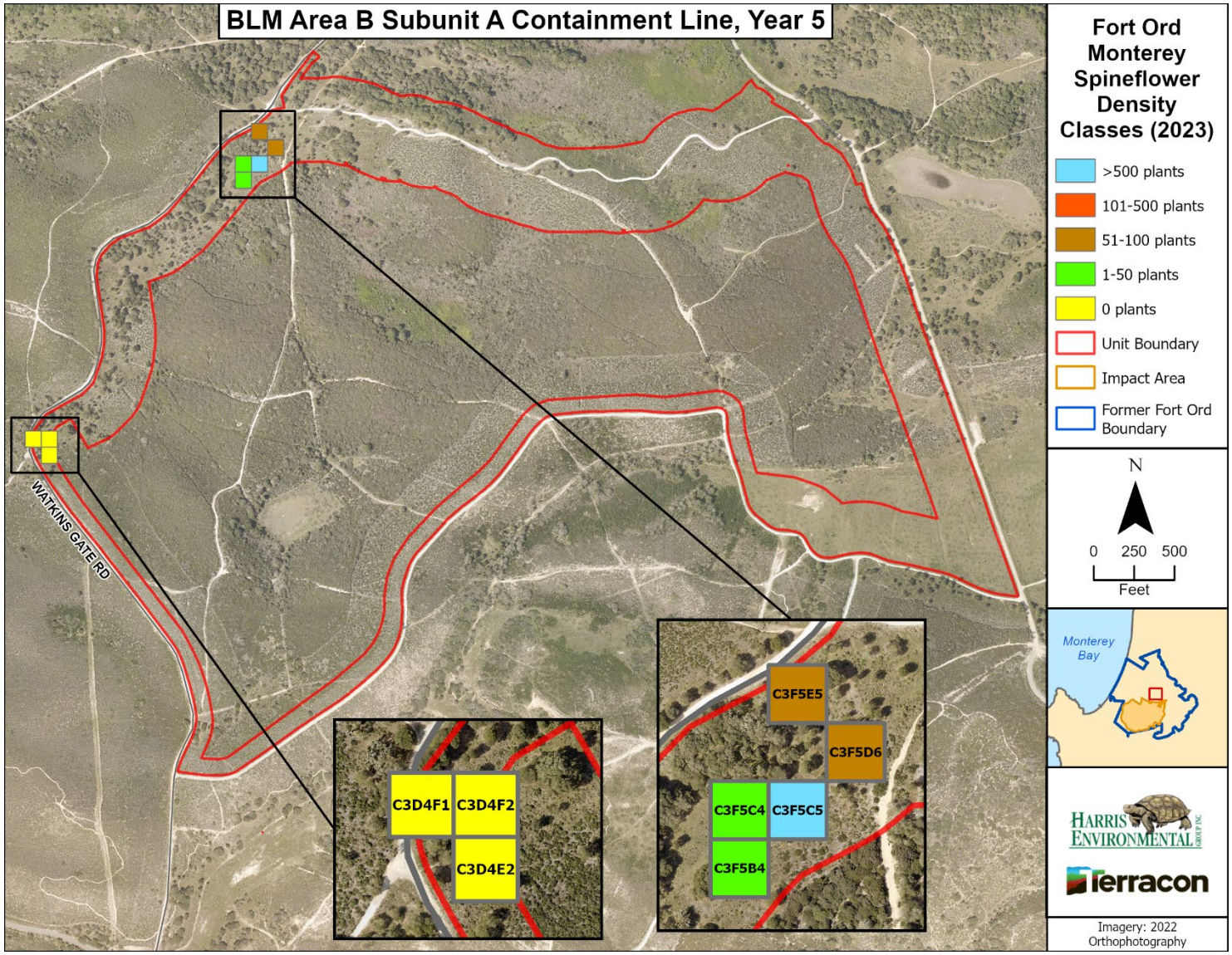


Figure B-6. Map of Monterey spineflower density; BLM Area B Subunit A Containment Line (Year 5).

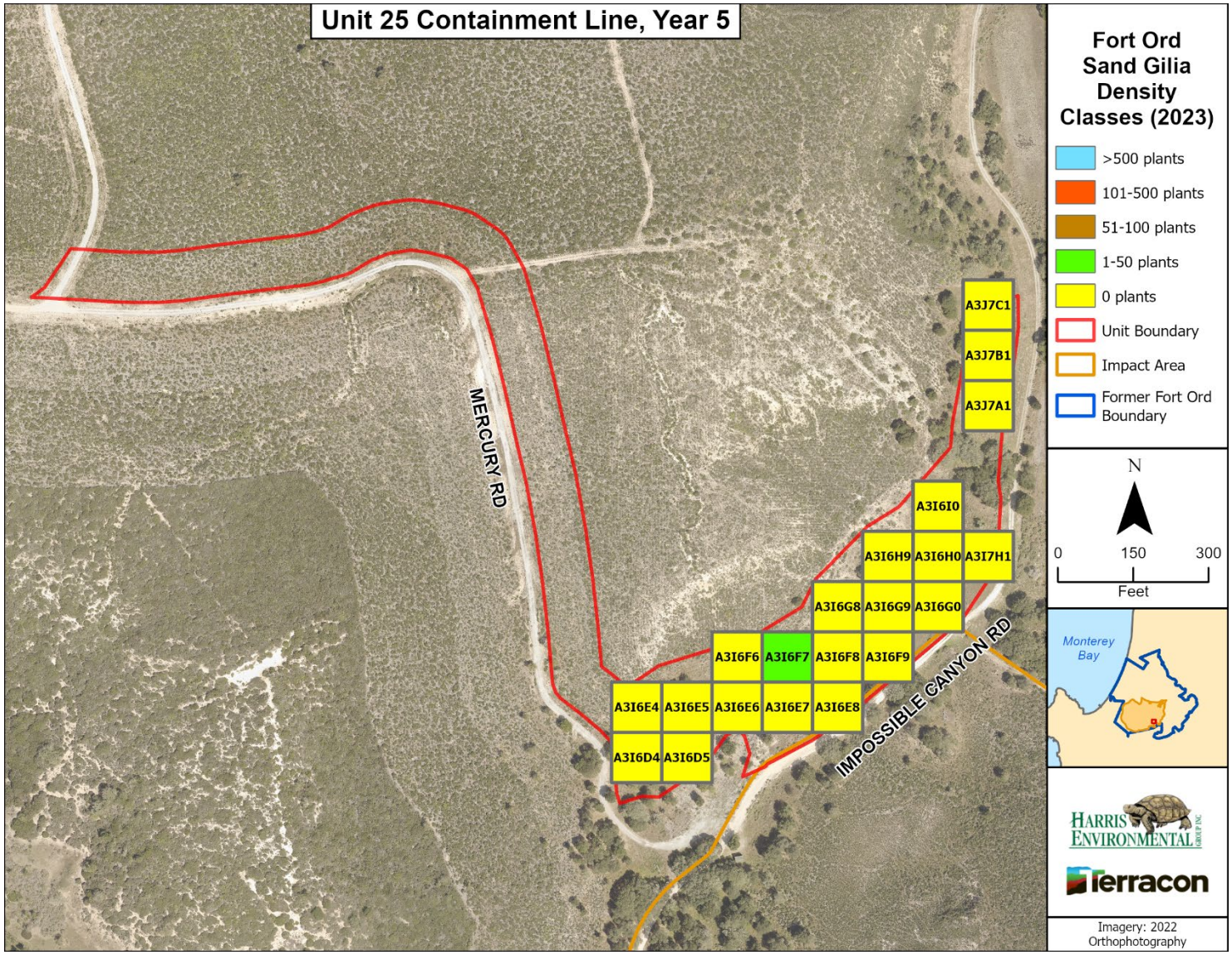


Figure B-7. Map of sand gilia density; Unit 25 Containment Line (Year 5).

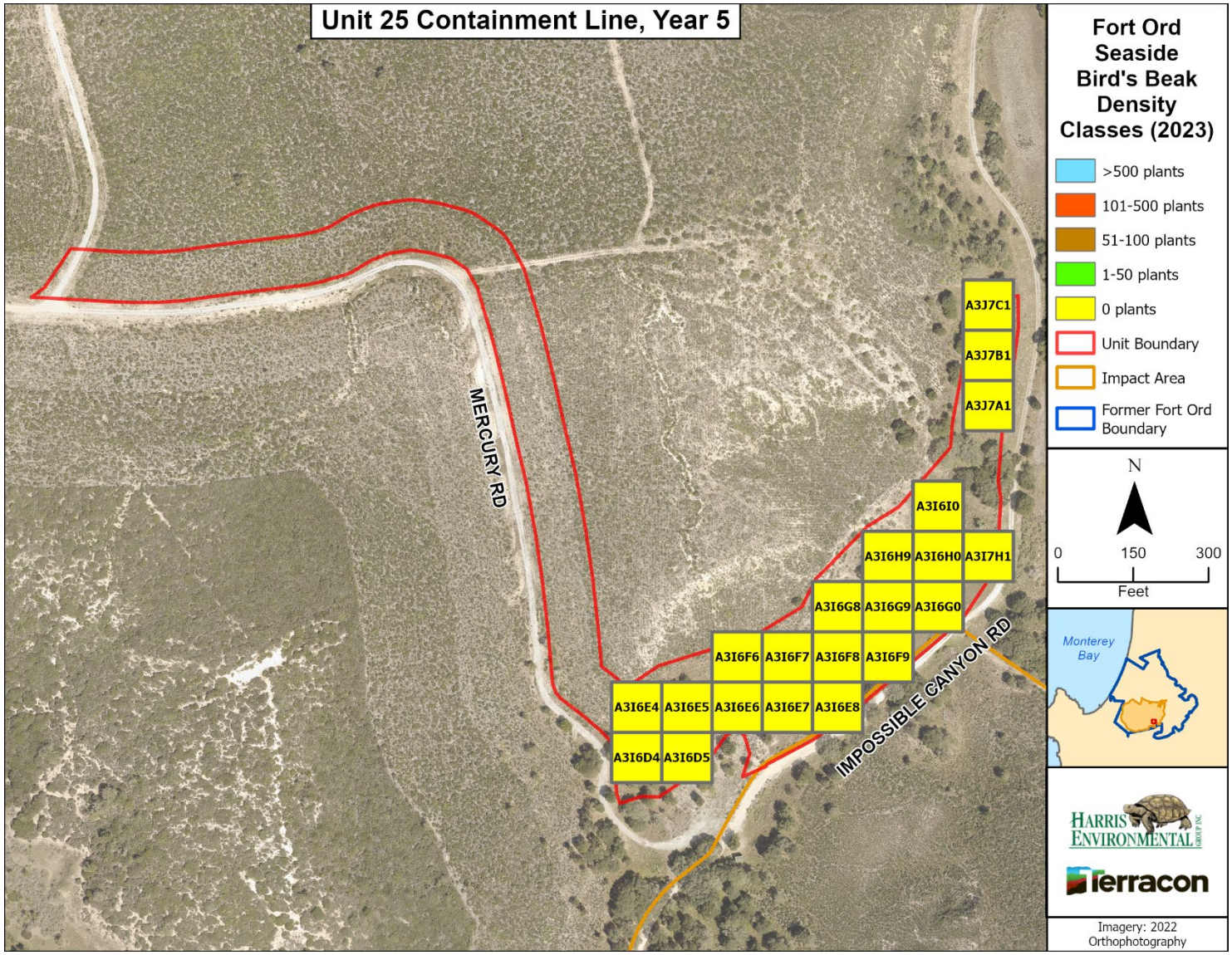


Figure B-8. Map of seaside bird's beak density; Unit 25 Containment Line (Year 5).

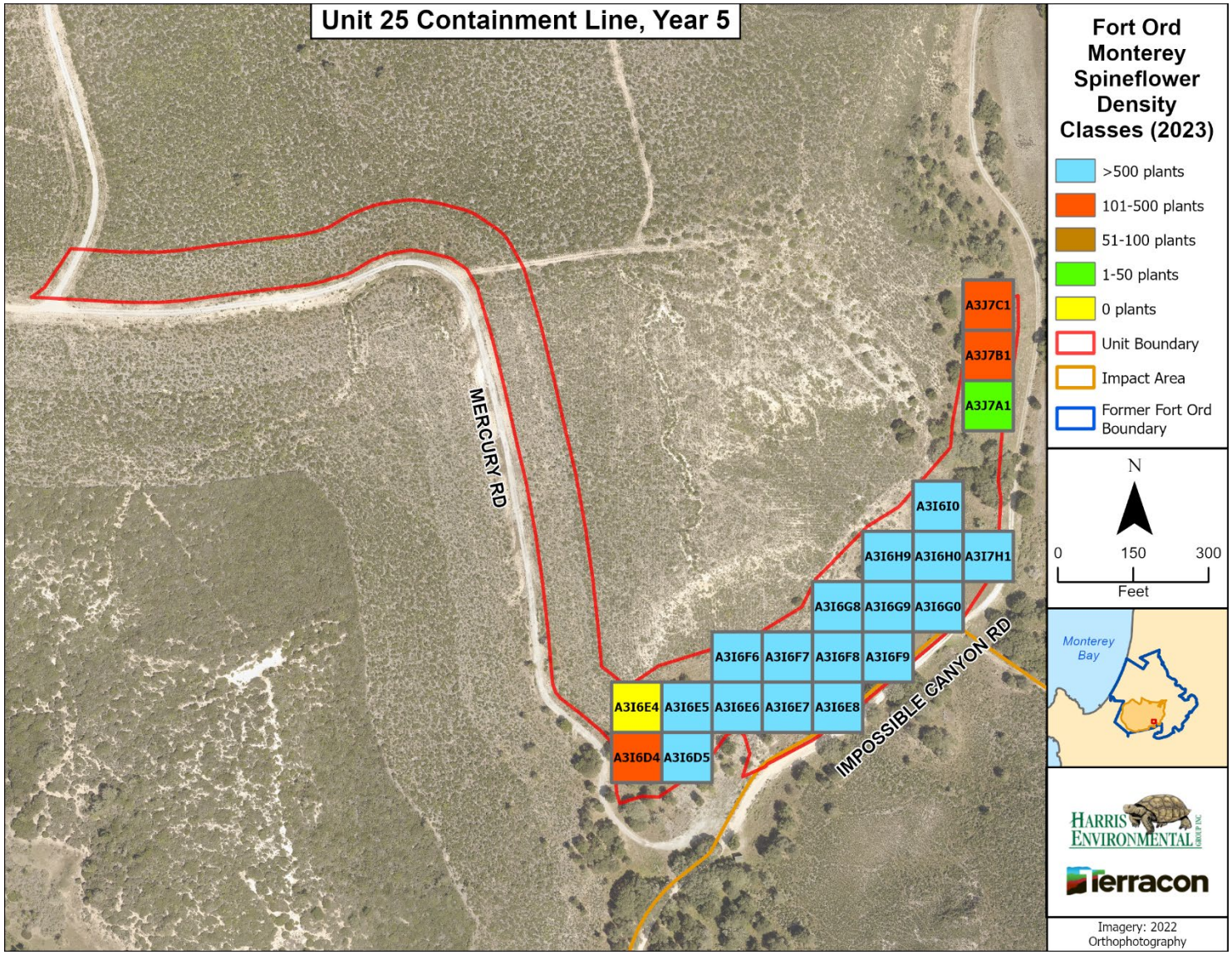


Figure B-9. Map of Monterey spineflower density; Unit 25 Containment Line (Year 5).

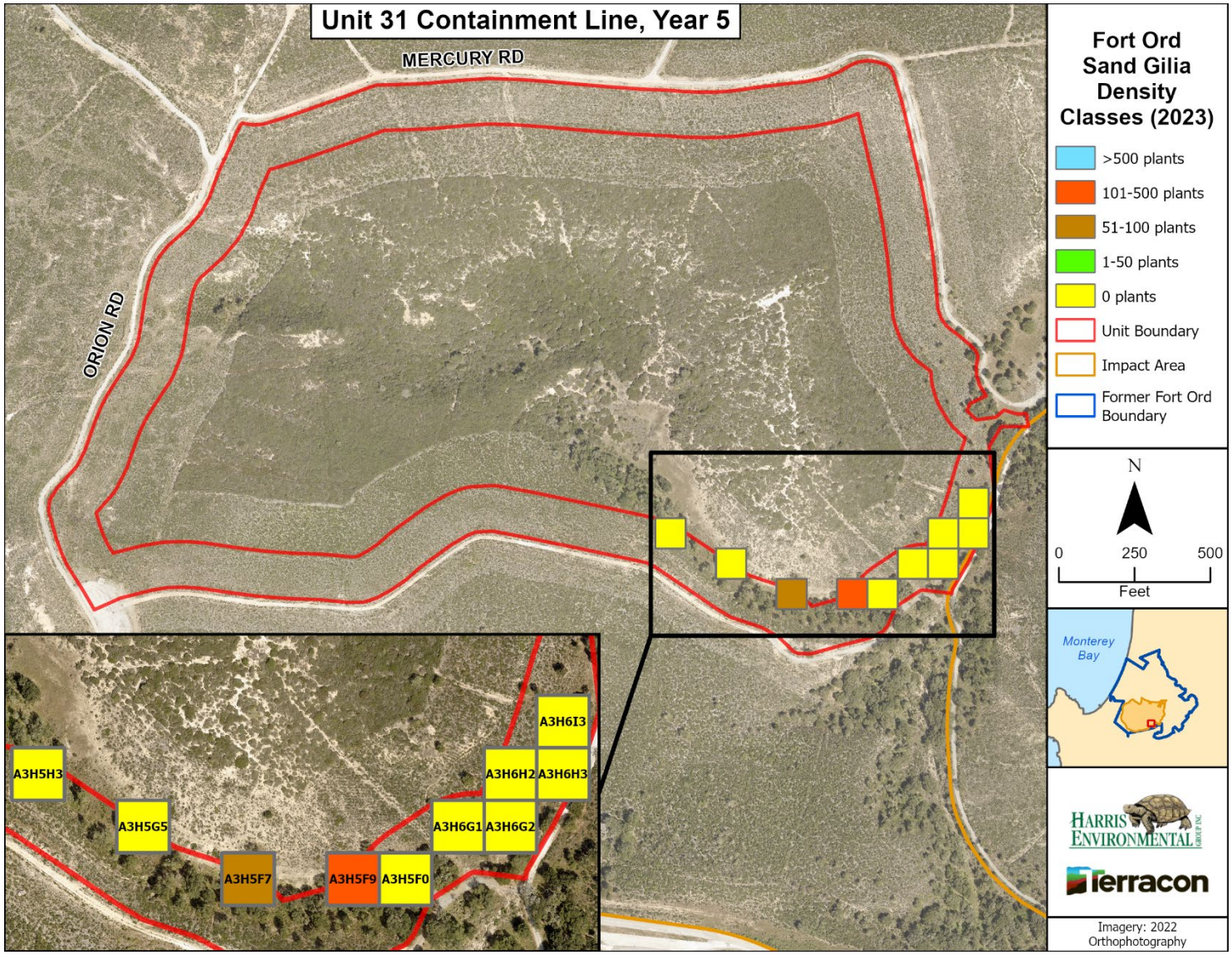


Figure B-10. Map of sand gilia density; Unit 31 Containment Line (Year 5).

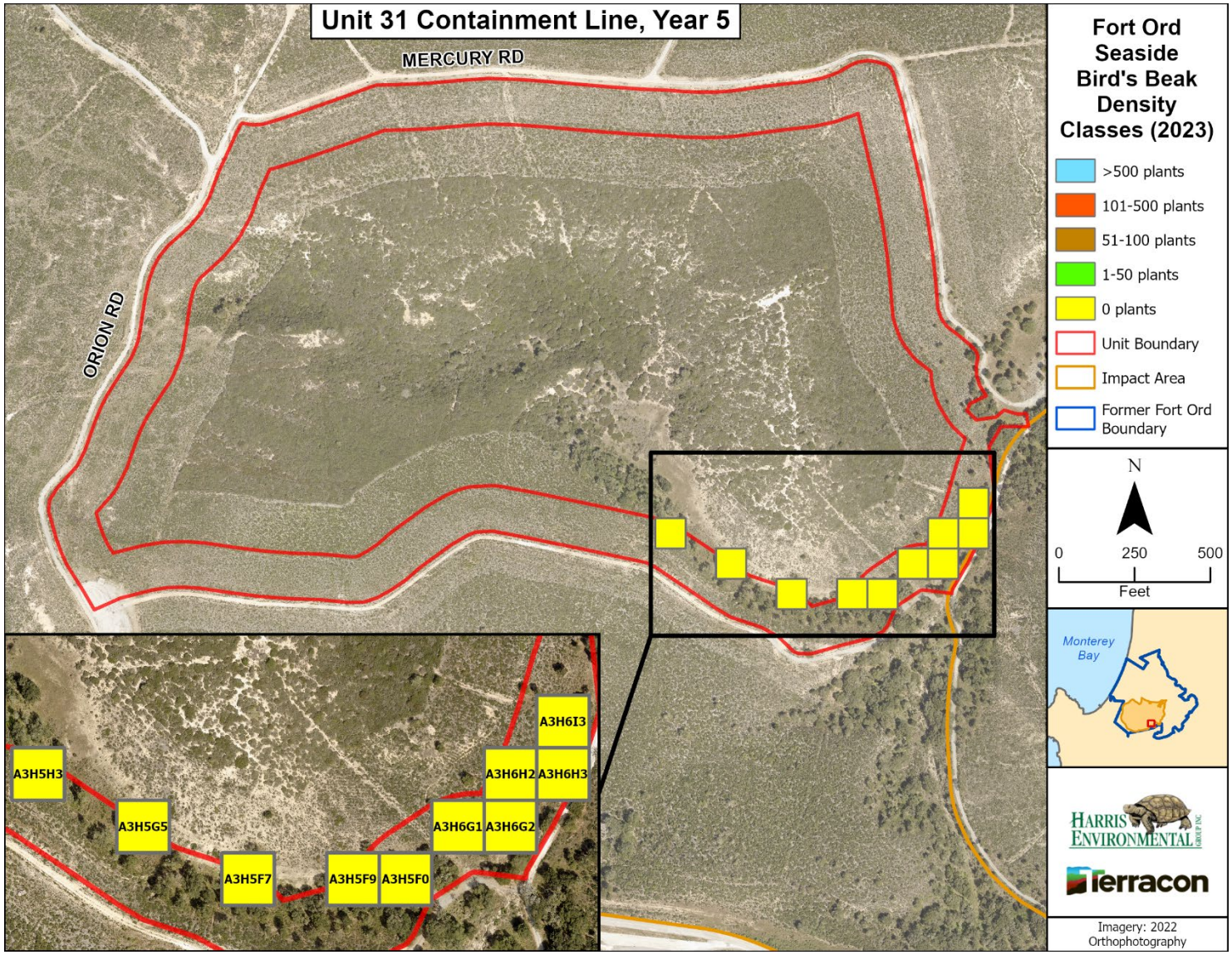


Figure B-11. Map of seaside bird's beak density; Unit 31 Containment Line (Year 5).

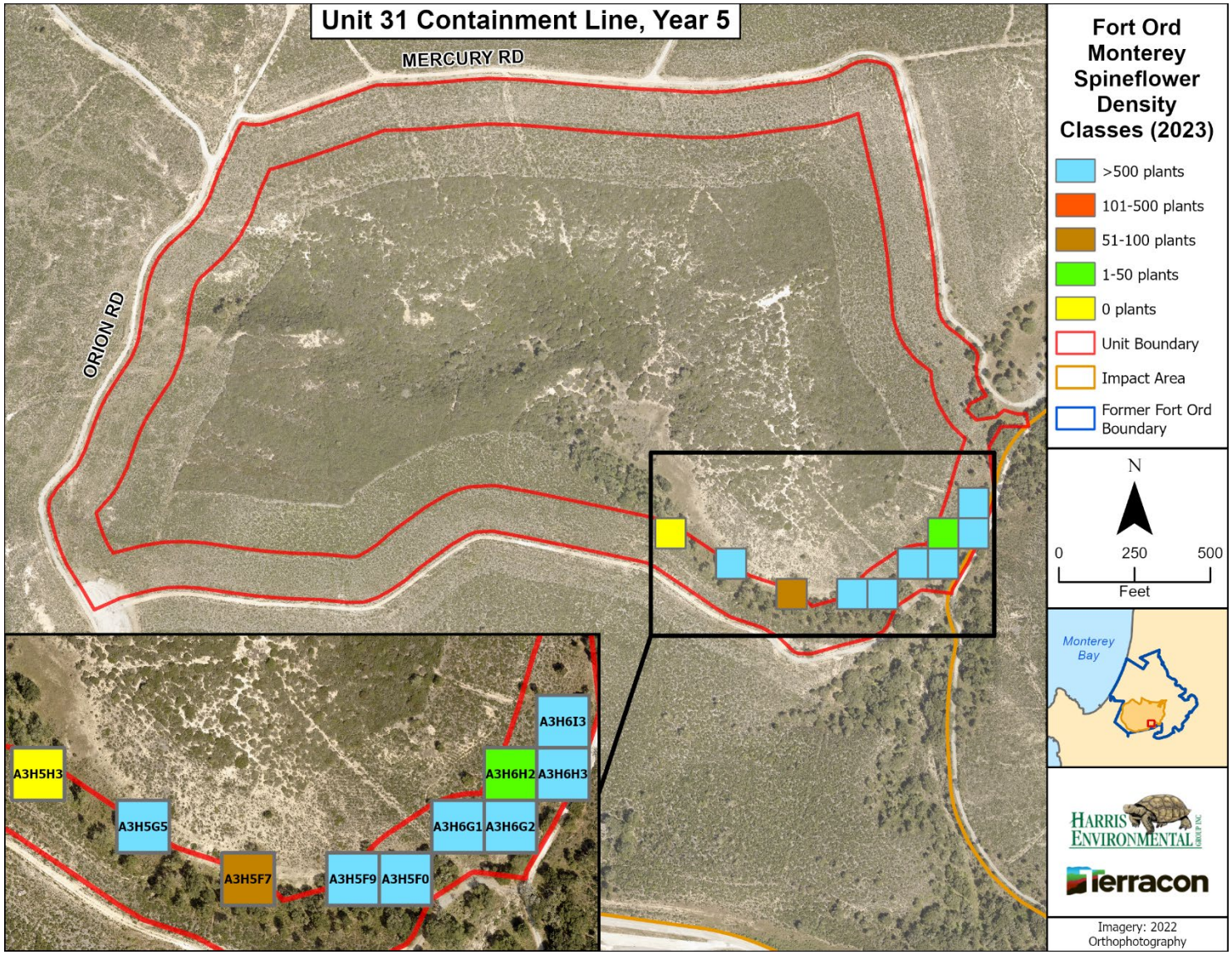


Figure B-12. Map of Monterey spineflower density; Unit 31 Containment Line (Year 5).

APPENDIX C

MAPS: HMP SHRUB TRANSECTS

This page intentionally left blank

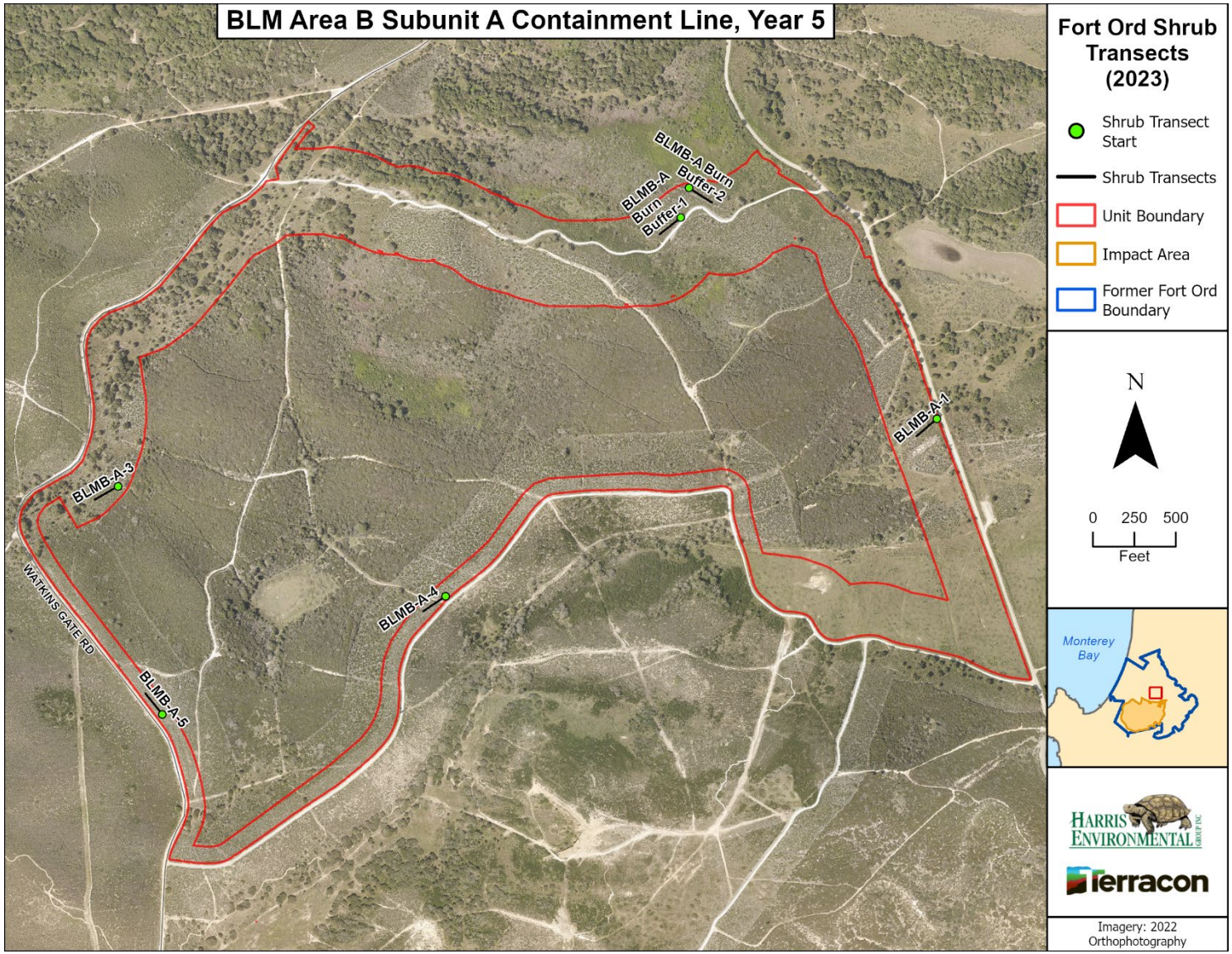


Figure C-1. Map of shrub transects; BLM Area B Subunit A Containment Line (Year 5).

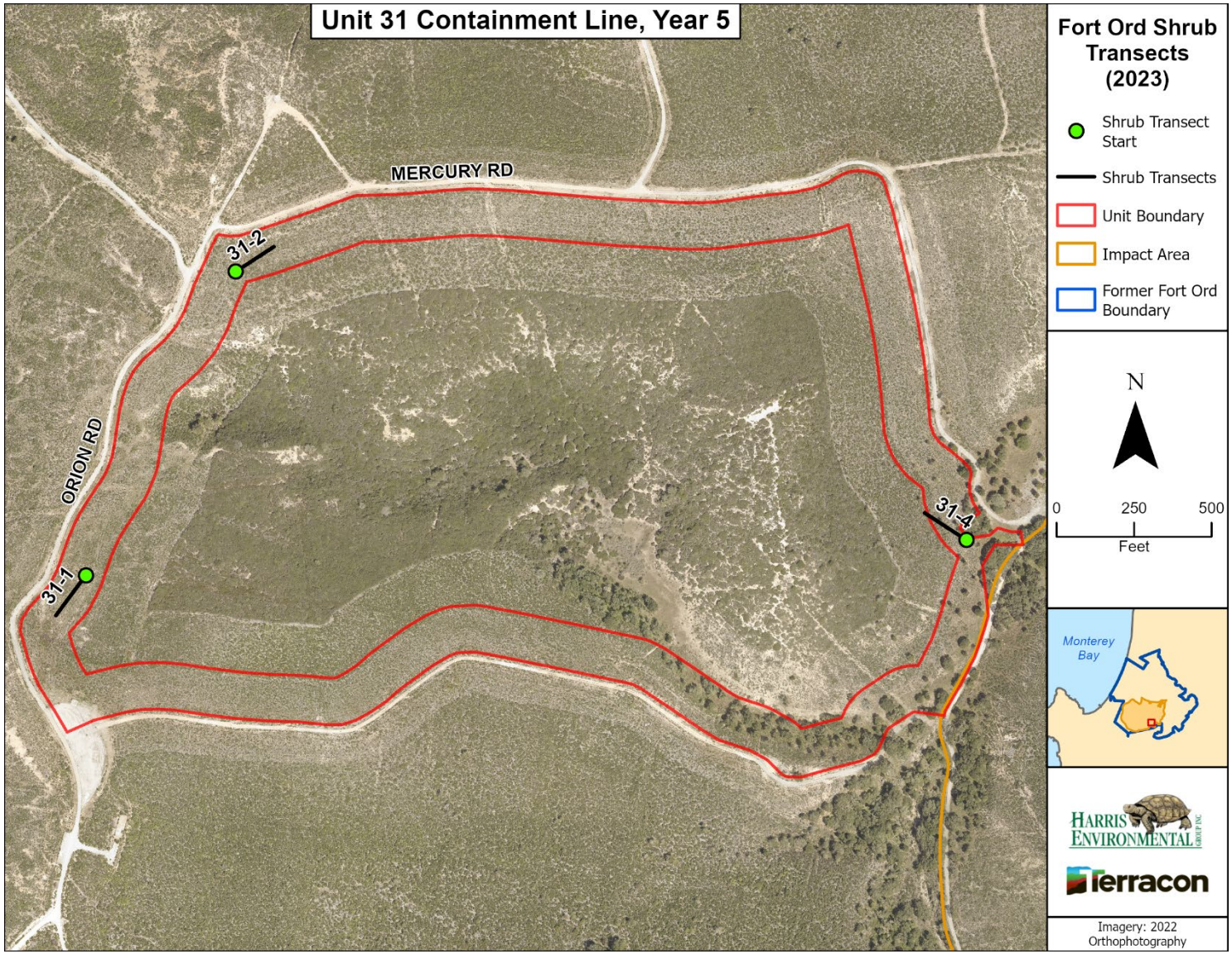


Figure C-2. Map of shrub transects; Unit 31 Containment Line (Year 5).

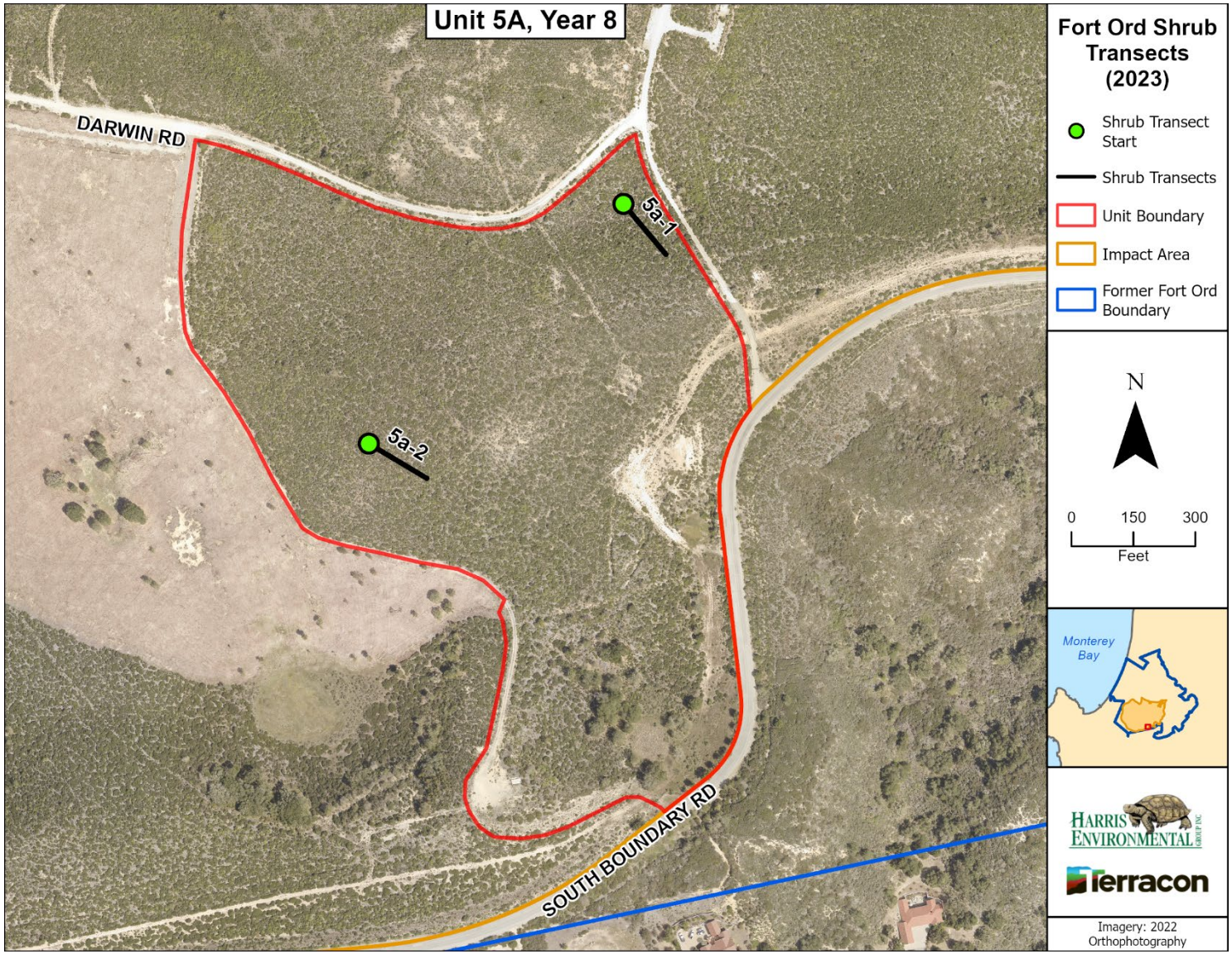


Figure C-3. Map of shrub transects; Unit 5A (Year 8).

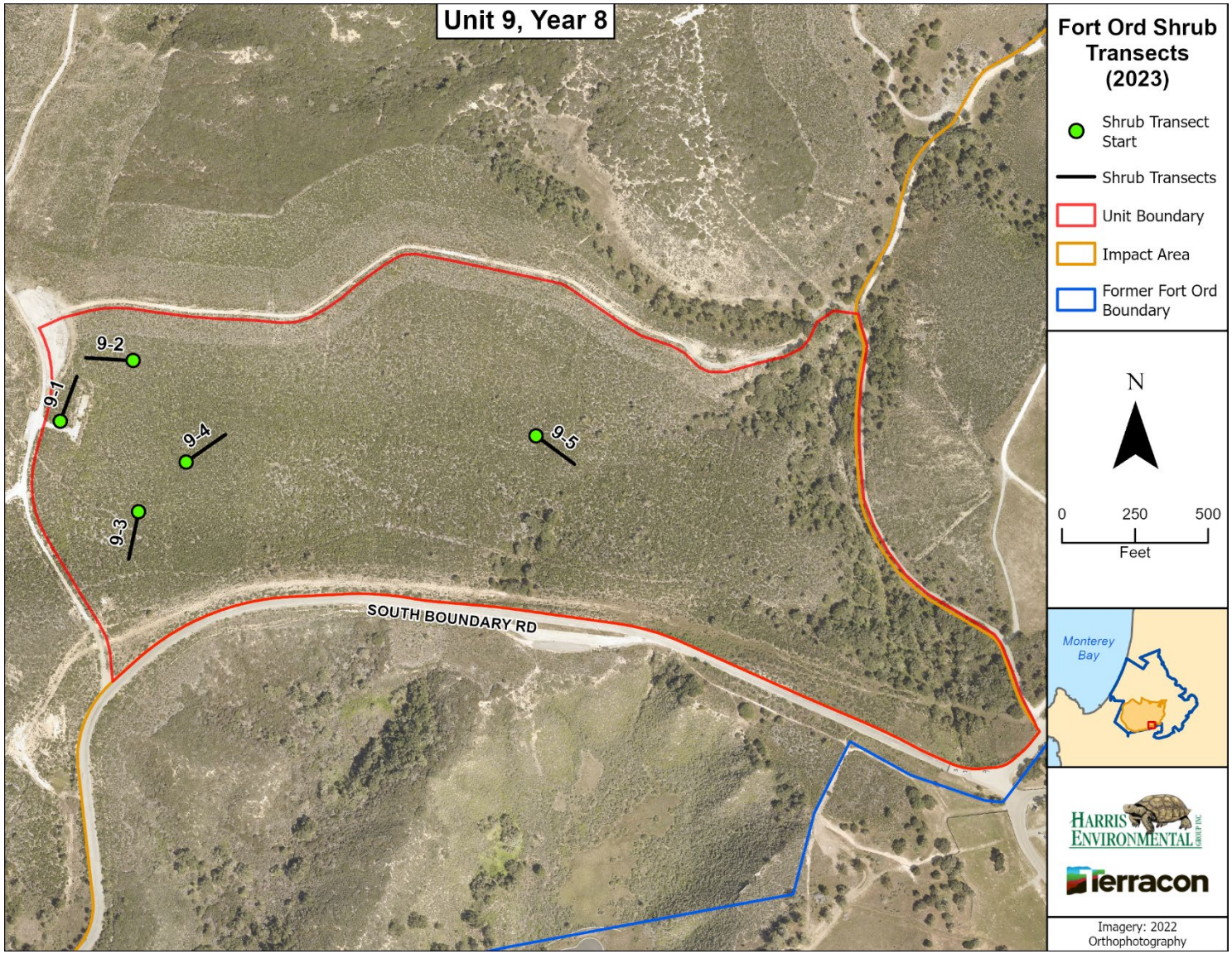


Figure C-4. Map of shrub transects; Unit 9 (Year 8).

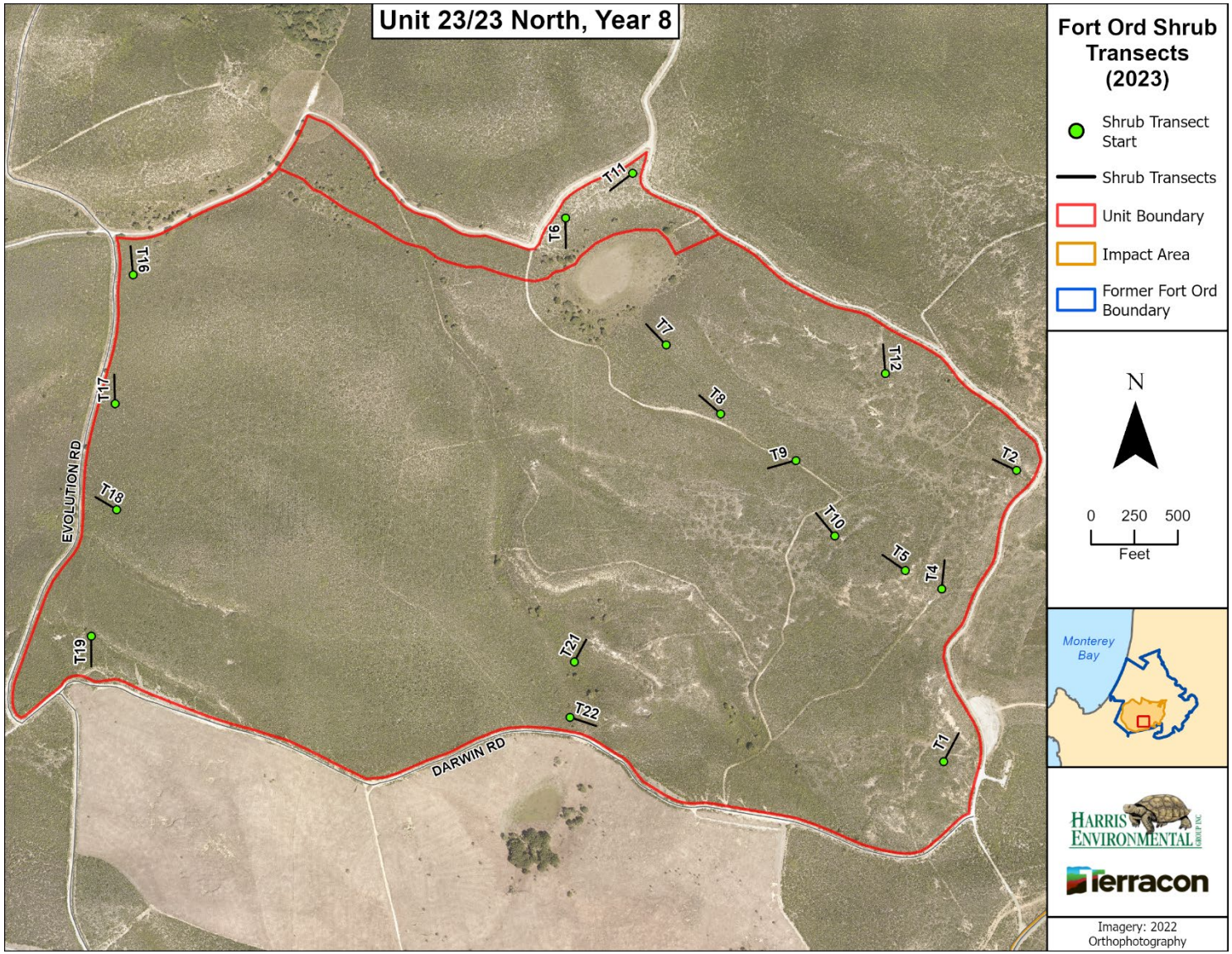


Figure C-5. Map of shrub transects; Unit 23/23 North (Year 8).

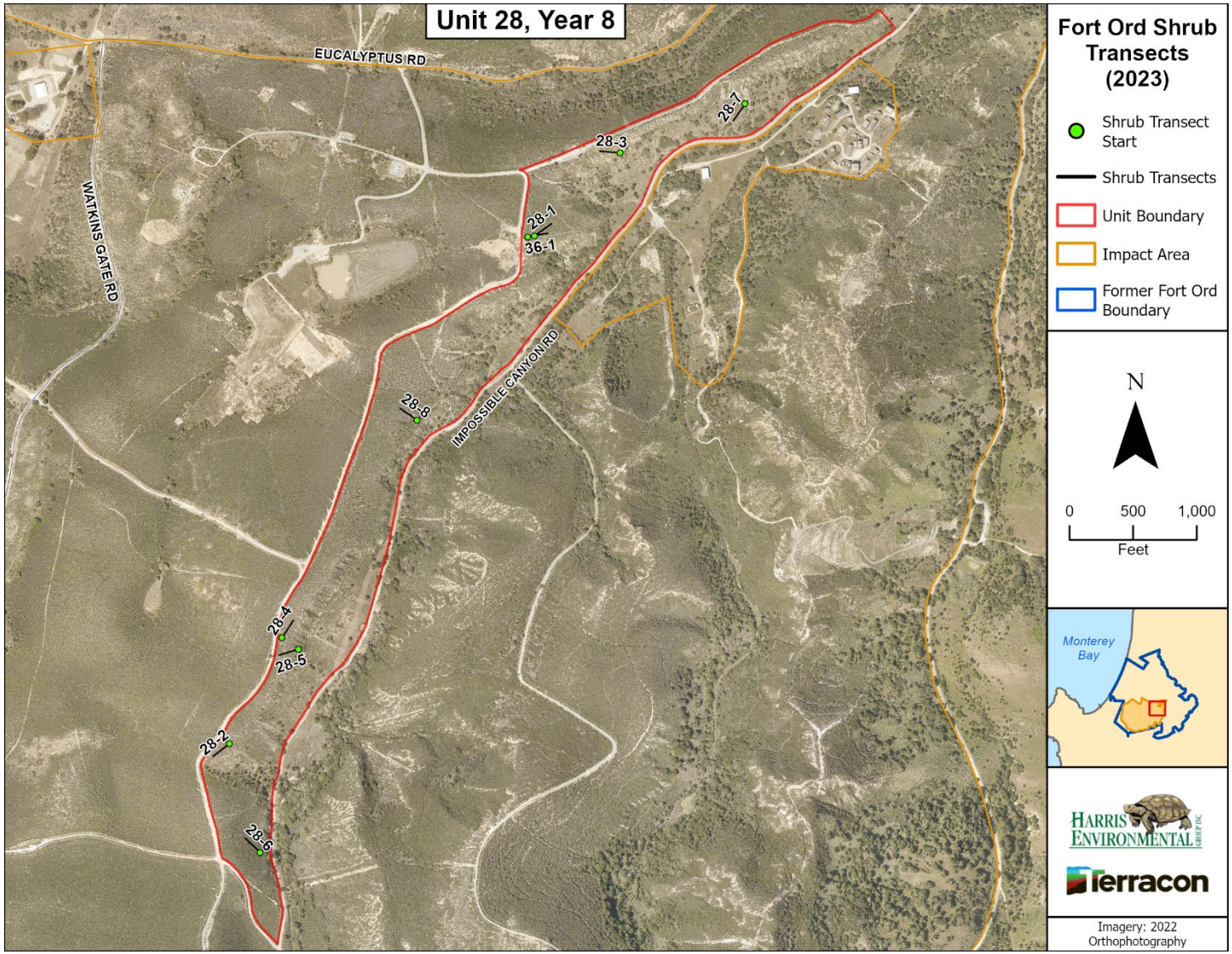


Figure C-6. Map of shrub transects; Unit 28 (Year 8).

APPENDIX D

MAPS: ANNUAL GRASS DENSITY

This page intentionally left blank

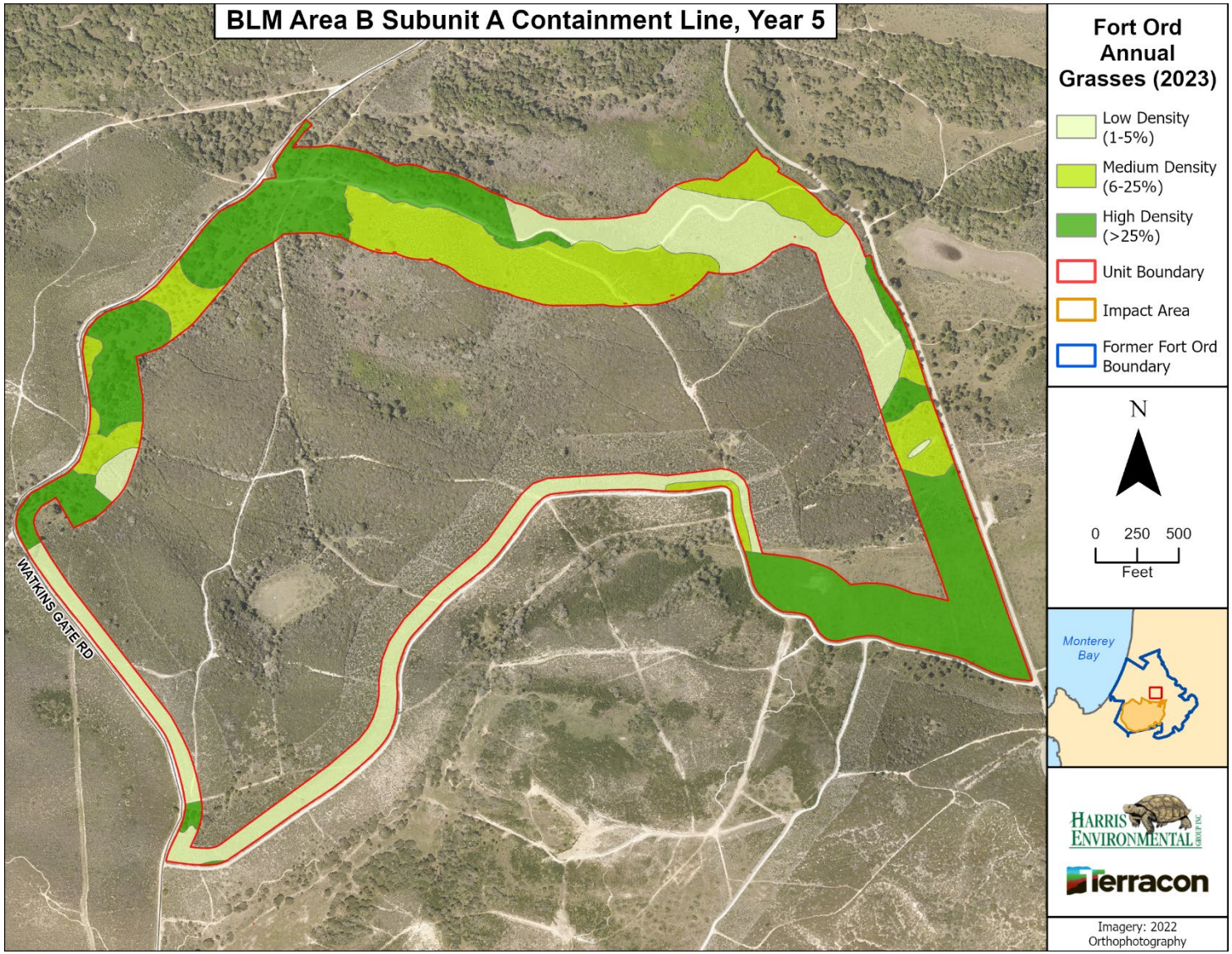


Figure D-1. Map of non-native annual grass density; BLM Area B Subunit A Containment Line (Year 5).

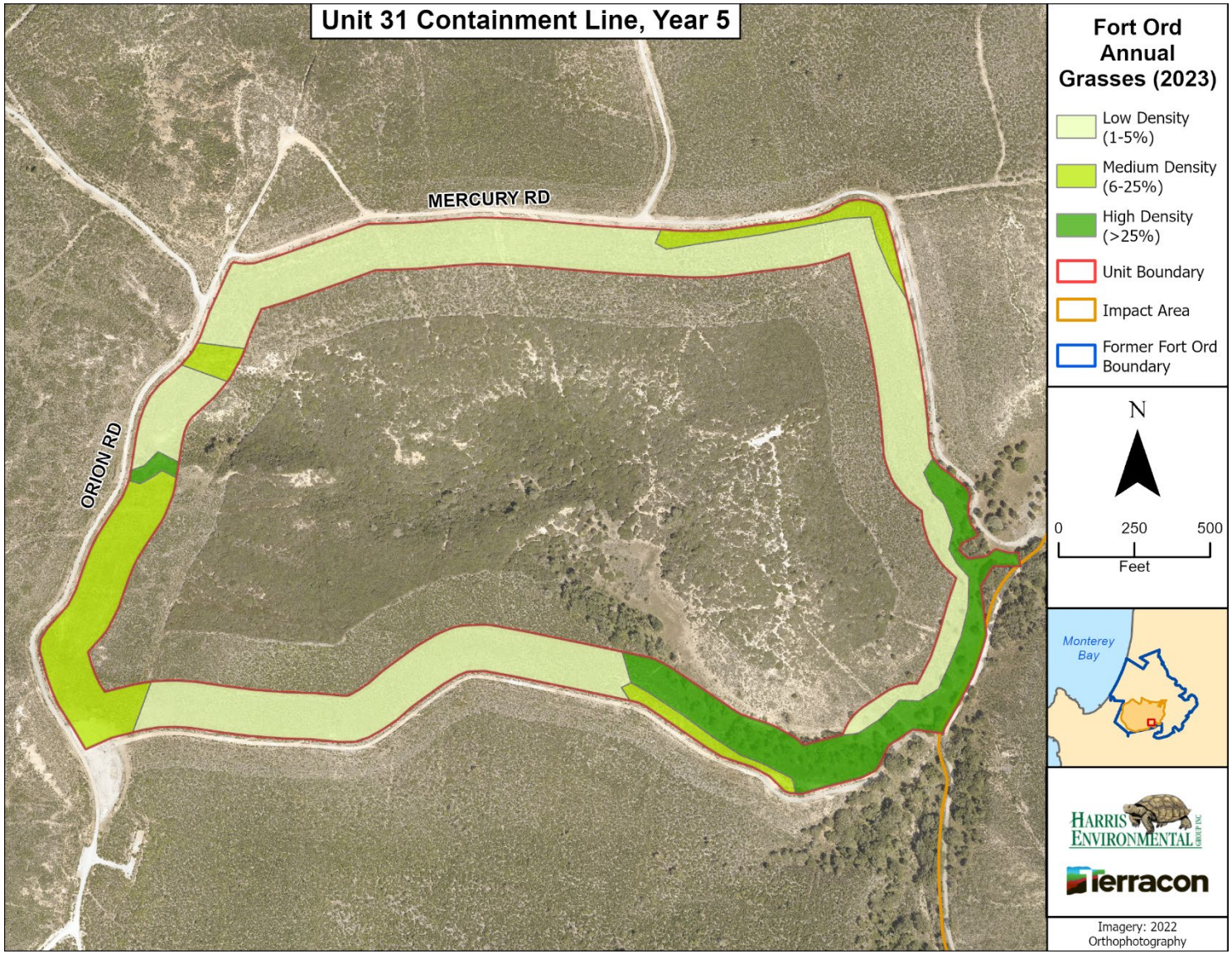


Figure D-2. Map of non-native annual grass density; Unit 31 Containment Line (Year 5).

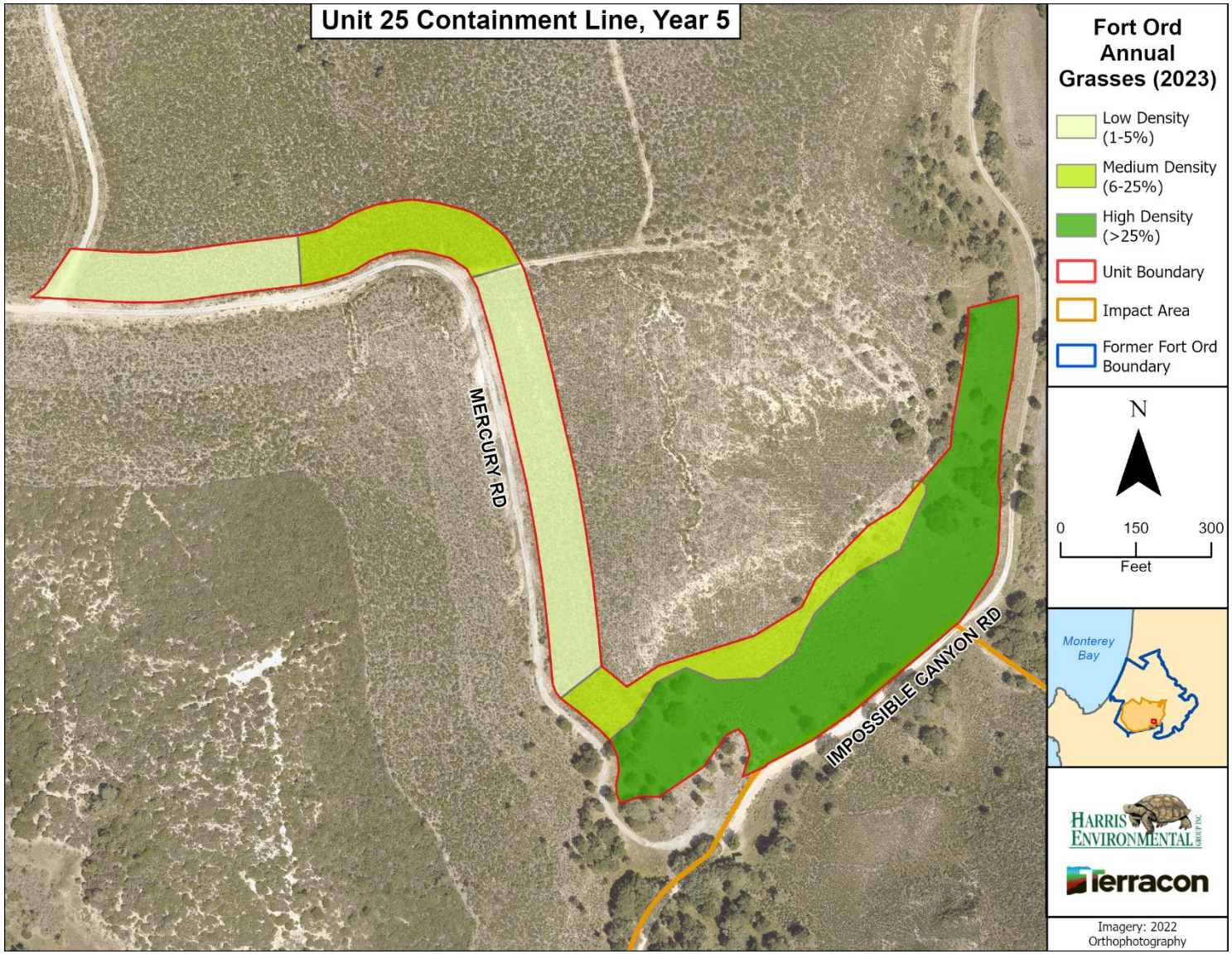


Figure D-3. Map of non-native annual grass density; Unit 25 Containment Line (Year 5).

This page intentionally left blank

APPENDIX E

MAPS: INVASIVE AND RARE SPECIES

This page intentionally left blank

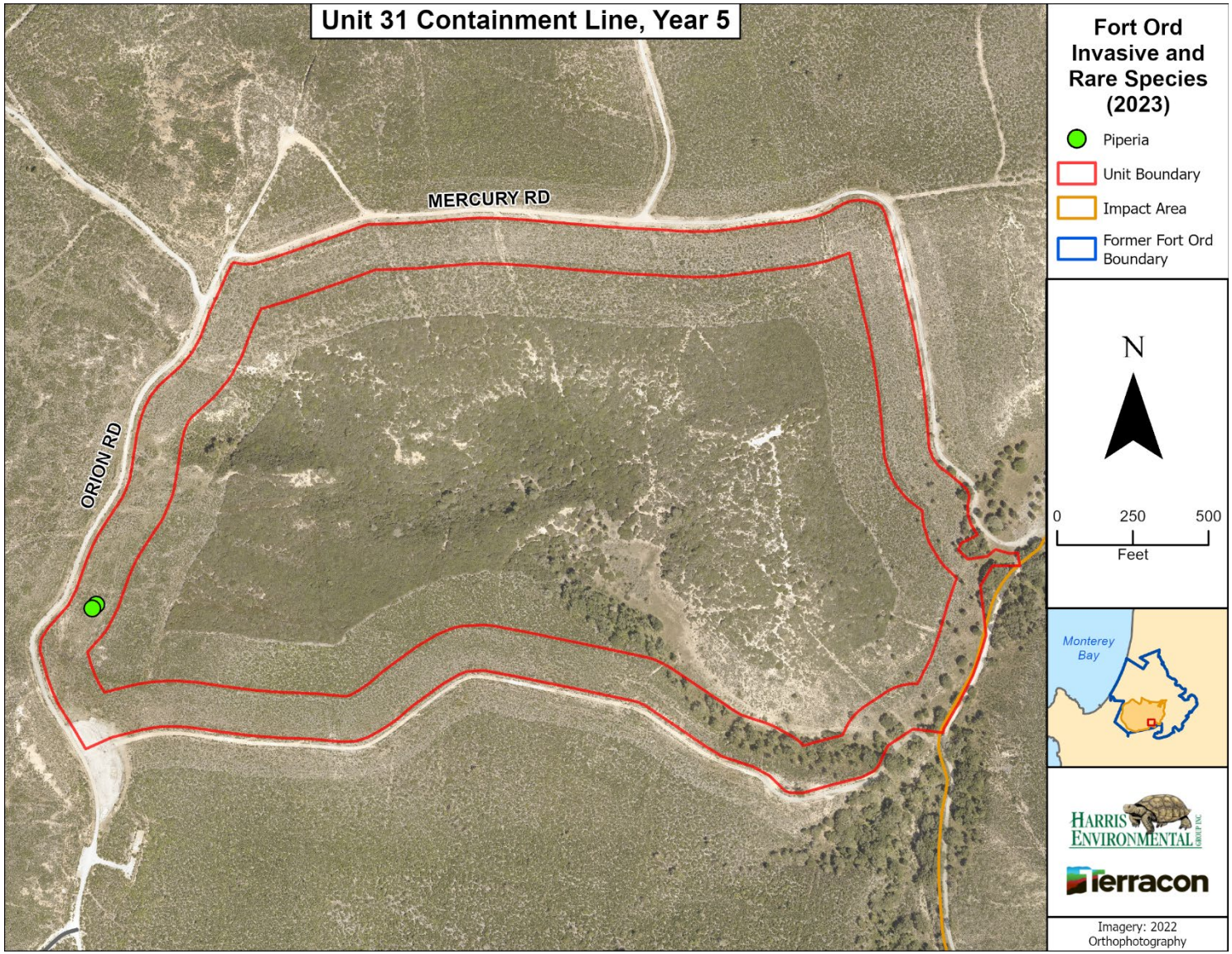


Figure E-1. Map of rare species; Unit 31 Containment Line (Year 5).

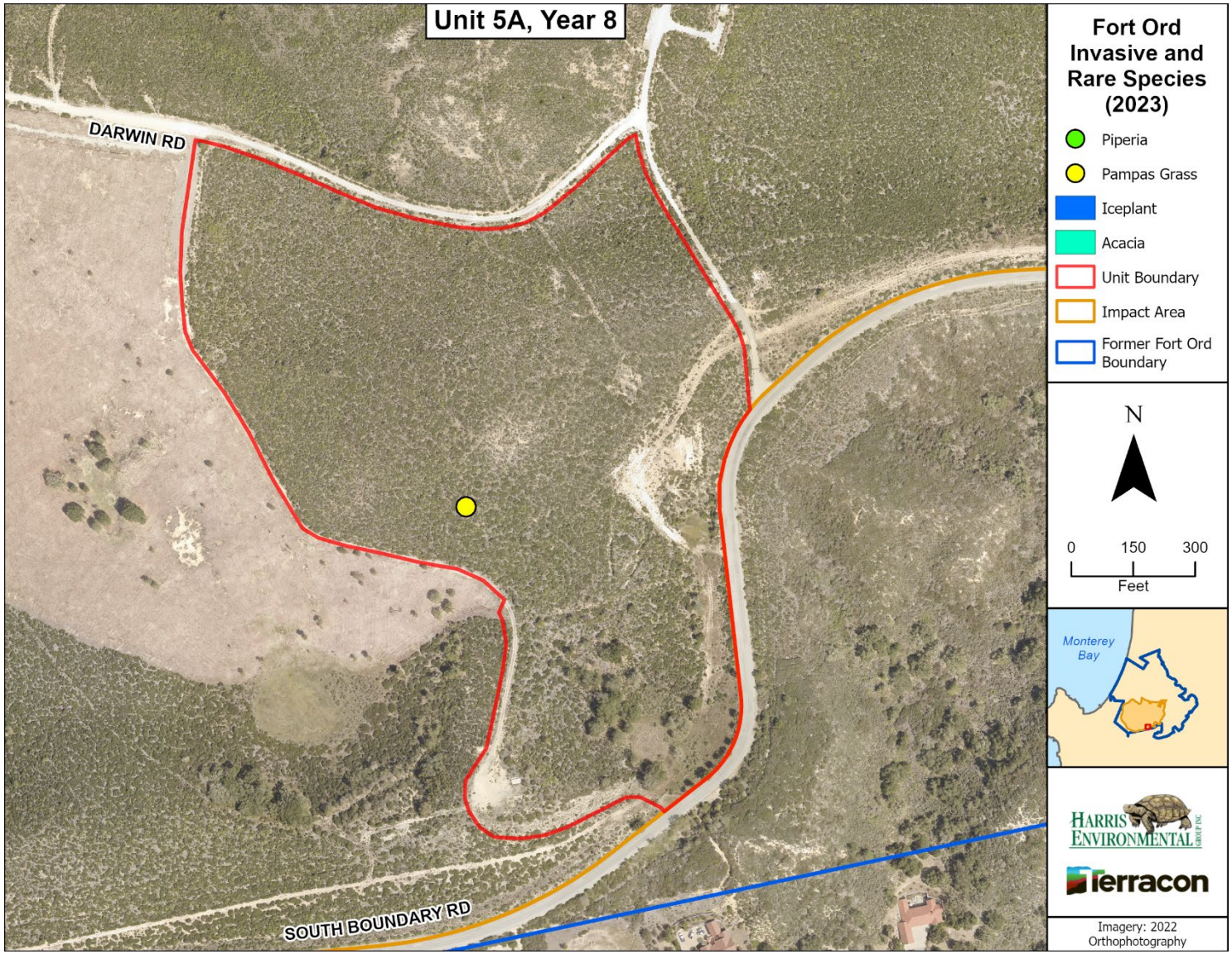


Figure E-2. Map of invasive and rare species; Unit 5A (Year 8).

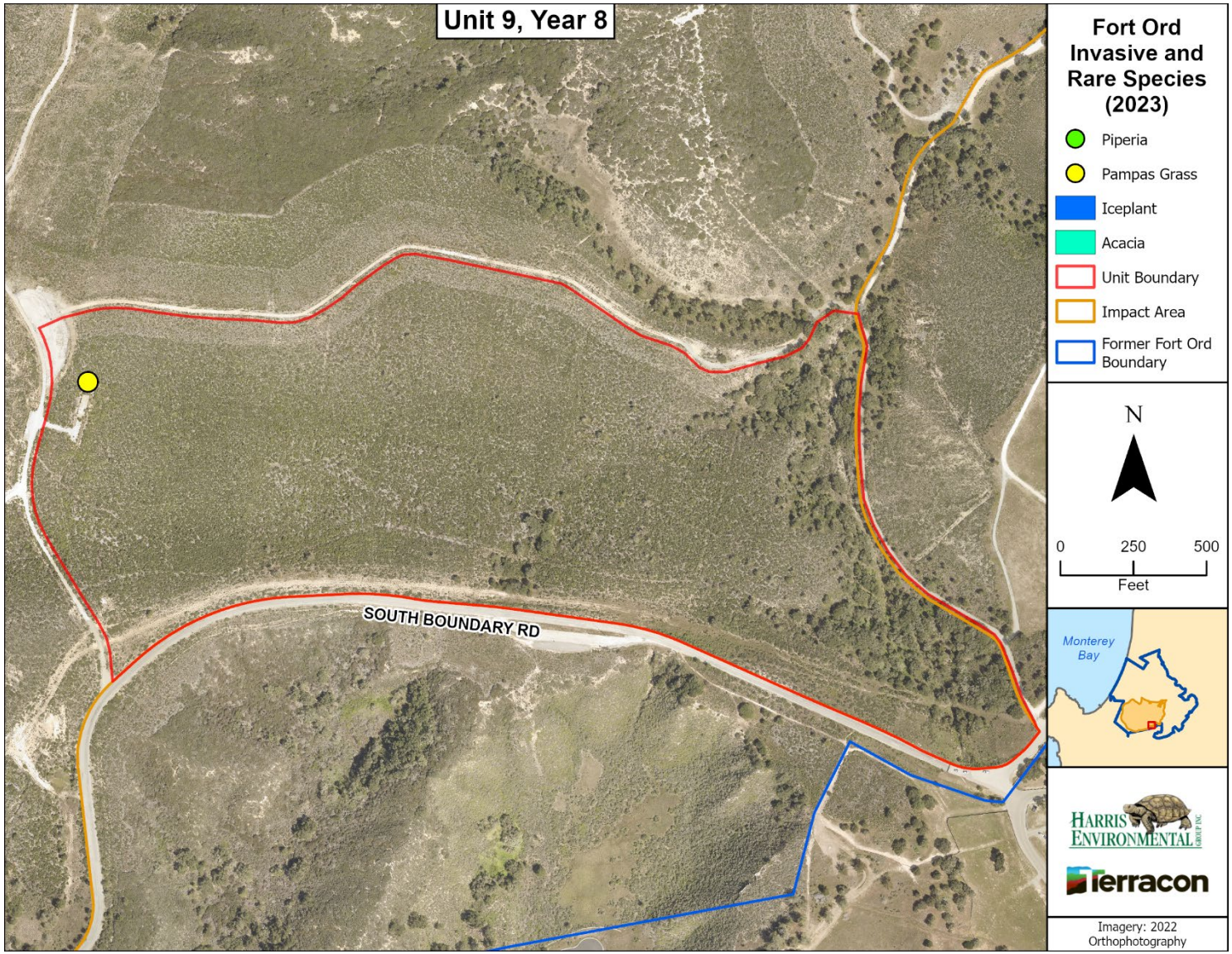


Figure E-3. Map of invasive and rare species; Unit 9 (Year 8).

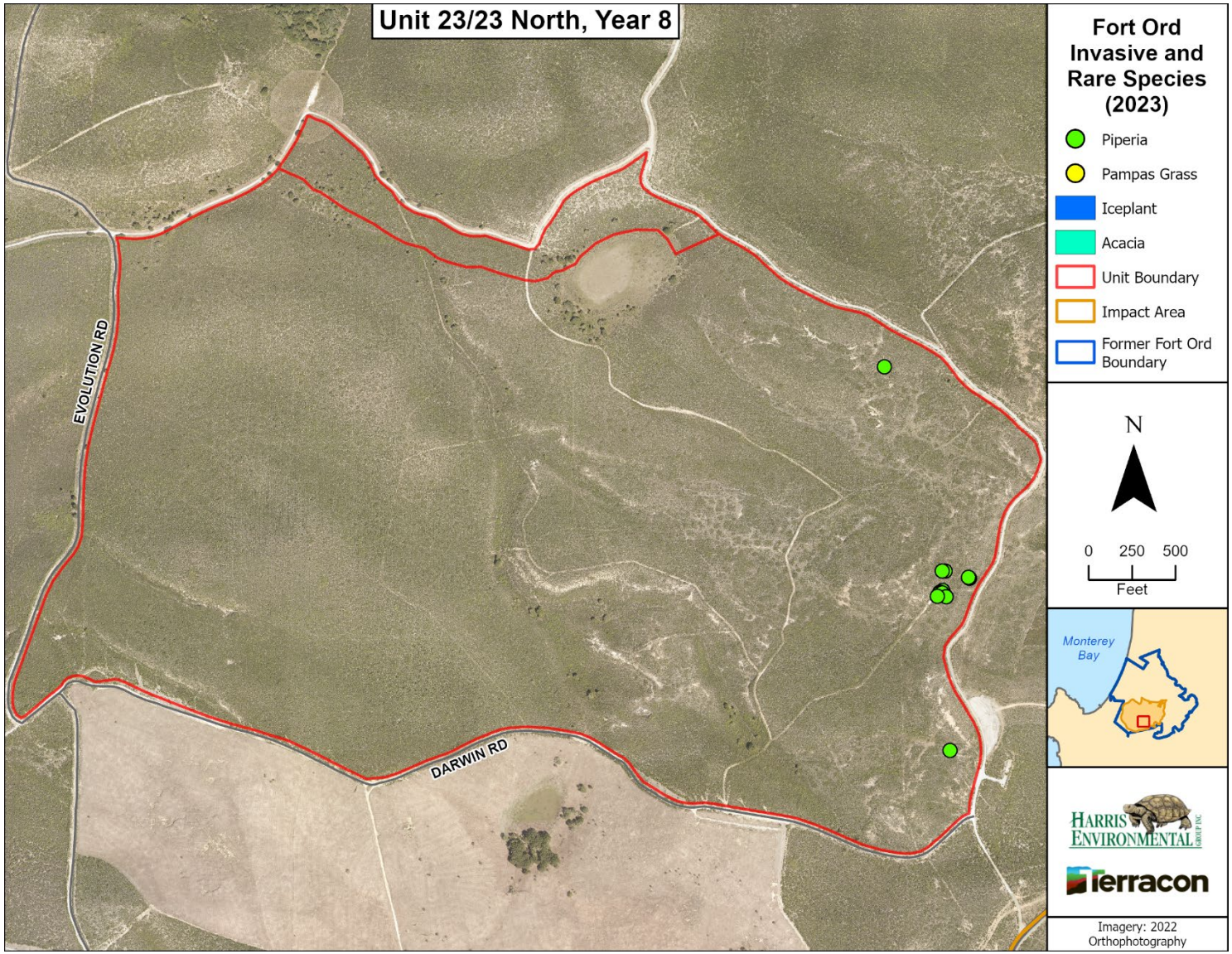


Figure E-4. Map of invasive and rare species; Unit 23/23 North (Year 8).

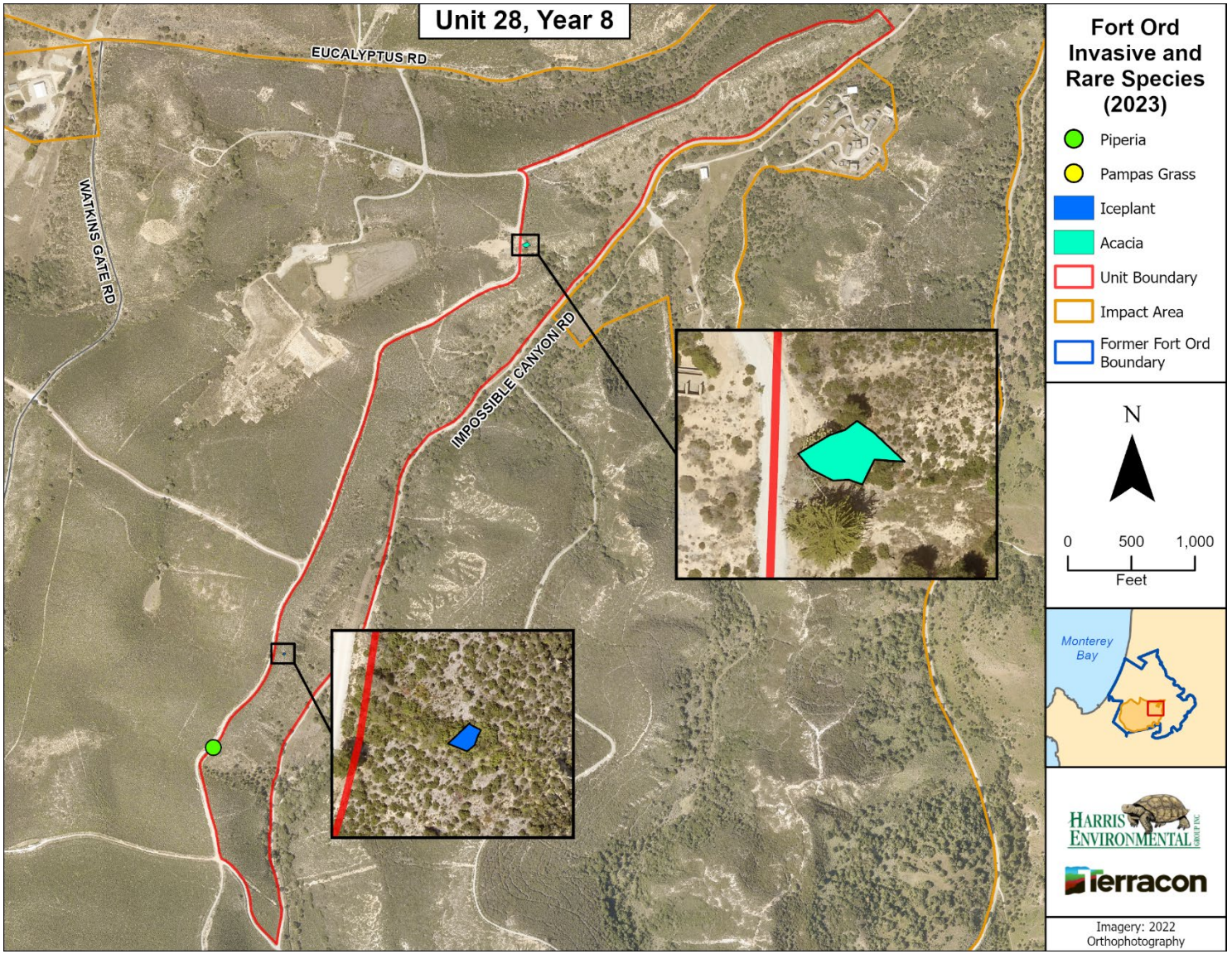


Figure E-5. Map of invasive and rare species; Unit 28 (Year 8).

This page intentionally left blank

APPENDIX F

SHRUB TRANSECT COVER DATA

This page intentionally left blank

Table F-1. Year 5 Shrub Transects, BLM Area B Subunit A Containment Line.

		BLM Area B Subunit A Containment Line					
Code	**Species**	**BLMB_A-1**	**BLMB_A-3**	**BLMB_A-4**	**BLMB_A-5**	**BLMB_A Burn Buffer-1**	**BLMB_A Burn Buffer-2**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	0.8	-	-	1.14	-	1.24
ADFA	*Adenostoma fasciculatum*	9.66	-	4.66	-	30.92	6.72
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	1.96	-	23.72	-	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	3
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	34.38	73.74	26.34	27.46	54.62	28.42
BAPI	*Baccharis pilularis*	0.46	8.86	0.42	-	3.22	6.78
CAED	*Carpobrotus edulis*	-	0.52	-	-	-	-
CEDE	*Ceanothus dentatus*	-	-	4.6	-	-	-
CERI	*Ceanothus rigidus*	0.72	-	-	-	-	0.32
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	-	0.5	-	0.96	5.22
DIAU	*Diplacus aurantiacus*	7.96	1.48	3.04	3.78	0.72	0.16
ERCA	*Eriodictyon californicum*	-	-	-	-	-	2.88
ERCO	*Eriophyllum confertiflorum*	-	-	-	3.04	2.18	1.18
ERER	*Ericameria ericoides*	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-
ERNUA	*Eriogonum nudum* var. *auriculatum*	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	0.86	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	-	1.1	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	-
LECA	*Lepechinia calycina*	4.16	1.82	-	-	15.74	6.54
PEMUM	*Pellaea mucronata* var. *mucronata*	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-
SAME	*Salvia mellifera*	2.44	8.12	1.06	3.28	3.1	0.94
TODI	*Toxicodendron diversilobum*	1.88	2.18	-	-	-	-
BG	Bare Ground	21.38	11.64	28.74	61.9	11.04	48.3
HERB	Herbaceous Cover	21.02	0.38	10.42	0.38	1.24	1.9

Table F-2. Year 5 Shrub Transects, Unit 31 Containment Line.

		Unit 31 Containment Line		
Code	**Species**	**31-1**	**31-2**	**31-4**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	1.52	-	-
ADFA	*Adenostoma fasciculatum*	28.06	24.64	14.34
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	11.26	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	21.28	42.62	41.8
BAPI	*Baccharis pilularis*	0.84	-	-
CAED	*Carpobrotus edulis*	-	-	1.78
CEDE	*Ceanothus dentatus*	-	9.22	13.14
CERI	*Ceanothus rigidus*	3.72	0.62	3.82
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	5.34	2.44	0.78
DIAU	*Diplacus aurantiacus*	0.7	0.52	-
ERCA	*Eriodictyon californicum*	-	-	-
ERCO	*Eriophyllum confertiflorum*	0.7	0.34	1.44
ERER	*Ericameria ericoides*	-	-	-
ERFA	*Ericameria fasciculata*	-	0.64	-
ERNUA	*Eriogonum nudum* var. *auriculatum*	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-
GAEL	*Garrya elliptica*	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-
LECA	*Lepechinia calycina*	0.54	-	-
PEMUM	*Pellaea mucronata* var. *mucronata*	-	-	-
QUAG	*Quercus agrifolia*	-	-	3.04
SAME	*Salvia mellifera*	-	0.52	-
TODI	*Toxicodendron diversilobum*	-	-	0.74
BG	Bare Ground	5.32	18.38	25.54
HERB	Herbaceous Cover	27.86	12.1	4.08

Table F-3. Year 8 Shrub Transects, Unit 5A.

		Unit 5A	
Code	**Species**	**5A-1**	**5A-2**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-
ADFA	*Adenostoma fasciculatum*	25.6	23.6
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	-
ARMO	*Arctostaphylos montereyensis*	0.8	-
ARPU	*Arctostaphylos pumila*	-	4.2
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	55.8	39.4
BAPI	*Baccharis pilularis*	-	-
CAED	*Carpobrotus edulis*	-	-
CEDE	*Ceanothus dentatus*	-	16
CERI	*Ceanothus rigidus*	-	2.2
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	-	-
DIAU	*Diplacus aurantiacus*	-	0.6
ERCA	*Eriodictyon californicum*	-	-
ERCO	*Eriophyllum confertiflorum*	-	-
ERER	*Ericameria ericoides*	-	-
ERFA	*Ericameria fasciculata*	-	-
ERNUA	*Eriogonum nudum* var. *auriculatum*	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-
FRCA2	*Fremontodendron californicum*	-	-
GAEL	*Garrya elliptica*	9	-
HEAR	*Heteromeles arbutifolia*	-	-
LECA	*Lepechinia calycina*	-	-
PEMUM	*Pellaea mucronata* var. *mucronata*	-	-
QUAG	*Quercus agrifolia*	-	-
SAME	*Salvia mellifera*	5.6	12.2
TODI	*Toxicodendron diversilobum*	-	-
BG	Bare Ground	17.4	18.6
HERB	Herbaceous Cover	1.4	-

Table F-4. Year 8 Shrub Transects, Unit 9.

		Unit 9				
Code	**Species**	**9-1**	**9-2**	**9-3**	**9-4**	**9-5**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-	-	-	-
ADFA	*Adenostoma fasciculatum*	15.4	18.6	7.6	11.6	24
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	1.4	-	2.6	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	12
ARPU	*Arctostaphylos pumila*	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	47.2	54.8	72	68.4	67.4
BAPI	*Baccharis pilularis*	2.6	-	0.2	-	-
CAED	*Carpobrotus edulis*	2.6	-	-	-	-
CEDE	*Ceanothus dentatus*	6	3	1.4	-	0.8
CERI	*Ceanothus rigidus*	11.4	1.2	6.8	6.4	2.6
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	0.4	-	-	-	-
DIAU	*Diplacus aurantiacus*	0.4	-	-	-	-
ERCA	*Eriodictyon californicum*	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-
ERER	*Ericameria ericoides*	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-
ERNUA	*Eriogonum nudum* var. *auriculatum*	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-
GAEL	*Garrya elliptica*	8	-	0.8	3.8	1.2
HEAR	*Heteromeles arbutifolia*	3	-	-	8	-
LECA	*Lepechinia calycina*	-	0.2	-	0.2	-
PEMUM	*Pellaea mucronata* var. *mucronata*	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-
SAME	*Salvia mellifera*	1	7	4.4	0.2	0.4
TODI	*Toxicodendron diversilobum*	-	-	-	-	-
BG	Bare Ground	23.2	22.4	13.2	16	12.4
HERB	Herbaceous Cover	2.4	0.6	-	-	-

Table F-5. Year 8 Shrub Transects, Unit 23 and 23 North.

		Unit 23								
Code	**Species**	**T1**	**T10**	**T12**	**T16**	**T17**	**T18**	**T19**	**T2**	**T21**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	-	-	-	-	-	-	-	-
ADFA	*Adenostoma fasciculatum*	42.4	43.6	28	36	44.2	62.4	26	58.4	33
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	6	9	4.8	-	1.6	-	-	0.4	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	0.6	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	0.4	-	-	0.4	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	20.6	20.4	40.4	44.2	40.8	47.8	60	31.8	29
BAPI	*Baccharis pilularis*	-	-	2.6	-	-	-	-	3.2	-
CAED	*Carpobrotus edulis*	-	-	0.2	-	1.2	-	-	-	2.4
CEDE	*Ceanothus dentatus*	-	0.6	4.8	9.8	-	-	8.2	0.2	15.2
CERI	*Ceanothus rigidus*	1	1.8	0.4	4.8	4.8	3.8	-	1.6	0.4
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	1	1	3.4	-	-	-	-	0.8	0.8
DIAU	*Diplacus aurantiacus*	0.4	3.6	-	-	-	4.2	1.4	1.2	1.4
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	0.4	-	-	-	-	0.8	-
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
ERNUA	*Eriogonum nudum* var. *auriculatum*	-	-	-	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-	-	-	0.8
GAEL	*Garrya elliptica*	-	-	-	-	0.2	-	3.2	0.4	-
HEAR	*Heteromeles arbutifolia*	4.8	1.8	-	-	-	-	0.2	-	-
LECA	*Lepechinia calycina*	-	-	-	-	-	1	2	-	1.2
PEMUM	*Pellaea mucronata* var. *mucronata*	-	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	2.8	-	-	-	-	-
SAME	*Salvia mellifera*	0.2	11.4	1.8	12.2	8.6	16	10.8	3	26.6
TODI	*Toxicodendron diversilobum*	-	-	-	-	0.4	-	-	3	17.2
BG	Bare Ground	21.8	16.8	19.2	17.2	20.58	7.8	12.2	6.6	15.8
HERB	Herbaceous Cover	17.2	27.8	20.6	-	-	-	-	36.8	1.6

Table F-5. Year 8 Shrub Transects, Unit 23 and 23 North (cont'd).

		Unit 23						Unit 23 North	
Code	**Species**	**T22**	**T4**	**T5**	**T7**	**T8**	**T9**	**T11**	**T6**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	0.4	-	-	-	-	5.2	6
ADFA	*Adenostoma fasciculatum*	24.6	58	18	39	30	43.6	21.2	32.8
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	4.6	1.4	-	0.4	2	-	-
ARMO	*Arctostaphylos montereyensis*	-	-	-	-	-	-	-	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	1.4
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	42.8	0.2	49	38	44.2	27.6	31	40.4
BAPI	*Baccharis pilularis*	-	-	-	-	0.8	-	0.4	-
CAED	*Carpobrotus edulis*	1.2	-	-	-	-	-	-	-
CEDE	*Ceanothus dentatus*	6	-	11.2	1.6	2.2	7.2	-	-
CERI	*Ceanothus rigidus*	2.4	3.6	0.6	3.2	1.4	5.4	-	1.2
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	2.6	2.4	3.2	-	1.4	-	2.4	0.6
DIAU	*Diplacus aurantiacus*	-	-	1.8	-	-	-	-	-
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	-	-	-	0.2
ERER	*Ericameria ericoides*	-	-	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	0.2	-
ERNUA	*Eriogonum nudum* var. *auriculatum*	-	-	-	-	-	-	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	3.4	-	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	-	3.2	0.8	-	0.8	-	-	-
HEAR	*Heteromeles arbutifolia*	-	-	-	-	-	2.6	-	-
LECA	*Lepechinia calycina*	2	-	1	0.2	0.6	1.2	-	-
PEMUM	*Pellaea mucronata* var. *mucronata*	-	-	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	-
SAME	*Salvia mellifera*	8.8	-	0.2	3	8	12.6	3.2	6.8
TODI	*Toxicodendron diversilobum*	0.8	-	-	-	1	3.4	-	-
BG	Bare Ground	18.2	10.4	21	24.6	21.2	19.4	32.6	16.4
HERB	Herbaceous Cover	2.2	27.4	4	1.2	1	1.8	13.8	8.6

Table F-6. Year 8 Shrub Transects, Unit 28.

		Unit 28								
Code	**Species**	**28-1**	**28-2**	**28-3**	**28-4**	**28-5**	**28-6**	**28-7**	**28-8**	**36-1**
ACGL	*Acmispon glaber* (*Lotus scoparius*)	-	22.2	-	-	0.4	-	0.8	-	-
ADFA	*Adenostoma fasciculatum*	28.8	43	46.6	14.6	21.6	53.2	37.8	10	32.4
ARHO	*Arctostaphylos hookeri* ssp. *hookeri*	-	0.6	-	-	-	-	-	-	-
ARMO	*Arctostaphylos montereyensis*	0.6	-	-	1.4	3.6	-	-	23	-
ARPU	*Arctostaphylos pumila*	-	-	-	-	-	-	-	-	-
ARTO	*Arctostaphylos tomentosa* ssp. *tomentosa*	54.2	27	-	67.6	37	44.6	8.6	34.2	55.6
BAPI	*Baccharis pilularis*	-	-	-	-	12.8	-	-	0.4	-
CAED	*Carpobrotus edulis*	-	-	3	-	11.6	-	-	6.8	-
CEDE	*Ceanothus dentatus*	1.8	0.6	-	0.6	3.8	0.2	-	1	2.2
CERI	*Ceanothus rigidus*	3.4	-	0.6	-	0.8	4	-	0.6	1.4
CRSC	*Crocanthemum* (*Helianthemum*) *scoparium*	1.6	0.6	-	0.8	-	0.2	0.4	0.4	0.6
DIAU	*Diplacus aurantiacus*	-	-	-	-	2.4	2.8	-	1	-
ERCA	*Eriodictyon californicum*	-	-	-	-	-	-	-	-	-
ERCO	*Eriophyllum confertiflorum*	-	-	-	-	0.4	-	-	-	-
ERER	*Ericameria ericoides*	-	-	0.2	-	-	-	-	-	-
ERFA	*Ericameria fasciculata*	-	-	-	-	-	-	-	-	-
ERNUA	*Eriogonum nudum* var. *auriculatum*	-	-	0.2	-	-	-	0.6	-	-
FRCA	*Frangula* (*Rhamnus*) *californica*	-	-	-	-	-	-	-	-	-
FRCA2	*Fremontodendron californicum*	-	-	-	-	-	-	-	-	-
GAEL	*Garrya elliptica*	0.2	-	-	-	0.6	0.8	-	0.4	1.6
HEAR	*Heteromeles arbutifolia*	-	4.6	-	-	-	2.2	-	7	-
LECA	*Lepechinia calycina*	-	-	-	0.2	-	3	-	-	-
PEMUM	*Pellaea mucronata* var. *mucronata*	-	-	1.2	-	-	-	-	-	-
QUAG	*Quercus agrifolia*	-	-	-	-	-	-	-	14.6	-
SAME	*Salvia mellifera*	2.2	1.6	19.4	3.4	14.4	4.8	17.2	0.8	0.8
TODI	*Toxicodendron diversilobum*	-	-	-	0.6	-	2.6	-	-	-
BG	Bare Ground	17.6	15.4	28.2	17.6	16.8	13.6	33.2	14.2	18.6
HERB	Herbaceous Cover	1.6	16.8	9.2	0.6	1.6	2.8	8.8	6.4	2.4

This page intentionally left blank

APPENDIX G

NON-NATIVE SPECIES

This page intentionally left blank

Table G-1. Non-Native Species Observed During Line Intercept Transect Monitoring in BLM Area B Subunit A Containment Line.

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silver hair grass	AICA
Briza maxima	rattlesnake grass	BRMA
Senecio glomeratus	cutleaf burnweed	SEGL
Trifolium angustifolium	narrow-leaf clover	TRAN

Table G-2. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 31 Containment Line.

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silver hair grass	AICA
Hypochaeris glabra	smooth cat's ear	HYGL

Table G-3. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 23.

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silver hair grass	AICA
Briza minor	small quaking grass	BRMI
Erigeron canadensis	horseweed	ERCA20
Festuca (*Vulpia*) *myuros*	rattail sixweeks grass	FEMY
Gastridium phleoides	nit grass	GAPH
Hypochaeris glabra	smooth cat's ear	HYGL
Logfia gallica	daggerleaf cottonrose	LOGA
Lysimachia arvensis	scarlet pimpernel	LYAR
Silene gallica	small flower catchfly	SIGA

Table G-4. Non-Native Species Observed During Line Intercept Transect Monitoring in Unit 28.

Non-Native Herbaceous Species Name	Common Name	Species Code
Aira caryophyllea	silver hair grass	AICA
Avena barbata	slender wild oat	AVBA
Bromus madritensis ssp. rubens	red brome	BRMAR
Festuca (*Vulpia*) *myuros*	rattail sixweeks grass	FEMY
Hypochaeris glabra	smooth cat's ear	HYGL
Logfia gallica	daggerleaf cottonrose	LOGA