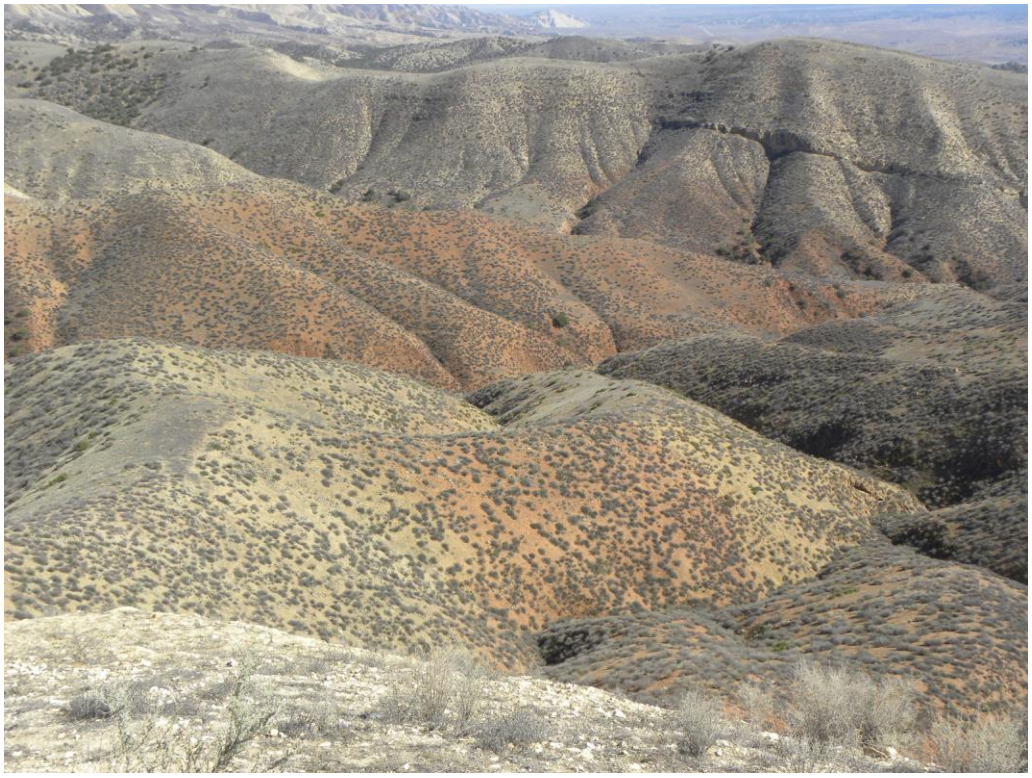
VEGETATION MAP OF ELK RANGE ADJACENT TO CARRIZO PLAIN ECOLOGICAL RESERVE AND NATIONAL MONUMENT SAN LUIS OBISPO COUNTY, CALIFORNIA



Department of Fish and Wildlife

Biogeographic Data Branch

Vegetation Classification and Mapping Program

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ABSTRACT

The California Department of Fish and Wildlife (CDFW) Vegetation Classification and Mapping Program (VegCAMP) has created a fine-scale vegetation map of part of the range of the American Ranch and Chimineas Ranch tule elk herds. This section of the elk range is adjacent to the Carrizo Plain National Monument and the Chimineas Ranch Unit of the Carrizo Plain Ecological Reserve, both of which have been previously mapped. This map has been seamed to the vegetation map of the Chimineas Ranch completed by VegCAMP (VegCAMP 2010) and the map of the Carrizo Plain National Monument produced by the California Native Plant Society (Stout et al. 2013), and completes the range of these two elk herds in San Luis Obispo County, California. Like those maps, this mapping follows Survey of California Vegetation, Federal Geographic Data Committee (FGDC), and National Vegetation Classification (NVC) standards (FGDC 2008, Jennings et al. 2009).

The map legend is based on the classification in Stout et al. (2013), with slight modifications as discussed in Appendix C. Reconnaissance-level sampling of vegetation stands in the project area was conducted in the spring of 2013. Polygons were drawn using heads-up digitizing with true color 1-foot aerial imagery from August 1, 2007 as the map base. Supplemental imagery included National Agricultural Imagery Program (NAIP) true color and color infrared (CIR) 1-meter resolution data from 2010–2012, Bing imagery, and current and historical imagery from Google Earth. The minimum mapping unit (MMU) is 1 acre, with the exception of wetland types, which have an MMU of ½ acre. Mapping is to the NVC hierarchy Association, Alliance, or Group level based on the ability of the photointerpreters to distinguish types based on all imagery available and on the field data. Two sub-Group level mapping units were used in instances where the vegetation types could not differentiated on the imagery. The first mapping unit is composed of the *Salvia leucophylla, Eriogonum fasciculatum*, *Artemisia californica,* and *Artemisia californica-Eriogonum fasciculatum* Alliances; the second is composed of the *Atriplex polycarpa* and *Atriplex canescens* Alliances. Accuracy assessment (AA) data was collected in spring of 2014. Map accuracy was calculated to be 89%; corrections were made to the map based on the AA data to increase the final accuracy.

PROJECT STAFF AND ACKNOWLEDGMENTS

Field staff included Rachelle Boul, George Butterworth, Mary Jo Colletti, Joslyn Curtis, Justin Cutler (USFWS), Melinda Elster, Craig Fiehler, Katie Gross, Diana Hickson, Dennis Kearns (BLM), Todd Keeler-Wolf, Kristi Lazar, Aicha Ougzin, Gina Radieve and Rosie Yacoub.

GIS and database support was provided by Rosie Yacoub and Aicha Ougzin. Data entry was completed by Mary Jo Colletti. Mapping and attribution were completed by Rachelle Boul, Joslyn Curtis, Diana Hickson, and Gina Radieve. The report was written by Rachelle Boul and Diana Hickson and was edited by Mary Jo Colletti. Thank you to Michael Dennis for land access. The title page photo is by George Butterworth, looking southeast across Red Rock Canyon on the Chimineas Ranch Unit on March 25, 2014, after a third year of drought.

CONTENTS

FIGURES

TABLES

APPENDICES

PURPOSE

The purpose of this vegetation map is to aid in management of the Chimineas Ranch and American Ranch tule elk herds. The new mapping for this project (Figure 1) has been seamed to existing maps to cover the range of the elk herds. The seamed map provides an inventory of habitat types for use in assessing the biological resources present in the area in order to determine appropriate elk management strategies.

METHODS

FIELD SAMPLING METHODS

Reconnaissance samples were collected from 588 vegetation stands during the weeks of April 1 and April 29, 2013 using the form in Appendix A. Sample point locations were collected with GPS-enabled data recording devices and are stored in a geodatabase maintained by VegCAMP. The reconnaissance data provides observational notes on stand composition and environmental attributes at specific GPS locations in the landscape, provides a short list of dominant plant species to substantiate the field-assessed vegetation type, and includes digital ground photos. The primary use of reconnaissance data is to aid in mapping.

Accuracy assessment data was collected during the weeks of March 24, March 31, April 7, and May 7, 2014, using the form in Appendix B, from mapped vegetation polygons that were selected using generalized random-tessellation stratified (GRTS) sample allocation (Stevens and Olsen 2004).

Concurrently within this effort, VegCAMP collected field data for an ongoing pilot project with the US Fish and Wildlife Service (USFWS) and US Geological Survey to test the use of Unmanned Aerial Systems (UAS) in assessing the accuracy of a vegetation map. Three 1-mile radius areas within the project boundary were established for using UAS. These areas were not necessarily optimal in terms of vegetation diversity, but they met the Federal Aviation Administration's criteria for placement. VegCAMP field verified vegetation polygons within each circle and recorded the person-hours required for the effort. In the spring of 2015, UAS will be used to collect very high-resolution imagery of the circles. The utility of this imagery for accuracy assessment will be tested, and the cost of collecting and processing the UAS data will be compared to the cost of a field-verification team collecting the same data. A total of 265 polygons are within the three chosen areas and VegCAMP was able to sample 99 of them during the 2014 field weeks. Although the data collected for the 99 polygons was not used to

determine the accuracy of the map, the data was used to make updates to the vegetation map after the scoring was complete.

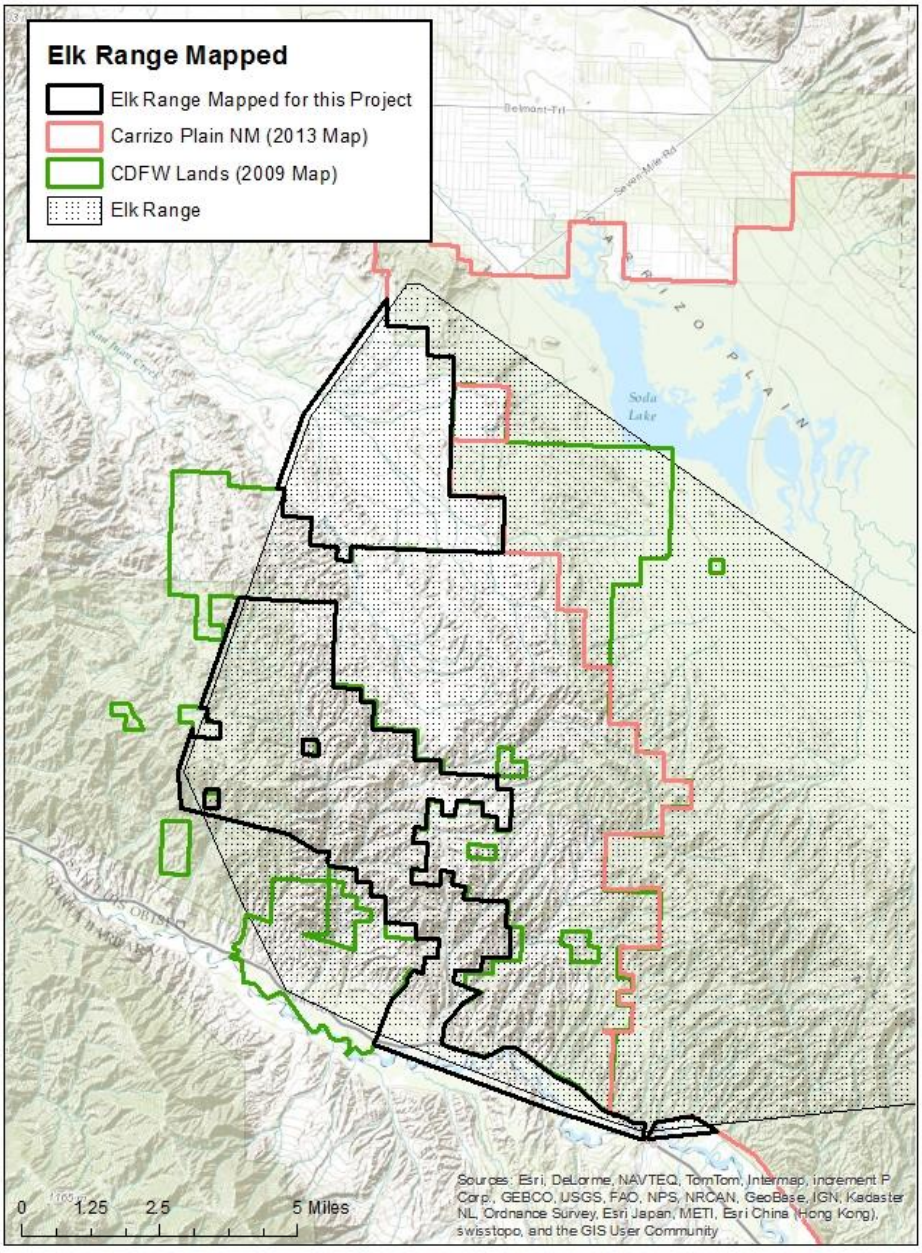

Figure 1: Portion of the tule elk range mapped for this project

VEGETATION CLASSIFICATION

The classification used for this project is the one developed for the Carrizo Plain National Monument by the California Native Plant Society (Stout et al. 2013), which incorporated data collected by VegCAMP for our 2010 map (VegCAMP 2010). A vegetation type key from the CNPS report, modified to include vegetation types local to this project, is attached as Appendix C.

Naming conventions for vegetation types follow the National Vegetation Classification System (FGDC 2008, Jennings et al. 2009) and the Manual of California Vegetation, 2nd Edition (Sawyer et al. 2009). An Association is defined by a group of samples that has similar dominant and characteristic species in the overstory, along with other important or indicator species, which are distinctive in a particular environmental setting. A set of similar Associations is grouped hierarchically to the next higher level in the classification, the Alliance. Alliances can be placed into Groups, and then Macrogroups, the next two levels up. For this map, vegetation was mapped to the Alliance level and most herbaceous polygons were mapped to Macrogroup. The entire hierarchy for this project is listed in Appendix D.

MAPPING RULES AND MAP ATTRIBUTES

Polygons were drawn using heads-up digitizing in ArcMap with true color 1-foot aerial imagery from August 1, 2007 as the map base. Although six years old at the time of mapping, this imagery was used for its high resolution and for consistency with the previous mapping of the adjacent CDFW lands and the Carrizo Plain National Monument, which also used it as the base. Supplemental imagery included NAIP true color and CIR 1-meter resolution data from 2010–2012, Bing imagery, and current and historical imagery from Google Earth.

Vegetation types were mapped to the NVC hierarchy level of Association, Alliance, or Group based on the ability of the photointerpreters to distinguish types based on all imagery available and on the field data. Two sub-Group level mapping units were used in instances where the vegetation types could not be differentiated on the imagery. The first mapping unit is composed of the *Salvia leucophylla, Eriogonum fasciculatum*, *Artemisia californica,* and *Artemisia californica-Eriogonum fasciculatum* Alliances; the second is composed of the *Atriplex polycarpa* and *Atriplex canescens* Alliances. See further discussion in the Map Accuracy section of this report, below.

MAPPING RULES

The vegetation map was delineated according to the following rules:

Minimum Mapping Unit (MMU):

- ½ acre for special types (e.g., wetland, alkali scald, or localized type)
- 1 acre for typical vegetation types (distinguished largely by overstory layer, when vegetation is not in a special type)
- 10 meter width for linear polygons

Polygon breaks (factors other than change in vegetation type):

- 3 acre MMU for cover class break in the overstory layer's cover (i.e., when the adjacent vegetation is of the same classification unit but the cover class is different)
- 5 acre MMU for cover class break in the understory layer
- 5 acre MMU for non-floristic breaks (height, clearing, other urban features)
- 1 acre MMU for impact changes of 2 classes (e.g., from high to low, but not from high to medium)

Delineation:

Scale of 1:800 to 1:4000 (varied based on imagery, ease of interpretation, etc.)

Imagery:

Base:	True-color 1-foot imagery flown for San Luis Obispo County on August 01, 2007
Supplemental:	National Agricultural Imagery Program (NAIP) 2012 (summer) true color and CIR
Ancillary:	Other NAIP years, ESRI Basemap Imagery, Google Earth, Bing

MAP ATTRIBUTES

The new mapping was seamed to existing mapping using most, but not all, of the same attributes. Attributes of the previous mapping are detailed in VegCAMP (2010) and Stout et al. (2013). All attribute fields from the three mapping efforts are included in this seamed map and so some fields will be blank depending on the mapping area. Only the attributes used for this map are described below.

Each mapped polygon in the current mapping has the following attributes:

NVCSName

Standardized name of the vegetation description used in the National Vegetation Classification System. Since the NVCS does not have categories for human land use or otherwise unvegetated land, those descriptions were drawn from the California Wildlife Habitat Relationships system.

NVCSLevel

The level of the National Vegetation Classification System Hierarchy to which the vegetation type corresponds.

MapClass
The name of the vegetation type of the polygon. Note that the lowest level of the hierarchy that could reasonably be photointerpreted was used; in most cases, this was the Alliance.

MapClassCode
The code assigned to the vegetation type of the polygon

Heterogeneity
The measure of uniformity of the vegetation type, cover class, and size class within the polygon. A low heterogeneity is desirable.

Low	<5% heterogeneous
Moderate	5–40% heterogeneous
High	>40% heterogeneous

ConifCover
The cover of conifer trees in the polygon, using the cover density values below

HdwdCover
The cover of hardwood trees in the polygon, using the cover density values below

TreeCover
The cover of all trees (conifer and hardwood) in the polygon, using the cover density values below

ShrubCover
The cover of all shrubs in the polygon, using the cover density values below

Cover density (total bird's-eye cover) is photointerpreted separately for conifer, hardwood, total tree, and shrub layers of vegetation, and placed into the following cover classes:

none visible
trace–0.9%
1–9.9%
10–19.9%
20–29.9%
30–39.9%
40–49.9%
50–59.9%
60–69.9%
70–79.9%
80–89.9%
90–100%
<null> is used for water features (ponds and streams)

HerbCover

The cover of herbaceous vegetation in the polygon. In the absence of field data, herbaceous vegetation cannot be definitely interpreted from imagery, and is modeled by the photointerpreters based on signature, topography, the overstory type if present, and adjacent field data. The herbaceous values are for absolute cover, not bird's-eye cover, that is, any shrub or tree cover over the herbaceous cover is not subtracted. Herbaceous cover is recorded in the following classes:

0%
<2%
2-9%
10-39%
40-59%
60-100%
can't determine

NonNative_Plants

The presence of non-native plants was determined from field observation and modeling based on ecological setting, since few of the non-natives are interpretable from the imagery.

Not Visible	no visible non-native plants
Low	total non-native cover is <33% of total vegetation cover
Medium	total non-native cover is 33–66% of total vegetation cover
High	total non-native cover is >66% of total vegetation cover

Roads_Trails

Not Visible	there are no visible roads or trails in the polygon, i.e. the polygon is "whole"
Low	roads or trails cross <1/3 of the polygon, so that one contiguous, unroaded, "whole" area within the polygon is at least 2/3 the size of the entire polygon
Medium	1/3–2/3 of the polygon is "whole"
High	<1/3 of the polygon is "whole"

OtherImpact:

Impacts observable in the imagery as follows:

OHV activity
Disking/grading
Development
Erosion/runoff
Ungulate Trails
none

Level_OtherImpact

Subjective determination of the level of any impact recorded in the previous field

- Not Visible
- Low
- Medium
- High

Method_ID:

Method of determining the vegetation type

- Rapid Assessment field data
- Relevé field data
- Field reconnaissance (after mapping)
- Photointerpretation
- Other information
- Pre-map reconnaissance (reconnaissance performed prior to mapping)
- Adjacent Alliance to Rapid Assessment or Relevé

DB_ID

The database ID of the Rapid Assessment, Relevé, or Reconnaissance used to determine the vegetation type (if one was used)

Delineator

The organization responsible for delineating the polygon.

- CDFW California Department of Fish and Wildlife
- CNPS California Native Plant Society

Attributer

The organization responsible for assigning attribute values to the polygon.

- CDFW California Department of Fish and Wildlife
- CNPS California Native Plant Society

UID

Unique identifier for each polygon

CalVegName

A crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) vegetation system (USDA Forest Service). Note that there may be a one-to-many relationship between CalVeg and NVCS.

CalVegCode

The CalVeg code

CWHRType
A crosswalk to the California Wildlife Habitat Relationships (CWHR) system. Note that there is usually a one-to-many relationship between CWHR and NVCS.

CWHRCode
The CWHR code.

GlobalRank
The global rarity rank of the plant community (only for polygons mapped to the Alliance level)

G1	fewer than 6 viable occurrences and/or 2,000 acres worldwide
G2	6–20 viable occurrences and/or 2,000–10,000 acres worldwide
G3	21–100 viable occurrences and/or 10,000–50,000 acres worldwide
G4	greater than 100 viable occurrences and/or greater than 50,000 acres worldwide
G5	community demonstrably secure due to secure worldwide abundance

StateRank
The state rarity rank of the plant community (only for polygons mapped to the Alliance level). The state rank will always be less than (more rare) or equal to the global rank.

S1	fewer than 6 viable occurrences and/or 2,000 acres statewide
S2	6–20 viable occurrences and/or 2,000–10,000 acres statewide
S3	21–100 viable occurrences and/or 10,000–50,000 acres statewide
S4	greater than 100 viable occurrences and/or greater than 50,000 acres statewide
S5	community demonstrably secure due to secure statewide abundance

Rare
Rarity of the vegetation type

Y	Alliances and Associations with state rank S1–S3
N	not rare

CaCode
California Natural Community Code; unique code assigned to Alliances and Associations

ProjectName
Identifies the mapping project:

Carrizo Plain Ecological Reserve
Carrizo Plain National Monument
Elk Range

NVCSAlliance
The standardized name for the Alliance within the National Vegetation Classification System

NVCSGroup
The standardized name for the Group within the National Vegetation Classification System

NVCSMG
The standardized name for the Macrogroup within the National Vegetation Classification System

MAP ACCURACY

VegCAMP staff conducted an accuracy assessment (AA) to validate that the vegetation map achieved at least an overall accuracy of 80%, the minimum acceptable by Federal Geographic Data Committee standards. The method that was used to allocate polygons was designed to ensure that all of the mapped vegetation types were assessed. Polygons were selected in excess of the count targeted for each type and were assigned a priority level based on whether the mapped type was rarely mapped (mapped less than 10 times), moderately common (mapped between 10 and 25 times), or common (mapped >25 times), with rarely mapped types having highest priority for the field crews to visit. Paper and digital field maps made use of the priority levels to guide field staff decisions regarding the time to spend to reach particular polygons, that is, since there were excess selected polygons, a field crew could decide to skip a low priority polygon that might require a long hike but decide to spend a lot of effort to visit a high priority polygon.

A total of 198 vegetation polygons were allocated using the method described above; 19 were targeted as high priority, 63 were polygons of moderately common types, and 116 were polygons of the most commonly mapped types. Field staff collected data on 136 of those polygons; 13 high priority polygons, 52 polygons of moderately common types, and 71 polygons of the most commonly mapped types.

In the office, data from the field AA forms was entered into an Access database and the vegetation type recorded by the photointerpreter (PI) was compared to the type determined in the field survey. Cover and disturbance attributes were not scored, but were provided as feedback to the photo interpreters for use in correcting the map. If the field crews could not identify the vegetation type based on the field key, a senior VegCAMP ecologist assigned the correct type, when possible, based on the species covers recorded, any additional notes taken by the field crews, and field photos. All field calls were reviewed and a "Final call" was recorded in the database when possible. Staff scored portions of the map that they did not map themselves.

A fuzzy logic method was used to score each AA point, rather than simply denoting whether a sample was correct or incorrect (Gopal and Woodcock 1994; Congalton and Green 1999; Foody 2002; Hagen

2003; Metzler and Sader 2005). Each field-verified polygon was scored according to a set of decision rules (Table 1), with a total of 5 possible points for each. Scores were summed for each vegetation type, then divided by the total possible score and multiplied by 100 for percent accuracy. The scored accuracy assessment samples were provided back to the photointerpreters, who corrected the map for specific and systematic errors.

Table 1*:* Scoring rules and points.

Code	Reason For Score	Score
A	PI completely correct.	5
B	The PI chose the correct Group OR the next level up in the hierarchy.	4
C	Threshold/transition between PI call and Final call. This was used when cover values of the dominant or indicator species were within several percentage points of the values that would key to the PI's type.	4
D	Correct Macrogroup OR next level up in hierarchy.	3
E	Based on close ecological similarity. Ecological similarity addresses assessed and mapped calls that contained vegetation with overlapping diagnostic species but were not technically closely related in the NVCS hierarchy. This was common in stands that contain a mix of species of late and early seral vegetation types and also common in zones of overlap between ecoregions.	3
F	Correct Division (the NVC level above Macrogroup).	2
G	Some floristic/hydrologic similarity. This addresses cases in which the mapped and the assessed vegetation type had different diagnostic species, but bore some similarity in ecological traits based on predicted and actual setting such as hydrologic regime, overall climate, or successional state.	2
H	Correct only at life form (tree, shrub, herb).	1
I	No similarity above Formation (the NVC level above Division) and incorrect life form.	0
J	Survey removed because there was a significant change in the polygon (e.g., the stand was burned, developed, or cleared since the date of the base imagery).	no score
K	Survey removed because inadequate portion (<10%) of the polygon was viewed by the field crew.	no score
L	Survey removed because field/PI data are incomplete, inadequate or confusing (e.g., cover values were not provided for key species in the stand).	no score
M	Supplementary record not scored (for multiple point assessments within a polygon where the AA call was the same).	no score

Two forms of accuracy (users' and producers') can be estimated from the data (Story and Congalton 1986). Users' accuracy provides an estimate of commission error, or how well spatial mapping data actually represents what is found on the ground, i.e., if the user goes to a location mapped as a certain class, what is the probability it is in fact that class? Producers' accuracy, on the other hand, measures omission error, or the probability that vegetation of a given class in the field is mapped as that class. Producers' accuracy may inform the mappers if a class can be recognized on the imagery (Story and Congalton 1986, Lea and Curtis 2010). The overall accuracy for the map, before any modifications were made to correct errors found during the AA, is 89% (Table 2).

Table 2: Summary of accuracy assessment.

Results by vegetation map unit. The count refers to the number of polygons visited.

Map Unit Name	Producers' Count	Producers' Average Score	% Producers' Accuracy	Users' Count	Users' Average Score	% Users' Accuracy
Juniperus californica	7	4.7	94.3	6	5.0	100.0
Quercus douglasii	7	5.0	100.0	7	5.0	100.0
Populus fremontii	1	5.0	100.0	1	5.0	100.0
Platanus racemosa	2	5.0	100.0	2	5.0	100.0
Quercus john-tuckeri	7	4.6	91.4	7	4.7	94.3
Adenostoma fasciculatum	19	4.6	91.6	17	4.7	94.1
Adenostoma fasciculatum - Salvia mellifera	7	3.9	77.1	5	4.4	88.0
Ceanothus cuneatus	10	4.5	90.0	6	4.8	96.7
Eriodictyon crassifolium Provisional	1	2.0	40.0			
Arctostaphylos glauca	8	5.0	100.0	12	4.5	90.0
Artemisia californica	3	4.3	86.7	6	4.0	80.0
Artemisia californica - Eriogonum fasciculatum	9	4.3	86.7	12	4.3	85.0
Eriogonum fasciculatum	8	4.5	90.0	8	4.3	85.0
Gutierrezia californica	1	4.0	80.0	1	2.0	40.0
Salvia leucophylla	13	4.4	87.7	11	4.2	83.6
Salvia mellifera	3	5.0	100.0	7	4.0	80.0
Ericameria linearifolia - Isomeris arborea	4	4.5	90.0	4	4.8	95.0
Hazardia (*squarrosa*, *stenolepis*)	2	5.0	100.0	2	5.0	100.0
Atriplex polycarpa	5	5.0	100.0	6	4.5	90.0
Ericameria nauseosa	1	2.0	40.0			
Ephedra viridis	1	2.0	40.0			
Baccharis salicifolia	1	0.0	0.0			

Map Unit Name	Producers' Count	Producers' Average Score	% Producers' Accuracy	Users' Count	Users' Average Score	% Users' Accuracy
Salix laevigata	1	4.0	80.0	1	0.0	0.0
California Annual and Perennial Grassland Macrogroup	6	4.0	80.0	9	5.0	100.0
California annual herb/grass	4	5.0	100.0			
Mediterranean California Naturalized Annual & Perennial Grassland & Meadow Macrogroup	3	5.0	100.0	2	5.0	100.0
Tamarix	2	2.5	50.0	2	3.5	70.0

The contingency table for this accuracy assessment is provided in Appendix E. Each column in the table represents a type as mapped by the PIs (producers); by reading down the column one can see what the field surveyors (users) assessed the mapped polygon types to be on the ground. Numbers on the diagonal are correct calls by the PIs. The contingency table displays the numbers of assessed polygons by type, not the fuzzy scores associated with the assessed polygons. However, the Producers' and Users' Accuracies were calculated using the fuzzy scores. In some cases, the Final Call was to Alliance level, when the mapper was only expected to map to Group level, such as for herbaceous types. In such cases, if the Alliance chosen by the mapper fell within the correct Group, a full score would be given and is reflected in Table 2, but the assessment would not show up on the diagonal in the contingency table.

Note that the accuracy scores reported above refer to the "pre-AA" polygons that were mapped of each type. After the scoring was completed, updates were made to the vegetation map based on the AA data. Updates included corrections to vegetation type, polygon delineations, strata covers, and disturbances. Because corrections were made (and in some cases systematic lessons were learned), the accuracy of the map is higher than reported here, although to what degree cannot be determined.

Although scores for the *Salvia leucophylla, Eriogonum fasciculatum*, *Artemisia californica,* and *Artemisia californica-Eriogonum fasciculatum* Alliances meet the minimum standard of 80%, errors between these types account for 50% of the confusion, as shown in the contingency table (Appendix E). Most of the errors within these types occur in the southern portion of the mapping area, around 2000' in elevation, where the dominant species mix. After the accuracy assessment, photointerpreters reassessed the mapping in this area and used a sub-Group level mapping unit, the *Salvia leucophylla- Artemisia californica- Eriogonum fasciculatum* Mapping Unit, to attribute polygons that had similar signatures.

When there was field data, however, these polygons were identified to Alliance level. Note that this mapping unit falls within the NVCS hierarchy between Group and Alliance level, but provides more information than using the Group level.

Several types did not achieve 80% accuracy (Table 2), however, in all but one instance, sample sizes were too low (<5) to account for the variance and reliability of the samples. Users' accuracy for *Adenostoma fasciculatum - Salvia mellifera* Alliance is 77% with 7 samples. This type was confused only with either the *Adenostoma fasciculatum* or *Salvia mellifera* Alliance, so the errors were in estimating the relative cover of the dominants. The other types, for which there were only 1 or 2 samples, include *Eriodictyon crassifolium* Provisional, *Ericameria nauseosa, Ephedra viridis*, *Gutierrezia californica* and *Baccharis salicifolia* Alliances and *Tamarix* spp. Semi-natural Stands. None of these types are common in the mapping area, except *Baccharis salicifolia* Alliance, which often occurs in stands well below the minimum mapping unit or minimum width.

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Appendix A

Reconnaissance Form

RECON FIELD FORM (Mar 26, 2013)

Date: | **Surveyors (circle recorder):**

Waypoint ID:

UID:

GPSname: **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Bearing: ______(degrees) Distance: ______(meters)

Base UTMs / projected UTMs (circle one)

UTME ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/- Elev.(m):

Size of stand (acres): <0.5 0.5-1 >1-5 > 5 Camera/Photos:

Field alliance name:

Comments:

% Cover: Conifer Tree: _______ Hardwood tree: _______ Tree: _______ Shrub: _______ Herb: _______ Total: _______

Disturbance from exotics (relative cover) None or not visible <33% 33-66% >66% Not Applicable

Strata	Species	% cover		Strata	Species	% cover		Strata	Species	% cover

Date: | **Surveyors (circle recorder):**

Waypoint ID:

UID:

GPSname: **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Bearing: ______(degrees) Distance: ______(meters)

Base UTMs / projected UTMs (circle one)

UTME ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/- Elev.(m):

Size of stand (acres): <0.5 0.5-1 >1-5 > 5 Camera/Photos:

Field alliance name:

Comments:

% Cover: Conifer Tree: _______ Hardwood tree: _______ Tree: _______ Shrub: _______ Herb: _______ Total: _______

Disturbance from exotics (relative cover) None or not visible <33% 33-66% >66% Not Applicable

Strata	Species	% cover		Strata	Species	% cover		Strata	Species	% cover

Date: | **Surveyors (circle recorder):**

Waypoint ID:

UID:

GPSname: **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Bearing: ______(degrees) Distance: ______(meters)

Base UTMs / projected UTMs (circle one)

UTME ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/- Elev.(m):

Size of stand (acres): <0.5 0.5-1 >1-5 > 5 Camera/Photos:

Field alliance name:

Comments:

% Cover: Conifer Tree: _______ Hardwood tree: _______ Tree: _______ Shrub: _______ Herb: _______ Total: _______

Disturbance from exotics (relative cover) None or not visible <33% 33-66% >66% Not Applicable

Strata	Species	% cover		Strata	Species	% cover		Strata	Species	% cover

Appendix B

Accuracy Assessment Form

Accuracy Assessment, Carrizo Lands Expansion (03/20/2014)

Recorder: **Other surveyors:** **Date:**

Waypoint ID/
Projected Waypoint ID:

Polygon UID:

GPSname: **Projected? Yes / No / Base / Digitized** If Yes/Digitized, enter:

Base Waypoint ID: _____ Bearing°: _____ Distance (m): _____ Inclination°: _____

UTMs or Projected UTMs

UTME __ __ __ __ __ __ __ __ **UTMN** __ __ __ __ __ __ __ __ **PDOP: +/-** _____

Camera/Photos: _____/ _____

Strata	Species	% cover	C	Strata	Species	% cover	C

Notes: (include recommendations for line-work revision, state of veg. "discernability" based on season and topography, classification interpretation, homogeneity and unusual sightings of plants or animals)

Alliance / Association

Cover Classes 1 Trace-0.9% 5 1-9.9% 15 10-19.9% 25 20-29.9% 35 30-39.9% 45 40-49.9% 55 50-59.9% 65 60-69.9% 75 70-79.9% 85 80-89.9% 95 90-100%

Cover Class: Conifer (incl JUCA): _____ Hardwood (not QUJO): _____ Total Tree: _____ Shrub: _____

Herb Cover: 0% <2% 2-9% 10-39% 40-59% >60% NA

Non-Native (absolute): Low (<33%) Medium (33-66%) High (>66%) NA

Estimated area of identifiable vegetation viewed: Radius (m) _____ or rough % of polygon _____

Linework ok Y / N | Only 1 vegetation type in this polygon Y / N | Vegetation change since imagery taken Y / N

Recorder: **Other surveyors:** **Date:**

Waypoint ID/
Projected Waypoint ID:

Polygon UID:

GPSname: **Projected? Yes / No / Base / Digitized** If Yes/Digitized, enter:

Base Waypoint ID: _____ Bearing°: _____ Distance (m): _____ Inclination°: _____

UTMs or Projected UTMs

UTME __ __ __ __ __ __ __ __ **UTMN** __ __ __ __ __ __ __ __ **PDOP: +/-** _____

Camera/Photos: _____/ _____

Strata	Species	% cover	C	Strata	Species	% cover	C

Notes: (include recommendations for line-work revision, state of veg. "discernability" based on season and topography, classification interpretation, homogeneity and unusual sightings of plants or animals)

Alliance / Association

Cover Classes 1 Trace-0.9% 5 1-9.9% 15 10-19.9% 25 20-29.9% 35 30-39.9% 45 40-49.9% 55 50-59.9% 65 60-69.9% 75 70-79.9% 85 80-89.9% 95 90-100%

Cover Class: Conifer (incl JUCA): _____ Hardwood (not QUJO): _____ Total Tree: _____ Shrub: _____

Herb Cover: 0% <2% 2-9% 10-39% 40-59% >60% NA

Non-Native (absolute): Low (<33%) Medium (33-66%) High (>66%) NA

Estimated area of identifiable vegetation viewed: Radius (m) _____ or rough % of polygon _____

Linework ok Y / N | Only 1 vegetation type in this polygon Y / N | Vegetation change since imagery taken Y / N

Appendix C

Field and Mapping Key for Distinguishing Vegetation Types

modified from Stout et al. (2013)

The following key was created to distinguish the mapped and classified vegetation types in the Carrizo Plain National Monument (Stout et al. 2013). For the current project, it was modified to include the following vegetation types: *Baccharis pilularis* Alliance, *Hazardia (squarrosa, stenolepis)* Alliance, and *Platanus racemosa* Alliance. This key was used to attribute each photo-interpreted polygon within the map.

Due to the diversity of vegetation in the mapping area, and to avoid an excessively long document, a series of paired statements (or couplets) was not developed for each option. Instead, sets of characteristics with choices beneath them are provided. Also, to make this key shorter and more easily applied in the field, it is somewhat artificial in not following the exact hierarchy (i.e., one does not have to key down through all levels of the hierarchy to get to the Association). The key will first lead the user to general options, and the individual selections for the finest-level vegetation types will be listed beneath these options. The user will need to work through the numbered list of types from the more general to the most specific options until the best fit is reached. Some broader level types (i.e., Macrogroup, Group) that were used to attribute difficult polygons are also included.

All choices are identified by a combination of alpha-numeric codes, using capital letters, numerals, uppercase and lowercase letters, and decimal points to distinguish the different key levels. The most basic, general levels in the key are on the left side of the alpha-numeric code, and the most specific are on the right side. This coding system in the key relates to a series of left indentations. Thus, the major groupings are down the left-hand side of the pages; nested within them are the sub-groupings. The preliminary key will direct you to the major groupings, such as forest/woodland, shrubland, and herbaceous, with the more specific choices beneath them. The more specific lists within these are generally based on presence/absence or dominance/sub-dominance of species. *Please note: since there may be more than two alternatives in a group, be sure to work through all of the options in a list before you decide on the best choice.*

Also, alliances that occur in the Chimineas Ranch or other adjacent CDFW and BLM lands but were not sampled in the Carrizo Plain National Monument are included in the key and are marked with an asterisk(*).

Terms and Concepts Used Throughout the Key

Dominance by layer: Tree, shrub, and herbaceous layers are considered physiognomically distinct. A vegetation type is considered to belong to a certain physiognomic group if it is dominated by one layer. Layers are prioritized in order of height when naming the type.

Dominant: Dominance refers to the preponderance of vegetation cover in a stand of uniform composition and site history. It may refer to cover of an individual species (as in "dominated by Blue Oak"), or it may refer to dominance by a physiognomic group, as in "dominated by shrubs." Dominance refers to the relative cover of one species or physiognomic group as compared to another species or physiognomic group.

Co-dominant: Co-dominance refers to two or more species in a stand that share dominance and have between 30 and 60 percent relative cover each.

Key to the vegetation types in the Carrizo Plain National Monument

as modified for the adjacent elk range

Class A. Vegetation characterized by an even distribution of overstory trees. Shrub or herbaceous species may total higher cover than trees. The tree overstory may have as low as 5% cover (e.g., in the *Juniperus californica* and *Quercus douglasii* Alliances) while shrubs may not be significant
= **Tree-Overstory (Woodland / Forest Vegetation), on page C-2**

Class B. Vegetation characterized by an even distribution of woody shrubs in the canopy. Herbaceous species may total higher cover than shrubs. The shrub canopy may have less than 10% total cover (i.e., 3% or greater), especially in areas of saline or alkaline soils, along washes, or in desert-transition areas (e.g., *Allenrolfea occidentalis, Atriplex spp., Eastwoodia elegans, Ephedra californica, Ericameria nauseosa, Gutierrezia californica, Lepidospartum squamatum, Lycium andersonii, Suaeda moquinii*)
= **Shrubland Vegetation, on page C-5**

Class C. Vegetation characterized by non-woody, herbaceous species in the canopy including grasses, graminoids, and broad-leaved herbaceous species. Shrubs, if present, usually comprise <3% of the vegetation. Trees, if present, generally have <5% cover
= Herbaceous Vegetation, on page C-13

Class D. Non-vegetated or urbanized types with <2% total vegetation cover
= **Unvegetated or Urbanized, on page C-19**

Class A. Tree-Overstory (Woodland / Forest Vegetation)

Woodlands and forests characterized by needle or scale-leaved conifer trees and/or broad-leaved evergreen and deciduous tree species. The trees may only occur intermittently in the overstory and may be associated with shrubs.

I.A. Stands are dominated or characterized by riparian winter deciduous trees or tall shrubs, including *Platanus racemosa, Populus fremontii* and/or a species of *Salix…*

I.A.1. *Platanus racemosa* is dominant or co-dominant in the riparian tree canopy, having >5% absolute cover. Other species may intermix in the overstory, including *Populus fremontii* or a tree species of *Quercus…*

***Platanus racemosa* Alliance (1212)**

I.A.2. *Populus fremontii* is dominant or co-dominant with >5% absolute cover in the tree canopy. Stands occur along streams, springs, and valleys with a subsurface water supply …

***Populus fremontii* Forest Alliance (1211)**

I.A.2.a. *P. fremontii* is dominant in the overstory with *Salix exigua* in the shrub layer and a variable mix of grasses and forbs …

***Populus fremontii/Salix exigua* Association**

I.A.2.b. *P. fremontii* is dominant in the overstory, and the understory has a variable mix of grasses and forbs …

***Populus fremontii* Association**

I.A.3. *Salix laevigata* dominates with >50% relative cover in the tree canopy, or >30% relative cover when *S. lasiolepis* is present in the sub-canopy…

***Salix laevigata* Woodland Alliance (4113)**
(No Association defined)

I.B. The tree overstory is characterized by a species of *Quercus* that is evenly distributed with >5% cover. The oak may be the sole dominant tree or share dominance with *Juniperus californica*…

I.B.1. *Quercus agrifolia* dominates the tree canopy and is an uncommon type that tends to grow on soils with high organic matter. A variety of shrubs such as *Adenostoma fasciculatum, Arctostaphylos glauca, Ericameria linearifolia, Eriogonum fasciculatum* and *Rhamnus ilicifolia* may be present in the understory…

***Quercus agrifolia* Woodland Alliance* (1111)**

I.B.2. *Quercus douglasii* or *Quercus* x*alvordiana* is the dominant oak species in an open to intermittent tree canopy. *Juniperus californica* may be present as a sub- to co-dominant tree…

***Quercus douglasii* Woodland Alliance (1131)**

I.B.2.a. *Juniperus californica* is a sub- to co-dominant tree with *Quercus douglasii*, while *Cercocarpus montanus* is present and dominant or co-dominant in the shrub understory…

Quercus douglasii–Juniperus californica/Cercocarpus montanus* Woodland Association

I.B.2.b. *Juniperus californica* is a sub- to co-dominant tree with *Quercus douglasii*, while *Ericameria linearifolia* is generally present and dominant or co-dominant in the shrub understory…

***Quercus douglasii–Juniperus californica/Ericameria linearifolia* Woodland Association**

I.B.2.c. *Quercus* x*alvordiana* is dominant in the tree canopy, typically with an herbaceous understory. *Juniperus californica* may be scattered…

***Quercus* x*alvordiana* Woodland Association**

I.B.2.d. *Quercus douglasii* is dominant with *Ericameria linearifolia* present in the shrub understory, which may mix with other shrubs such as *Arctostaphylos glauca, Adenostoma fasciculatum, Artemisia californica, Eriogonum fasciculatum, Rhamnus ilicifolia, and Salvia leucophylla*. *Poa secunda* is generally present in this association within the study area, and *Juniperus californica* is absent or low in cover (<1% absolute cover) …

Quercus douglasii/Ericameria linearifolia* Woodland Association

I.B.2.e. *Quercus douglasii* is dominant with annual grasses and forbs dominant the understory, and shrubs have no or low (<3%) absolute cover. The most common herb species are non-natives *Bromus diandrus, B. hordeaceus, B. rubens,* and *Erodium cicutarium*. Native grasses *Nassella cernua* and *Poa secunda* are often present…

Quercus douglasii/*Herbaceous Woodland Association

I.C. *Quercus john-tuckeri* is the dominant oak or it intermixes as a low tree with similar or higher cover than *Juniperus californica*. A variety of shrubs such as *Ceanothus cuneatus, Ericameria linearifolia, Eriogonum fasciculatum* and *Salvia leucophylla* may be present in the shrub understory …

***Quercus john-tuckeri* Shrubland Alliance (2111)**

I.C.1. *Juniperus californica* occurs in the tree canopy and is similar or lower in cover to *Quercus john-tuckeri*. *Ericameria linearifolia* often intermixes in the shrub layer, and a variety of other sub-dominant shrubs such as *Eriogonum fasciculatum* and *Salvia leucophylla* can also occur…

***Quercus john-tuckeri–Ericameria linearifolia/Juniperus californica* Shrubland Association**

I.C.2. *Quercus john-tuckeri* is the sole dominant in the low tree or tall shrub canopy. Other plants may be present at relatively low cover including *Adenostoma fasciculatum, Ceanothus cuneatus* and *Salvia leucophylla*…

***Quercus john-tuckeri* Shrubland Association**

I.D. The tree canopy is characterized by an even distribution of *Juniperus californica* with >4% absolute cover. *Quercus douglasii* is typically absent in the overstory and soils tend to be shallow and sandy or silty…

***Juniperus californica* Woodland Alliance (1121)**

I.D.1. *Salvia leucophylla* is present in the shrub understory and other shrubs such as *Eriogonum fasciculatum* may be sub- to co-dominant. If *Ericameria linearifolia* present, it is much lower cover in cover than the *S. leucophylla*…

***Juniperus californica/Salvia leucophylla* Woodland Association**

I.D.2. *Ericameria linearifolia* is present in the shrub understory and other shrubs such as *Eriogonum fasciculatum* or *Ephedra viridis* may be present and co-dominant with *E. linearifolia*. If *Salvia leucophylla* is present, it is much lower in cover than *E. linearifolia.* Various herbs are present in the understory…

***Juniperus californica/Ericameria linearifolia/*Herbaceous Woodland Association**

I.D.3. Annual grasses and forbs dominate the understory and shrubs have low cover (<2% absolute cover)…

***Juniperus californica/*Herbaceous Woodland Association**

Class B. Shrubland Vegetation

Class B. Group I. Shrublands dominated by sclerophyllous temperate broad-leaved shrubs (with leaves hardened by a waxy cuticle). They are dominated by typical chaparral shrub genera; including chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos*), scrub oaks (*Quercus*), etc.

I.A. *Prunus fasciculata* is the dominant shrub in the canopy, often occurring in riparian areas and steep moist slopes. *Ribes quercetorum* and *Juniperus californicus* may be present and low in cover …

***Prunus fasciculata* Shrubland Association**
in the *Prunus fasciculata* Shrubland Alliance (4215)

I.B. *Ribes quercetorum* is the dominant shrub in the canopy, often growing clonally in stands on steep north-facing slopes, which have resprouted recently after fire…

***Ribes quercetorum* Shrubland Association**
in the *Ribes quercetorum* Shrubland Alliance (2611)

I.C. *Quercus berberidifolia* is dominant to co-dominant in the shrub canopy. Stands are small, rare and likely found on north-facing slopes with well- to extensively-drained soils…

Quercus berberidifolia–Ceanothus cuneatus
in the *Quercus berberidifolia* Shrubland Alliance* (2211)

I.D. *Quercus john-tuckeri* is dominant or it intermixes with similar or higher cover than *Juniperus californica*. A variety of other shrubs such as *Ceanothus cuneatus, Ericameria linearifolia, Eriogonum fasciculatum* and *Salvia leucophylla* may be present. Stands are found primarily on north-facing slopes with well- to extensively-drained soils…

***Quercus john-tuckeri* Shrubland Alliance (2111)**

I.D.1. *Juniperus californica* occurs in the tree canopy and is similar or lower in cover to *Quercus john-tuckeri*. *Ericameria linearifolia* often intermixes in the shrub layer, and a variety of other sub-dominant shrubs such as *Eriogonum fasciculatum* and *Salvia leucophylla* can also occur…

***Quercus john-tuckeri–Ericameria linearifolia/Juniperus californica* Shrubland Association**

I.D.2. *Quercus john-tuckeri* is the sole dominant shrub in the shrub canopy. Other shrubs may be present at relatively low cover including *Adenostoma fasciculatum, Ceanothus cuneatus* and *Salvia leucophylla*…

***Quercus john-tuckeri* Shrubland Association**

I.E. *Ceanothus cuneatus* is dominant or shares dominance with *Adenostoma fasciculatum* or other shrubs (e.g. *Artemisia californica, Malacothamnus* sp.) in the canopy. Soils are often sandy and well-drained…

***Ceanothus cuneatus* Shrubland Alliance* (2227)**

I.E.1. *Adenostoma fasciculatum* co-dominates in the shrub canopy, sometimes having twice as much cover as *Ceanothus cuneatus…*

Adenostoma fasciculatum–Ceanothus cuneatus* Shrubland Association

I.F. *Arctostaphylos glauca* is dominant or shares dominance with *Adenostoma fasciculatum* in the shrub canopy…

***Arctostaphylos glauca* Shrubland Alliance (2231)**

I.F.1. *A. glauca* is the sole dominant in the shrub canopy, and other shrubs if present are low in cover…

***Arctostaphylos glauca* Shrubland Association**

I.F.2. *Quercus john-tuckeri* is sub- to co-dominant in the shrub canopy…

***Arctostaphylos glauca–Quercus john-tuckeri* Provisional Shrubland Association**

I.F.3. *Adenostoma fasciculatum* co-dominates in the shrub canopy, sometimes having twice as much cover as *Arctostaphylos glauca…*

Adenostoma fasciculatum–Arctostaphylos glauca* Shrubland Association

I.G. *Cercocarpus betuloides* (=*C. montanus*) intermixes as a co-dominant to dominant shrub with other chaparral species. Stands occur in mesic scrub settings on north-facing, protected slopes and are rare in the region…

***Cercocarpus montanus* Shrubland Alliance* (2212)**

I.H. *Salvia mellifera* shares dominance with *Adenostoma fasciculatum* in the shrub canopy, with *A. fasciculatum* sometimes having twice as much cover as *S. mellifera.* Found on slopes of all aspects, but especially those with south-facing exposure…

Adenostoma fasciculatum–Salvia mellifera* Shrubland Association
in the *Adenostoma fasciculatum–Salvia mellifera* Shrubland Alliance* (2226)

I.I. *Adenostoma fasciculatum* dominates the shrub canopy with >50% relative cover…

***Adenostoma fasciculatum* Shrubland Alliance* (2223)**

I.I.1. *Adenostoma fasciculatum* is the sole dominant shrub, and generally has greater than 20% absolute cover in the region. A variety of shrubs can occur as sub-dominants with sparse or low cover, including *Arctostaphylos glauca, Ceanothus cuneatus, Eriogonum fasciculatum, Salvia leucophylla, Hesperoyucca whipplei,* and others…

Adenostoma fasciculatum* Shrubland Association

I.J. *Adenostoma sparsifolium* is dominant or co-dominant in the shrub layer with other chaparral or coastal scrub species. Scattered, uncommon stands occur in the CDFW Gifford unit and possibly other areas in the southwest portion of the Chimineas Ranch...

***Adenostoma sparsifolium* Shrubland Alliance† (2112)**
†From observations in surrounding area, no survey data from the project

I.K. *Eriodictyon crassifolium* is dominant in an open shrub canopy. This uncommon type often occurs in chaparral stands that that have had recent fire or similar disturbance.

***Eriodictyon crassifolium* Provisional Shrubland Alliance† (2228)**
†From observations in surrounding area, no survey data from the project

<u>Class B. Group II.</u> Shrublands dominated by scale-like, microphyllous, or broad-leaved species, including drought-deciduous and cold-deciduous species. These are generally considered to be part of desert transition, riparian, coastal sage scrub or other more soft-leaved shrub habitats. Includes species of *Allenrolfea, Artemisia, Atriplex, Baccharis, Ephedra, Ericameria, Pluchea, Salix, Salvia,* and others.

II.A. Shrublands characterized by species that can tolerate saline or alkaline soils, but are not necessarily restricted to these conditions. Includes *Allenrolfea, Atriplex, Frankenia,* and *Suaeda…*

II.A.1. *Allenrolfea occidentalis* dominates with >2% absolute cover on seasonally saturated soils, and other alkaline-tolerant shrubs such as *Atriplex spinifera* may be present at low cover. *Lasthenia* (*gracilis*) is sub-dominant to dominant with *Bromus rubens, Delphinium recurvatum, L. ferrisiae,* and others in the herb layer …

***Allenrolfea occidentalis/Lasthenia* (*gracilis*) Shrubland Association**
In the *Allenrolfea occidentalis* Shrubland Alliance (4311)

II.A.2. *Suaeda moquinii* dominates the shrub canopy with >2% absolute cover. *Lepidium dictyotum, Atriplex* spp.*, Frankenia salina, Hordeum murinum, Descurainia sophia,* and other alkaline-tolerant species may be present…

***Suaeda moquinii/Lepidium dictyotum* Provisional Shrubland Association**
in the *Suaeda moquinii* Shrubland Alliance (4314)

II.A.3. *Frankenia salina* dominates as a sub-shrub or herb with >4% absolute cover, though non-native herbs may be high in cover during some years…

(No Association defined)
***Frankenia salina* Herbaceous Alliance (4317)**

II.A.4. A species of *Atriplex* is dominant or co-dominant in the shrub canopy with >50% relative cover and >2% absolute cover. Other shrubs such as *Eastwoodiae elegans, Ericameria linearifolia,* or *Eriogonum fasciculatum* may be present at lower cover…

II.A.4.a. *Atriplex spinifera* dominates the shrub canopy. The herb layer has open to intermittent cover including *Bromus rubens, Erodium cicutarium* and *Lasthenia* (*gracilis*)…

***Atriplex spinifera/*Herbaceous Shrubland Association**
in the *Atriplex spinifera* Shrubland Alliance (4312)

II.A.4.b. *Atriplex canescens* dominates the shrub canopy. Herbs such as *Erodium cicutarium, Malacothrix coulteri, Monolopia lanceolata, Phacelia* and *Schismus* are present and may be higher in cover than the shrub layer…

***Atriplex canescens/*Herbaceous Provisional Shrubland Association**
in the *Atriplex canescens* Shrubland Alliance (2413)

II.A.4.c. *Atriplex polycarpa* dominates the shrub canopy. Herbs such as *Amsinckia tessellata, Bromus rubens, Eremalche parryi, Erodium cicutarium, Lotus wrangelianus,* and *Monolopia lanceolata* are present and can be higher in cover than the shrub layer…

***Atriplex polycarpa/*Annual Herbaceous Shrubland Association**
in the *Atriplex polycarpa* Shrubland Alliance (2411)

II.A.5. Shrublands in alkaline basins and high marshes with dominant plants or mixture of plants not like above…

Intermountain basins alkaline–saline shrub wetland Group (4300) in the
Cool (and Warm) Semi-Desert Alkaline–Saline Wetland Macrogroup (4300, 6200 and 6400)

II.B. Shrublands characterized by species that grow in seasonally or intermittently flooded habitats on alluvial soils. Stands often occur along riparian and stream corridors, lake margins, permanent springs, marshes, or washes. Includes *Baccharis salicifolia, Lepidospartum, Pluchea, Salix* and others...

II.B.1. *Lepidospartum squamatum* characterizes an open shrub canopy along alluvial streams, washes, or fans, and may have as little as 2% absolute cover. Other shrubs such as *Artemisia californica* or *Ericameria nauseosa* may intermix as co-dominants …

***Lepidospartum squamatum* Shrubland Alliance (4213)**

II.B.1.a. *Artemisia californica* is sub-dominant to co-dominant in the shrub canopy…

Lepidospartum squamatum-Artemisia californica* Shrubland Association

II.B.1.b. Other shrubs if present occur at low cover, and a variety of herbs are present in the understory …

***Lepidospartum squamatum/*Mixed ephemeral annuals Shrubland Association**

II.B.2. *Salix exigua* is dominant or co-dominant in the shrub canopy with >50% relative cover or >30% relative cover when *S. lasiolepis* is present...

***Salix exigua* Shrubland Alliance[†] (4112)**

[†]From observations in surrounding area, no survey data from the project

II.B.3. *Salix lasiolepis* is dominant in the shrub or tree canopy, typically with >50% relative cover…

***Salix lasiolepis* Shrubland Alliance[†] (4116)**

[†]From observations in surrounding area, no survey data from this project

II.B.4. *Pluchea sericea* is present in the canopy with >2% absolute cover and no other shrub species have equal or greater cover. Stands occur around springs, seeps, irrigation ditches, canyon bottoms, streamsides, and seasonally flooded washes. May include *Baccharis salicifolia, Atriplex, Ericameria nauseosa,* and others…

***Pluchea sericea* Shrubland Alliance (4221)**

II.B.5. *Baccharis salicifolia* is dominant or co-dominant in the shrub canopy usually with >3% cover. Stands occur along canyon bottoms, floodplains, irrigation ditches, lake margins, or stream channels and they may include a variety of other shrub species…

***Baccharis salicifolia* Shrubland Alliance (4111)**

II.B.5.a. Other shrubs if present are low cover, and annual herbs including *Bromus rubens*, *Melilotus indicus,* and *Erodium* spp. are usually present and may be abundant in the understory…

***Baccharis salicifolia* Shrubland Association**

II.B.5.b. *Pluchea sericea* is sub- to co-dominant in the shrub canopy (usually with lower cover than *Baccharis salicifolia*)…

***Baccharis salicifolia*–*Pluchea sericea* Shrubland Association**

II.B.6. *Baccharis pilularis* is dominant in the shrub overstory, forming an open to intermittent canopy. A species of *Salix* may be present and lower in cover, often over a well-developed herbaceous understory. Found in meadows and disturbed riparian areas…

***Baccharis pilularis* Shrubland Alliance (3111)**

II.B.7. Stands not as above and characterized by any combination of *Salix exigua*, *Salix lasiolepis,* and *Baccharis salicifolia. Populus fremontii* and other *Salix* species may intermix. No clear dominance or co-dominance by any of these species. …

Warm Mediterranean & Desert Riparian, Flooded & Swamp Forest Macrogroup (4110)

II.B.8. *Ambrosia salsola* (=*Hymenoclea salsola*) characterizes an open to intermittent shrub canopy on sandy alluvial soils with >4% absolute cover. Other shrubs, such as *Eriogonum fasciculatum* and *Ericameria linearifolia,* may be present at lower cover in the canopy…

***Ambrosia salsola* Shrubland Association in the *Ambrosia salsola* Shrubland Alliance (2416)**

Field Cod

II.B.9. *Ericameria nauseosa* has >50% relative cover in the shrub canopy and grows on well-drained soils in washes, stream terraces or slopes. The shrub layer may include *Atriplex canescens, Ephedra californica, Ericameria linearifolia, Gutierrezia californica, Hymenoclea salsola* and others, which are typically low in cover…

***Ericameria nauseosa* Shrubland Association in the *Ericameria nauseosa* Shrubland Alliance (2511)**

II.B.10. *Forestiera pubescens* has >50% relative cover in the shrub canopy and grows in steep ravines and washes…

***Forestiera pubescens* Provisional Shrubland Association**
***Forestiera pubescens* Shrubland Alliance (4114)**

II.B.11. *Tamarix* sp. has >75% relative cover in the shrub canopy in riparian areas…

***Tamarix* Shrubland Semi-natural Stands (9141)**

II.C. Shrublands not as above and characterized by desert or desert-transition shrubs. Includes *Ambrosia, Eastwoodia, Ephedra, Ericameria, Isomeris, Krascheninnikovia* and *Lycium…*

II.C.1. *Ephedra californica* has >2% absolute cover in an open shrub canopy on low elevation uplands and washes, with sandy soils. Other shrubs may be sub- to co-dominant, such as *Ambrosia salsola* and *Gutierrezia californica…*

***Ephedra californica* Shrubland Alliance (4211)**

II.C.1.a. Stands occur in uplands where other shrubs are not present or low in cover. The herb layer is open to dense and may include *Amsinckia tessellata, Bromus rubens, Poa secunda, Uropappus lindleyi,* and others …

***Ephedra californica*/Annual-perennial herb Shrubland Association**

II.C.1.b. Stands occur in washes where *Ambrosia salsola* is typically present as a sub- to co-dominant. The herb layer is variable…

***Ephedra californica*–*Ambrosia salsola* Shrubland Association**

II.C.2. *Ephedra californica* occurs at >2% cover and usually co-dominates with *Eriogonum fasciculatum* in the shrub canopy. Often found on southern exposures with herbs such as *Amsinckia tessellata, Erodium cicutarium, Schismus* and others…

***Eriogonum fasciculatum*–*Ephedra californica* Provisional Shrubland Association**
in the *Eriogonum fasciculatum* Shrubland Alliance (2317)

II.C.3. *Ambrosia salsola* (=*Hymenoclea salsola*) characterizes an open to intermittent shrub canopy on sandy alluvial soils with >4% absolute cover. Other shrubs, such as *Eriogonum fasciculatum* and *Ericameria linearifolia,* may be present at lower cover in the canopy…

***Ambrosia salsola* Shrubland Association**
in the *Ambrosia salsola* Shrubland Alliance (2416)

Field Cod

II.C.4. *Lycium andersonii* has >50% relative cover in the shrub canopy and grows on low elevation uplands or near washes. The shrub layer may include *Ephedra californica, Eriogonum fasciculatum, Gutierrezia californica*, *Krascheninnikovia lanata,* and others…

***Lycium andersonii* Shrubland Association**
in the *Lycium andersonii* Shrubland Alliance (2522)

II.C.5. *Artemisia tridentata* is dominant or co-dominant on sandy alluvial soils in the lower Cuyama River drainage. Stands tend to be small and scattered in the mapping area...

***Artemisia tridentata* Shrubland Alliance[†] (2711)**
[†]From observations in surrounding area, no survey data from this project

II.C.6. *Ericameria linearifolia, Isomeris arborea,* and/or *Eastwoodiae elegans* is dominant to co-dominant with each other or other shrubs in the shrub canopy. The shrub layer may also include *Gutierrezia californica, Ephedra californica, Eriophyllum confertiflorum, Eriogonum fasciculatum* and others. The herb layer can be well-developed, and *Poa secunda* is characteristically present…

***Ericameria linearifolia–Isomeris arborea* Shrubland Alliance (2335)**

II.C.6.a. *Eastwoodia elegans* is dominant or shares dominance with *Ericameria linearifolia…*

***Eastwoodia elegans* Association**

II.C.6.b. *Isomeris arborea* is primarily dominant or shares dominance with *Ericameria linearifolia* in the shrub canopy…

***Isomeris arborea* Shrubland Association**

II.C.6.c. *Ericameria linearifolia* is primarily dominant or co-dominant with other shrubs in the shrub overstory…

***Ericameria linearifolia* Shrubland Association**

II.C.6.d. *Krascheninnikovia lanata* and/or *Eriogonum fasciculatum* are sub- to co-dominant in the shrub canopy with *Eastwoodia elegans…*

***Eastwoodia elegans–Krascheninnikovia lanata* Shrubland Association**

II.C.7. *Krascheninnikovia lanata* is dominant in the shrub canopy. Other shrub species may include *Eastwoodia elegans, Ephedra californica, Gutierrezia californica,* and *Eriogonum fasciculatum…*

***Krascheninnikovia lanata* Shrubland Association**
in the *Krascheninnikovia lanata* Shrubland Alliance (2521)

II.C.8. *Ericameria nauseosa* has >50% relative cover in the shrub canopy and grows on well-drained soils in washes, stream terraces or slopes. The shrub layer may include *Atriplex canescens, Ephedra californica, Ericameria linearifolia, Gutierrezia californica, Hymenoclea salsola* and others, which are typically low in cover…

***Ericameria nauseosa* Shrubland Association**
in the *Ericameria nauseosa* Shrubland Alliance (2511)

II.C.9. *Ephedra viridis* is dominant or sometimes can be co-dominant with *Ericameria linearifolia* or *Eriogonum fasciculatum*. The shrub layer may also include *Isomeris arborea* and others, and the herb understory is well-developed with *Poa secunda* characteristically present…

***Ephedra viridis–Ericameria linearifolia/Monolopia lanceolata* Provisional Shrubland Association**
in the *Ephedra viridis* Shrubland Alliance (2525)

II.D. Shrublands characterized by coastal sage or seral shrub species . Includes *Artemisia californica, Baccharis pilularis, Eriogonum fasciculatum, Hazardia stenolepis, Salvia* spp.*,* and *Lupinus albifrons…*

II.D.1. *Gutierrezia californica* dominates an open shrub canopy, and other shrubs may occur at low cover. The herb layer is usually well-developed, including natives such as *Poa secunda* and non-natives such as *Bromus* and *Erodium* species…

***Gutierrezia californica/Poa secunda* Association**
in the *Gutierrezia californica* Shrubland Alliance (2321)

II.D.2. *Lupinus albifrons* dominates in the shrub canopy and grows on slopes that may be disturbed, steep, and unstable. A variety of coastal sage shrubs may be present, including *Ericameria linearifolia, Eriogonum fasciculatum,* and others…

***Lupinus albifrons* Shrubland Association**
in the *Lupinus albifrons* Shrubland Alliance (2324)

II.D.3. *Baccharis pilularis* is dominant or characteristic, often intermixing with shrubs of coastal sage, such as *Artemisia californica* and *Salvia leucophylla.* Found in disturbed areas such as old fields, road banks, and along stream and drainage borders…

***Baccharis pilularis* Shrubland Alliance (3111)**

II.D.4. *Hazardia stenolepis* is the dominant shrub, often forming a low, open canopy over mixed native and non-native forbs and grasses. Other shrub species may co-occur as sub-dominants…

***Hazardia* (*squarrosa, stenolepis*) Shrubland Alliance (2336)**

II.D.5. *Salvia leucophylla* is dominant or shares dominance with *Artemisia californica, Eriogonum fasciculatum,* and/or *Ericameria linearifolia…*

***Salvia leucophylla* Shrubland Alliance (2325)**

II.D.5.a. *Salvia leucophylla* is the sole dominant (>60% relative cover) in the shrub canopy…

***Salvia leucophylla* Shrubland Association**

II.D.5.b. *Artemisia californica* is co-dominant with *Salvia leucophylla*, and *Eriogonum fasciculatum* and *Hesperoyucca whipplei* are often present…

***Salvia leucophylla–Artemisia californica* Shrubland Association**

II.D.5.c. *Eriogonum fasciculatum* is sub- to co-dominant with *Salvia leucophylla* and the two species characterize the shrub canopy. Sometimes other shrubs such as short-lived *Malacothamnus* can be present and co-dominant…

***Salvia leucophylla–Eriogonum fasciculatum* Shrubland Association**

II.D.6. *Salvia mellifera* is dominant or shares dominance with *Eriogonum fasciculatum* in the shrub overstory. Typically occurs on steep slopes…

***Salvia mellifera* Shrubland Alliance (2328)**

II.D.6.a. *Eriogonum fasciculatum* is sub- to co-dominant with *Salvia mellifera* and *Bromus rubens* is typically present in the understory…

***Salvia mellifera–Eriogonum fasciculatum/Bromus rubens* Shrubland Association**

II.D.7. *Artemisia californica* and *Eriogonum fasciculatum* are co-dominant in the shrub canopy, with both having >30% relative cover. Stands tend to occur on relatively hot and steep slopes. The shrub layer may include *Hesperoyucca whipplei, Salvia leucophylla, Malacothamnus* spp or other shrubs….

***Artemisia californica–Eriogonum fasciculatum* Shrubland Association**
in the *Artemisia californica–Eriogonum fasciculatum* Shrubland Alliance (2314)

II.D.8. *Artemisia californica* dominates (with >60% relative cover) in the shrub canopy while other shrubs have sparse or low cover. Often found on relatively steep slopes…

***Artemisia californica* Shrubland Association**
in the *Artemisia californica* Shrubland Alliance (2312)

II.D.9. *Eriogonum fasciculatum* is dominant or shares dominance with *Hesperoyucca whipplei* in the shrub canopy. Soils are usually sandy and well-drained…

***Eriogonum fasciculatum* Shrubland Alliance (2317)**

II.D.9.a. *Eriogonum fasciculatum* is the dominant in the shrub layer, and other shrub species have sparse or low cover…

***Eriogonum fasciculatum* Shrubland Association**

II.D.9.b. *Hesperoyucca whipplei* occurs at >2% cover and usually co-dominates with *Eriogonum fasciculatum* in the shrub canopy. Sometimes *E. fasciculatum* is low in cover and *H. whipplei* has a much higher relative cover. Often found on southern exposures with native herbs such as *Amsinckia tessellata, Dichelostemma capitatum, Salvia columbariae, Uropappus lindleyi, Plantago erecta,* and others…

***Eriogonum fasciculatum–Hesperoyucca whipplei* Shrubland Association**

II.D.9.c. *Ephedra californica* occurs at >2% cover and usually co-dominates with *Eriogonum fasciculatum* in the shrub canopy. Often found on southern exposures with herbs such as *Amsinckia tessellata, Erodium cicutarium, Schismus* and others…

***Eriogonum fasciculatum–Ephedra californica* Shrubland Association**

II.D.10. *Ericameria linearifolia, Isomeris arborea,* and/or *Eastwoodia elegans* is dominant to co-dominant with each other or with other shrubs in the shrub canopy. The shrub layer may also include *Gutierrezia californica, Ephedra californica, Eriophyllum confertiflorum, Eriogonum fasciculatum* and others. The herb layer can be well-developed, and *Poa secunda* is characteristically present…

***Ericameria linearifolia–Isomeris arborea* Shrubland Alliance (2335)**

(See above for key step II.C.7. for associations in this alliance)

Class C. Herbaceous Vegetation

Vegetation characterized by non-woody, herbaceous species in the canopy including grass, graminoid, and broad-leaved herbaceous species. Woody species may be emergent, typically with <5% cover.

I.A. Vegetation is characterized mainly by wetland graminoid, playa or vernal pool species, including graminoids such as *Distichlis, Juncus*, *Eleocharis*, *Schoenoplectus,* and forbs such as *Atriplex, Lasthenia,* and *Lepidium.*

I.A.1. *Eleocharis* sp. is dominant or co-dominant along lakeshores, streambeds, swales, pastures, ditches, and ponds.

I.A.1.a. *Eleocharis macrostachya* is dominant or co-dominant along lakeshores, streambeds, swales, pastures, ditches, and ponds. *Juncus arcticus* (var. *mexicanus* or *balticus*)*, Polypogon monspeliensis, Rumex crispus, Distichlis spicata,* and a variety of other wetland herbs may be present…

***Eleocharis macrostachya* Herbaceous Alliance* (6312)**

I.A.1.a.i. *E. macrostachya* is strongly dominant (>66% average cover) in freshwater ponds, reservoir margins, and streamsides…

Eleocharis macrostachya* Association

I.A.1.b. *Eleocharis acicularis* dominant in streambeds, swales, and spring areas. A variety of other wetland herbs may be present.

***Eleocharis acicularis* Alliance* (6311)**
(No Association defined)

I.A.2. *Juncus arcticus* var. *balticus* is dominant or co-dominant along edges of streams, lakes, and ponds. A variety of wetland graminoids or forbs intermix in the herbaceous layer, and *Rorippa nasturtium-aquaticum* and *Polypogon monspeliensis* may have similar or higher cover than *Juncus arcticus.* …

***Juncus arcticus* (var. *balticus*, *mexicanus*) Herbaceous Alliance (6211)**

I.A.2.a. *Juncus arcticus* var. *balticus* is typically dominant in the herb layer…

***Juncus arcticus var. balticus* Association**

I.A.3. *Schoenoplectus americanus* dominates or co-dominates along streams, around ponds and lakes, marshes, and roadside ditches. Soils are poorly drained. *Typha* spp.*, Distichlis spicata, Eleocharis parishii, Leymus triticoides, Polypogon monspeliensis, Schoenoplectus maritimus, Scirpus pungens,* and a variety of other wetland herbs may be present…

***Schoenoplectus americanus* Herbaceous Alliance (6111)**

I.A.3.a. *Scirpus pungens* co-dominanates with *Schoenoplectus americanus*…

Scirpus pungens*–*Schoenoplectus americanus* Provisional Association

I.A.3.b. *Schoenoplectus americanus* dominates, and other herbs are lower in cover…

***Schoenoplectus americanus* Association**

I.A.4. Vegetation not as above and characterized by other tall perennial graminoids such as *Schoenoplectus, Scirpus, Typha,* and *Juncus effusus…*

Western North American Temperate Lowland Wet Shrubland, Wet Meadow & Marsh Macrogroup (6100, 6200, and 6400)

I.A.4.a. Vegetation including *Juncus* spp.

Western North American Maritime Lowland Wet Meadow & Herbaceous Seep Group (6200)

I.A.4.b. Vegetation including *Schoenoplectus, Scirpus,* and *Typha* spp.

Western North American Temperate Interior Freshwater Marsh Group (6100)

I.A.5. Vegetation not as above and characterized by vernal pool, playa, and swale species such as *Eleocharis* spp., *Eryngium* spp.*, Lasthenia fremontii, Layia* spp.*, Downingia* spp.*, Psilocarphus* spp.*,* and others. Restricted to winter-flooded or at least winter-saturated substrates; not of convex or upland slopes - watered only by ambient precipitation. This vegetation occurs in alkaline vernal pools and playas in the study area …

Western North American Vernal Pool Macrogroup (6300)
California Vernal Pool Group (6310)

I.A.5.a. Native annual species *Atriplex vallicola, Lasthenia ferrisiae,* and/or *Lepidium jaredii* dominate, co-dominate, or are characteristically present in stands. Sometimes, *Lepidium nitidum* or *L. dictyotum* may be higher cover than the indicator species of the association, and other native herbs such as *Spergularia marina* are often present and variable in cover. ...

***Atriplex vallicola*–*Lasthenia ferrisiae*–*Lepidium jaredii* Herbaceous Association**
in the *Lasthenia fremontii*–*Distichlis spicata* Alliance (6313)

I.A.5.b. Native annual and perennial species such as *Frankenia salina, Myosurus minimus, Psilocarphus brevissimus,* and *Plagiobothrys leptocladus* dominate, co-dominate, or are characteristically present in stands…

***Frankenia salina*–*Psilocarphus brevissimus* Provisional Herbaceous Association**
in the *Frankenia salina* Alliance (4317)

I.A.6. Native perennial grasses and forbs are characteristic and evenly distributed across the herbaceous layer, though non-native herbs sometimes are dominant. Diagnostic species include *Distichlis spicata, Leymus triticoides,* and *Frankenia salina* in alkaline wetlands, playas, intermittently flooded terraces, and other similar locations…

I.A.6.a. *Distichlis spicata* is dominant or co-dominant with >30% relative cover in the herb layer. Soils are often deep, alkaline or saline, and poorly drained. *Descurainia sophia, Erodium cicutarium, Bromus, Hordeum, Amsinckia, Lasthenia,* and a variety of other native and non-native forbs and grasses may be present…

***Distichlis spicata* Herbaceous Alliance (6411)**

I.A.6.a.i. *Distichlis spicata* dominant (>50% relative cover) in the herb layer, though various annual forbs may be present…

***Distichlis spicata* Herbaceous Association**

I.A.6.b. *Leymus triticoides* is dominant or co-dominant (>30% relative cover) and with >15% absolute cover on poorly drained floodplains, pond/lake margins, drainage and valley bottoms. *Hordeum murinum, Erodium cicutarium, Amsinckia, Bromus, Distichlis spicata,* and a variety of other native and non-native forbs and grasses may be present…

***Leymus triticoides* Herbaceous Association**
in the *Leymus triticoides* Herbaceous Alliance (6213)

I.A.6.c. *Frankenia salina* is dominant or co-dominant (>30% relative cover) in playas, alkaline depressions and alkali sinks that have poorly drained soils. *Atriplex* spp., *Cressa truxillensis* and other species may be present…

(No Association defined)
***Frankenia salina* Herbaceous Alliance (4317)**

I.A.7. Stands with low cover of alkaline/saline adapted herbaceous plants (like *Distichlis spicata, Frankenia salina,* and *Leymus triticoides)* and not like above…

Intermountain basins alkaline–saline herb wet flat Group in the Cool (and Warm) Semi-Desert Alkaline–Saline Wetland Macrogroup (4300, 6200 and 6400)

I.B. Vegetation is characterized mainly by upland and mesic herbaceous species, including native and non-native grasses and forbs…

I.B.1. A perennial *Eriogonum* species, *Corethrogyne filaginifolia,* or *Isocoma acradenia* characterizes the herb layer on shallow soils derived from sedimentary substrate. Stands typically have grazing or other disturbance history…

I.B.1.a. *Eriogonum nudum* or *E. elongatum* is dominant on low hills, mound, and toeslopes that usually have exposed bare ground and rocky soils, which may be disturbed by small mammals or grazing animals …

***Eriogonum* (*elongatum, nudum*) Herbaceous Alliance (5132)**

I.B.1.a.i. *Eriogonum elongatum* is dominant or co-dominant with *Bromus rubens* on low hills and mounds…

***Eriogonum elongatum* Provisional Herbaceous Association (5132)**

I.B.1.a.ii. *Eriogonum nudum* is dominant or is co-dominant with other herb species…

***Eriogonum nudum* Provisional Herbaceous Association (5132)**

I.B.1.b. *Corethrogyne filaginifolia* is dominant on gentle to moderately slopes with sandy soils with *Castilleja exserta, Erodium cicutarium* and other herbs…

***Corethrogyne filaginifolia* Provisional Herbaceous Association**
***Corethrogyne filaginifolia* Provisional Herbaceous Alliance (5131)**

I.B.1.c. *Isocoma acradenia* is dominant on flat to gentle slopes near Soda Lake or base of the Temblor Range with a variety of herbs…

***Isocoma acradenia* Provisional Association of the *Isocoma acradenia* Alliance (2323)**

I.B.2. Annual native herbs are characteristic and evenly distributed across the herbaceous layer, though non-native forbs and grasses may be dominant. Diagnostic species include *Amsinckia* spp., *Coreopsis calliopsidea, Eschscholzia* spp*., Lasthenia* spp*., Monolopia* spp., *Phacelia* spp., *Plantago erecta,* and *Vulpia microstachys…*

California Annual Herb/Grass Group (5110)

I.B.2.a. Native annual species *Vulpia microstachys*, *Plantago erecta* and/or *Lasthenia californica* (or *L. gracilis)* characteristically present in stands and usually at least 10% relative in cover to other herbs. Other native species such as *Castilleja exserta, Crassula connata, Lepidium nitidum, Lupinus,* and *Trifolium* species are often well-represented (and sometimes co-dominant to dominant) as well as a variety of herbs. Soils may be clayey, wet to moist in spring and dry by summer …

***Lasthenia californica*–*Plantago erecta*–*Vulpia microstachys* Herbaceous Alliance (5114)**

I.B.2.a.i. *Erodium* and *Schismus* appear co-dominant to dominant in stands with *Vulpia microstachys,* and other native herbs such as *Amsinckia tessellata, Astragalus didymocarpus, Eriogonum gracillimum, Lepidium nitidum, Malacothrix coulteri, Microseris elegans,* and *Trifolium gracilentum,* with a variety of other native and non-native herbs…

***Erodium cicutarium*–*Vulpia microstachys* Association**

I.B.2.a.ii. *Erodium cicutarium* and *Bromus rubens* are present and sub-dominant while *Vulpia microstachys, Lepidium nitidum,* and/or *Trifolium gracilentum* are co-dominant to dominant with other herbs…

Lepidium nitidum–Trifolium gracilentum–Vulpia microstachys **Association**

I.B.2.a.iii. *Erodium* and *Bromus* appear sub-dominant to dominant in stands with *Lasthenia* (*gracilis*), *Plantago erecta, Plagiobothrys canescens, Crassula connata,* and a variety of other native herbs…

Lasthenia gracilis–Plantago erecta–Plagiobothrys canescens **Herbaceous Association**

I.B.2.a.iv. *Lasthenia* (*gracilis*) appears dominant or co-dominant with other herbs on vernal alkaline flats…

Lasthenia gracilis **Herbaceous Association**

I.B.2.a.v. *Lasthenia minor* appears dominant or co-dominant with other herbs on vernal alkaline flats of the valley floor. Stands are rare in the region …

Lasthenia minor **Provisional Herbaceous Association**

I.B.2.b. *Pectocarya linearis* or *P. penicillata* is seasonally co-dominant to dominant on sandy flats with *Calandrinia ciliata, Camissonia campestris, Erodium cicutarium, Lasthenia gracilis, Linanthus liniflorus, Schismus* sp., *Vulpia microstachys,* and other herbs. Stands interdigitate with *Amsinckia* herb stands and *Ephedra* shrub stands …

***Pectocarya* (*linearis, penicillata*) Herbaceous Association**
in the *Lasthenia californica–Plantago erecta–Vulpia microstachys* Herbaceous Alliance (5114)

I.B.2.c. *Eschscholzia californica* and/or *Lupinus bicolor* is/are seasonally dominant on upland slopes or flats with sandy to loamy soils that are well drained. *Amsinckia*, *Avena, Bromus*, *Castilleja exserta, Erodium cicutarium, Uropappus lindleyi* and a variety of other native and non-native forbs and grasses may be present…

Eschscholzia (californica) **Herbaceous Alliance (5113)**

I.B.2.c.i *Eschscholzia californica* is seasonally dominant on upland slopes or flats…

Eschscholzia californica **Herbaceous Association**

I.B.2.c.ii *Lupinus bicolor* is seasonally dominant on grazed flats…

Lupinus bicolor **Provisional Herbaceous Association**

I.B.2.d. *Amsinckia menziesii*, *A. tessellata, A. vernicosa, Phacelia ciliata* and/or *P. tanacetifolia* is/are seasonally characteristic in the herbaceous layer with greater than or equal to 10% relative cover. Soils are often well-drained and loamy and may have high levels of bioturbation (e.g., kangaroo rat precincts), high levels of (past/current) grazing and/or other disturbance...

***Amsinckia* (*menziesii, tessellata*) Herbaceous Alliance (5111)**

I.B.2.d.i. *Erodium cicutarium* is present and sub-dominant to dominant with *Amsinckia tessellata*. *Astragalus didymocarpus, Bromus rubens, Guillenia lasiophylla, Lotus wrangelianus,* and *Vulpia microstachys* may be present with a variety of other native and non-native herbs…

Amsinckia tessellata–Erodium cicutarium **Herbaceous Association**

I.B.2.d.ii. *Phacelia ciliata* is present and sub-dominant to dominant with *Amsinckia*, *Bromus rubens, Descurainia sophia, Erodium cicutarium, Guillenia lasiophylla, Lasthenia* and other species. Stands occur on terraces, flats and toeslopes usually adjacent to *Amsinckia* stands on well-drained soils and on grazed lands…

Phacelia ciliata **Provisional Herbaceous Association**

I.B.2.d.iii. *Phacelia tanacetifolia* is seasonally dominant or co-dominant on steep, dry slopes on siltstone derived soils. A variety of other herbs such as *Amsinckia tessellata, A. vernicosa, Astragalus didymocarpus, Caulanthus inflatus, Eremalche parryi, Erodium cicutarium, Salvia columbariae, Lupinus succulentus, Eriogonum elongatum* are present. Stands typically on moderate to steep slopes facing southeast and southwest...

***Phacelia tanacetifolia* Provisional Herbaceous Association**

I.B.2.e. *Coreopsis calliopsidea, Monolopia spp,* and/or *Mentzelia pectinata* is/are seasonally dominant or co-dominant on steep, dry slopes. A variety of other native herbs such as *Amsinckia tessellata, Astragalus didymocarpus, Caulanthus inflatus,* and *Malacothrix coulteri* are often present…

***Monolopia (lanceolata)–Coreopsis (calliopsidea)* Herbaceous Alliance (5115)**

I.B.2.e.i. *Coreopsis calliopsidea* and/or *Mentzelia pectinata* are seasonally dominant on steep, dry slopes with siltstone and gypsum-derived soils. A variety of other herbs such as *Amsinckia tessellata, Caulanthus inflatus, Camissonia boothii, Chaenactis stevioides, Guillenia lasiophylla, Erodium cicutarium,* and *Phacelia* species are present…

***Coreopsis calliopsidea–Mentzelia pectinata* Herbaceous Association**

I.B.2.e.ii. *Monolopia lanceolata* is seasonally dominant or co-dominant on fine-textured, moderate to steep slopes in the Temblor and Caliente ranges and sometimes on flats/terraces above Soda Lake with *Amsinckia* spp…

***Monolopia lanceolata* Herbaceous Association**

I.B.2.e.iii. *Monolopia stricta* is seasonally dominant on clay and silty hill slopes directly above Soda Lake with *Coreopsis calliopsidea, Erodium cicutarium, Layia munzii*, *Lepidium nitidum, Phacelia tanacetifolia,* and *Poa secunda*…

***Monolopia stricta* Provisional Herbaceous Association**

I.B.2.f. *Salvia carduacea* is dominant or co-dominant on moist alluvial toeslopes and terraces adjacent to washes with well-drained sandy soils and alluvium. *Camissonia campestris, Chaenactis glabriuscula, Erodium cicutarium, Malacothrix californica, Linanthus liniflorus, Pectocarya penicillata, Schismus* and others also occur in the herb layer, and *Gutierrezia californica* typically occurs at low cover in the shrub layer...

***Salvia carduacea* Herbaceous Association**
in the *Salvia carduacea* Provisional Herbaceous Alliance (5116)

I.B.3. Perennial native grasses are characteristic and evenly distributed across the herbaceous layer, though non-native forbs and grasses may be dominant. Diagnostic species include *Poa secunda* and *Nassella cernua…*

California Perennial Grassland Group (5120)

I.B.3.a. *Poa secunda* characterizes the herbaceous layer…

***Poa secunda* Herbaceous Alliance (5122)**

I.B.3.a.i. *Coreopsis calliopsidea, Monolopia stricta,* and/or *Poa secunda* are seasonally co-dominant to dominant in the Soda Lake basin associated with *Erodium cicutarium, Heterodraba unilateralis, Layia munzii, Layia platyglossa,* and other herbs…

***Monolopia stricta–Poa secunda* Herbaceous Association**

I.B.3.a.ii. *Poa secunda* is dominant or co-dominant with *Bromus rubens* on clayey soils on both flats and north-facing hillslopes along with *Allium* spp., *Claytonia parviflora, Erodium cicutarium, Dichelostemma capitata, Trifolium willdenovii,* and other herbs …

***Poa secunda–Bromus rubens* Herbaceous Association**

I.B.3.b. *Nassella cernua* characterizes the herbaceous layer with >2% absolute cover on well-drained soils. *Erodium cicutarium* is usually present and co-dominant, though it may be dominant to *N. cernua. Castilleja exserta, Bromus rubens, Lasthenia californica, Lotus wrangelianus, Trifolium albopurpureum,* and *Pectocarya penicillata* are often present…

***Nassella cernua* Provisional Herbaceous Association**
in the *Nassella cernua* Provisional Herbaceous Alliance (5121)

I.B.4. Vegetation not as above and characterized or dominated by a pure to mixed assemblage of annual or perennial herbs and grasses. Adapted to winter precipitation and summer drought, typically not of bottomland or concave conditions, but of uplands. Stands may have significant non-native herbaceous cover, but they contain diagnostic presence native species of forbs and/or grasses…

California Annual & Perennial Grassland Macrogroup (5100)

I.B.5. Vegetation not as above and strongly dominated by non-native annual herbaceous and/or grass species including *Aegilops triuncialis, Avena spp., Brachypodium distachyon, Brassica nigra, Bromus spp., Centaurea melitensis, Conium maculatum, Cynosurus echinatus, Foeniculum vulgare, Lolium perenne, Schismus, Sisymbrium irio* and other mustards. Native plants, if present, are trace in presence and abundance. Often in heavily disturbed or developed areas, including past agricultural and livestock areas.

Mediterranean California naturalized annual and perennial grassland Group (5200)

I.B.5.a. *Bromus rubens, Schismus* spp. and/or *Erodium* spp. strongly dominant in stands, and native plants, if present, are trace (<1%) in cover.

***Bromus rubens-Schismus* (*arabicus, barbatus*) Herbaceous Semi-natural Stands**

Class D. Unvegetated or Urbanized

I.A. Unvegetated (9110)

I.A.1. Developed (9111)
- **I.A.2. Road (9112)**
- **I.A.3. Cliff & Rock Outcrops (9113)**
- **I.A.4. River & Lacustrine Flats & Streambeds (9114)**
- **I.A.5. Playa (9115)**

I.B. Agriculture (9120)

I.C. Water (9130)
- **I.C.1. Perennial Stream Channel (9131)**
- **I.C.2. Reservoirs & Ponds (9132)**

I.D. Exotic trees and shrubs (9140)

I.E. Unknown (9999)

Appendix D

Classification Hierarchy

Classification Hierarchy for the Tule Elk Range in the Carrizo Plain

Class 1. Mesomorphic Tree Vegetation (Forest and Woodland)
- **Subclass 1.C. Temperate Forest**
  - **Formation 1.C.1. Warm Temperate Forest**
    - **Division 1.C.1.c. Madrean Forest and Woodland**
      - **MG009. California Forest and Woodland Macrogroup**
        - **Californian broadleaf forest and woodland Group**
          - *Quercus agrifolia* Alliance 1111
          - *Quercus douglasii* Alliance 1131
        - **Californian evergreen coniferous forest and woodland Group**
          - *Juniperus californica* Alliance 1121
  - **Formation 1.C.3. Temperate Flooded and Swamp Forest**
    - **Division 1.C.3.b Western North America Flooded and Swamp Forest**
      - **MG036. Southwestern North American Riparian, Flooded and Swamp Forest Macrogroup**
        - Madrean warm-temperate riparian/wash scrub 4110
        - **Southwestern North American introduced riparian scrub Group**
          - *Tamarix* Semi-natural Stands 9141
        - **Southwestern North American riparian evergreen and deciduous woodland Group**
          - *Platanus racemosa* Alliance 1212
          - *Populus fremontii* Alliance 1211
          - *Salix laevigata* Alliance 4113
        - **Southwestern North American riparian/wash scrub Group**
          - *Baccharis salicifolia* Alliance 4111
          - *Forestiera pubescens* Alliance 4114
          - *Salix exigua* Alliance 4112

Class 2. Mesomorphic Shrub and Herb Vegetation (Shrubland and Grassland)
- **Sub-Class 2.B. Mediterranean Scrub and Grassland**
  - **Formation 2.B.1. Mediterranean Scrub**
    - **Division 2.B.1.a. California Scrub**
      - **MG043. California Chaparral Macrogroup**
        - **Californian mesic chaparral Group**
          - *Cercocarpus montanus* Alliance 2212
          - *Prunus ilicifolia* Alliance Alliance 2240
        - **Californian xeric chaparral Group**
          - *Adenostoma fasciculatum* Alliance 2223
          - *Adenostoma fasciculatum* - *Salvia mellifera* Alliance 2226
          - *Arctostaphylos glauca* Alliance 2231
          - *Ceanothus cuneatus* Alliance 2227
          - *Eriodictyon crassifolium* Provisional Alliance 2228
      - **MG044. California Coastal Scrub Macrogroup**
        - **Central and south coastal California seral scrub Group**
          - *Corethrogyne filaginifolia* Provisional Alliance 5131
          - *Ericameria linearifolia* - *Isomeris arborea* Provisional Alliance 2335
          - *Eriogonum (elongatum, nudum)* Provisional Alliance 5132
          - *Gutierrezia californica* Provisional Alliance 2321
          - *Hazardia (squarrosa, stenolepis)* Alliance 2336
          - *Isocoma acradenia* Provisional Alliance 2323
          - *Lupinus albifrons* Alliance 2324

Central and South Coastal Californian coastal sage scrub Group

Artemisia californica - Eriogonum fasciculatum Alliance 2314

Artemisia californica Alliance 2312

Eriogonum fasciculatum Alliance 2317

Salvia leucophylla Alliance 2325

Salvia leucophylla - Artemisia californica - Eriogonum fasciculatum Mapping Unit 2327

Salvia mellifera Alliance 2328

Formation 2.B.2. Mediterranean Grassland and Forb Meadow

Division 2.B.2.a. California Grassland and Meadow

MG045. California Annual and Perennial Grassland Macrogroup 5100

California annual forb/grass vegetation Group 5110

Amsinckia (menziesii, tessellata) Alliance 5111

Lasthenia californica - Plantago erecta - Vulpia microstachys Alliance 5114

Monolopia (lanceolata) - Coreopsis (calliopsidea) Provisional Alliance 5115

Salvia carduacea Provisional Alliance 5116

California perennial grassland Group

Nassella cernua Provisional Alliance 5121

Mediterranean California naturalized annual and perennial grassland Group 5200

Subclass 2.C. Temperate and Boreal Shrubland and Grassland

Formation 2.C.1. Temperate Grassland, Meadow, and Shrubland

Division 2.C.1.a. Vancouverian and Rocky Mountain Grassland and Shrubland

MG048. Western North American Temperate Grassland and Meadow Macrogroup

Western dry upland perennial grassland Group

Poa secunda Alliance 5122

MG049. Western Cordilleran Montane Shrubland and Grassland Macrogroup

Western Cordilleran montane deciduous scrub Group

Ribes quercetorum Provisional Alliance 2611

Division 2.C.1.x. Western North America Interior Sclerophyllous Shrubland

MG051. Warm Interior Chaparral Macrogroup

Western Mojave and Western Sonoran Desert borderland chaparral Group

Adenostoma sparsifolia Alliance 2112

Quercus john-tuckeri Alliance 2111

Formation 2.C.3. Temperate and Boreal Scrub and Herb Coastal Vegetation

Division 2.C.3.b. Pacific Coast Scrub and Herb Littoral Vegetation

MG058. Vancouverian Coastal Dune and Bluff Macrogroup

California Coastal evergreen bluff and dune scrub Group

Baccharis pilularis Alliance 3111

Formation 2.C.5. Temperate and Boreal Freshwater Marsh

Division 2.C.5.b. Western North American Freshwater Marsh

MG073. Western North American Freshwater Marsh Macrogroup 6400

Arid West freshwater emergent marsh Group

Typha (angustifolia, domingensis, latifolia) Alliance 6511

MG074. Western North America Vernal Pool Macrogroup

Californian mixed annual/perennial freshwater vernal pool/swale/plain bottomland Group 6310

Lasthenia fremontii - Distichlis spicata Alliance

Atriplex vallicola - Lasthenia ferrisiae - Lepidium jaredii Provisional Association 6313

MG075. Western North America Wet Meadow and Low Shrub Carr Macrogroup

Californian warm temperate marsh/seep Group 6210

Juncus arcticus (var. balticus, mexicanus) Alliance 6211

Leymus triticoides Alliance 6213

Formation 2.C.6. Temperate and Boreal Salt Marsh
Division 2.C.6.c Temperate and Boreal Pacific Coastal Salt Marsh
MG081. North American Pacific Coastal Salt Marsh Macrogroup
Temperate Pacific tidal salt and brackish meadow Group
Distichlis spicata Alliance 6411
Division 2.C.6.d Western North American Interior Alkali–Saline Wetland
MG083. Warm Semi-Desert/Mediterranean Alkali–Saline Wetland Macrogroup
Southwestern North American alkali marsh/seep vegetation Group
Schoenoplectus americanus Alliance 6111
Southwestern North American salt basin and high marsh Group
Allenrolfea occidentalis Alliance 4311
Atriplex spinifera Alliance 4312
Frankenia salina Alliance 4317
Suaeda moquinii Alliance 4314

Class 3. Xeromorphic Scrub and Herb Vegetation (Semi-Desert)
Atriplex polycarpa-Atriplex canescens MU 2412
Subclass 3.A. Warm Semi-Desert Scrub and Grassland
Formation 3.A.1. Warm Semi-Desert Scrub and Grassland
Division 3.A.1.a Sonoran and Chihuahuan Semi-Desert Scrub and Grassland
MG088. Mojavean–Sonoran Desert Scrub Macrogroup
Lower Bajada and Fan Mojavean–Sonoran desert scrub Group
Ambrosia salsola Alliance 2416
Atriplex polycarpa Alliance 2411
MG092. Madrean Warm Semi-Desert Wash Woodland/Scrub Macrogroup
Mojavean semi-desert wash scrub Group
Ephedra californica Alliance 4211
Lepidospartum squamatum Alliance 4213
Prunus fasciculata Alliance 4215
Sonoran-Coloradan semi-desert wash woodland/scrub Group
Pluchea sericea Alliance 4221
Subclass 3.B. Cool Semi-Desert Scrub and Grassland
Formation 3.B.1. Cool Semi-Desert Scrub and Grassland
Division 3.B.1.a. Western North American Cool Semi-Desert Scrub and Grassland
MG093. Cool Semi-Desert Alkali-Saline Flats Macrogroup
Shadscale-saltbush cool semi-desert scrub Group
Atriplex canescens Alliance 2413
MG095. Cool Semi-desert wash and disturbance scrub Macrogroup
Intermontane seral shrubland Group
Ericameria nauseosa Alliance 2511
MG096. Western North America Tall Sage Shrubland and Steppe Macrogroup
Inter-Mountain West mesic tall sagebrush shrubland and steppe Group
Artemisia tridentata Alliance 2711
MG098. Inter-Mountain Dry Shrubland and Grassland Macrogroup
Intermontane deep or well-drained soil scrub Group
Ephedra viridis Alliance 2525
Krascheninnikovia lanata Alliance 2521
Lycium andersonii Alliance 2522

Appendix E

Contingency Table

Final Call \ Mapped Type	Adenostoma fasciculatum	Adenostoma fasciculatum - Salvia mellifera	Arctostaphylos glauca	Artemisia californica	Artemisia californica - Eriogonum fasciculatum	Atriplex polycarpa	Baccharis salicifolia	California Annual and Perennial Grassland Macrogroup	California annual herb/grass	Californian mixed annual / perennial freshwater vernal pool / swale bottomland	Ceanothus cuneatus	Ephedra viridis	Ericameria linearifolia - Isomeris arborea	Ericameria nauseosa	Eriodictyon crassifolium Provisional	Eriogonum fasciculatum	Gutierrezia californica	Hazardia (squarrosa, stenolepis)	Juniperus californica	Mediterranean California Naturalized Annual & Perennial Grassland & Meadow	Platanus racemosa	Populus fremontii	Quercus douglasii	Quercus john-tuckeri	Salix exigua	Salix laevigata	Salvia leucophylla	Salvia mellifera	Tamarix	Grand Total
Adenostoma fasciculatum	12	3	2								1																1			19
Adenostoma fasciculatum - Salvia mellifera	1	2																										4		7
Arctostaphylos glauca			8																											8
Artemisia californica				1	2																									3
Artemisia californica - Eriogonum fasciculatum				1	5	1									1												1			9
Atriplex polycarpa						5																								5
Baccharis salicifolia									1																					1
California Annual and Perennial Grassland Macrogroup							4								1	1														6
California annual herb/grass							4																							4
Californian mixed annual / perennial freshwater vernal pool / swale bottomland																														
Ceanothus cuneatus	4		1							5																				10
Ephedra viridis					1																									1
Ericameria linearifolia - Isomeris arborea				1								3																		4
Ericameria nauseosa																													1	1
Eriodictyon crassifolium Provisional																											1			1
Eriogonum fasciculatum					1										4												3			8
Gutierrezia californica												1																		1
Hazardia (squarrosa, stenolepis)																	2													2
Juniperus californica																		6						1						7
Mediterranean California Naturalized Annual & Perennial Grassland & Meadow							1												2											3
Platanus racemosa																				2										2
Populus fremontii																					1									1
Quercus douglasii																						7								7
Quercus john-tuckeri			1																				6							7
Salix exigua																														
Salix laevigata																									1					1
Salvia leucophylla				3	3										2												5			13
Salvia mellifera																												3		3
Tamarix																										1			1	2
Grand Total	17	5	12	6	12	6	9	1	6	4	8	1	2	6	2	2	1	7	7	1	1	11	7	2	136					