Vegetation Classification of Alliances and Associations in Santa Cruz and Santa Clara Counties, California

By
Kendra Sikes, Jennifer Buck-Diaz, Savannah Vu, and Julie M. Evens
California Native Plant Society, Vegetation Program
2707 K Street, Suite 1
Sacramento, CA 95816

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Sequoia sempervirens Forest Alliance with a well-developed herbaceous understory at Wilder Ranch (photo by Alexis LaFever-Jackson)

Photos on Cover:

Top Left: *Quercus wislizeni – Quercus parvula* (tree) Forest & Woodland Alliance at Wilder Ranch State Park (photo by Alex Hubner)

Top Right: *Lupinus chamissonis – Ericameria ericoides* Shrubland Alliance at Wilder Ranch State Park (photo by Lucy Ferneyhough)

Bottom Left: *Adenostoma fasciculatum* Shrubland Alliance with emergent *Quercus agrifolia* in the foreground along Montevina Road, and *Sequoia sempervirens* Forest and *Pseudotsuga menziesii* – (*Notholithocarpus densiflorus – Arbutus menziesii*) Forest & Woodland Alliances in the ravine above Lyndon Canyon Creek (photo by Julie Evens)

Bottom Right: *Lasthenia californica – Plantago erecta – Vulpia microstachys* Herbaceous Alliance at Coyote Ridge Open Space Preserve (photo by Claire Mallen)

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Field/Office Staff and Data Analysts in 2020 – 2023:

Mark Bibbo (CNPS)
Shelly Benson (CNPS)
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Abstract

This report describes approximately 130 alliances and 330 associations that occur in Santa Clara and Santa Cruz Counties, California, comprising the most comprehensive local vegetation classification to date. The vegetation types were defined using a standardized classification approach consistent with the Survey of California Vegetation (SCV) and the United States National Vegetation Classification (USNVC) system. This floristic classification forms the basis for an integrated, countywide vegetation map supported through a collaboration by Santa Cruz Mountains Stewardship Network, Tukman Geospatial LLC, and other partners of the Countywide Vegetation Map and Landscape Database Project, Santa Clara & Santa Cruz. Vegetation ecologists from the California Native Plant Society analyzed plant species data from over 8,600 field surveys collected between 1992 and 2022. The data included over 1,200 new surveys collected in 2020 and 2021 in association with this classification effort. Additional surveys were compiled for the analysis from previous sampling efforts in Santa Clara and Santa Cruz Counties (847), and from nearby counties (more than 6,600) to provide a broad, regional understanding. A total of 32 tree-overstory, 41 shrubland, and 60 herbaceous alliances are described, with 119 tree-overstory, 89 shrubland, and 126 herbaceous associations.

The report results include summary tables of county-wide classification results including a count of surveys by alliance. Appendices include a floristic field key of vegetation types, a table of vegetation types nested within the USNVC hierarchy, and descriptions of each vegetation alliance and association. The descriptions contain stand tables which summarize structural and plant species cover data for each type; stand tables serve as a reference for the county-wide expression of vegetation, as well as plant palettes for future restoration efforts.

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Introduction

Ecological Setting

Santa Clara and Santa Cruz Counties share a boundary along the crest of the Santa Cruz Mountains approximately 70 km (43 miles) in length. While the entirety of Santa Cruz County lies within the Santa Cruz Mountains in the outer coast range, only about one-third of Santa Clara County is within this area (Thomas 1961). To the northeast of the Santa Cruz Mountains, Santa Clara County includes the urbanized Santa Clara Valley and the Diablo Range, or the inner coast range, including Mount Hamilton.

The land area of Santa Cruz County covers about 115,000 hectares (285,000 acres) in a band between the ocean north of Monterey Bay and the crest of the Santa Cruz Mountains. At the county's widest point, the crest is about 25 km (15 miles) from the ocean. Thus, the entire county has direct marine influence with all watersheds draining into the Pacific Ocean, and the coastline being about 58 km (36 miles) in length. The county can be split into four primary watershed units (see Figure 1; CalWater 2004), plus two watersheds that lie primarily in San Mateo County along the northwestern boundary. The vegetation includes Coast Redwood groves, Douglas-fir and tanoak forests, oak and bay woodlands, willow and alder riparian stringers, maritime chaparral, coastal and dune scrub, coastal prairie, freshwater and brackish marshes, and tidal marshes. In the central part of the county are the San Lorenzo and Aptos-Soquel watersheds where the core of the Coast Redwood and Douglas-fir forests occur. In southern Santa Cruz County, the Pajaro River has formed an extensive valley (Thomas 1961) where much of the agricultural lands of the county are concentrated, near Watsonville.

In contrast, Santa Clara County lies on the leeward side of the Santa Cruz Mountains and encompasses about 334,000 hectares (825,000 acres) of land. Only a minor portion of the county boundary has a shoreline along the southern end of the San Francisco Bay. The majority of the county is drained via the Guadalupe River into the bay, except for the southern end of the county which drains into the Pacific by way of the Pajaro River via Llagas Creek (Thomas 1961). The divide occurs in the vicinity of Morgan Hill (ICF International 2012). The county can be split into 8 watersheds, which may or may not extend into adjacent counties (see Figure 1; CalWater 2004). The vegetation includes grasslands, oak woodlands, and bay forests; coastal scrub, mesic and xeric chaparral; freshwater, brackish and salt marshes and salt ponds; willow, maple, and sycamore passageways; pine woodlands and mixed oak forests.

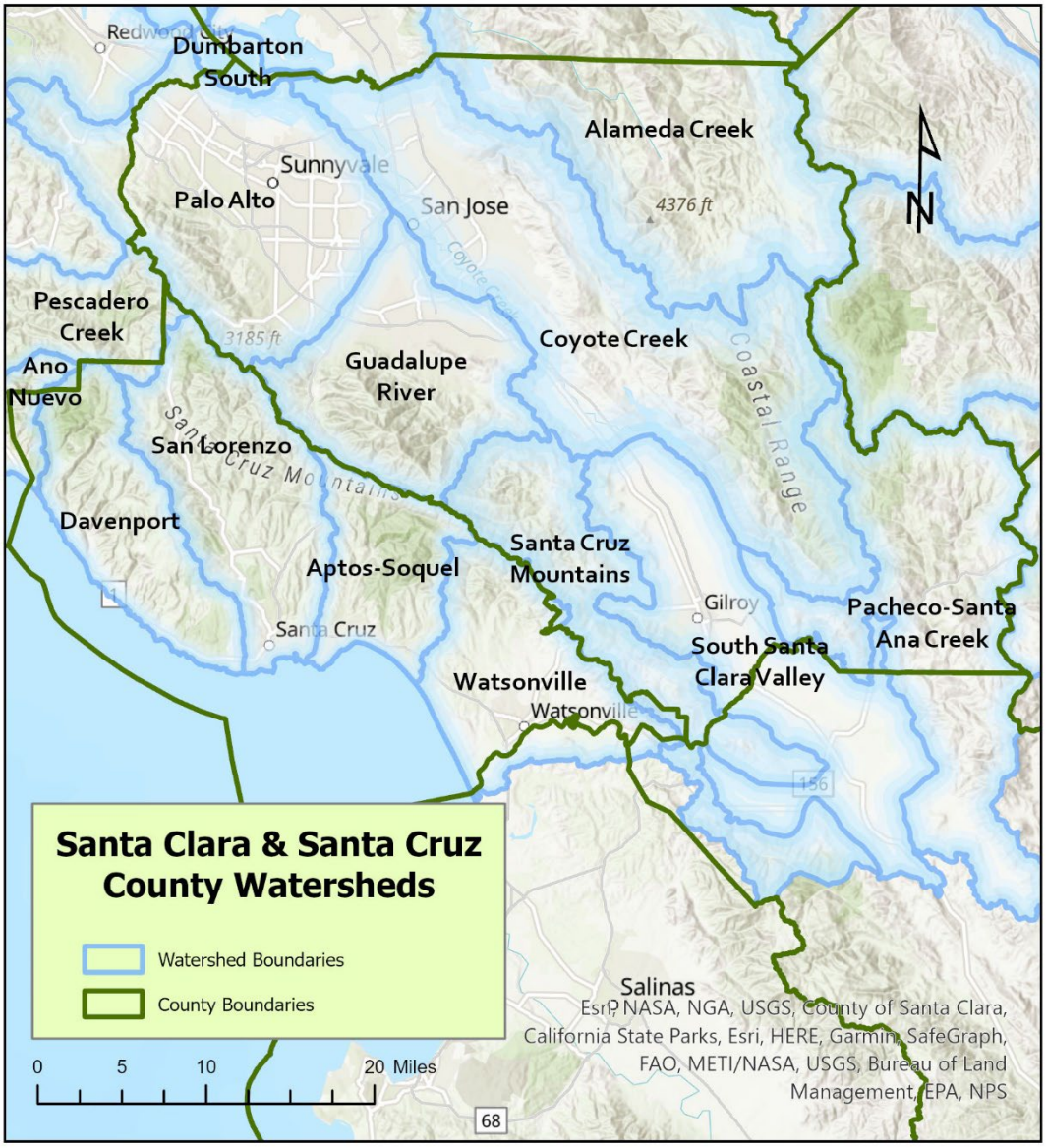

Figure 1. Fourteen watershed units as defined by CalWater (2004) in Santa Clara and Santa Cruz Counties. These units divide the counties into regions and are noted as sample locations in the vegetation descriptions.

As with other areas of central California, the San Andreas Fault forms a boundary between areas underlain by Franciscan Complex rocks on the east side of the fault and underlain by granitic rocks of the Salinian block to the west (Anderson et al. 2001). Serpentine soils occur in zones of faulting and mountain uplift. Serpentine soil has unique chemistry, which is low in calcium and nutrients (N, P, and K) and high in iron and magnesium, and limits plant growth (Alexander 2022). A number of endemic species have evolved to tolerate these soil conditions. Serpentine soils are

prevalent in Santa Clara County. The Santa Clara Valley Habitat Plan estimated 35,000 acres of serpentine soils in their study area which includes 62% of the county (ICF International 2012). This figure translates to 4.2% of the county having serpentine soils. The largest occurrence of serpentine is at Coyote Ridge, with additional outcrops at the Santa Teresa Hills, Communications Hill, Tulare Hill, the foothills of the Santa Cruz Mountains near Chesbro and Calero Reservoirs, the foothills west of Anderson Reservoir, and the foothills west of Coyote Creek upstream of Anderson and Coyote Reservoirs (ICF International 2012).

Another unique habitat in the study area is the Sandhills of Santa Cruz County. Excessively drained sandy Zayante soils cover about 8,000 acres, or 3% of the county (Lee 1994). Unusual vegetation found there includes stands dominated by Ponderosa Pine, and communities previously designated as Sand Parkland and Sand Chaparral (Lee 1994, McGraw 2004).

The typical Mediterranean climate of warm dry summers and cool rainy winters is moderated by the Pacific Ocean, the San Francisco Bay, and fog. Precipitation varies widely across the two counties, with the highest precipitation along the southwest boundary at the crest of the Santa Cruz Mountains, and the lowest rainfall in the valley bottoms (ICF International 2012). Santa Cruz County receives more rainfall than Santa Clara; mean annual rainfall is almost double that of its inland neighbor (101 cm or 39.6 in. versus 59 cm or 23.3 in). Annual rainfall in Santa Cruz ranges from 47 to 155 cm (18.6 –61.1 inches) while rainfall in Santa Clara County varies from 37 to 144 cm (14.6 – 56.6), depending on location. There is a strong difference between the humid coastal belt of coast redwood and Douglas-fir forests and the drier inland portions of grasslands, oak savannah / woodlands, and rocky chaparral (1981-2010 data, PRISM 2012).

The amount of fog also varies between the two counties on either side of the Santa Cruz Mountain crest, with the limit of well-developed coast redwood forests coinciding with the limit of summer coastal fogs (Thomas 1961). Fog and cloud cover data, for June, July, August, and September 1999-2009, show average hours per day of fog or clouds to vary from 2.7 hrs to 9.1 hours per day in Santa Cruz County, depending on location within the county, with a mean of 4.3 hours. Santa Clara County receives less summer fog and cloud cover, varying from 2.0 to 6.5 hours per day, with a mean of 3.4 (Torregrosa et al. 2016). At the same time, average annual maximum temperature varies from 62 to 74° F (16-23° C) across both counties with similar mean values for both (PRISM 2006).

Project & Classification Overview

In 2020, a collaborative group of agencies and partners formed the Vegetation Map and Landscape Database Project for Santa Cruz and Santa Clara Counties, initiated by the Santa Cruz Mountain Stewardship Network (SCMSN) to map the region's topography, physical and biotic features, and diverse plant communities. The foundation for the map is the standard vegetation classification approach, which is supported by the California Native Plant Society Vegetation Program (CNPS) and the California Department of Fish and Wildlife's (CDFW) Vegetation Classification and Mapping Program (VegCAMP). This report summarizes the methods and results of the classification effort completed by CNPS and vetted by VegCAMP and NatureServe ecologists, to describe the vegetation types found across Santa Clara and Santa Cruz Counties.

CNPS uses an integrated set of steps for classification compliant with *A Manual of California Vegetation* (CNPS 2023) and the United States National Vegetation Classification System (FGDC 2008). The field key and descriptions of the vegetation for Santa Clara and Santa Cruz Counties are included herein, as well as a table showing the hierarchical relationship of the full local classification to the United States National Vegetation Classification (USNVC). The USNVC hierarchy is composed of eight levels, organized into three upper, three middle, and two lower levels as shown below in Table 1.

Table 1. The levels of the USNVC hierarchy for natural vegetation.

Level	Example
Upper	
Level 1 – Formation Class	Forest & Woodland
Level 2 – Formation Subclass	Temperate & Boreal Forest & Woodland
Level 3 – Formation	Cool Temperate Forest & Woodland
Middle	
Level 4 – Division	Vancouverian Forest & Woodland
Level 5 – Macrogroup	Vancouverian Coastal Rainforest
Level 6 – Group	Californian Coastal Redwood Forest
Lower	
Level 7 – Alliance	*Sequoia sempervirens* Forest & Woodland Alliance
Level 8 – Association	*Sequoia sempervirens* – *Notholithocarpus densiflorus* / *Vaccinium ovatum* Association

The regional classification defines vegetation at the two finest levels, Alliance and Association. The Alliance is defined by plant species composition, habitat conditions, physiognomy, and diagnostic species; at least one of the diagnostic species is typically found in the uppermost or dominant stratum (Jennings et al. 2009). The Association is the most detailed classification level and reflects more specific characteristics of vegetation such as finer-level differences in species composition, topography, soils, substrate, climate, hydrology, and disturbance regime (FGDC 2008). Associations often recognize two or more diagnostic species found in different vegetation layers (Sawyer et al. 2009).

While this document represents the most comprehensive vegetation classification of Santa Clara and Santa Cruz Counties to date, further refinement of types is expected with additional site-specific data collection and analyses from the greater Bay Area region as well as future changes to vegetation due to disturbance (e.g., fire, drought, and climate change), and natural successional shifts that occur across the landscape over time.

Methods

Data Collection

CNPS, Santa Cruz Mountains Stewardship Network, and Tukman Geospatial LLC initially compiled available vegetation datasets from previous sampling, classification, and mapping efforts. CNPS, CDFW, and the mapping team drafted a preliminary list of classification and mapping units, and many agency partners assisted in refining this preliminary list. Then we identified specific vegetation types that needed further representation in classification surveys, and determined target sampling sizes, while agency partners helped identify priority locations, and provided land access for sampling. The project manager (Danny Franco, Golden Gate National Park Conservancy) additionally coordinated land access, which assisted in spatially expanding the sampling effort on public and private lands.

Beginning with a training in the fall of 2020, the SCMSN field staff (Emma Wheeler) joined a team from UC Santa Cruz Arboretum, led by Lucy Ferneyhough, and Santa Clara Valley Water District (Clare Mallen) to sample vegetation across the region. CNPS vegetation staff (Jennifer Buck-Diaz and Kendra Sikes) met with the sampling team weekly to help coordinate the sampling effort. The field staff sampled opportunistically to capture a range of vegetation types across the study area.

Field staff used the CNPS-CDFW Combined Vegetation Rapid Assessment and Relevé protocol for sampling (see https://www.cnps.org/plant-science/field-protocols-guidelines for copies of the field form and protocol) after training and calibration by CNPS and CDFW staff. Protocols comply with state and national standards as defined by the Survey of California Vegetation (SCV; VegCAMP 2022) and the US National Vegetation Classification (USNVC 2020) and are dependent on the recognition of a *stand* as the basic physical unit of vegetation in a landscape. A stand has both compositional and structural integrity. Compositional integrity is defined as similarity in species composition and relative cover; structural integrity refers to general regularity in the horizontal and vertical spacing of plant species as a result of topography, soils, geology, climate, slope, exposure, and site or disturbance history. A stand has no set size and may represent patterns as small as zones within a vernal pool, or quite expansive patches, such as a Douglas-fir forest occupying several hundred acres.

The survey data included the date of sampling, GPS location, environmental characteristics of the sampled stands, vegetation layer information, site history, and the field-assessed vegetation type. Additionally, four digital photos were taken in the cardinal directions at the GPS point for each survey location, using digital cameras having a minimum of 8-megapixel resolution. Complete species lists were recorded for plot-based relevé surveys, while the most dominant and/or characteristic species were recorded for stand-based Rapid Assessment surveys (RA's). Percent cover estimates were recorded for all species listed in relevés and RA's. Data were primarily recorded on paper field forms, while Valley Water used Survey123 to collect all data electronically. Spatial information and a subset of the data included on the datasheets were captured on GPS-enabled devices running ESRI's Collector application. Spatial data were stored in a geodatabase feature class. Survey data from field forms and field devices were entered into a standardized Microsoft Access database and were quality-controlled for accuracy.

Analysis and Classification

Vegetation rapid assessment and relevé data were analyzed by CNPS in 2022. Prior to analysis, scientific names of all taxa were first converted to standard alpha-numeric codes used by the PLANTS Database (USDA NRCS 2023). A prefix of "2" was applied to custom codes for taxa recognized by the Jepson eFlora (Jepson Flora Project 2023) or A Manual of California Vegetation (CNPS 2023), but not the PLANTS Database. General life forms, such as moss and lichen, also have codes beginning with the number 2 (e.g., 2MOSS). Abundance (cover) values for all taxa

were converted to seven different classes using the following modified Braun-Blanquet (1932) cover categories: 1=<1%, 2=1–5%, 3=>5–15%, 4=>15–25%, 5=>25–50%, 6=>50–75%, 7=>75%. The data were then screened for outliers using the Sorensen (Bray-Curtis) Distance Measure, and taxa that occur in a small number of plots (i.e., less than 6 plots) were removed to generate additional plot-by-species matrices with lower coefficients of variation for species (typically <200%) and to minimize chaining.

CNPS analyzed the species cover data using PC-Ord and R software (McCune and Mefford 2006, R Core Team 2013). The cluster analysis used the Sørensen Distance Measure and Flexible Beta Linkage method at -0.25 (McCune and Grace 2002). Using this method of agglomerative clustering, surveys were grouped together based on similarities in species composition and abundance (McCune and Mefford 1997). CNPS conducted an initial cluster analysis including all surveys in the available dataset. The initial cluster analysis was performed to partition the dataset into manageable subsets. Indicator species analysis (ISA) was used to select cluster group levels for classification analysis. ISA produced indicator values for each species across different cluster group levels (ranging from 2 to 50), testing for statistical significance using a quantitative/binary response with 4999 randomizations (Dufrêne and Legendre 1997). The cluster group levels that had relatively high numbers of significant indicators and relatively low overall mean p-values were chosen for the final evaluation of the community classification (McCune and Grace 2002).

The initial analysis consisted of the following steps:

1. Import a plot-by-species matrix into PC-Ord with percent cover values of plants converted into Braun-Blanquet cover classes
2. Run summary statistics on the complete dataset and remove taxa occurring in < 2, 3, etc. surveys. Determine the coefficient of variation (CV), and species and plot outliers for each output. Use an output with a CV less than 200%, if possible
3. Decide on an output from step 2 and remove plot and species outliers greater than 3 standard deviations from the mean, using Sorensen Distance Measure
4. Run cluster analysis on the chosen output to determine the arrangement of samples based on species abundance and presence
5. Run indicator species analysis (ISA) at each cluster group level, from 2 groups up to the maximum number possible (all groups must have at least 2 samples)

6. Use ISA results to settle on the best number of subsets to use in subsequent analyses.

Because there was a large number of surveys within the dataset that had already been classified, not all of the 9 subsets went through a secondary cluster analysis. Two subsets that had over 90% of their samples already classified were not analyzed further, instead the remaining surveys were named by using the results of their initial cluster analysis. Five of the subsets were further analyzed using supervised techniques of vegclust, an R analysis package (De Cáceres 2021). One of the five subsets was run through vegclust using the Fuzzy c-means (FCM) model which creates groups of like surveys without fixed classes (De Cáceres and Wiser 2021).

Four of the subsets were run using vegclust with the Hard Noise Clustering (HNC) model (De Cáceres and Wiser 2021). Fixed classes were chosen by querying whether the named surveys in any subset shared an association name with other surveys in a different subset. If less than 80% of the surveys of that association were in the subset, that association was excluded from selection as a fixed class. Also excluded from fixed classes were vegetation types that were only to alliance level or only had a single named survey. The analysis assigns surveys to one of the selected fixed classes, which match an existing vegetation association, to one mobile class created by the analysis, and a noise class.

Two subsets were analyzed using a secondary PCOrd cluster analysis. Whatever secondary analysis procedure was performed, the classification process proceeded as follows:

1. Determine preliminary alliance and association names for each of the samples based on cluster or group membership, species constancy, abundance, and existing classification rules
2. Develop decision and membership rules for each association and alliance by summarizing species cover, species constancy, and diagnostic species for the type for the floristic field key and descriptions
3. Use the decision and membership rules to assign final alliance and association names to all samples included in the analysis and all outlier samples removed from the dataset.

During the classification process, samples were partitioned into groups based on cluster membership. Membership rules for assigning samples to Alliance and an Association (if possible) were defined primarily by species constancy and abundance; however, pre-existing classifications and floras were consulted to define

analogous/similar types. Each sample was evaluated for consistency within a group, and samples that were misclassified in the cluster analysis were reclassified based on the membership rules. The resulting floristic classification is compliant with *A Manual of California Vegetation* (CNPS 2023) and the USNVC (FGDC 2008, USNVC 2020). The most specific vegetation type, the association, is defined by a group of samples that have similar dominant and/or characteristic species in the overstory as well as other important or indicator species, whereby these species are distinctive for a particular environmental setting. A set of similar associations is grouped hierarchically to the next higher level in the classification, the alliance. These are grouped sequentially into the group, macrogroup, division, and upwards through the formation, sub-class, and class levels.

Following the analysis of field data and development of the classification and field key, CNPS engaged peer reviewers including state ecologists at VegCAMP (including Rachelle Boul and Todd Keeler-Wolf) and national ecologists at NatureServe (Don Faber-Langendoen). This process has involved two parallel efforts: 1) evaluate the existing alliance and association units to determine types for addition or revision in both the state and national classification systems, and 2) apply the upper levels of the recently revised USNVC hierarchy (see table 1) to ensure conformity in our state classification (per USNVC 2023). While working to apply the most current version of the 8-level USNVC hierarchy, we also are making recommendations on revisions and refinements for the upper levels of the hierarchy as well as the lower levels (Faber-Langendoen et al. 2018). This dynamic process is on-going since it includes various peer reviewers (such as western regional ecologists from the Washington Heritage Program), whereby updates and improvement still may occur in the future. In the meantime, the California state classification may have minor differences in the alliance and association names as compared to the USNVC (or in their concepts), and we are working towards aligning these state and national efforts.

Upon conferring alliance and association units, CNPS has written detailed local vegetation descriptions for Santa Clara and Santa Cruz Counties. CNPS office staff (namely, Kendra Sikes, Savannah Vu, and Julie Evens) wrote and edited the descriptions. The descriptions are divided into three sections based on general lifeform (dominance by trees, shrubs, and herbs); they are organized alphabetically by alliance within each section followed by their respective association descriptions. Alliance descriptions begin with a statewide and a local narrative, including vegetation lifeform summary information and membership rules. Next, a summary of the environmental setting is provided including elevation, aspect, slope, macro

topography, ground surface cover, soil texture, geology and county distribution by watershed (see watershed map, Figure 1). Cover of exotic species are noted as site impacts, along with a list of associations found in either county. Finally, classification comments are provided along with data references, global and state rarity ranks, and sample size. References for datasets in the descriptions may not be included in the Reference section of this report. All references are available for review using the bibliography available through *A Manual of California Vegetation* Online (CNPS 2023).

Each alliance and association description includes a stand table that summarizes species composition by type and lists constancy and cover estimate values (average, minimum and maximum) for all taxa occurring in at least 20% of stands. For vegetation types with a low sample size from Santa Clara and Santa Cruz Counties (<6), related surveys from surrounding counties are included in the data summaries. The definitions and conventions used to develop the descriptions and the field key are available as a comprehensive glossary in Appendix A.

Results

Data Compilation

A total of 747 surveys of vegetation were sampled from September 2020 through September 2021 through funding provided specifically for this classification effort, including 305 rapid assessment (RA), 267 relevé, and 175 reconnaissance surveys (Figure 2; pink dots). In addition, Valley Water contributed data by collecting 420 RA surveys (Figure 2; blue dots), primarily in riparian zones, to build a dataset for reference conditions in restoration projects which began in May of 2020 (Mallen 2020). Valley Water collaborated with CNPS to ensure that the data collected would be suitable for classification purposes. CNPS contributed additional surveys for long-term monitoring of redwoods in post-fire and unburned conditions (17 releves; Evens and LaFever-Jackson 2023), as well as other post-fire stands within State Parks and other lands collected by CNPS and UCSC teams after the CZU and SCU fire complexes in 2020 (55 RA's, 2 releves). Thus, a total of 1241 surveys were conducted in 2020 and 2021.

Surveys from previous sampling and mapping efforts in the two-county region (841) and from adjacent coastal counties (6,601) were compiled to include in the classification analysis and provided a broader, regional understanding of vegetation types with overlapping floristic and ecological characteristics. The compiled data were collected between 1992 and 2021, with many of the surveys coming from Marin, San Mateo, and Sonoma Counties (see Buck-Diaz et al. 2021, Sikes et al. 2021, Klein et al. 2015). Data compiled specifically from Santa Clara and Santa Cruz Counties are listed in Table 2. CNPS reviewed the quality and accuracy of the data and archived it with newly collected data into a standardized Microsoft Access database. Data will be publicly available through CDFW's Biogeographic Information and Observation System (BIOS) and other data-sharing platforms upon project completion.

Species names were entered in the survey database as they were recorded in the field, yet the PLANTS Database (USDA NRCS 2023) was used as the standard for nomenclature (both botanical names and accompanying codes) for this classification effort. Taxa that could not be found in the PLANTS Database were assigned custom codes based on the Jepson eFlora (Jepson Flora Project 2023).

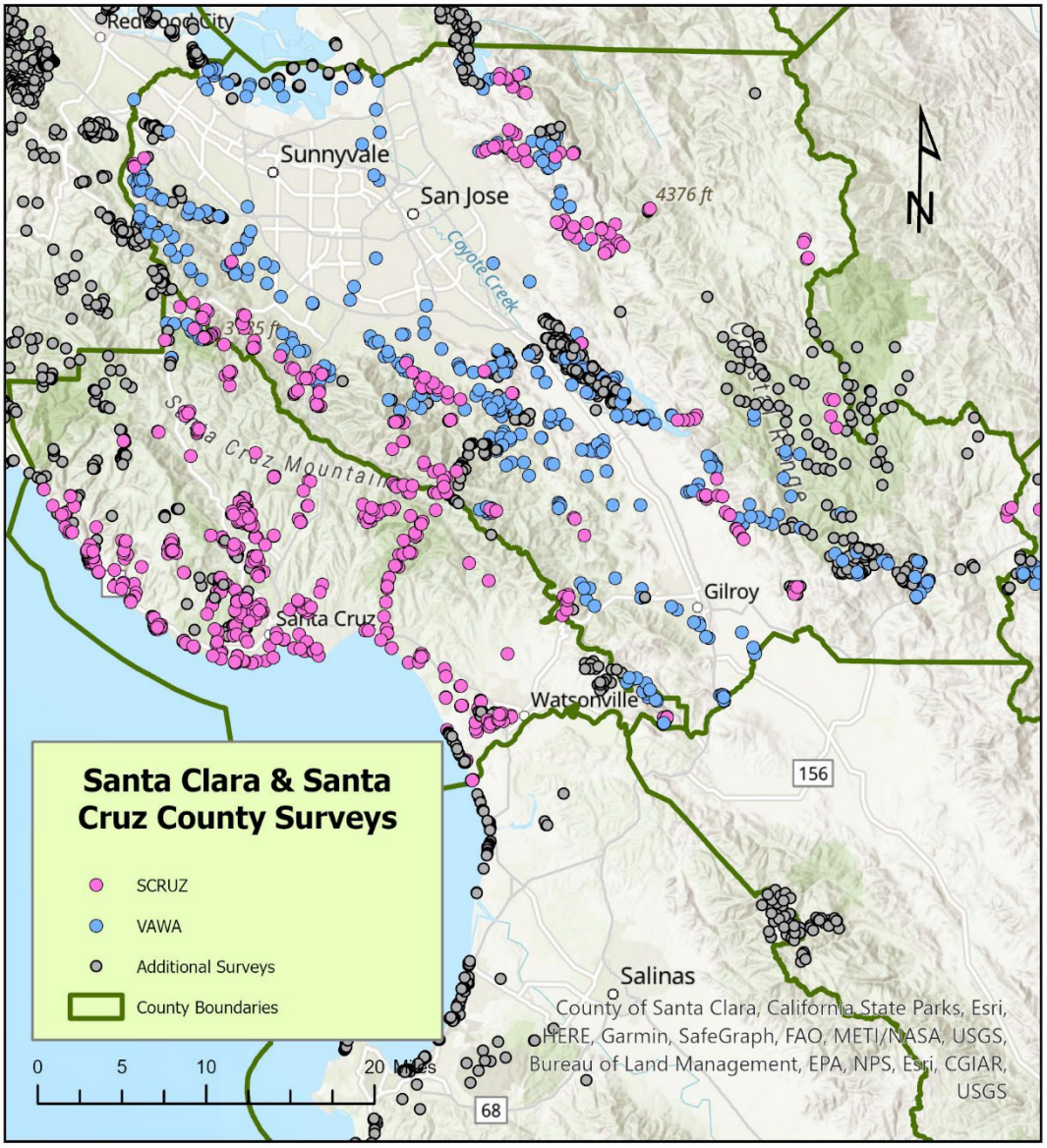

Figure 2. Locations of vegetation survey points in Santa Clara and Santa Cruz Counties. The pink and blue points show surveys collected in 2020 and 2021 specifically for this project. The smaller gray points show surveys compiled from other projects and included in the classification.

Table 2. Compilation of vegetation classification samples by focal area and entity within Santa Clara (SCL) and Santa Cruz (SCR) Counties. The first 2 rows are the surveys collected specifically for this project as displayed in Figure 2.

Focus/Location of sampling	Entity	Type of survey	SCL samples	SCR samples
Santa Cruz & Santa Clara Counties	UCSC / CNPS / SCMSN staff	RA's, Relevés, Recons	223	541
Santa Clara Co. Riparian	Valley Water (Claire Mallen)	RA's	391	21
Redwoods Long-Term Monitoring	CNPS / UC Santa Cruz	Relevés	0	17
Post-fire CZU burn footprint	CNPS / UC Santa Cruz	RA's, Recons	0	24
Post-fire SCU burn footprint	CNPS / UC Santa Cruz	RA's, Relevés, Recons	31	0
Alameda Watershed	SFPUC / Nomad Ecology	RA's, Relevés	16	0
Canada de los Osos ER	DFW Region 3	RA's	56	0
Coyote Ridge	CNPS chapter / state staff	Relevés	90	0
Coyote Ridge	Santa Clara Valley Open Space Authority	Transects	58	0
Don Edwards National Wildlife Refuge	USGS Western Ecological Research Center (K. Thorne)	Transects	56	0
Grasslands	Sasha Gennet (TNC), UCB Range Ecology	Relevés	9	2
Grasslands, Central Coast	San Jose State University / Cort Johnson Thesis	Point-Intercept Transect	82	15
Post-fire Hermit Thrush habitat	Allison R.P. Nelson	RA's	0	5
Loma Prieta fire area	Santa Clara Valley Open Space Authority	Relevés	30	0

Focus/Location of sampling	Entity	Type of survey	SCL samples	SCR samples
Maritime chaparral	UC Santa Cruz (B. Hall) & San Francisco State (M. Vasey)	Macro Plots, Relevés	11	14
Naval Lands Santa Cruz	E. Wrubel, Garcia & Assoc.	RA's	0	7
Quail Hollow Quarry	Jodi McGraw	Relevés	0	109
Range Management	Point Blue Conservation Science	Transects	6	24
Santa Clara County	CNPS chapter	RA's, Relevés	140	0
Santa Cruz County	CNPS chapter	RA's, Relevés	2	16
San Mateo Veg Classification	Golden Gate National Parks Conservancy / UC Santa Cruz	RA's	3	4
State Parks Central Coast	State Parks, Geographic Information Center	RA's, Relevés	39	12
Sycamore Alluvial Woodland	CDFW	Point-Intercept Transect	10	0
Watsonville Slough ER	DFW Region 3	RA's	0	15
Northern Coastal Scrub	San Francisco State / E. Wrubel	Relevés	0	3
		Total	**1253**	**829**

Classification

Vegetation rapid assessment and relevé data were analyzed by CNPS in 2022. An additional 6,601 surveys from neighboring counties were included to provide a broader, regional understanding of vegetation types with overlapping floristic and ecological characteristics. Figure 3 provides a representation of data that was newly compiled and classified in comparison to surveys that were classified by CNPS in earlier work (Sikes et al. 2021).

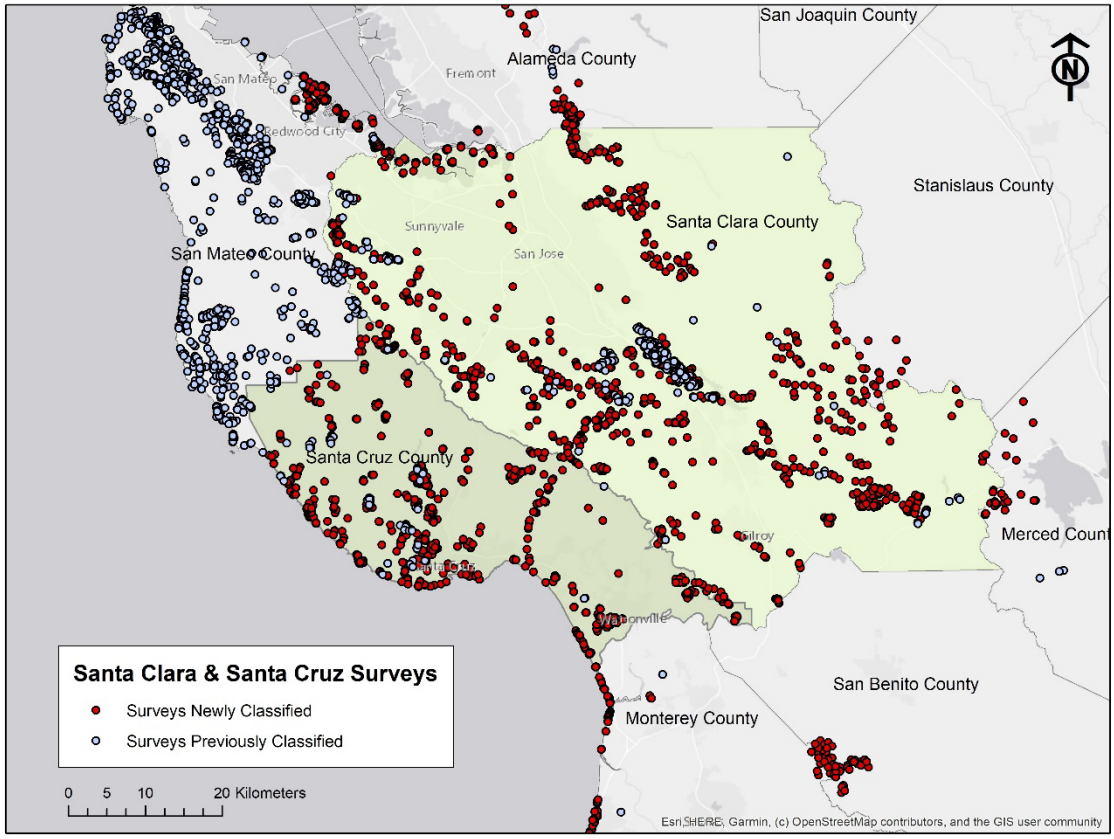

Figure 3. Locations of survey points in Santa Clara, Santa Cruz and adjacent counties. The red points were newly classified for this project. The other points show surveys included in the classification analyses which were previously classified (Sikes et al. 2021).

The dataset was partitioned into nine subsets during analysis that broadly corresponded to patterns of redwoods, oaks and douglas-fir, beach/dune, coastal scrub, coyote bush, dry interior vegetation, chaparral, riparian, and saline habitats. Cluster and Indicator Species Analyses were conducted on two of the nine subsets to select appropriate cluster grouping variables for community classification. Both broad- and fine-scale cluster grouping variables were selected for each subset

based on the presence of relatively high numbers of significant indicators and low average p-values. Five of the subsets were grouped using the supervised classification techniques of vegclust, an R analysis package (De Cáceres 2021).

After producing a draft classification, VegCAMP and NatureServe ecologists reviewed it and provided feedback for additional refinement. The floristic vegetation classification resulted in approximately 130 alliances and 330 associations within Santa Clara or Santa Cruz Counties: 32 tree-overstory, 41 shrubland, and 60 herbaceous/grassland alliances (Table 3); and 119 tree-overstory, 89 shrubland, and 126 herbaceous/grassland associations (Appendix B, Table 4). Of the alliances, 66 are currently considered sensitive plant communities (S1-S3), 44 are ranked as S4 or S5 (not sensitive). While most of the associations have not been formally ranked, over 200 of the associations are estimated to be sensitive plant communities (S1-S3). Of the types classified, 20 alliances and 29 associations are considered “Semi-Natural” or “Ruderal” because they are dominated and characterized by non-native plants that are reproducing and maintaining populations in the wild.

The attributes of sampled vegetation, including species composition, structure, and cover, were used to develop a floristic field key to the vegetation types of Santa Clara and Santa Cruz Counties (Appendix C) and the local descriptions (Appendix D). The field key is organized by vegetation layer (e.g., tree-overstory, shrubland, herbaceous), USNVC hierarchical level (e.g., Group, Alliance, and Association), and environmental setting (e.g., riparian / wetland, upland). The field key provides users the ability to assess vegetation types while in the field and wasfield tested in collaboration with the mapping team during field reconnaissance trips and field sampling in Santa Cruz and Santa Clara counties. Both the field key and descriptions contain membership rules for each alliance in the classification. While 8,673 surveys were included in the comprehensive vegetation classification analysis, the descriptions (Appendix D) are limited to those located in Santa Cruz or Santa Clara Counties (2,082 surveys), unless otherwise noted in the classification comments (when sample size was low). In addition, 214 surveys were excluded from the descriptions because they were within 200 m of a survey of the same association or were return visits to the same plot location.

Additionally, Table 5 in Appendix B represents the classification list of alliances and associations in Santa Clara and Santa Cruz Counties nested within the USNVC hierarchy. The classification names for each field survey are included within a survey database. The survey data will be publicly available upon project completion through CDFW’s Biogeographic Information and Observation System (BIOS; https://apps.wildlife.ca.gov/bios6/).

Table 3. Alliance list with sample size (n) for surveys collected in Santa Clara and Santa Cruz Counties, California. An asterisk (*) denotes alliances that are likely present or known to be present but do not have classification surveys in either county.

Lifeform	Alliance Name	n
Forest And Woodland	*Acer macrophyllum – Alnus rubra* Alliance	48
	Acer negundo Alliance	6
	Aesculus californica Alliance	16
	Alnus rhombifolia Alliance	19
	Arbutus menziesii Alliance	5
	Eucalyptus spp. – *Ailanthus altissima – Robinia pseudoacacia* Semi-Natural Alliance	4
	Fraxinus latifolia Alliance	3
	Hesperocyparis (pigmaea, abramsiana, macrocarpa, goveniana) Alliance	4
	Hesperocyparis macrocarpa – Pinus radiata Semi-Natural Alliance*	0
	Juglans hindsii and Hybrids Alliance	1
	Notholithocarpus densiflorus Alliance	16
	Pinus attenuata Alliance	17
	Pinus coulteri Alliance	1
	Pinus muricata – Pinus radiata Alliance	4
	Pinus ponderosa Alliance	28
	Pinus sabiniana Alliance	9
	Platanus racemosa – Quercus agrifolia Alliance	68
	Populus fremontii – Fraxinus velutina – Salix gooddingii Alliance	7
	Populus trichocarpa Alliance	16
	Pseudotsuga menziesii – (Notholithocarpus densiflorus – Arbutus menziesii) Alliance	18
	Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni) Alliance	5
	Quercus agrifolia Alliance	99
	Quercus chrysolepis (tree) Alliance	20
	Quercus douglasii Alliance	40
	Quercus kelloggii Alliance	20
	Quercus lobata Alliance	28
	Quercus lobata Riparian Alliance	18
	Quercus wislizeni – Quercus parvula (tree) Alliance	21
	Salix gooddingii – Salix laevigata Alliance	32
	Salix lucida ssp. lasiandra Alliance	8
	Schinus (molle, terebinthifolius) – Myoporum laetum Semi-Natural Alliance	1
	Sequoia sempervirens Alliance	61
	Umbellularia californica Alliance	44
Shrubland	*Acacia* spp. – *Grevillea* spp. – *Leptospermum laevigatum* Provisional Semi-Natural Alliance	1

Lifeform	Alliance Name	n
	Adenostoma fasciculatum Alliance	35
	Adenostoma fasciculatum – Salvia spp. Alliance	1
	Arctostaphylos (canescens, manzanita, stanfordiana) Alliance	3
	Arctostaphylos (crustacea, tomentosa) Alliance	87
	Arctostaphylos (nummularia, sensitiva) – Chrysolepis chrysophylla Alliance	13
	Arctostaphylos glandulosa Alliance	1
	Arctostaphylos glauca Alliance	30
	Artemisia californica – (Salvia leucophylla) Alliance	45
	Baccharis pilularis Alliance	60
	Baccharis salicifolia Alliance	6
	Ceanothus (oliganthus, tomentosus) Alliance	1
	Ceanothus cuneatus Alliance	13
	Ceanothus papillosus Alliance	5
	Ceanothus thyrsiflorus Alliance	9
	Cercocarpus montanus Alliance	9
	Cornus sericea Alliance	8
	Corylus cornuta var. californica Alliance	4
	Cytisus scoparius – Genista monspessulana – Cotoneaster spp. Semi-Natural Alliance	3
	Diplacus aurantiacus Alliance	5
	Eriogonum wrightii – Eriogonum heermannii – Buddleja utahensis Alliance	7
	Frangula californica – Rhododendron occidentale – Salix breweri Alliance	13
	Gaultheria shallon – Rubus (ursinus) Alliance	7
	Lotus scoparius – Lupinus albifrons – Eriodictyon spp. Alliance	28
	Lupinus arboreus Alliance	3
	Lupinus chamissonis – Ericameria ericoides Alliance	5
	Malacothamnus fasciculatus – Malacothamnus spp. Alliance	2
	Prunus ilicifolia – Heteromeles arbutifolia – Ceanothus spinosus Alliance	18
	Quercus berberidifolia Alliance	7
	Quercus durata Alliance	21
	Quercus wislizeni – Quercus chrysolepis (shrub) Alliance	1
	Rhus trilobata – Crataegus rivularis – Forestiera pubescens Alliance	2
	Ribes quercetorum – Rhus trilobata – Frangula californica Alliance	1
	Rosa californica Alliance	3
	Rubus armeniacus – Sesbania punicea – Ficus carica Semi-Natural Alliance	1
	Rubus spectabilis – Morella californica Alliance	2
	Salix exigua Alliance	8
	Salix hookeriana – Salix sitchensis – Spiraea douglasii Alliance	1

Lifeform	Alliance Name	n
	Salix lasiolepis Alliance	24
	Salvia mellifera – (Artemisia californica) Alliance	15
	Toxicodendron diversilobum Alliance	9
Herbaceous	*Abronia latifolia – Ambrosia chamissonis* Alliance	18
	Ammophila arenaria Semi-Natural Alliance	2
	Amsinckia (menziesii, tessellata) – Phacelia spp. Alliance	1
	Atriplex prostrata – Cotula coronopifolia Semi-Natural Alliance	3
	Avena spp. – *Bromus* spp. Semi-Natural Alliance	31
	Azolla (filiculoides, microphylla) Alliance	3
	Bidens cernua – Euthamia occidentalis – Ludwigia palustris Provisional Alliance	6
	Bolboschoenus maritimus Alliance	7
	Brassica nigra – Centaurea (solstitialis, melitensis) Semi-Natural Alliance	4
	Bromus carinatus – Elymus glaucus Alliance	22
	Cakile (edentula, maritima) Provisional Semi-Natural Alliance	2
	Calamagrostis nutkaensis Alliance	1
	Carex barbarae Alliance	1
	Carex nudata Alliance	1
	Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus Alliance	11
	Centromadia (pungens) Alliance	1
	Ceratophyllum demersum Aquatic Provisional Alliance	2
	Conium maculatum – Foeniculum vulgare Semi-Natural Alliance	6
	Corethrogyne filaginifolia – Eriogonum (elongatum, nudum) Alliance	44
	Cortaderia (jubata, selloana) Semi-Natural Alliance*	0
	Cressa truxillensis – Distichlis spicata Alliance	5
	Cynodon dactylon – Crypsis spp. – Paspalum spp. Semi-Natural Alliance	2
	Cynosurus echinatus – Arrhenatherum elatius Semi-Natural Alliance*	0
	Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica Alliance	17
	Distichlis spicata – Frankenia salina Coastal Alliance	27
	Eleocharis (acicularis, macrostachya) Alliance	12
	Eriophyllum staechadifolium – Erigeron glaucus – Eriogonum latifolium Alliance	24
	Eryngium aristulatum Alliance*	0
	Eschscholzia (californica) – Lupinus (nanus) Alliance	6
	Festuca idahoensis – Danthonia californica Alliance	31
	Heterotheca (oregona, sessiliflora) Alliance	1
	Holcus lanatus – Anthoxanthum odoratum Semi-Natural Alliance	2
	Holocarpha (heermannii, virgata) Alliance	4
	Hydrocotyle (ranunculoides, umbellata) Alliance	3

Lifeform	Alliance Name	n
	Juncus arcticus (var. balticus, mexicanus) Alliance	7
	Juncus (effusus, patens) – Carex (pansa, praegracilis) Alliance	24
	Lasthenia californica – Plantago erecta – Vulpia microstachys Alliance	106
	Lasthenia glaberrima Alliance*	0
	Lepidium latifolium – (Lactuca serriola) Semi-Natural Alliance	9
	Leymus cinereus – Leymus triticoides Alliance	16
	Leymus mollis Alliance	6
	Lilaeopsis occidentalis Provisional Alliance*	0
	Lolium perenne Semi-Natural Alliance	27
	Ludwigia (hexapetala, peploides) – Eichhornia crassipes Provisional Semi-Natural Alliance	4
	Mesembryanthemum spp. – *Carpobrotus* spp. Semi-Natural Alliance	3
	Mimulus guttatus – Cirsium spp. – *Stachys* spp. Alliance	24
	Monolopia (lanceolata) – Coreopsis (calliopsidea) Alliance*	0
	Nassella spp. – *Melica* spp. Alliance	147
	Nuphar lutea Freshwater Aquatic Provisional Alliance*	0
	Phalaris aquatica – Phalaris arundinacea Semi-Natural Alliance	3
	Plagiobothrys nothofulvus Alliance	2
	Poa pratensis – Agrostis gigantea – Agrostis stolonifera Semi-Natural Alliance	2
	Polygonum lapathifolium – Xanthium strumarium Alliance	27
	Ruppia (cirrhosa, maritima) Alliance*	0
	Sarcocornia pacifica (Salicornia depressa) Alliance	49
	Schoenoplectus (acutus, californicus) Alliance	20
	Schoenoplectus americanus Alliance	15
	Sedum spathulifolium Provisional Alliance*	0
	Selaginella (bigelovii, wallacei) Alliance	6
	Sparganium (angustifolium) Alliance	3
	Spartina foliosa Alliance	10
	Stuckenia (pectinata) – Potamogeton spp. Alliance	3
	Trifolium variegatum Alliance	1
	Typha (angustifolia, domingensis, latifolia) Alliance	11
Sparsely Vegetated	*Allium* spp. – *Streptanthus* spp. – *Hesperolinon* spp. Serpentinite Alliance	11
	Dudleya cymosa – Dudleya lanceolata / Lichen – Moss Alliance*	0

Discussion

While the sampling effort was in the planning stages, two large fires occurred in the study area between August and September 2020. The CZU (San Mateo – Santa Cruz Unit) lightning complex fire affected the west end of Santa Cruz County and a portion of the adjacent San Mateo County. Roughly 22% of the land area of Santa Cruz County was burned (CAL FIRE 2021). The concurrent SCU (Santa Clara Unit) lightning complex fire burned in the Diablo Range and impacted the northeastern portion of Santa Clara County and extended into 5 adjacent counties. About 20% of the total land area of Santa Clara County was burned (CAL FIRE 2021). These fires limited our ability to survey intact vegetation within certain regions of the project area.

While a similar number of alliances were sampled in each county (Santa Cruz with 95, Santa Clara 101), only 67 vegetation alliances were sampled in both counties. Almost half of the alliances described have samples in one but not both of the two counties. Some of the alliances that were only sampled in one county may also occur in the other county, but are less common there or were not sampled due to the vagaries of land access, accessibility and post-fire conditions in some areas. Other alliances are restricted to one of the counties because suitable habitats are only found there (e.g., sandhills vegetation of various lifeforms in Santa Cruz, serpentine chaparral and grassland vegetation in Santa Clara County).

Though Santa Clara is three times larger in area than Santa Cruz, a similar number of alliances were sampled in each county. Santa Cruz alliances that were not sampled in Santa Clara primarily include near-coastal alliances, endemic conifer types such as *Hesperocyparis (pigmaea, abramsiana, macrocarpa, goveniana)* and *Pinus muricata – Pinus radiata*, or beach and dune types such as *Lupinus arboreus* and *Abronia latifolia – Ambrosia chamissonis*. Santa Clara alliances not found in Santa Cruz include those adapted to hotter, drier conditions or nutrient-poor soils, such as *Pinus coulteri* and *Eriogonum wrightii – Eriogonum heermannii – Buddleja utahensis*.

At the association-level, there was less overlap between the two counties. Only about a third of the associations were sampled in both counties. This meets expectations since associations are often of more limited range than alliances. While Santa Clara had more associations sampled than Santa Cruz (245 as compared to 189), the difference is not proportional to the size of the counties. Santa Clara County has a significantly higher amount of grassland vegetation including associations in the *Lasthenia californica – Plantago erecta – Vulpia microstachys*

Alliance and xeric chaparral such as *Adenostoma fasciculatum* and *Ceanothus cuneatus* Alliances, while Santa Cruz has a greater coverage of moist, forested vegetation including associations in the *Sequoia sempervirens* Alliance.

In this classification, we described 26 new associations. Five of the new associations were wetland types ranging from mudflat to tidal habitats. Four of the new associations were described from the sandhill habitat of Santa Cruz County: *Pinus ponderosa / Chorizanthe pungens*, *Ceanothus cuneatus – (Arctostaphylos* spp.) Maritime, *Lupinus albifrons – Lotus scoparius / Chorizanthe pungens*, and *Chorizanthe pungens – Eriogonum nudum* var. *decurrens – Heterotheca sessiliflora*.

Changes at the alliance level in this classification were primarily expansions to include new associations. Three new alliances were reconfigurations of previously existing types, including broadening or narrowing of alliance concepts due to their similarity in ecological settings. For example, *Salvia mellifera – (Artemisia californica)* Alliance has been merged from the previously accepted *Salvia mellifera* and *Artemisia californica – Salvia mellifera* Alliances. A new *Distichlis spicata – Frankenia salina* Coastal Alliance has been recognized which separates coastal influence salt-tolerant vegetation from interior, alkaline stands of similar composition (i.e., *Distichlis spicata* and related species), to more closely align with the separate ecological units in the USNVC hierarchy. This coastal alliance also includes dominant plants that were previously included in separate alliances, *Distichlis spicata, Frankenia salina*, and *Grindelia stricta*. A similar reconfiguration resulted in the expanded concept of the *Mimulus guttatus – Cirsium* spp. – *Stachys* spp. Alliance. Forbs that are indicative of seeps in lowland situations were combined together, while higher elevation *Mimulus* wetland areas are now treated in the *Senecio triangularis – Veratrum californicum – Mimulus* spp. Alliance.

A few USNVC types are being split and/or recognized at the Alliance level, upon review by western regional ecologists and/or database management by NatureServe for acceptance nationally. This includes the woodland and forest alliances of *Arbutus menziesii* and *Notholithocarpus densiflorus* being split and the *Umbellularia californica* Alliance being recognized. A summary of these changes from both the state and national systems is included in Appendix B, Table 5. Some decisions still pending review by Western Heritage ecologists include the broadening or merging of alliance concepts for coastal freshwater to brackish marshes and aquatic wetlands; we are still gathering input and analysis from California to Washington and east to Colorado. These and future revisions will be forthcoming in the *Manual of California Vegetation* and the USNVC. Updates to state rarity ranking will also need to be

addressed once fine-scale mapping and classification data are synthesized and evaluated.

The classification recognizes various ‘semi-natural’ or ‘ruderal’ types when invasive (non-native) weedy generalist plant species overwhelmingly dominate stands (e.g., >90% relative cover) and substantially replace the typical diagnostic native plants. Setting a high threshold minimizes the creation of new types until it is certain that a characteristic combination of species has been formed (Faber-Langendoen et al. 2018). Semi-natural types include *Ammophila arenaria* and *Mesembryanthemum* spp. – *Carpobrotus* spp., among various other herbaceous alliances. One expanded ruderal shrubland type is the *Cytisus scoparius* – *Genista monspessulana* – *Cotoneaster* spp. Alliance and a new type is the *Acacia* spp. – *Grevillea* spp. – *Leptospermum laevigatum* Alliance. Classifying and mapping these ruderal types can be important to identify and evaluate restoration actions, particularly for ruderal types that negatively impact the local ecosystems – i.e., when the impacts of non-native plant dominance change the natural ecological processes and/or increase threats (e.g., non-native herbs disrupting active dune assemblages, invasive shrubs increasing fuel loads and wildfire threats).

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Appendix A

Glossary

The following terms with their respective definitions have been established in developing the vegetation classification, field keys, and descriptions.

- **Taxon** – Species names defined in the PLANTS Database (USDA NRCS 2023), except in two cases: When a more current name has been assigned in the Jepson eflora (Jepson Flora Project 2023), or for general vegetation terms such as moss and lichen.
- **Lifeform terms:**
  - **Tree** – Is a one-stemmed woody plant that normally grows to be greater than 5 meters tall. In some cases, trees may be multiple-stemmed (ramifying) after fire or other disturbance, but size of mature plants is typically greater than 5 m and undisturbed individuals of these species are usually single stemmed.
  - **Regenerating tree** – seedlings and saplings defined as follows:
    - *Seedlings* – trees clearly of a young age that have less than 1" diameter at breast height (dbh) or have not reached breast height. Applies only to trees propagating from seed; resprouts are not recorded here even if they meet the size requirements.
    - *Saplings* – trees with 1" – 6" dbh and young in age, OR small trees that are less than 1" dbh, are clearly of appreciable age, and are kept short by repeated browsing, burning, or other disturbance. Includes trees that are re-sprouting from roots or stumps following fire, logging or other disturbance. These re-sprouts may exhibit a shrubby form, with multiple small trunks, but are species that are generally considered trees. If a majority of the trunks are greater than 6" dbh, then the re-sprouts would be recorded under the "Tree" stratum.
  - **Understory tree** – trees that grow beneath the main canopy of a forest/woodland.
  - **Shrub** – Is normally a multi-stemmed woody plant that generally has several erect, spreading, or prostrate stems and that is usually between 0.2 meters and 5 meters tall, giving it a bushy appearance. Definitions are blurred at the low and the high ends of the height scales. At the tall end, shrubs may approach trees based on disturbance frequencies (e.g., old-growth re-sprouting species such as *Quercus wislizeni,* etc., may frequently attain "tree size"). At the low end, woody perennial herbs or sub-shrubs of various species are often difficult to categorize into a single life-form; usually sub-shrubs (per USDA-NRCS 2023) were categorized in the "shrub" category.
  - **Herb** – Is any vascular plant species that has no main woody stem-development, and includes grasses, forbs, and perennial species that die-back seasonally.

- **Cryptogam –** Is a nonvascular plant or plant-like organism without specialized water or fluid conducting vascular tissue (i.e., xylem and phloem). Includes mosses, lichens, liverworts, hornworts, and algae.

- **Cover** – The primary metric used to quantify the abundance of a particular species or a particular vegetation layer within a plot. It was measured by estimating the aerial extent of the living plants, or the "bird's-eye view" looking from above for each category. Various subcategories of cover for species and vegetation are defined as follows:
  - **Absolute cover** – Refers to the actual percentage of the ground (surface of the plot or stand) that is covered by a species or group of species. For example, *Pseudotsuga menziesii* covers between 5% and 10% of the stand. Absolute cover of all species or groups if added in a stand or plot may total greater or less than 100% because it is not a proportional number.
  - **Relative cover** – Refers to the amount of the surface of the plot or stand sampled that is covered by one species (or physiognomic group) as compared to (relative to) the amount of surface of the plot or stand covered by all species (in that group). Thus, 50% relative cover means that half of the total cover of all species or physiognomic groups is composed of the single species or group in question. Relative cover values are proportional numbers and, if added, total 100% for each stand (sample).
  - **Dense/Continuous cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where there is greater than 66 percent absolute cover.
  - **Intermittent cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where there is 33-66 percent absolute cover.
  - **Open cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is less than 33 percent absolute cover.
  - **Sparse cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the *average* cover value is <2% absolute cover (though the range in cover could be <1-9% cover).
  - **Emergent** – A plant (or vegetation layer) is considered emergent if it includes plants that rises above a predominant vegetation layer, but that are sparse in cover. It is considered as a member of the next tallest layer, but typically has an absolute cover < 10%.

- **Constancy, Cover-Abundance, and Related Terms** – Used in the key, descriptions and the vegetation constancy tables for the species summarized within all stands of the alliance or association (codes from tables in parentheses):
  - **Constancy** (Con) – Number of occurrences divided by the number of samples X 100%
  - **Diagnostic** – A species or group of species whose relative constancy or abundance differentiates one vegetation type from another; the term can include character, constant, differential, and indicator species (Jennings et al. 2006).
  - **Dominant** (D) – Must be in at least 75% of the samples, with at least 50% relative cover in all samples.

- **Co-dominant** (cD) – Must be in at least 75% of the samples, with at least 30% relative cover in all samples.
- **Characteristic** (Char) – Present in at least 75% of the samples for that vegetation type, with no restriction on cover.
- **Abundant** – Present in 50 to 75% of the samples, with at least 50% relative cover.
- **Usually/Often** (Often) – Present in 50 to 75% of the samples, with no restriction on cover.
- **Sometimes** – Present in 25 to 50% of the samples, with no restriction on cover.
- **Average** (Avg) **and Relative Cover** (RelCov) – Average cover for a taxon in a vegetation type is calculated as the sum of its 'absolute' cover values divided by the total sample size; relative cover is calculated as the comparative sum of cover values for one taxon compared to the sum of cover values of other taxa, in which proportional numbers are derived (see **Cover** section for more details).
- **Minimum** (Min) and **Maximum** (Max) – The minimum and maximum cover values that a taxon had from the surveys of a vegetation type. Values could be an absolute cover value (e.g., 1%) and/or a mid-point value of a cover class (e.g., 2.5% for a cover class of 1–5 %) depending on data available

- **Stand** – Is the basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small such as wetland seeps, and some may be several square kilometers in size such as desert or forest types. A stand is defined by two main unifying characteristics:
  - It has *compositional* integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or gradual.
  - It has *structural* integrity. It has a similar history or environmental setting, affording relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest formerly dominated by the same species, but that has burned on the upper part of the slope and not the lower is divided into two stands. Likewise, a sparse woodland occupying a slope with shallow rocky soils is considered a different stand from an adjacent slope of a denser woodland/forest with deep moister soil and the same species.

- **Vegetation:**
  - **Woodland and forest vegetation**: In the National Vegetation Classification, a woodland is defined as a tree-dominated stand of vegetation with between 25 and 60 percent cover of trees and a forest is defined as a tree-dominated stand of vegetation with 60 percent or greater cover of trees.
  - **Shrubland vegetation**: Shrubs (including dwarf-shrubs) are evenly distributed throughout the stand, providing a consistent (even if sparse) structural component, and one or both of the following criteria are met: (1) Shrubs influence the distribution or population dynamics of other plant species; (2) Shrubs play an important role in ecological processes within the stand.
  - **Herbaceous vegetation**: Herbs are evenly distributed throughout the stand, providing a consistent (even if sparse) structural component, and play an

important role in ecological processes within the stand, and the stand cannot be characterized as a tree or shrub stand.
    - **Nonvascular vegetation**: Nonvascular organisms provide a consistent (even if sparse) structural component and play an important role in ecological processes within the stand.
    - **Semi-natural/ruderal vegetation**: Stands characterized by naturalized non-native species. Examples include *Tamarix* spp., and *Brassica* spp. Note: the terminology for semi-natural versus ruderal plant communities is still under discussion with ESA Vegetation Panel and Hierarchy Review Working Group, and in the last 5 years the classification names have gone back and forth between these two terms.

- **US National Vegetation Classification (USNVC, or NVC) Hierarchy Levels:**
    - **Class** – A vegetation classification unit of high rank (1st level) defined by a broad combination of dominant general growth forms adapted to basic moisture, temperature, and/or substrate or aquatic conditions (FGDC 2008).
    - **Subclass –** A vegetation classification unit of high rank (2nd level) defined by a combination of general dominant and diagnostic growth forms that reflect global mega- or macroclimatic factors driven primarily by latitude and continental position, or that reflect overriding substrate or aquatic conditions (FGDC 2008).
    - **Formation –** A vegetation classification unit of high rank (3rd level) defined by a Combination of dominant and diagnostic growth forms that reflect global macroclimatic conditions as modified by altitude, seasonality of precipitation, substrates, and hydrologic conditions (FGDC 2008).
    - **Division –** A vegetation classification unit of intermediate rank (4th level) defined by a combination of dominant and diagnostic growth forms and a broad set of diagnostic plant species that reflect biogeographic differences in composition and continental differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (FGDC 2008).
    - **Macrogroup** – A vegetation classification unit of intermediate rank (5th level) defined by a moderate set of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (FGDC 2008).
    - **Group** – A vegetation classification unit of intermediate rank (6th level) defined by combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (FGDC 2008).
    - **Alliance** – A classification unit of vegetation of low rank (7th level), containing one or more associations and defined by one or more diagnostic species, often of high cover, in the uppermost layer or the layer with the highest canopy cover. Alliances reflect physiognomy as well as regional to subregional climates, substrates, hydrology, and disturbance regimes (Jennings et al. 2006, FGDC 2008). The USNVC assigns Alliances a database code and scientific name.
    - **Association** – A vegetation classification unit of low rank (8th level) defined by a diagnostic species, a characteristic range of species composition, physiognomy,

and distinctive habitat conditions (Jennings et al. 2006). Associations reflect local topo-edaphic climates, substrates, hydrology, and disturbance regimes**.**

- **Other Classification Terms:**
  - **Provisional Type –** A vegetation type that is not yet formally described, but expected to be an addition to the existing list of USNVC types for a project area. The type may be represented by plot samples (e.g., <10 samples), while it may or may not be particularly common or because it is localized in extent; however, it could be documented in additional location(s) outside of the study area.
- **Conservation Rank** – The California Department of Fish and Wildlife's Vegetation Classification and Mapping Program's Survey of California Vegetation (SCV) uses the state Heritage Program methodology per NatureServe for natural community conservation ranks as defined below (and see http://www.natureserve.org). "G" indicates the alliance's rarity and threat globally, and "S" indicates the alliance's rarity and threat in California:
  - **G1 and S1** – Critically Imperiled—At very high risk of extinction due to extreme rarity. Often 5 or fewer viable occurrences and/or up to 518 hectares.
  - **G2 and S2** – Imperiled—At high risk of extinction due to very restricted range, very few occurrences, steep declines, or other factors. Often 6–20 viable occurrences, and/or 518–2,590 hectares
  - **G3 and S3** – Vulnerable—At moderate risk of extinction due to a restricted range, relatively few populations, recent and widespread declines, or other factors. Often 21–100 viable occurrences and/or 2,590–12,950 hectares.
  - **G4 and S4** – Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors. Often greater than 100 viable occurrences and/or more than 12,950 hectares.
  - **G5 and S5** – Secure—Common; widespread and abundant.
    - If a vegetation type (i.e., alliance or association) is marked with a G1 through a G3 code, it is rare and threatened throughout its range. A type marked with a G5 and an S1 through an S3 code is secure through its range outside the state but is rare and threatened in California. A G4/S4 type may or may not be endemic to the state and is secure statewide.
    - Semi-natural alliances and associations are not ranked.
- **Abbreviations and Other Characters:**
  - **Parentheses ( )** – When parentheses are used around a species name within a vegetation type name, it indicates that the species is often present as an indicator of that association or alliance, but it does not meet a threshold of 75% or more constancy. The parentheses may be used around the full scientific name or only around the species epithet. An example is the *Pinus muricata – (Arbutus menziesii – Notholithocarpus densiflorus) / Vaccinium ovatum* Association. If parentheses are only around the species epithet, it means that the genus is consistently present but another species could also be present from that genus. An example is the *Artemisia californica / Nassella (pulchra)* Association, where

the genus may be represented by one or more species found within the parentheses.

- **NVC Alliance Code:** The assigned database code and scientific name for the Alliances in the USNVC.

- **Local Environmental Attributes –** Used in the alliance and association descriptions.
  - **Macrotopography** – broad topographic term to describe general position of a stand in the surrounding watershed (e.g., top, upper third, middle third, lower third, and/or bottom) followed by the number of surveys noted in parentheses within each position.
  - **% Surface cover:** The abiotic ground surface substrates of the plot/survey.
    - **Large rock** – percent cover of rocks on the ground with a diameter greater than 25 cm. Includes rocks that were recorded in the field as bedrock, boulder (>60 cm in diameter) and stone (>25 cm – 60 cm in diameter).
    - **Small rock** – percent cover of rocks on the ground with a diameter ranging from 2 mm to 25 cm. Includes rocks that were recorded in the field as gravel (2 mm – 7.5 cm in diameter) and cobble (>7.5 cm – 25 cm in diameter).
    - **Fines Cover** – percent (exposed) cover of fine sediment or soil particles with a diameter less than 2 mm; i.e., ground that is not covered by litter, small rock, or large rock.
    - **Litter Cover** – percent cover of litter, duff, and/or unattached wood on the ground.
  - **County Watersheds** – List of county-wide distribution by watershed unit followed by the number of surveys noted in parentheses within each unit (CalWater 2004).

- **Site Impacts –** Used in the alliance and association descriptions to depict the degree of non-native plant cover and most frequent or abundant non-native plant species. Categories for the average non-native plant cover relative to native cover include low (≤20% relative cover), moderate (20-50% relative cover), and high (>50% relative cover).

Appendix B

Vegetation Classification Tables

Vegetation Classification for Santa Clara and Santa Cruz Counties is organized within two tables, one including the Alliances and Associations, and the other with Alliances nested in the current USNVC hierarchy.

Table 4. Alliances and associations with surveys in Santa Clara (SCL) and Santa Cruz (SCR) Counties, with number of surveys classified for that association in the greater Bay Area (in column All). Status column (Stat) includes the following abbreviations for association status: rev = revised definition, new = new type.

Lifeform						
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
Forest and Woodland					
Acer macrophyllum – Alnus rubra					
	Acer macrophyllum – Pseudotsuga menziesii / Polystichum munitum	1	5	9	
	Acer macrophyllum / (Rubus ursinus)	6	2	17	
	Alnus rubra / Rubus spectabilis – Sambucus racemosa		2	46	
	Alnus rubra / Salix lasiolepis – Rubus spp.		10	51	
	Umbellularia californica – Acer macrophyllum	19	3	51	
	*Umbellularia californica / Rhododendron occidentale**			6	
Acer negundo					
	Acer negundo / (Rubus ursinus)		6	15	
Aesculus californica					
	Aesculus californica	6	1	10	
	Aesculus californica – Umbellularia californica	2		14	
	Aesculus californica / Toxicodendron diversilobum / Moss	6	1	20	
Alnus rhombifolia					
	Alnus rhombifolia	2		5	
	Alnus rhombifolia – Acer macrophyllum	1	2	9	
	Alnus rhombifolia – Platanus racemosa	5		5	
	Alnus rhombifolia – Umbellularia californica – (Quercus chrysolepis)	3	1	13	
	Alnus rhombifolia / Carex (nudata)	3	2	18	
Arbutus menziesii					
	Arbutus menziesii – (Quercus agrifolia)		4	45	
	Arbutus menziesii – Umbellularia californica	1		30	
Eucalyptus* spp. – *Ailanthus altissima – Robinia pseudoacacia					
	Eucalyptus (globulus, camaldulensis)	1	3	16	
	*Ailanthus altissima**			0	
	*Acacia melanoxylon**			3	
Fraxinus latifolia					
	*Fraxinus latifolia**			5	

Lifeform						
Alliance		**Association**	**SCL**	**SCR**	**All**	**Stat**
		Fraxinus latifolia – Salix laevigata	3		3	
	Hesperocyparis (pigmaea, abramsiana, macrocarpa, goveniana)					
		Hesperocyparis abramsiana / Arctostaphylos spp. *– Adenostoma fasciculatum*		4	6	rev
	Hesperocyparis macrocarpa – Pinus radiata*					
		*Hesperocyparis macrocarpa**			18	
		Pinus radiata plantations*			12	
	Juglans hindsii and Hybrids					
		Juglans hindsii / Sambucus nigra	1		1	
	Juniperus californica*					
		Juniperus californica alliance*			2	
	Notholithocarpus densiflorus					
		Notholithocarpus densiflorus	1	1	10	
		Notholithocarpus densiflorus – Arbutus menziesii	4	7	40	
		Notholithocarpus densiflorus – Quercus chrysolepis	2		6	
		*Notholithocarpus densiflorus / Vaccinium ovatum**			7	
		Notholithocarpus densiflorus alliance		1	2	
	Pinus attenuata					
		Pinus attenuata / Arctostaphylos (crustacea)	4	9	15	
		Pinus attenuata / Arctostaphylos (manzanita, canescens)	3		13	
		Pinus attenuata alliance		1	3	
	Pinus coulteri					
		*Pinus coulteri – Quercus wislizeni**			1	
		Pinus coulteri alliance	1		1	
	Pinus muricata – Pinus radiata					
		Pinus radiata – Quercus agrifolia / Toxicodendron diversilobum		3	6	
		Pinus radiata / Toxicodendron diversilobum		1	5	
	Pinus ponderosa					
		Pinus ponderosa – (Quercus agrifolia – Arbutus menziesii)	2	6	8	new
		Pinus ponderosa / Chorizanthe pungens		20	20	new
	Pinus sabiniana					
		Pinus sabiniana / Artemisia californica – Ceanothus ferrisiae – Heteromeles arbutifolia	5		5	
		Pinus sabiniana / Ceanothus cuneatus – (Rhamnus ilicifolia)	2		4	rev

Lifeform						
Alliance		**Association**	**SCL**	**SCR**	**All**	**Stat**
		Pinus sabiniana / herbaceous	1		6	
		Pinus sabiniana / Quercus durata	1		12	
	Platanus racemosa – Quercus agrifolia					
		Platanus racemosa – Quercus agrifolia	10		12	
		Platanus racemosa – Quercus agrifolia alliance		1	3	
		Platanus racemosa – Quercus lobata	4		7	
		Platanus racemosa – Salix laevigata / Salix lasiolepis – Baccharis salicifolia	15		15	
		Platanus racemosa / annual grass	7		20	
		Platanus racemosa / Baccharis salicifolia	2		2	
		Platanus racemosa / Toxicodendron diversilobum	8		9	
		Quercus agrifolia / Salix lasiolepis	9	3	26	
		Umbellularia californica – Platanus racemosa	7	2	9	
	Populus fremontii – Fraxinus velutina – Salix gooddingii					
		Populus fremontii – Salix laevigata / Salix lasiolepis – Baccharis salicifolia	5	1	6	
		Populus fremontii / Rubus ursinus	1		1	
	Populus trichocarpa					
		Populus trichocarpa	1	1	2	
		Populus trichocarpa – Alnus rubra		2	5	new
		Populus trichocarpa – Quercus agrifolia		1	2	
		Populus trichocarpa – Salix laevigata	3		3	
		Populus trichocarpa / Cornus sericea / Carex obnupta		2	4	
		Populus trichocarpa / Salix lasiolepis		5	5	rev
		Populus trichocarpa alliance		1	1	
	Pseudotsuga menziesii – (Notholithocarpus densiflorus – Arbutus menziesii)					
		Pseudotsuga menziesii – Arbutus menziesii		2	18	
		Pseudotsuga menziesii – Chrysolepis chrysophylla – Notholithocarpus densiflorus		1	8	
		Pseudotsuga menziesii – Notholithocarpus densiflorus – Umbellularia californica / Toxicodendron diversilobum	2		18	
		*Pseudotsuga menziesii – Notholithocarpus densiflorus / Vaccinium ovatum**			8	
		Pseudotsuga menziesii – Quercus agrifolia	1	7	51	
		Pseudotsuga menziesii – Quercus chrysolepis	1		24	
		Pseudotsuga menziesii – Quercus kelloggii	1		3	

Lifeform						
Alliance		**Association**	**SCL**	**SCR**	**All**	**Stat**
		Pseudotsuga menziesii – Umbellularia californica / (Toxicodendron diversilobum)	1	1	56	
		Pseudotsuga menziesii – (*Umbellularia californica) / Frangula californica**			23	
		*Pseudotsuga menziesii – Umbellularia californica / Polystichum munitum**			25	
		*Pseudotsuga menziesii / Baccharis pilularis**			50	
		*Pseudotsuga menziesii / Corylus cornuta / Polystichum munitum**			9	
		Pseudotsuga menziesii / (Toxicodendron diversilobum)	1		16	
	Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni)					
		Mixed oak – *Quercus agrifolia / Toxicodendron diversilobum*	3		4	
		Mixed oak – *Quercus kelloggii /* grass	1		2	
		Quercus douglasii – Quercus lobata – Quercus agrifolia / Toxicodendron diversilobum	1		4	
	Quercus agrifolia					
		Quercus agrifolia	1	4	6	
		Quercus agrifolia – Aesculus californica	2	1	4	
		Quercus agrifolia – Arbutus menziesii – Umbellularia californica	3	4	60	
		Quercus agrifolia – Arbutus menziesii / Corylus cornuta – Rubus spp.	2	5	18	
		Quercus agrifolia – Quercus kelloggii	4		8	
		Quercus agrifolia – Umbellularia californica / Heteromeles arbutifolia – Quercus berberidifolia	21	2	33	
		*Quercus agrifolia / Adenostoma fasciculatum – (Salvia mellifera)**			4	
		Quercus agrifolia / Arctostaphylos (crustacea)		15	21	
		Quercus agrifolia / Artemisia californica	3		3	
		Quercus agrifolia / Frangula californica – Heteromeles arbutifolia	2	2	5	
		Quercus agrifolia / grass	10	3	58	
		Quercus agrifolia / Toxicodendron diversilobum	10	4	71	
		Quercus agrifolia alliance		1	8	
	***Quercus chrysolepis* (tree)**					
		*Quercus chrysolepis**			0	
		Quercus chrysolepis – Arbutus menziesii – Notholithocarpus densiflorus var. *densiflorus*	4	3	14	

Lifeform						
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
	Quercus chrysolepis – Umbellularia californica	7	2	23	
	Quercus chrysolepis / Arctostaphylos crustacea		4	4	new
	*Quercus chrysolepis / Quercus (wislizeni, parvula)**			3	
Quercus douglasii					
	Quercus douglasii – Aesculus californica / grass	4		6	
	Quercus douglasii – Pinus sabiniana / Ceanothus cuneatus – Cercocarpus montanus	5		5	
	Quercus douglasii – Pinus sabiniana / grass	3		4	
	Quercus douglasii – Quercus agrifolia	3		10	
	Quercus douglasii – Quercus wislizeni – Pinus sabiniana	4		4	
	Quercus douglasii / Mixed herbaceous	20		35	
	Quercus douglasii / Toxicodendron diversilobum / grass	1		1	
Quercus kelloggii					
	Quercus kelloggii – Arbutus menziesii – Quercus agrifolia	1	1	22	
	Quercus kelloggii – Pinus ponderosa	4		4	
	Quercus kelloggii – Pseudotsuga menziesii – Acer macrophyllum	1		1	
	Quercus kelloggii – Quercus chrysolepis	2	4	6	
	Quercus kelloggii / grass – herb	4	1	10	
	Quercus kelloggii / Toxicodendron diversilobum	2		2	
Quercus lobata					
	Quercus lobata – Quercus agrifolia / grass	6	1	40	
	Quercus lobata – Quercus douglasii	1		1	
	Quercus lobata / Baccharis pilularis – Diplacus aurantiacus	7		7	new
	Quercus lobata / grass	12	1	37	
***Quercus lobata* Riparian**					
	Quercus lobata – Quercus agrifolia / Toxicodendron diversilobum – (Symphoricarpos spp.*)*	10		14	new
	Quercus lobata / herbaceous semi-riparian	1		3	
	Quercus lobata / Rubus ursinus – Rosa californica	5	1	10	
	Quercus lobata Riparian alliance	1		3	

Lifeform						
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
***Quercus wislizeni – Quercus parvula* (tree)**					
	Quercus (parvula, wislizeni) – Arbutus menziesii / Toxicodendron diversilobum		4	19	rev
	Quercus parvula var. *shrevei*	2	10	17	new
	Quercus wislizeni – Aesculus californica	1		1	
	*Quercus wislizeni / Heteromeles arbutifolia**			2	
	Quercus wislizeni – Quercus parvula (tree) alliance	3	1	5	
Salix gooddingii – Salix laevigata					
	Salix gooddingii – Salix laevigata alliance	2		4	
	Salix laevigata	6		6	
	Salix laevigata / (Cornus sericea – Ribes spp.*) / Scirpus microcarpus – Carex* spp.	8	1	14	
	Salix laevigata / Salix lasiolepis	13	2	24	
Salix lucida* ssp. *lasiandra					
	Salix lucida ssp. *lasiandra*		8	31	
Schinus (molle, terebinthifolius) – Myoporum laetum*					
	*Schinus molle**	1		1	
Sequoia sempervirens					
	Sequoia sempervirens		1	1	
	Sequoia sempervirens – Acer macrophyllum – Umbellularia californica	5	4	46	
	Sequoia sempervirens – Arbutus menziesii / Vaccinium ovatum		4	26	
	Sequoia sempervirens – Notholithocarpus densiflorus / Vaccinium ovatum	2	20	95	
	Sequoia sempervirens – Pseudotsuga menziesii – Notholithocarpus densiflorus		5	55	
	Sequoia sempervirens – Pseudotsuga menziesii – Umbellularia californica	1	3	20	
	Sequoia sempervirens – Umbellularia californica		4	43	
	Sequoia sempervirens / (Pteridium aquilinum) – Woodwardia fimbriata		5	21	
	Sequoia sempervirens / Oxalis oregana		2	10	
	Sequoia sempervirens / Polystichum munitum		4	18	
	Sequoia sempervirens alliance		1	9	
Umbellularia californica					
	Umbellularia californica	1	2	52	
	Umbellularia californica – Quercus agrifolia / Toxicodendron diversilobum	29		147	

Lifeform						
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
	Umbellularia californica – Quercus wislizeni	2		18	
	Umbellularia californica / Polystichum munitum	1	1	56	
	Umbellularia californica / Toxicodendron diversilobum	8		14	
Shrubland					
Acacia* spp. – *Grevillea* spp. – *Leptospermum laevigatum					
	Acacia (cyclops, dealbata)		1	3	
Adenostoma fasciculatum					
	Adenostoma fasciculatum	5	1	38	
	Adenostoma fasciculatum – (Ceanothus cuneatus)	3		6	
	Adenostoma fasciculatum – (Lotus scoparius – Eriodictyon spp.*)*	10		13	
	Adenostoma fasciculatum – Diplacus aurantiacus	10	3	47	
	Adenostoma fasciculatum – Heteromeles arbutifolia / Melica torreyana	2		3	
	Adenostoma fasciculatum alliance	1		4	
***Adenostoma fasciculatum – Salvia* spp.**					
	Adenostoma fasciculatum – Salvia mellifera	1		5	
Arctostaphylos (canescens, manzanita, stanfordiana)					
	Arctostaphylos canescens	3		10	
	*Arctostaphylos canescens – Arctostaphylos glandulosa – Adenostoma fasciculatum**			5	
	*Arctostaphylos manzanita**			23	
Arctostaphylos (crustacea, tomentosa)					
	Arctostaphylos (andersonii, pallida)	1	2	3	new
	Arctostaphylos (crustacea, tomentosa) alliance		1	2	
	Arctostaphylos crustacea	3	10	29	
	Arctostaphylos crustacea – Adenostoma fasciculatum – Ceanothus (cuneatus, papillosus)	9	17	35	
	Arctostaphylos silvicola		44	44	rev
Arctostaphylos (nummularia, sensitiva) – Chrysolepis chrysophylla					
	Arctostaphylos (nummularia, sensitiva) – Chrysolepis chrysophylla alliance	1		2	
	Arctostaphylos glutinosa		1	1	new
	Arctostaphylos sensitiva		10	43	
	Chrysolepis chrysophylla / Vaccinium ovatum		1	25	

Lifeform						
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
Arctostaphylos glandulosa					
	*Arctostaphylos glandulosa**			25	
	*Arctostaphylos glandulosa – Adenostoma fasciculatum**			30	
	Arctostaphylos glandulosa – Adenostoma fasciculatum – Quercus berberidifolia	1		2	
Arctostaphylos glauca					
	Arctostaphylos glauca	6		7	
	Arctostaphylos glauca – Adenostoma fasciculatum	6		8	
	Arctostaphylos glauca – Artemisia californica – Salvia mellifera	7		7	
	Arctostaphylos glauca / Melica torreyana	11		11	
Artemisia californica – (Salvia leucophylla)					
	Artemisia californica	10		33	
	Artemisia californica – (Salvia leucophylla) alliance	3	1	4	
	Artemisia californica – Diplacus aurantiacus	20	3	57	
	Artemisia californica / Nassella (pulchra)	8		26	
Baccharis pilularis					
	Baccharis pilularis	5	2	40	
	Baccharis pilularis – (Frangula californica) – Rubus spp.	2	6	195	
	Baccharis pilularis – Artemisia californica	12	1	94	
	*Baccharis pilularis – Ceanothus thyrsiflorus**			18	
	Baccharis pilularis – Toxicodendron diversilobum	7	4	127	
	Baccharis pilularis / (Nassella pulchra – Elymus glaucus – Bromus carinatus)		2	90	
	Baccharis pilularis / Annual grass – herb	4	3	71	
	*Baccharis pilularis / Carex obnupta – Juncus patens**			52	
	*Baccharis pilularis / Danthonia californica**			60	
	*Baccharis pilularis / Deschampsia cespitosa**			20	
	Baccharis pilularis / Eriophyllum staechadifolium		2	33	
	Baccharis pilularis alliance		1	24	
	Frangula californica ssp. *californica – Baccharis pilularis / Scrophularia californica*	4	5	48	
	*Garrya elliptica**			5	
Baccharis salicifolia					
	Baccharis salicifolia	6		8	

Lifeform						
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
Ceanothus (oliganthus, tomentosus)					
	*Ceanothus leucodermis**			0	
	Ceanothus oliganthus	1		2	
Ceanothus cuneatus					
	Ceanothus cuneatus – (Arctostaphylos spp.*)* Maritime		8	10	new
	Ceanothus cuneatus – Adenostoma fasciculatum	5		22	
Ceanothus papillosus					
	*Ceanothus papillosus – Adenostoma fasciculatum**			3	
	Ceanothus papillosus – Eriodictyon californicum	2	3	5	new
Ceanothus thyrsiflorus					
	Ceanothus incanus		2	5	
	Ceanothus thyrsiflorus – (Rubus ursinus)		4	39	rev
	Ceanothus thyrsiflorus – Baccharis pilularis – Toxicodendron diversilobum		1	31	
	Ceanothus thyrsiflorus alliance		2	2	
Cercocarpus montanus					
	Cercocarpus montanus – Adenostoma fasciculatum	5		7	
	Cercocarpus montanus – Prunus ilicifolia	2		3	
	Cercocarpus montanus var. *glaber*	2		5	
Cornus sericea					
	Cornus sericea – Salix (lasiolepis, exigua)		8	17	
Corylus cornuta* var. *californica					
	Corylus cornuta / Polystichum munitum	1	3	33	
***Cytisus scoparius – Genista monspessulana – Cotoneaster* spp.**					
	*Cotoneaster (lacteus, pannosus)**			1	
	*Cytisus scoparius**			1	
	Genista monspessulana		2	23	
	*Hypericum canariense**			2	
	Spartium junceum	1		1	
	*Ulex europaeus**			7	
Diplacus aurantiacus					
	Diplacus (aurantiacus, puniceus)	1	4	8	
Ericameria nauseosa*					
	Ericameria nauseosa alliance*			0	
Eriogonum fasciculatum*					
	*Eriogonum fasciculatum**			0	

Lifeform						
Alliance	**Association**		**SCL**	**SCR**	**All**	**Stat**
Eriogonum wrightii – Eriogonum heermannii – Buddleja utahensis						
	Eriogonum wrightii – Eriogonum heermannii – Buddleja utahensis alliance		1		1	
	*Eriogonum wrightii (*ssp. *subscaposum,* ssp. *wrightii)*		6		6	
Frangula californica – Rhododendron occidentale – Salix breweri						
	Frangula californica ssp. *californica*		2		3	
	Frangula californica ssp. *tomentella / Cirsium fontinale* var. *campylon – Mimulus guttatus*		8		8	
	Rhododendron occidentale – Frangula californica ssp. *tomentella*			3	11	
Gaultheria shallon – Rubus (ursinus)						
	*Holodiscus discolor – Baccharis pilularis – Rubus ursinus**				14	
	Rubus parviflorus		1		10	
	Rubus ursinus		1	5	43	
***Lotus scoparius – Lupinus albifrons – Eriodictyon* spp.**						
	Eriodictyon californicum / herbaceous		2	2	13	
	Lotus scoparius		5	2	11	
	Lotus scoparius – Lupinus albifrons – Eriodictyon spp. alliance		1		2	
	*Lupinus albifrons**				11	
	Lupinus albifrons – Lotus scoparius / Chorizanthe pungens			16	17	new
Lupinus arboreus						
	Lupinus arboreus			3	49	
	*Baccharis pilularis – Lupinus arboreus**				8	
Lupinus chamissonis – Ericameria ericoides						
	Ericameria ericoides			5	18	
	*Lupinus chamissonis**				7	
	*Lupinus chamissonis – Ericameria ericoides**				42	
***Malacothamnus fasciculatus – Malacothamnus* spp.**						
	Malacothamnus (aboriginum, fremontii, hallii)		2		2	rev
Prunus ilicifolia – Heteromeles arbutifolia – Ceanothus spinosus						
	Ceanothus ferrisiae – Heteromeles arbutifolia		5		5	new
	Heteromeles arbutifolia Serpentine		4		4	
	Prunus ilicifolia – Rhamnus (crocea, ilicifolia)		6		7	new
	Prunus ilicifolia ssp. *Ilicifolia – Heteromeles arbutifolia*		2		13	

Lifeform						
Alliance	**Association**		**SCL**	**SCR**	**All**	**Stat**
	Prunus ilicifolia ssp. *Ilicifolia / Sanicula crassicaulis*		1		15	
Quercus berberidifolia						
	Quercus berberidifolia		1		4	
	Quercus berberidifolia – Adenostoma fasciculatum		3		7	
	Quercus berberidifolia – Arctostaphylos glauca		1		1	
	Quercus berberidifolia – Ceanothus cuneatus		2		2	
Quercus durata						
	Quercus durata		2		5	
	Quercus durata – Adenostoma fasciculatum		3		19	
	Quercus durata – Arctostaphylos glauca – Artemisia californica / Grass		2		2	
	Quercus durata – Arctostaphylos glauca – Garrya congdonii / Melica torreyana		7		7	
	Quercus durata – Frangula californica ssp. *tomentella – Arctostaphylos glauca*		3		4	
	Quercus durata – Heteromeles arbutifolia – Umbellularia californica		4		11	
***Quercus wislizeni – Quercus chrysolepis* (shrub)**						
	Quercus agrifolia – Quercus chrysolepis – Quercus parvula (shrub)			1	4	
	Quercus parvula (shrub)*				10	
Rhus trilobata – Crataegus rivularis – Forestiera pubescens						
	Sambucus nigra		1	1	5	
Ribes quercetorum – Rhus trilobata – Frangula californica						
	Prunus virginiana Coast Range		1		3	new
Rosa californica						
	Rosa californica		1	2	3	
Rubus armeniacus – Sesbania punicea – Ficus carica						
	Rubus armeniacus			1	5	
	*Delairea odorata**					
Rubus spectabilis – Morella californica						
	Sambucus racemosa – (Rubus ursinus)			2	8	
Salix exigua						
	Salix exigua		6	2	15	
Salix hookeriana – Salix sitchensis – Spiraea douglasii						
	Salix sitchensis			1	11	

Lifeform						
Alliance	**Association**		**SCL**	**SCR**	**All**	**Stat**
	Salix lasiolepis					
		Salix lasiolepis	2	4	27	
		Salix lasiolepis – Rubus spp.	7	8	102	
		Salix lasiolepis – Salix lucida		2	12	
		Salix lasiolepis alliance		1	1	
	Salvia mellifera – (Artemisia californica)					
		Salvia mellifera	7	1	12	rev
		Salvia mellifera – Artemisia californica	7		8	rev
	Toxicodendron diversilobum					
		Toxicodendron diversilobum – (Baccharis pilularis)	9		64	
Herbaceous						
	Abronia latifolia – Ambrosia chamissonis					
		Abronia latifolia – Calystegia soldanella – Lathyrus littoralis		2	18	
		Ambrosia chamissonis		11	26	
		Ambrosia chamissonis – Abronia umbellata		5	6	
	Ammophila arenaria					
		Ammophila arenaria		2	14	
		*Baccharis pilularis / Ammophila arenaria**			13	
	***Amsinckia (menziesii, tessellata) – Phacelia* spp.**					
		Amsinckia (intermedia, menziesii)	1		1	
	Atriplex prostrata – Cotula coronopifolia					
		Atriplex prostrata	1	2	4	
		*Cotula coronopifolia**			1	
	***Avena* spp. – *Bromus* spp.**					
		Avena barbata – Avena fatua	5	1	53	
		Avena barbata – Bromus hordeaceus	2		17	
		Avena spp. – *Bromus* spp. alliance	5	2	20	
		Brachypodium distachyon	1	4	38	
		*Briza maxima**			6	
		Bromus diandrus	2		16	
		Bromus diandrus – Avena spp.	3	5	14	
		Bromus hordeaceus – Erodium botrys	1		24	
	Azolla (filiculoides, microphylla)					
		Azolla (filiculoides, microphylla)		3	6	
	Bidens cernua – Euthamia occidentalis – Ludwigia palustris					
		Baccharis douglasii		3	5	new

Lifeform						
Alliance		**Association**	**SCL**	**SCR**	**All**	**Stat**
		Bidens cernua – Euthamia occidentalis – Ludwigia palustris alliance		2	3	
		*Bidens frondosa**			2	
		Euthamia occidentalis		1	2	
	Bolboschoenus maritimus					
		Bolboschoenus maritimus	7		14	
	Brassica nigra – Centaurea (solstitialis, melitensis)					
		*Brassica nigra**			3	
		Carduus pycnocephalus – Silybum marianum		2	8	
		*Carthamus lanatus**			0	
		Centaurea solstitialis	1		4	
		Raphanus sativus		1	12	
	Bromus carinatus – Elymus glaucus					
		Bromus carinatus	5	7	68	
		Bromus carinatus – Elymus glaucus alliance	1		2	
		Elymus glaucus	4	4	27	
		Pteridium aquilinum – Grass		1	39	
		Thermopsis californica – Bromus carinatus – Annual Brome*			7	
	Cakile (edentula, maritima)					
		Cakile (edentula, maritima)		2	7	
	Calamagrostis nutkaensis					
		*Calamagrostis nutkaensis**			7	
		Calamagrostis nutkaensis – Carex (obnupta) – Juncus (patens)		1	37	
		*Calamagrostis nutkaensis / Baccharis pilularis**			33	
	Carex barbarae					
		Carex barbarae		1	5	
	Carex nudata					
		Carex nudata	1		6	
	Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus					
		Argentina egedii – (Juncus lescurii)		5	15	
		*Carex obnupta – Argentina egedii**			5	
		*Carex obnupta – Juncus patens**			15	
		Carex obnupta		4	43	
		*Juncus lescurii**			14	
		Oenanthe sarmentosa	1	1	7	
		*Scirpus microcarpus**			19	

Lifeform						
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
Centromadia (pungens)					
	Centromadia (pungens) alliance		1	1	
***Ceratophyllum demersum* Aquatic**					
	Ceratophyllum demersum Western	2		4	
Conium maculatum – Foeniculum vulgare					
	Conium maculatum		3	4	
	*Foeniculum vulgare**				
	Dipsacus (fullonum, sativus)	3		5	
Corethrogyne filaginifolia – Eriogonum (elongatum, nudum)					
	Chorizanthe pungens – Eriogonum nudum var. *decurrens – Heterotheca sessiliflora*		39	39	new
	Eriogonum nudum	2		5	
	Viola pedunculata – (Eschscholzia californica – Nassella pulchra)	3		13	new
Cortaderia (jubata, selloana)*					
	*Cortaderia (jubata, selloana)**			2	
Cressa truxillensis – Distichlis spicata					
	Cressa truxillensis – Distichlis spicata alliance	2	3	5	
***Cynodon dactylon – Crypsis* spp. – *Paspalum* spp.**					
	Crypsis (schoenoides, vaginiflora)	1		1	
	Cynodon dactylon – Crypsis spp. – *Paspalum* spp. alliance	1		1	
Cynosurus echinatus – Arrhenatherum elatius*					
	Cynosurus echinatus – (*Danthonia pilosa – Nassella manicata*)*			17	
Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica					
	Deschampsia cespitosa – Danthonia californica		8	46	
	*Deschampsia cespitosa – Eryngium armatum**			26	
	*Deschampsia cespitosa – Iris douglasiana**			32	
	*Deschampsia (cespitosa, holciformis)**			7	
	Hordeum brachyantherum Lowland	7	2	24	
***Distichlis spicata – Frankenia salina* Coastal**					
	Argentina egedii – Distichlis spicata		2	4	new
	Distichlis spicata	2	1	5	
	Distichlis spicata – Ambrosia chamissonis		1	3	
	Distichlis spicata – annual grasses*			3	
	Distichlis spicata – Frankenia salina – Jaumea carnosa		7	34	

Lifeform						
Alliance	**Association**		**SCL**	**SCR**	**All**	**Stat**
	Distichlis spicata – Frankenia salina Coastal alliance			3	11	
	Distichlis spicata – Sarcocornia pacifica		1	2	20	
	Frankenia salina – Limonium californicum – Monanthochloe littoralis – Sarcocornia pacifica		3	1	24	rev
	Grindelia stricta			4	19	rev
	Dudleya cymosa – Dudleya lanceolata* / Lichen – Moss					
	Dudleya farinosa / Lichen – Moss*				7	
	Eleocharis (acicularis, macrostachya)					
	Eleocharis (acicularis, macrostachya) alliance			1	3	
	Eleocharis macrostachya		11		25	
	Eriophyllum staechadifolium – Erigeron glaucus – Eriogonum latifolium					
	*Armeria maritima – Plantago (maritima)**				3	new
	Artemisia pycnocephala			5	37	
	Erigeron glaucus – Fragaria chiloensis			6	33	
	*Eriogonum parvifolium**				9	
	Eriophyllum staechadifolium – Eriogonum latifolium			13	50	
	Eryngium aristulatum*					
	Eryngium aristulatum alliance*				2	
	Eschscholzia (californica) – Lupinus (nanus)					
	Bromus hordeaceus – Lupinus nanus – Trifolium spp.		1	1	11	
	Eschscholzia (californica) – Lupinus (nanus) alliance		1		1	
	Eschscholzia californica		1	1	18	
	Lupinus bicolor		1		6	
	Festuca idahoensis – Danthonia californica					
	Danthonia californica – Nassella pulchra		2	10	106	
	Danthonia californica Coastal		3	14	61	
	*Festuca californica**				11	
	Festuca idahoensis – (Danthonia californica – Koeleria macrantha)			1	66	
	*Festuca idahoensis – Nassella pulchra**				22	
	Festuca idahoensis Ultramafic*				6	
	*Festuca rubra**				2	
	*Heterotheca sessiliflora – Danthonia californica**				4	
	Perideridia kelloggii – Danthonia californica		1		11	

Lifeform						
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
Heterotheca (oregona, sessiliflora)					
	Heterotheca oregona	1		6	
Holcus lanatus – Anthoxanthum odoratum					
	Holcus lanatus		2	34	
	*Holcus lanatus – Anthoxanthum odoratum**			6	
Holocarpha (heermannii, virgata)					
	Holocarpha heermannii			2	new
	Holocarpha virgata	4		4	
Hydrocotyle (ranunculoides, umbellata)					
	Hydrocotyle ranunculoides	1	2	5	
Juncus (effusus, patens) – Carex (pansa, praegracilis)					
	Carex amplifolia – Carex gynodynama		1	2	
	Carex densa	1		5	
	*Carex pansa**			1	
	Carex praegracilis Lowland	2		12	rev
	Carex serratodens	5		15	
	*Carex tumulicola**			8	
	Juncus (effusus, patens) – Carex (pansa, praegracilis) alliance	1	2	16	
	Juncus effusus	2	2	63	
	Juncus patens	1	2	20	
	*Juncus patens – Holcus lanatus**			17	
	*Juncus patens – Juncus occidentalis**			15	
	Juncus phaeocephalus		1	36	
	Juncus xiphioides	3	1	4	rev
***Juncus arcticus* (var. *balticus, mexicanus*)**					
	Juncus arcticus var. *balticus – (*var. *mexicanus)*	7		9	
Lasthenia californica – Plantago erecta – Vulpia microstachys					
	*Erigeron glaucus – Lasthenia californica**			7	
	Hemizonia congesta – Lolium perenne	19		49	
	Lasthenia (californica, gracilis)	3		6	
	Lasthenia californica – Plantago erecta – Hesperevax sparsiflora	54		63	
	Lasthenia californica – Plantago erecta – Vulpia microstachys alliance	2	1	11	
	Lotus humistratus – Plantago erecta – Lomatium spp.*			4	
	*Micropus californicus**			0	
	Plantago erecta – Lolium perenne lichen-rocky	15	2	22	

Lifeform						
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
	Vulpia microstachys – Plantago erecta	6		6	
	Vulpia microstachys – Plantago erecta – Calycadenia (truncata, multiglandulosa)	4		22	
Lasthenia glaberrima*					
	*Lasthenia glaberrima – Pleuropogon californicus**			3	
Lepidium latifolium – Lactuca serriola					
	Dittrichia graveolens – Pseudognaphalium luteoalbum	7		7	new
	*Lepidium latifolium**			2	
	Lepidium latifolium – Lactuca serriola alliance	2		2	
Leymus cinereus – Leymus triticoides					
	Leymus triticoides	10	5	25	
	Leymus triticoides – Bromus spp. *– Avena* spp.	1		3	
	*Leymus triticoides – Lolium perenne**			4	
Leymus mollis					
	Leymus mollis – Abronia latifolia – (Cakile sp.*)*		6	19	
Lilaeopsis occidentalis*					
	Lilaeopsis occidentalis alliance*			0	
Lolium perenne					
	Aegilops triuncialis – Hemizonia congesta	1		2	
	Lolium perenne	6	14	66	
	Lolium perenne – Bromus hordeaceus	4		8	
	*Lolium perenne – Hordeum marinum – Ranunculus californicus**			5	
	*Lolium perenne – Lotus corniculatus**			8	
	Lolium perenne alliance	1	1	5	
Ludwigia (hexapetala, peploides) – Eichhornia crassipes					
	Ludwigia (hexapetala, peploides)		4	10	
***Mesembryanthemum* spp. – *Carpobrotus* spp.**					
	Carpobrotus (edulis)		2	17	
	Mesembryanthemum spp. *– Carpobrotus* spp. alliance		1	1	
***Mimulus guttatus – Cirsium* spp. – *Stachys* spp.**					
	Cirsium fontinale	17		20	
	Mimulus guttatus	2	4	10	
	Mimulus guttatus – Cirsium spp. *– Stachys* spp. alliance		1	1	

Lifeform						
Alliance	**Association**		**SCL**	**SCR**	**All**	**Stat**
Monolopia (lanceolata) – Coreopsis (calliopsidea)						
	Monolopia (lanceolata) – Coreopsis (calliopsidea) alliance				3	
Nuphar lutea Freshwater* Aquatic						
	Nuphar lutea ssp. *polysepala**				5	
***Nassella* spp. – *Melica* spp.**						
	Elymus multisetus – (Eschscholzia californica – Plantago erecta)		12		29	
	Melica californica		5	2	48	
	Melica torreyana		8	1	25	
	Nassella lepida		4	1	26	
	Nassella pulchra		7	10	31	
	Nassella pulchra – Avena spp. *– Bromus* spp.		46	6	111	
	Nassella pulchra – Corethrogyne filaginifolia		1		1	
	Nassella pulchra – Hemizonia congesta		6		40	
	Nassella pulchra – Lolium perenne – (Trifolium spp.*)*		3		18	
	Nassella pulchra – Lolium perenne – Plantago erecta Serpentine		33		74	
	Nassella pulchra – Melica californica – annual grass		2		3	
Phalaris aquatica – Phalaris arundinacea						
	Phalaris aquatica		2	1	20	
Plagiobothrys nothofulvus						
	Plagiobothrys nothofulvus – Castilleja exserta – Lupinus nanus			1	1	
	Plagiobothrys nothofulvus alliance		1		1	
Poa pratensis – Agrostis gigantea – Agrostis stolonifera						
	Festuca arundinacea			1	10	
	Poa pratensis – Agrostis gigantea – Agrostis stolonifera alliance			1	1	
Polygonum lapathifolium – Xanthium strumarium						
	*Alisma (triviale)**				4	
	Cyperus erythrorhizos – Gnaphalium palustre		5		6	new
	Polygonum (amphibium, lapathifolium)		5	8	17	
	Polygonum lapathifolium – Xanthium strumarium alliance		4	1	5	
	Xanthium strumarium		4		8	
Ruppia (cirrhosa, maritima)*						
	Ruppia (cirrhosa, maritima) alliance*				0	

Lifeform					
Alliance	**Association**	**SCL**	**SCR**	**All**	**Stat**
Sarcocornia pacifica (Salicornia depressa)					
	Sarcocornia pacifica – Atriplex prostrata	2	2	5	
	*Sarcocornia pacifica – Cotula coronopifolia**			3	
	Sarcocornia pacifica – Jaumea carnosa – Distichlis spicata	6	4	103	
	Sarcocornia pacifica – Schoenoplectus americanus	7		7	new
	Sarcocornia pacifica (Salicornia depressa) alliance	1		3	
	Sarcocornia pacifica Tidal	25	2	127	
Schoenoplectus (acutus, californicus)					
	Schoenoplectus acutus	8	3	21	
	Schoenoplectus californicus	3	5	27	
	Schoenoplectus californicus – Schoenoplectus acutus	1		1	
Schoenoplectus americanus					
	Schoenoplectus americanus	11	2	13	
	Schoenoplectus pungens – Argentina egedii		2	5	new
Sedum spathulifolium*					
	Sedum spathulifolium – Polypodium californicum / Lichen – Moss*			6	
Selaginella (bigelovii, wallacei)					
	Selaginella bigelovii / Eriogonum fasciculatum	6		10	
Sparganium (angustifolium)					
	Sparganium eurycarpum		3	8	
Spartina foliosa					
	Spartina foliosa	3		17	
	Spartina foliosa – Sarcocornia pacifica	7		38	rev
***Stuckenia (pectinata) – Potamogeton* spp.**					
	Potamogeton spp.	1		1	
	Stuckenia pectinata	1	1	2	
Trifolium variegatum					
	Trifolium variegatum	1		4	
Typha (angustifolia, domingensis, latifolia)					
	Typha (angustifolia, domingensis, latifolia) alliance	1	1	6	
	Typha (latifolia, angustifolia)	1	6	17	
	Typha domingensis	1	1	4	

Lifeform						
Alliance	**Association**		**SCL**	**SCR**	**All**	**Stat**
	Zostera (marina, pacifica)*					
		*Zostera marina**			0	
Sparsely Vegetated						
	***Allium* spp. – *Streptanthus* spp. – *Hesperolinon* spp. Serpentinite**					
		Allium falcifolium – Eriogonum luteolum – Streptanthus (batrachopus, morrisonii)	1		10	new
		Streptanthus glandulosus – Dudleya abramsii / Lichen – Moss	10		14	
	Dudleya cymosa – Dudleya lanceolata* / Lichen – Moss					
		Dudleya farinosa / Lichen – Moss*			7	

Table 5. Vegetation classification at the Alliance level, organized within the current USNVC hierarchy, for Santa Clara and Santa Cruz Counties. Two status columns for the National Vegetation Classification (NVC) and for the Manual of California Vegetation (MCV) indicate whether the alliance is newly added based upon this project (new) with modifiers for whether the alliance was merged (-m) or split (-s) from existing Alliance concepts, or whether the alliances were expanded (expand) or otherwise revised (revise) from their existing concepts. An asterisk (*) denotes alliances that are likely present or are present but have not been sampled in the region.

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
1. Forest & Woodland						
1.B. Temperate & Boreal Forest & Woodland						
1.B.1 Warm Temperate Forest & Woodland						
	1.B.1.Nc.	Californian Forest & Woodland				
		M009	Californian Forest & Woodland			
			G195	Californian Broadleaf Forest & Woodland		
				Aesculus californica		
				Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni)		
				Quercus agrifolia		
				Quercus chrysolepis (tree)		
				Quercus douglasii		
				Quercus kelloggii		
				Quercus lobata		
				Quercus wislizeni–Quercus parvula	expand	expand
				Umbellularia californica	new-s	
			G198	Californian Conifer Forest & Woodland		
				Hesperocyparis (pigmaea, abramsiana, macrocarpa, goveniana)		
				Pinus attenuata		
				Pinus coulteri		
				Pinus muricata – Pinus radiata		

Class & Subclass							
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
				Pinus ponderosa		revise
				Pinus sabiniana		
		M513	Californian Ruderal Forest			
			G678	Californian Ruderal Forest		
				Eucalyptus spp. – *Ailanthus altissima* – *Robinia pseudoacacia*	expand	
				Hesperocyparis macrocarpa – *Pinus radiata**	new	
				Schinus (molle, terebinthifolius) – *Myoporum laetum**		
1.B.2	**Cool Temperate Forest & Woodland**					
	1.B.2.Nd	Vancouverian Forest & Woodland				
		M024	Vancouverian Coastal Rainforest			
			G235	Californian Coastal Redwood Forest		
				Sequoia sempervirens		
		M886	Southern Vancouverian Dry Foothill Forest & Woodland			
			G208	Californian Moist Coastal Mixed Evergreen Forest		
				Pseudotsuga menziesii – *(Notholithocarpus densiflorus* – *Arbutus menziesii)*		
				Notholithocarpus densiflorus	new-s	
				Arbutus menziesii	new-s	
1.B.3	**Temperate Flooded and Swamp Forest**					
	1.B.3.Nd	Western North American Interior Flooded Forest				
		M036	Interior Warm & Cool Desert Riparian Forest			
			G797	Western Interior Riparian Forest & Woodland		
				Acer negundo		
				Juglans hindsii and Hybrids		
				Platanus racemosa – *Quercus agrifolia*		

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
				Populus fremontii – Fraxinus velutina – Salix gooddingii		
				Quercus lobata Riparian		
				Salix gooddingii – Salix laevigata		
		M298	Interior West Ruderal Flooded & Swamp Forest & Woodland			
			G510	Interior West Ruderal Riparian Forest & Scrub		
				Rubus armeniacus - Sesbania punicea - Ficus carica		
	1.B.3.Ng.	Vancouverian Flooded & Swamp Forest				
		M035	Vancouverian Flooded & Swamp Forest			
			G851	North-Central Pacific Lowland Riparian Forest		
				Acer macrophyllum – Alnus rubra		
				Alnus rhombifolia		
				*Fraxinus latifolia**		
				Populus trichocarpa		
				Salix lucida ssp. *lasiandra*		
2. Shrub & Herb Vegetation						
2.B. Temperate & Boreal Grassland & Shrubland						
2.B.1 Mediterranean Scrub & Grassland						
	2.B.1.Na.	Californian Scrub & Grassland				
		M043	Californian Chaparral			
			G257	Californian Xeric Chaparral		
				Adenostoma fasciculatum		
				Adenostoma fasciculatum – Salvia spp.		
				Arctostaphylos (canescens, manzanita, stanfordiana)		
				Arctostaphylos glauca		
				Ceanothus cuneatus		
			G258	Californian Maritime Chaparral		
				Arctostaphylos (crustacea, tomentosa)	expand	expand

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
				Arctostaphylos (nummularia, sensitiva) – Chrysolepis chrysophylla	expand	expand
			G261	Californian Mesic & Pre-montane Chaparral		
				Arctostaphylos glandulosa		
				Ceanothus (oliganthus, tomentosus)		
				Ceanothus papillosus		
				Cercocarpus montanus		
				Prunus ilicifolia – Heteromeles arbutifolia – Ceanothus spinosus	expand	expand
				Quercus berberidifolia		
				Quercus durata		
				Quercus wislizeni – Quercus chrysolepis (shrub)	new-s	
		M044	Californian Coastal Scrub			
			G264	Central & Southern Californian Coastal Sage Scrub		
				Artemisia californica – (Salvia leucophylla)	revise	
				Eriogonum fasciculatum		
				Salvia mellifera – (Artemisia californica)		new-m
			G662	Californian North Coastal & Mesic Scrub		
				Baccharis pilularis		
				Ceanothus thyrsiflorus		
				Corylus cornuta var. *californica*		
				Toxicodendron diversilobum		
			G782	Californian Coastal-Foothill Seral Scrub		
				Diplacus aurantiacus	revise	
				Lotus scoparius – Lupinus albifrons – Eriodictyon spp.	revise	expand
				Malacothamnus fasciculatus – Malacothamnus spp.		

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
		M045 Californian Annual & Perennial Grassland				
			G496 Californian Perennial Grassland			
				Corethrogyne filaginifolia – Eriogonum (elongatum, nudum)	expand	expand
				Nassella spp. – *Melica* spp.	new-m	
			G766 Californian Annual Grassland & Forb Meadow			
				Amsinckia (menziesii, tessellata) – Phacelia spp.		
				Eschscholzia (californica) – Lupinus (nanus)		
				Holocarpha (heermannii, virgata)		
				Lasthenia californica – Plantago erecta – Vulpia microstachys		
				*Monolopia (lanceolata) – Coreopsis (calliopsidea)**		
				Plagiobothrys nothofulvus		
		M046 Californian Ruderal Grassland, Meadow & Scrub				
			G497 Californian Ruderal Grassland, Meadow & Scrub			
				Acacia spp. – Grevillea spp. – *Leptospermum laevigatum*	new	
				Avena spp. – Bromus spp.		
				Brassica nigra – Centaurea (solstitialis, melitensis)	revise	
				Lolium perenne		
2.B.2	**Temperate Grassland & Shrubland**					
	2.B.2.Nf. Western North American Grassland & Shrubland					
		M094 Cool Interior Chaparral				
			G282 Western North American Montane Chaparral			

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
				Ribes quercetorum – Rhus trilobata – Frangula californica	new	expand
		M493	Western North American Ruderal Grassland & Shrubland			
			G648	Southern Vancouverian Lowland Ruderal Grassland & Shrubland		
				Conium maculatum – Foeniculum vulgare	revise	
				*Cortaderia (jubata, selloana)**		
				*Cynosurus echinatus – Arrhenatherum elatius**	new	
				Cytisus scoparius – Genista monspessulana – Cotoneaster spp.	expand	
				Holcus lanatus – Anthoxanthum odoratum		
		M050	Southern Vancouverian Lowland Grassland & Shrubland			
			G488	Southern Vancouverian Shrub & Herbaceous Bald, Bluff & Prairie		
				Bromus carinatus – Elymus glaucus		
				Calamagrostis nutkaensis		
				Festuca idahoensis – Danthonia californica		
				Gaultheria shallon – Rubus (ursinus)	new	
2.B.4	**Temperate to Polar Scrub & Herb Coastal Vegetation**					
	2.B.4.Nb.	Pacific North American Coastal Scrub & Herb Vegetation				
		M059	Pacific Coastal Beach & Dune			
			G498	North Pacific Maritime Dune & Coastal Beach		
				Leymus mollis		
			G663	Californian Coastal Beach & Dune		
				Abronia latifolia – Ambrosia chamissonis		
				Eriophyllum staechadifolium – Erigeron glaucus – Eriogonum latifolium	new-s	
				Lupinus arboreus		
				Lupinus chamissonis – Ericameria ericoides	new-s	
		M511	North Pacific Coastal Ruderal Grassland & Shrubland			

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
			G647	North Pacific Maritime Coastal Ruderal Dune		
				Ammophila arenaria		
				Cakile (edentula, maritima)	new	
				Mesembryanthemum – Carpobrotus spp.		
2.C. Shrub & Herb Wetland						
2.C.4	**Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland**					
	2.C.4.Nb.	Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland				
		M073	Vancouverian Lowland Marsh, Wet Meadow & Shrubland			
			G322	Vancouverian Wet Shrubland		
				Cornus sericea		
				Frangula californica – Rhododendron occidentale – Salix breweri	new	
				Rubus spectabilis – Morella californica	expand	
				Salix hookeriana – Salix sitchensis – Spiraea douglasii		
		M073	Vancouverian Lowland Marsh, Wet Meadow & Shrubland			
			G517	Vancouverian Freshwater Wet Meadow & Marsh		
				Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica	expand	
				Carex barbarae	new	
				Carex nudata	new	
				Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus	new-m	
				Juncus (effusus, patens) – Carex (pansa, praegracilis)	expand	
				Juncus arcticus (var. *balticus, mexicanus)*		
				Mimulus guttatus – Cirsium spp. *– Stachys* spp.	new-m	new-m
			G525	Temperate Pacific Freshwater Wet Mudflat		

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
				Bidens cernua – Euthamia occidentalis – Ludwigia palustris	expand	expand
				Heterotheca (oregona, sessiliflora)		
				*Lilaeopsis occidentalis**		
				Polygonum lapathifolium – Xanthium strumarium	new	
		M074	Western North American Vernal Pool			
			G530	Californian Vernal Pool		
				Centromadia (pungens)		
				Cressa truxillensis – Distichlis spicata		
				Eleocharis (acicularis, macrostachya)	revise	
				*Eryngium aristulatum**		
				*Lasthenia glaberrima**		
				Trifolium variegatum		
		M301	Western North American Ruderal Marsh, Wet Meadow & Shrubland			
			G524	Western North American Ruderal Marsh, Wet Meadow & Shrubland		
				Atriplex prostrata – Cotula coronopifolia	new	
				Cynodon dactylon – Crypsis spp. – *Paspalum* spp.	expand	
				Lepidium latifolium – Lactuca serriola		revise
				Phalaris aquatica – Phalaris arundinacea	expand	
				Poa pratensis – Agrostis gigantea – Agrostis stolonifera		
		M888	Arid West Interior Freshwater Marsh			
			G531	Arid West Interior Freshwater Marsh		
				Schoenoplectus (acutus, californicus)		
				Schoenoplectus americanus		
				Typha (angustifolia, domingensis, latifolia)		
		M893	Western North American Montane Marsh, Wet Meadow & Shrubland			
			G526	Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland		

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
				Rhus trilobata – Crataegus rivularis – Forestiera pubescens	expand	
	2.C.4.Nc.	Southwestern North American Warm Desert Freshwater Marsh & Bosque				
		M076	Warm Desert Lowland Freshwater Marsh, Wet Meadow & Shrubland			
			G533	North American Warm Desert Riparian Low Bosque & Shrubland		
				Baccharis salicifolia		
				Rosa californica		
				Salix lasiolepis		
				Salix exigua		
2.C.5 Salt Marsh						
	2.C.5.Nc.	Temperate and Boreal Pacific Coastal Salt Marsh				
		M081	North American Pacific Coastal Salt Marsh			
			G499	Temperate Pacific Salt Marsh		
				Bolboschoenus maritimus		
				Distichlis spicata – Frankenia salina Coastal		new-m
				Sarcocornia pacifica (Salicornia depressa)		
				Spartina foliosa		
	2.C.5.Nd.	North American Western Interior Brackish Marsh, Playa & Shrubland				
		M082	Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland			
			G538	North American Desert Alkaline-Saline Marsh & Playa		
				Leymus cinereus – Leymus triticoides		
3. Desert & Semi-Desert						
3.B. Cool Semi-Desert Scrub & Grassland						
3.B.1 Cool Semi-Desert Scrub & Grassland						
	3.B.1.Ne.	Western North American Cool Semi-Desert Scrub & Grassland				
		M171	Great Basin-Intermountain Dry Shrubland & Grassland			
			G296	Mojave Mid-Elevation Mixed Desert Scrub		
				Eriogonum wrightii – Eriogonum heermannii – Buddleja utahensis		

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
				*Juniperus californica**		
			G310	Intermountain Semi-Desert Steppe & Shrubland		
				*Ericameria nauseosa**		
5. Aquatic Vegetation						
5.A. Saltwater Aquatic Vegetation						
5.A.3 Benthic Vascular Saltwater Vegetation						
	5.A.3.We.	Temperate Seagrass Aquatic Vegetation				
		M184	Temperate Pacific Seagrass Intertidal Vegetation			
			G373	Temperate Pacific Seagrass Bed		
				Zostera (marina, pacifica) Pacific Aquatic*	expand	
	5.A.3.Wf.	Temperate Estuarine & Inland Brackish Aquatic Vegetation				
		M186	Ditchgrass Saline Aquatic Vegetation			
			G383	Widgeongrass Bed		
				*Ruppia (cirrhosa, maritima)**		
5.B. Freshwater Aquatic Vegetation						
5.B.2 Temperate to Polar Freshwater Aquatic Vegetation						
	5.B.2.Na.	North American Freshwater Aquatic Vegetation				
		M109	Western North American Freshwater Aquatic Vegetation			
			G544	Western North American Temperate Freshwater Aquatic Vegetation		
				Azolla (filiculoides, microphylla)		
				Ceratophyllum demersum Aquatic		
				Hydrocotyle (ranunculoides, umbellata)		
				*Nuphar lutea**		
				Sparganium (angustifolium)		
				Stuckenia (pectinata) – *Potamogeton* spp.		
		M401	North American Temperate Ruderal Aquatic Vegetation			
			Gxxx	North American Temperate Ruderal Aquatic Vegetation	new	
				Ludwigia (hexapetala, peploides) – *Eichhornia crassipes*	new	revise

Class & Subclass						
Formation	**Division**	**Macrogroup**	**Group**	**Alliance**	**NVC**	**MCV**
6. Open Rock Vegetation						
6.B. Temperate & Boreal Open Rock Vegetation						
6.B.1 Temperate & Boreal Cliff, Scree & Other Rock Vegetation						
	6.B.1.Nb.	Western North American Temperate Cliff, Scree & Rock Vegetation				
		M887	Western North American Cliff, Scree & Rock Vegetation			
			G563	Californian Cliff, Scree & Rock Vegetation		
				Allium spp. – *Streptanthus* spp. – *Hesperolinon* spp. Serpentinite		
				Dudleya cymosa – Dudleya lanceolata – Lichen/Moss*		
				*Sedum spathulifolium**		

Appendix C

Vegetation Field Key for Santa Clara and Santa Cruz Counties

This field key is for the vegetation types, including alliances and associations, found in Santa Clara and Santa Cruz Counties, based on the classification developed by analyzing vegetation field survey data collected for this and other relevant projects. The key is intended as a guide to field-based and image interpretation-based identification of vegetation. This key is not dichotomous; instead, it follows the hierarchy of the United States National Vegetation Classification (USNVC), in which we are updating the state classification of *A Manual of California Vegetation* (MCV; Sawyer et al. 2009) to conform to the revised USNVC (USNVC 2023). The USNVC hierarchy is promoted by the Federal Geographic Data Committee (FGDC), the Ecological Society of America's Vegetation Panel (FGDC 2008, Faber-Langendoen et al. 2012, 2014), and the California Department of Fish & Wildlife's Survey of California Vegetation (SCV). This key provides additions and revisions to both the USNVC and MCV, and future updates will be found online (USNVC 2023, CNPS 2023).

This key lists vegetation types starting with the current or recently updated version of the USNVC Macrogroup level and proceeding down to the Association level. The complete hierarchy for this classification is listed in the Appendix B, Vegetation Classification for Santa Clara and Santa Cruz Counties, California.

Due to a high diversity of the vegetation types in the counties, this key is complex. Follow the instructions in a section carefully and sequentially to arrive at the determined vegetation type. You will need to collect or refer to plant composition data that includes both species that are dominant and also those "indicator" or characteristic/diagnostic species, whose presence may cause a stand to key to a particular vegetation type. If it seems that a stand of vegetation could key to more than one type, review the descriptions (e.g., stand tables, environmental information) for each type to determine which one fits best. Note that this vegetation key may include types that are not accurately detectable in remotely-sensed imagery.

Terms, Concepts, and Symbols used throughout the Key

Stand: The basic physical unit of plant communities in a landscape. It has no set size. Some vegetation stands are very small, such as certain wetland types, and some may be several square kilometers in size, such as certain forest types. A stand is defined by two main unifying characteristics:

1. It has compositional integrity. Throughout the stand, the combination of species is similar. The stand is differentiated from adjacent stands by a discernible boundary that may be abrupt or occur indistinctly along an ecological gradient.

2. It has structural integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest originally dominated by the same species that burned on

the upper part of the slopes but not the lower would be divided into two stands. Likewise, a sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.

The compositional and structural features of a stand are often combined into a term called homogeneity. For an area to meet the definition of a stand, it must be homogeneous at the scale being considered.

United States National Vegetation Classification (*USNVC*)*:* A central organizing framework for how all vegetation in the United States is inventoried and studied, from broad scale formations (biomes) to fine-scale plant communities. The purpose of the NVC is to produce uniform statistics about vegetation resources across the nation, based on vegetation data gathered at local, regional, or national levels. The latest classification standard was published in by the FGDC (2008).

The hierarchy units in the USNVC from highest to lowest (i.e., broadest to finest) are:

1. Formation Class
2. Formation Subclass
3. Formation
4. Division
5. Macrogroup
6. Group
7. Alliance
8. Association

Alliance: Plant communities based on dominant/diagnostic species of the uppermost or dominant stratum. Accepted alliances are part of the USNVC hierarchy. For the Santa Clara and Santa Cruz Counties vegetation mapping effort, map classes are typically at the alliance level of the USNVC hierarchy (though sometimes at the Group or Macrogroup levels).

Association: The most botanically detailed or finest-scale plant community designation based on dominant species and multiple co-dominant or sub-dominant indicator species from any stratum. Associations are also part of the USNVC hierarchy. The San Mateo Co. map classes are not typically defined to the association level, but they are noted in the key below the Alliance to represent the variation within each alliance that has been identified during the project.

Asterisks (*) – Those types not currently known for or sampled in the study area, but that have a high potential to occur, are sometimes included in the key with an * after the alliance or association name.

Botanical nomenclature: We use the PLANTS database (USDA NRCS 2023) as our standard for botanical names, including scientific names, so this information can be shared nationally with our USNVC partners. However, when a more current name has been assigned in *The Jepson Manual, second edition* (Jepson Flora Project 2023), we may substitute names by the TJM2 and a species code beginning with “2JM” is assigned. General vegetation types, such as moss and lichen, have database codes beginning with the number 2 (e.g., 2MOSS).

Plant community nomenclature: Taxa separated by "–" are typically within the same stratum; taxa separated by "/" are in different strata.

Cover: The primary metric used to quantify the importance/abundance of a particular species or a particular vegetation layer within a stand. Cover is measured by estimating the aerial extent of the living plants, or the bird's-eye view looking from above, for each category. Cover in this project uses the concept of "porosity" or foliar cover rather than "opacity" or crown cover. Thus, field crews are trained to estimate the amount of light versus shade produced by the canopy of a plant or a stratum by taking into account the amount of shade it casts excluding the openings it may have in the interstitial spaces (e.g., between leaves or branches). This is assumed to provide a more realistic estimate of the actual amount of shade cast by the individual or stratum which, in turn, relates to the actual amount of light available to individual species or strata beneath it. However, as a result, cover estimates can vary substantially between leaf-on versus leaf-off conditions. Stands dominated by deciduous species (e.g., *Aesculus californica, Toxicodendron diversilobum*) should be sampled during *leaf-on* since they will have substantially less cover when leaves are absent and may key to another type.

Absolute cover: The actual percentage of the surface area at a survey area covered by a species or physiognomic group (trees, shrubs, herbaceous), as in "tan oak covers 10% of the area being surveyed." Absolute cover of all species or physiognomic groups, when added together, may total greater than 100%, because this is not a proportional number and plants can overlap with each other. For example, a stand could have 25% tree cover in the upper layer, 40% shrub cover in the middle layer, and 50% herbaceous cover when surveyed on the ground. However, when aerial interpretation is being used, the maximum absolute value is 100%, since lower levels of vegetation cannot be seen through the overstory on aerial photographs.

Relative cover: The percentage of surface area at a survey area covered by one species relative to other species within the same physiognomic stratum (tree, shrub, herbaceous) or by one stratum relative to the total vegetation cover in an area (or polygon). Thus, 50% relative cover of *Quercus douglasii* in the tree layer means that *Q. douglasii* comprises half the cover of all tree species within a stand, while 50% relative shrub cover means that shrubs make up half the cover of all vegetation within a stand. Relative cover values are proportional numbers that, when added together, total 100% for each species within a stratum or each stratum within a stand of vegetation.

Dominance: 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 tan oak," or it may refer to dominance by a physiognomic group, as in "dominated by shrubs." When we use the term in the key, a species is dominant if it is in relatively high cover in each stand (e.g. relative cover exceeds 50% of a layer's total cover). See "dominance by layer," below, for further explanation.

Strongly dominant: A species in the dominant lifeform stratum has 60% *or* greater relative cover.

Co-dominant: Co-dominance refers to two or more species in a stand with similar cover. Specifically, each species has between 30% and 60% relative cover. For example in a coastal scrub stand with 5% *Baccharis pilularis*, 4% *Frangula*

californica, and 3% *Rubus ursinus* (total 12% shrub cover), technically only the *Baccharis* (5/12 = 42% relative cover) and the *Frangula* (4/12 = 33% relative cover) would be co-dominant because *Rubus* would only have 23% relative cover (3/12 = 25%).

Characteristic/Diagnostic species: Present in at least 80% of the stands of the type, with no restriction on cover. Relatively even spacing throughout the stand is important, particularly in vegetation with low total cover. Characteristic species that are evenly distributed can be better indicators than species with higher cover and patchy distribution.

Other terms for species, pertaining to presence or cover or a site characteristic:

Typically or *Usually*: trend in at least 80% of the stands

Often: trend in at least 50% of the stands

Sometimes: trend in 30% of the stands or less

Dominance by layer/stratum: Tree, shrub, and herbaceous layers are considered physiognomically distinct. Alliances are usually named by the dominant and/or characteristic species of the *tallest characteristic layer* (see tree-characterized, shrub-characterized, and herb-characterized vegetation definitions below). Average covers within the dominant layer reflect the "modal" concept of the health/age/environment of a particular vegetation type. For example, a higher average cover of woody plants within a stand not recently affected by disturbance reflects a mode of general availability of water, nutrition, and equitable climate, while lower average cover under similar conditions would reflect lower availability of these things.

Woody plant: A vascular plant species that has a noticeably woody stem (e.g., shrubs and trees). It does not include herbaceous species with woody underground portions such as tubers, roots, or rhizomes.

Tree: A one-stemmed woody plant that normally grows to be greater than 5 meters tall. In some cases, trees may be multi-stemmed (due to fire or other disturbance) but the height of mature plants typically exceeds 5 meters. If less than 5 meters tall, undisturbed individuals of these species are usually single-stemmed. Certain species that sometimes resemble shrubs but may be trees in other areas (e.g., *Aesculus californica*) are, out of statewide tradition or by the USNVC, called trees. Species are “traditionally” placed in one life-form or another. We use the accepted lifeforms in the USNVC or the PLANTS Database (USDA NRCS 2023) to do this.

Tree-characterized vegetation: Trees are evenly distributed throughout the stand. In the Mediterranean climate of the North Coast, tree-dominated alliances typically have >10% absolute tree cover, providing a consistent structural component.

Forest: A forest is defined as a tree-dominated stand of vegetation with 60% or greater absolute cover of trees. Most forest alliances tend to have average cover of trees >60%, but individual stands under certain conditions may drop lower than 60%.

Woodland: A woodland is defined as a tree-dominated stand of vegetation with between 25% and 60% absolute cover of trees. Most woodland alliances tend to have average cover of trees with 25-60%, but individual stands under certain conditions may drop higher or lower than this range.

Emergent: A plant or vegetation layer is considered emergent if it has low cover and rises above a layer with more cover in the stand. For example, *Pseudotsuga menziesii* trees may comprise an emergent tree layer of 2% cover over dense *Gaultheria shallon* and *Rubus parviflorus* in the shrub understory; the stand would be considered within the *Gaultheria shallon – Rubus* (*ursinus*) Shrubland Alliance because the total tree cover is <10% and the shrub cover is >10%. Medium to tall shrubs are not considered emergent over shorter shrubs, but short trees are considered emergent over tall shrubs.

Shrub: A multi-stemmed woody plant that is usually 0.2-5 meters tall. Definitions are blurred at the low and high ends of the height scales. At the tall end, shrubs may approach tree-size based on disturbance frequencies (e.g., old-growth re-sprouting chaparral species such as *Cercocarpus montanus*, *Prunus ilicifolia*, and so forth, may frequently attain "tree size", but are still typically multi-stemmed and are considered shrubs in this key). At the short end, woody perennial herbs or sub-shrubs of various species are often difficult to categorize into a consistent life-form (e.g., *Eriogonum latifolium*, *Lupinus chamissonis*); in such instances, we refer to the PLANTS Database or “pick a lane” based on best available definitions.

Sub-shrub: A multi-stemmed plant with noticeably woody stems less than 0.5 meter tall. May be easily confused with a perennial herb or small shrub. We lump them into the “shrub” category in stand tables and descriptions of vegetation types.

Shrub-characterized vegetation: Shrubs, including sub-shrubs, are evenly distributed throughout the stand, providing a consistent (even if sparse) structural component; the stand cannot be characterized as a tree stand; and one or both of the following criteria are met: 1) shrubs influence the distribution or population dynamics of other plant species; 2) shrubs play an important role in ecological processes within the stand. Shrub alliances typically have at least 10% absolute shrub cover.

Herbaceous plant: Any species of plant that has no main woody stem development; includes grasses, forbs, and perennial species that die back each year.

Herb-characterized vegetation: Herbs are evenly distributed throughout the stand, providing a consistent (even if sparse) structural component and playing an important role in ecological processes within the stand. The stand cannot be characterized as a tree or shrub stand.

Nonvascular vegetation: Nonvascular organisms characterize a stand, providing a consistent (even if sparse) structural component and playing an important role in ecological processes within the stand.

Class A. Vegetation dominated, co-dominated, or characterized by an even distribution of overstory trees. The tree canopy is generally greater than 10%, but may occasionally be less than 10% over a denser understory of shrubs and/or herbs **= Tree-Overstory (Woodland & Forest) Vegetation (Page 6)**

Class B. Vegetation dominated, co-dominated, or characterized by woody shrubs in the canopy. Shrubs usually have at least 10% cover. Tree species, if present, generally total less than 10% absolute cover. Herbaceous species may have higher cover than shrubs **= Shrubland Vegetation (Page 17)**

Class C. Vegetation dominated, co-dominated, or characterized by non-woody, herbaceous species in the canopy, including grasses, graminoids, and broad-leaved herbaceous species. Shrubs, if present, usually comprise less than 10% of the vegetation cover. Trees, if present, generally comprise less than 10% cover. However, sometimes vegetation is sparse (<10%) or variable in herbaceous cover on rock outcrops, open sand, and other substrates, and will key here. **= Herbaceous & Sparse Vegetation (Page 30)**

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

Section I: Woodlands and forests dominated or characterized by needle or scale-leaved conifer trees. Includes *Hesperocyparis*, *Pinus*, *Pseudotsuga*, and *Sequoia*.

1. Temperate rainforest dominated or co-dominated by *Sequoia sempervirens*. Found either at the bottoms with cold air drainage or along ridgetops with fog influence in the Santa Cruz Mountains.

Vancouverian Coastal Rainforest Macrogroup

Californian Coastal Redwood Forest Group

1a. *Sequoia sempervirens* dominates, co-dominates, or characterizes (rarely with as little as 5% cover) stands near streams on terraces, along all slopes and aspects, or on ridges. Associated trees include *Acer macrophyllum*, *Arbutus menziesii, Notholithocarpus densiflorus*, *Pseudotsuga menziesii*, *Torreya californica*, and *Umbellularia californica*, which are typically sub- to co-dominant but may occasionally exceed *Sequoia* in cover. *Vaccinium ovatum*, *Oxalis oregana, Polystichum munitum, Toxicodendron diversilobum*, *Woodwardia fimbriata,* and other shrubs and herbs may intermix in the understory.

***Sequoia sempervirens* Alliance**
Sequoia sempervirens Association
Sequoia sempervirens – Acer macrophyllum – Umbellularia californica Association
Sequoia sempervirens – Arbutus menziesii / Vaccinium ovatum Association
Sequoia sempervirens – Notholithocarpus densiflorus / Vaccinium ovatum Association
Sequoia sempervirens – Pseudotsuga menziesii – Notholithocarpus densiflorus Association

Sequoia sempervirens – Pseudotsuga menziesii – Umbellularia californica Association
Sequoia sempervirens – Umbellularia californica Association
Sequoia sempervirens / Oxalis oregana Association
Sequoia sempervirens / (Pteridium aquilinum) – Woodwardia fimbriata Riparian Association
Sequoia sempervirens / Polystichum munitum Association

2. *Pinus ponderosa* or *Pseudotsuga menziesii,* dominate stands or co-dominate in combination with hardwoods in the tree overstory in cool-temperate coniferous forests and woodlands influenced by warm, relatively dry summers and cool rainy winters.

2a. *Pinus ponderosa* is dominant or co-dominant in the overstory, usually at greater than 15% absolute cover, with other trees such as *Arbutus menziesii, Quercus agrifolia,* and/or *Quercus chrysolepis,* along with an open to dense understory of shrubs.

Southern Vancouverian Montane-Foothill Forest Macrogroup

Californian Montane Conifer Forest & Woodland Group

***Pinus ponderosa* Alliance**
Pinus ponderosa – (Quercus agrifolia – Arbutus menziesii) Provisional Association

2b. *Pinus ponderosa* is dominant, though tree cover is usually less than 20% absolute cover, with an understory of shrubs, subshrubs, and herbs characteristic of sand parkland. It occurs in sandhill habitats of Santa Cruz County.

Pinus ponderosa / *Chorizanthe pungens* Association

2c. *Pseudotsuga menziesii* is dominant or co-dominant with *Arbutus menziesii*, *Notholithocarpus densiflorus, Quercus agrifolia*, *Q. chrysolepis*, or *Umbellularia californica*. If *P. menziesii* co-dominates with *Quercus kelloggii* key to that alliance (*Q. kelloggii* Alliance (step 5c4) below).

Southern Vancouverian Dry Foothill Forest & Woodland Macrogroup

Californian Moist Coastal Mixed Evergreen Forest Group

***Pseudotsuga menziesii – (Notholithocarpus densiflorus – Arbutus menziesii)* Alliance**
Pseudotsuga menziesii / (Toxicodendron diversilobum) Association
Pseudotsuga menziesii – Arbutus menziesii Association
Pseudotsuga menziesii – Chrysolepis chrysophylla – Notholithocarpus densiflorus Association
Pseudotsuga menziesii – Notholithocarpus densiflorus – Umbellularia californica / Toxicodendron diversilobum Association
Pseudotsuga menziesii – Notholithocarpus densiflorus / Vaccinium ovatum Association*
Pseudotsuga menziesii – Quercus agrifolia Association
Pseudotsuga menziesii – Quercus chrysolepis Association
Pseudotsuga menziesii – Quercus kelloggii Association
Pseudotsuga menziesii – Umbellularia californica / (Toxicodendron diversilobum) Association
Pseudotsuga menziesii – (*Umbellularia californica) / Frangula californica* Association*

Pseudotsuga menziesii – Umbellularia californica / Polystichum munitum Association*
Pseudotsuga menziesii / Baccharis pilularis Association*
Pseudotsuga menziesii / Corylus cornuta / Polystichum munitum Association*

3. Other closed-cone or xerophyllic conifers, including *Hesperocyparis* spp., *Juniperus californica, Pinus attenuata*, *Pinus coulteri, Pinus muricata*, *Pinus radiata,* or *Pinus sabiniana* is dominant or co-dominant in the overstory.

Californian Forest & Woodland Macrogroup

Californian Conifer Forest & Woodland Group

3a. *Hesperocyparis abramsiana* dominates on slopes of low-nutrient sandstone or granitic substrates. Chaparral shrubs can be similar or higher in cover than the tree cover, including *Adenostoma fasciculatum*, *Arctostaphylos crustacea,* and *A. sensitiva*, and regenerating *Quercus parvula* var. *shrevei* or hybrids with *Quercus wislizeni* are commonly found in stands.

***Hesperocyparis (pigmaea, abramsiana, macrocarpa, goveniana)* Alliance**
Hesperocyparis abramsiana / Arctostaphylos spp. – Adenostoma fasciculatum Provisional Association

3b. *Pinus attenuata* dominates or co-dominates with *Quercus chrysolepis* in the tree overstory; shrubs are typically present with an intermittent to dense cover various shrubs such as *Arctostaphylos crustacea, A. sensitiva, A. canescens, A. manzanita* and *Vaccinium ovatum* in the understory. Sites are usually nutrient-poor rocky slopes including shale, siltstone, and serpentine.

***Pinus attenuata* Alliance**
Pinus attenuata / Arctostaphylos (crustacea) Provisional Association
Pinus attenuata / Arctostaphylos (manzanita, canescens) Provisional Association

3c. *Pinus coulteri* dominates or co-dominates in the tree overstory. This alliance occurs in Santa Clara County but is not common. Survey data is limited to one reconnaissance of a post-fire stand in the Diablo Range.

***Pinus coulteri* Alliance**
Pinus coulteri – Quercus wislizeni Association*

3d. *Pinus sabiniana* dominates in the tree overstory; shrubs are typically present in the understory and may exceed pine in cover. Sites often transition to chaparral and often nutrient-poor serpentine or meta-sedimentary.

***Pinus sabiniana* Alliance**
Pinus sabiniana / Artemisia californica – Ceanothus ferrisiae – Heteromeles arbutifolia Association
Pinus sabiniana / Ceanothus cuneatus – (Rhamnus ilicifolia) Association
Pinus sabiniana / herbaceous Association
Pinus sabiniana / Quercus durata Association

3e. *Pinus radiata* is dominant or co-dominant in naturally occurring stands with other conifers, or rarely subdominant with hardwoods in the tree overstory and/or regenerating tree layer. The understory may include moderate to dense cover of

shrubs such as *Arctostaphylos* spp., *Baccharis pilularis, Gaultheria shallon*, *Toxicodendron diversilobum* and *Vaccinium ovatum*. Most stands of Monterey Pine in Santa Cruz County are planted or naturalized except for a limited area of native stands between Ano Nuevo and Davenport.

***Pinus muricata – Pinus radiata* Alliance**

Pinus radiata – Quercus agrifolia / Toxicodendron diversilobum Association

Pinus radiata / Toxicodendron diversilobum Association

3f. *Juniperus californica* is dominant in stands. While no surveys were collected, the alliance may potentially occur in northeast Santa Clara Co. with *Pinus sabiniana* and *Quercus douglasii*.

Great Basin-Intermountain Dry Shrubland & Grassland Macrogroup

Mojave Mid-Elevation Mixed Desert Scrub Group

Juniperus californica* Alliance

3g. Stands dominated or co-dominated by planted or naturalized Mediterranean conifer species including *Hesperocyparis macrocarpa, Pinus pinea,* and/or *Pinus radiata.*

Californian Ruderal Forest Macrogroup

Californian Ruderal Forest Group

Hesperocyparis macrocarpa – Pinus radiata* Semi-Natural Alliance

3g1. *Pinus radiata* dominates the conifer canopy. Planted stands of *Pinus radiata* are found along roadsides or on slopes where they were introduced. Note that native populations of *Pinus radiata* occur in Santa Cruz Co. in a limited area between Ano Nuevo and Davenport; these would key to the *Pinus muricata – Pinus radiata* Alliance above.

Pinus radiata plantations Semi-Natural Association*

3g2. Planted *Hesperocyparis macrocarpa* dominates in patches or along roads. In this region of California, stands are considered semi-natural since they are not naturally occurring.

Hesperocyparis macrocarpa Ruderal Semi-Natural Association*

Section II. Woodlands, forests, and riparian vegetation characterized and/or dominated mainly by native and non-native broad-leaved evergreen and deciduous trees. Includes species of *Aesculus*, *Acer*, *Alnus*, *Arbutus*, *Fraxinus*, *Juglans*, *Notholithocarpus*, *Populus*, *Quercus*, *Salix*, and *Umbellularia*.

4. Vegetation dominated, co-dominated, or characterized by one or more of the following broadleaf trees: *Arbutus menziesii*, *Chrysolepis chrysophylla,* or *Notholithocarpus densiflorus*.

4a. Broadleaf trees such as *Arbutus menziesii* or *Notholithocarpus densiflorus* dominate, co-dominate, or characterize moist, coastal, mixed evergreen forests and woodlands.

4a1. *Arbutus menziesii* is either dominant with sub-dominant *Quercus agrifolia* or is dominant to co-dominant with *Quercus kelloggii* and/or *Umbellularia californica*. *Pseudotsuga menziesii*, *Heteromeles arbutifolia*, and *Toxicodendron diversilobum* are often present. If *Arbutus* is sub- to co-dominant with *Quercus agrifolia*, *Q. chrysolepis*, or *Notholithocarpus densiflorus*, key to the one of these alliances instead of *A. menziesii*.

Southern Vancouverian Dry Foothill Forest & Woodland Macrogroup

Californian Moist Coastal Mixed Evergreen Forest Group

***Arbutus menziesii* Alliance**
Arbutus menziesii – (*Quercus agrifolia*) Association
Arbutus menziesii – Umbellularia californica Association

4a2. *Notholithocarpus densiflorus* is strongly dominant in the tree canopy or co-occurs with sub-dominant to co-dominant hardwoods *Arbutus menziesii, Quercus chrysolepis,* or *Umbellularia californica*.

***Notholithocarpus densiflorus* Alliance**
Notholithocarpus densiflorus Association
Notholithocarpus densiflorus – Arbutus menziesii Association
Notholithocarpus densiflorus – Quercus chrysolepis Association
Notholithocarpus densiflorus / Vaccinium ovatum Association*

4b. *Chrysolepis chrysophylla* is dominant to co-dominant in dense, clonal stands occurring on upper slopes and ridges, often transitional between forest and chaparral. *Vaccinium ovatum* is often present and can be co-dominant in the shrub layer.

Californian Chaparral Macrogroup

Californian Maritime Chaparral Group

***Arctostaphylos* (*nummularia*, *sensitiva*) – *Chrysolepis chrysophylla* Alliance**
Chrysolepis chrysophylla / Vaccinium ovatum Association

5. Vegetation dominated or co-dominated by the following broadleaf, primarily upland tree species: *Aesculus californica*, *Quercus agrifolia*, *Q. chrysolepis*, *Q. douglasii*, *Q. kelloggii*, *Q. lobata*, *Q. parvula*, *Q. wislizeni*, and/or *Umbellularia californica*.

Californian Forest & Woodland Macrogroup

Californian Broadleaf Forest & Woodland Group

5a. *Aesculus californica* dominates in open to moderately dense woodlands. If *Umbellularia californica* is present, it is sub-dominant. A variety of herbs may be found in the understory.

***Aesculus californica* Alliance**
Aesculus californica Association
Aesculus californica – Umbellularia californica Association
Aesculus californica / Toxicodendron diversilobum / Moss Association

5b. *Umbellularia californica* is either dominant or co-dominant with *Quercus agrifolia* or *Quercus wislizenii* in open to dense woodlands. If *Quercus agrifolia* is co-dominant and the shrub layer is significant with toyon, scrub oak, or manzanita, key to the *Quercus agrifolia* Alliance. Found in a variety of upland settings, such as coastal bluffs, inland ridges, steep north-facing slopes, rocky outcrops and post-fire landscapes. If *U. californica* is found in a riparian setting, key to *Acer macrophyllum – Alnus rubra* Alliance. If *U. californica* is co-dominant with *Arbutus*, *Acer*, *or Pinus sabiniana* on serpentine, or *Pseudotsuga menziesii*, *Quercus chrysolepis, Q. lobata, Q. kelloggii*, or *Sequoia*, key to one of these other hardwood or conifer alliances instead.

***Umbellularia californica* Alliance**
Umbellularia californica Association
Umbellularia californica – Quercus agrifolia / Toxicodendron diversilobum Association
Umbellularia californica – Quercus wislizeni Association
Umbellularia californica / Polystichum munitum Association
Umbellularia californica / Toxicodendron diversilobum Association

5c. One or more species of *Quercus* listed above (step 5) dominates or co-dominates in the tree overstory.

5c1. Multiple *Quercus* tree species intermix (at least three species) and it is difficult to assign to an alliance defined by one oak species. Co-dominating oaks may include *Quercus agrifolia*, *Quercus chrysolepis, Quercus douglasii*, *Quercus kelloggii, Quercus lobata, Quercus parvula, and/or Q. wislizeni.* If one or two oak species dominate read steps to key to individual oak alliances below.

***Quercus* (*agrifolia*, *douglasii*, *garryana*, *kelloggii*, *lobata*, *wislizeni*) Alliance**
Mixed oak – *Quercus agrifolia / Toxicodendron diversilobum*
Mixed oak – *Quercus kelloggii /* grass
Quercus douglasii – Quercus lobata – Quercus agrifolia / Toxicodendron diversilobum Association

5c2. *Quercus chrysolepis* is dominant or co-dominant with *Arbutus menziesii* or *Umbellularia californica* in the tree overstory. *Quercus wislizeni* is occasionally found as a sub-dominant tree.

***Quercus chrysolepis* (tree) Alliance**
Quercus chrysolepis Association*
Quercus chrysolepis – Arbutus menziesii – Notholithocarpus densiflorus var. *densiflorus* Association
Quercus chrysolepis – Umbellularia californica Association
Quercus chrysolepis / Arctostaphylos crustacea Association
Quercus chrysolepis / Quercus (wislizeni, parvula) Association*

5c3. *Quercus douglasii* dominates or co-dominates with *Aesculus californica, Pinus sabiniana, Quercus agrifolia,* or *Arbutus menziesii* in the tree overstory. The understory herbaceous layer is often moderately dense to dense, with a mixture of native and non-native forbs and grasses.

***Quercus douglasii* Alliance**
Quercus douglasii – Aesculus californica / grass Association

Quercus douglasii – Pinus sabiniana / Ceanothus cuneatus – Cercocarpus montanus Association
Quercus douglasii – Pinus sabiniana / grass Association
Quercus douglasii – Quercus agrifolia Association
Quercus douglasii – Quercus wislizeni – Pinus sabiniana Association
Quercus douglasii / Mixed herbaceous Association
Quercus douglasii / Toxicodendron diversilobum / grass Association

5c4. *Quercus kelloggii* or *Quercus × morehus* dominates or co-dominates with *Pinus ponderosa*, *Q. agrifolia*, *Q. chrysolepis,* and/or *Umbellularia californica* in the tree overstory. *Arbutus menziesii* is often present as a sub-dominant species. Stands are found inland, above maritime influence, often on northerly slopes.

***Quercus kelloggii* Alliance**
Quercus kelloggii – Arbutus menziesii – Quercus agrifolia Association
Quercus kelloggii – Pinus ponderosa Association
Quercus kelloggii – Pseudotsuga menziesii – Acer macrophyllum Association
Quercus kelloggii – Quercus chrysolepis Association
Quercus kelloggii / grass – herb Association
Quercus kelloggii / *Toxicodendron diversilobum* Association

5c5. *Quercus lobata* dominates or co-dominates with *Quercus agrifolia, Q. douglasii, Q. kelloggii,* and/or *Umbellularia californica* in the tree overstory in an upland habitat. Stands are typically found on slopes and summit valleys with an open grassy understory and *Toxicodendron diversilobum* is a common understory shrub. If the habitat is riparian, go to **step 6.**

***Quercus lobata* Alliance**
Quercus lobata – Quercus agrifolia / Grass Association
Quercus lobata – Quercus douglasii Association
Quercus lobata / Baccharis pilularis – Diplacus aurantiacus Association
Quercus lobata / Grass Association

5c6. *Quercus agrifolia, Q. parvula, Q. wislizeni* or other *Quercus* spp. dominates and/or co-dominates as a shrub, co-occurring with *Umbellularia*, *Adenostoma*, and a variety of other shrubs that prefer more mesic, northerly exposures. *Quercus parvula* and *Q. wislizeni* are not always morphologically distinct.

***Quercus wislizeni – Quercus chrysolepis* (shrub) Alliance**
Quercus agrifolia – Quercus chrysolepis – Quercus parvula (shrub) Provisional Association
Quercus parvula (shrub) Provisional Association*

5c7. The tree form of *Quercus parvula* and/or *Q. wislizeni* dominates or co-dominates in the tree canopy, often with *Arbutus menziesii*, *Pseudotsuga menziesii*, and/or *Umbellularia californica*. If the oaks have a shrubby habit or are regenerating and intermixing with a variety of other shrub species, key to the *Quercus wislizeni – Quercus chrysolepis* (shrub) Alliance above.

***Quercus wislizeni – Quercus parvula* (tree) Alliance**
Quercus (*parvula*, *wislizeni) – Arbutus menziesii / Toxicodendron diversilobum* Association

Quercus parvula var. *shrevei* Association
Quercus wislizeni – Aesculus californica Association
Quercus wislizeni / Heteromeles arbutifolia Association*

5c8. *Quercus agrifolia* dominates or co-dominates with *Arbutus menziesii* in the canopy in an upland setting (see step 6 for riparian settings). If *Q. douglasii* (or hybrid *Q. ×eplingii*), *Q. lobata*, or *Q. wislizeni* is co-dominant to dominant, key to one of these other alliances instead of *Q. agrifolia*. If codominant with *Umbellularia californica,* key here if shrub understory is significant and includes toyon, scrub oak, or manzanita. The understory herbaceous layer often contains a mixture of native and non-native herbs and/or shrubs. If the habitat is riparian, go to **step 6.**

***Quercus agrifolia* Alliance**
Quercus agrifolia Association
Quercus agrifolia – Aesculus californica Association
Quercus agrifolia – Arbutus menziesii – Umbellularia californica Association
Quercus agrifolia – Arbutus menziesii / Corylus cornuta – Rubus spp. Association
Quercus agrifolia – Quercus kelloggii Association
Quercus agrifolia – Umbellularia californica / Heteromeles arbutifolia – Quercus berberidifolia Association
Quercus agrifolia / Adenostoma fasciculatum – (Salvia mellifera) Association*
Quercus agrifolia / Arctostaphylos (crustacea) Association
Quercus agrifolia / Artemisia californica Association
Quercus agrifolia / Frangula californica – Heteromeles arbutifolia Association
Quercus agrifolia / grass Association
Quercus agrifolia / Toxicodendron diversilobum Association

6. *Acer negundo*, *Juglans hindsii*, *Platanus racemosa, Populus fremontii*, *Quercus agrifolia, Quercus lobata,* or *Salix laevigata* is dominant, co-dominant or characteristic in permanently moist or riparian settings, where sub-surface water is available all year. Nearby upland vegetation is often dominated by broadleaf evergreen or deciduous trees, as opposed to conifers.

Interior Warm & Cool Desert Riparian Forest Macrogroup

Western Interior Riparian Forest & Woodland Group

6a. *Acer negundo* dominates in the tree overstory with other riparian plants such as *Fraxinus*, *Populus*, *Rubus*, and *Salix*, or codominates with *Umbellularia californica,* often along major streams and rivers. Stands are considered rare in the state and may be small and monospecific.

***Acer negundo* Alliance**
Acer negundo / (Rubus ursinus) Association

6b. *Salix laevigata* dominates along streams, rivers, ditches, floodplains, and lake edges. If *Populus fremontii* is emergent with >5% absolute cover, key to the *Populus fremontii – Fraxinus velutina – Salix gooddingii* Alliance**.** Associated trees and shrubs include *Alnus rhombifolia*, *Quercus agrifolia*, *Rubus*, *Salix*, and others. Note that *Salix gooddingii* does not occur in the Santa Cruz Mountains.

***Salix gooddingii – Salix laevigata* Alliance**
Salix laevigata Association

Salix laevigata – (Cornus sericea – Ribes spp.*) / Scirpus microcarpus – Carex* spp. Association
Salix laevigata / Salix lasiolepis Association

6c. *Juglans hindsii* or hybrids dominate in stands along riparian corridors, floodplains, and terraces. Other riparian species may be present, including *Acer, Fraxinus, Platanus, Rubus* and *Sambucus*. Understory is variable and often includes *Sambucus nigra* or *Rubus* spp.

***Juglans hindsii* and Hybrids Alliance**
Juglans hindsii / Sambucus nigra Provisional Association

6d. *Populus fremontii* dominates or co-dominates with *Acer negundo, Juglans,* and/or *Salix*, sometimes with *Populus* having as little as 5% absolute cover in riparian settings with a diverse mix of riparian species. If *Juglans hindsii* is co-dominant, but *Populus* has at least 20% relative cover in the tree layer, key to this alliance.

***Populus fremontii – Fraxinus velutina – Salix gooddingii* Alliance**
Populus fremontii / Rubus ursinus Association
Populus fremontii – Salix laevigata / Salix lasiolepis – Baccharis salicifolia Association

6e. *Quercus agrifolia* dominates in a riparian setting, or *Platanus racemosa* is dominant, co-dominant, or characteristically present at >15% relative cover in the tree canopy of riparian habitats with *Acer macrophyllum, Acer negundo, Aesculus californica, Juglans hindsii, Quercus agrifolia, Quercus lobata*, *Salix laevigata*, or *Umbellularia californica*. If *Alnus rhombifolia* is codominant, key to *Alnus rhombifolia* Alliance. If *Populus fremontii* or *Populus trichocarpa* is present, key to the alliance of the species with the most cover.

***Platanus racemosa – Quercus agrifolia* Alliance**
Platanus racemosa – Quercus agrifolia Association
Platanus racemosa – Quercus lobata Association
Platanus racemosa – Salix laevigata / Salix lasiolepis – Baccharis salicifolia Association
Platanus racemosa / annual grass Association
Platanus racemosa / Baccharis salicifolia Association
Platanus racemosa / Toxicodendron diversilobum Association
Quercus agrifolia / Salix lasiolepis Association
Umbellularia californica – Platanus racemosa Association

6f. *Quercus lobata* dominates or co-dominates with *Fraxinus latifolia, Quercus agrifolia, Quercus kelloggii, Salix lasiolepis,* and/or *Umbellularia californica* in the tree overstory. Stands are typically found along valley bottoms and lower slopes on seasonally saturated soils that may flood intermittently. Common understory shrubs include *Rosa californica*, *Rubus* spp., and *Toxicodendron diversilobum*.

***Quercus lobata* Riparian Alliance**
Quercus lobata – Quercus agrifolia / Toxicodendron diversilobum – (Symphoricarpos spp.) Association
Quercus lobata / Rubus ursinus – Rosa californica Association
Quercus lobata / herbaceous semi-riparian Association

7. *Alnus rhombifolia*, *Alnus rubra, Acer macrophyllum, Fraxinus latifolia*, *Populus trichocarpa,* and/or *Salix lucida* are dominant, co-dominant, or characteristic of broadleaf riparian tree vegetation. Stands are more likely to occur near cool temperate coniferous forests, unlike vegetation of the Western Interior Riparian Forest & Woodland Group described above. Found along riparian corridors, incised canyons, seeps, stream banks, mid-channel bars, floodplains, and terraces

Vancouverian Flooded & Swamp Forest Macrogroup

North-Central Pacific Lowland Riparian Forest Group

7a. *Populus trichocarpa* dominates or co-dominates with *Alnus rubra* or *Salix* spp. in the tree overstory. Stands for this type will often have other riparian trees present. A variety of shrubs and herbs may be found in the understory, including *Cornus sericea, Rubus ursinus*, *Salix lasiolepis*, and *Stachys bullata*.

***Populus trichocarpa* Alliance**
Populus trichocarpa Association
Populus trichocarpa – Alnus rubra Provisional Association
Populus trichocarpa – Quercus agrifolia Association
Populus trichocarpa – Salix laevigata Association
Populus trichocarpa / Salix lasiolepis Association
Populus trichocarpa / Cornus sericea / Carex obnupta Association

7b. *Alnus rhombifolia* dominates or co-dominates with *Acer macrophyllum, Platanus racemosa,* or *Umbellularia californica* in the tree overstory. *Umbellularia californica* may be higher in cover, though stands for this type will often have other riparian trees along with *Alnus rhombifolia* to be classed here. If *Fraxinus latifolia* is co-dominant, key to the *Fraxinus latifolia* Alliance below. A variety of shrubs and herbs may be found in the understory, including *Rubus*, *Toxicodendron*, and numerous ferns. Careful identification of alder stands closer to the coast is necessary to differentiate from *A. rubra* stands.

***Alnus rhombifolia* Alliance**
Alnus rhombifolia Association
Alnus rhombifolia – Acer macrophyllum Association
Alnus rhombifolia – Platanus racemosa Association
Alnus rhombifolia – Umbellularia californica – (Quercus chrysolepis) Association
Alnus rhombifolia / Carex (nudata) Association

7c. *Alnus rubra* dominates in the tree canopy in riparian settings, typically within a few miles of the coast. The understory is often comprised of one to many species of *Rubus, Salix lasiolepis,* and *Sambucus racemosa*, which sometimes exceed *Alnus* in cover. If *Salix lucida* is co-dominant, key to that *Salix* alliance. *Alnus rubra* stands were encountered in riparian or swampy bottomlands but can also occur along rocky streambeds in similar settings to *A. rhombifolia* stands. Careful identification of the *Alnus* species is important closer to the coast.

***Acer macrophyllum – Alnus rubra* Alliance**
Alnus rubra / Rubus spectabilis – Sambucus racemosa Association
Alnus rubra / Salix lasiolepis – Rubus spp. Association

7d. *Acer macrophyllum* dominates or co-dominates with *Umbellularia californica* in riparian stands, OR *Umbellularia californica* is dominant in riparian stands with *Acer macrophyllum* or *Pseudotsuga menziesii* characteristically present. An understory of riparian shrubs such as *Rubus* spp. or *Rhododendron occidentale* are sometimes present.

***Acer macrophyllum – Alnus rubra* Alliance**
Acer macrophyllum / *(Rubus ursinus)* Association
Acer macrophyllum – Pseudotsuga menziesii / Polystichum munitum Association
Umbellularia californica – Acer macrophyllum Association
Umbellularia californica / Rhododendron occidentale Association*

7e. *Salix lucida* ssp. *lasiandra* dominates in the overstory, sometimes with higher or similar cover by shrubs in the understory, such as *Rubus* spp. and *Salix lasiolepis*. Sometimes *Alnus rubra* may be co-dominant with *S. lucida,* and adjacent stands may be dominated by *Alnus* spp., *Quercus agrifolia* or conifers.

***Salix lucida* ssp. *lasiandra* Alliance**
Salix lucida ssp. *lasiandra* Association

7f. *Fraxinus latifolia* dominates or co-dominates with *Acer negundo*, *Umbellularia californica,* or *Salix laevigata* in the tree overstory.

***Fraxinus latifolia* Alliance**
Fraxinus latifolia Association*
Fraxinus latifolia – Salix laevigata Association

8. A non-native tree species dominates in planted or naturalized stands.

Californian Ruderal Forest Macrogroup and Group

8a. A tree species of *Eucalyptus, Acacia melanoxylon,* or *Ailanthus altissima* dominates in planted or naturalized stands. Often found in groves, windbreaks, uplands, and along stream courses. Stands were observed but rarely sampled. For tall shrubby species of *Acacia*, see the Californian Ruderal Grassland, Meadow & Scrub Group in **Section II, 8d**.

***Eucalyptus* spp. – *Ailanthus altissima – Robinia pseudoacacia* Semi-Natural Alliance**
Eucalyptus (globulus, camaldulensis) Semi-Natural Association
Ailanthus altissima Semi-Natural Association*
Acacia melanoxylon Provisional Semi-Natural Association*

8b. *Myoporum laetum* or *Schinus molle* dominant in open to dense stands.

Schinus (molle, terebinthifolius) – Myoporum laetum* Semi-Natural Alliance
Schinus molle Semi-Natural Association*

Class B. Shrubland Vegetation

Section I. Riparian or moist hillside settings with vegetation dominated or co-dominated by the following shrubs: *Baccharis salicifolia, Frangula californica* (including all subspecies), *Lonicera involucrata, Morella californica*, *Prunus virginiana, Rhododendron occidentale*, *Rosa californica, Rubus armeniacus*, *R. spectabilis*, *Salix breweri*, *S. exigua*, *S. lasiolepis*, *S. melanopsis*, *S. sitchensis, Sambucus nigra,* and/or *Sambucus racemosa*. *Note: if *Rubus ursinus* or *Rubus parviflorus* dominates, key to the *Gaultheria shallon – Rubus* (*ursinus*) Alliance in Section II below (step 5b4).

1. Non-native shrub *Rubus armeniacus, Rosa eglanteria,* or *Delairea odorata* is strongly dominant in riparian sites, mesic clearings, disturbed areas and stock ponds.

Interior West Ruderal Flooded & Swamp Forest & Woodland Macrogroup

Interior West Ruderal Riparian Forest & Scrub Group

***Rubus armeniacus – Sesbania punicea – Ficus carica* Semi-Natural Alliance**
Rubus armeniacus Semi-Natural Association
Delairea odorata Semi-Natural Association*

2. *Cornus sericea, Lonicera involucrata, Morella californica*, *Rubus spectabilis, Salix sitchensis* and/or *Sambucus racemosa* dominate or co-dominate with other *Rubus* spp.

2a. Vegetation dominated or co-dominated by *Morella californica* and/or *Rubus spectabilis*. Stands may be small and are generally found close to the coast on moist or wet soils, ravines, and riparian areas.

Vancouverian Lowland Marsh, Wet Meadow & Shrubland Macrogroup

Vancouverian Wet Shrubland Group

***Rubus spectabilis – Morella californica* Alliance**
Morella californica – Rubus spp. Provisional Association*
Rubus spectabilis Association*

2b. *Sambucus racemosa* dominates in the shrub overstory, often preferring riparian streams, seeps along slopes, and moist post-fire slopes where there was past disturbance.

***Rubus spectabilis – Morella californica* Alliance**
Sambucus racemosa – (Rubus ursinus) Provisional Association

2c. *Cornus sericea* is dominant in the shrub layer or co-dominant with plants such as *Salix* spp. Emergent riparian trees and shrubs such as *Rubus ursinus, Salix* spp. and *Toxicodendron diversilobum* are often present.

***Cornus sericea* Alliance**
Cornus sericea – Salix (lasiolepis, exigua) Association

2d. *Salix sitchensis* dominates or co-dominates with *S. lasiolepis* along coastal or low elevation streams, lagoons. A variety of sub-dominant trees and shrubs may be present, including *Alnus*, *Morella,* and *Rubus*.

***Salix hookeriana – Salix sitchensis – Spiraea douglasii* Alliance**
Salix sitchensis Provisional Association

3. *Frangula californica*, *Prunus virginiana, Rhododendron occidentale*, *Salix breweri*, *S. exigua*, *S. lasiolepis*, *S. melanopsis*, and/or *Sambucus nigra* dominant or co-dominant with *Baccharis pilularis* or *Rubus* spp.

3a. *Frangula californica* and/or *Rhododendron occidentale* dominate or co-dominate together with *Rubus*. Stands are found along springs, seeps, and ravines in wetland and riparian settings, often on sedimentary and serpentine substrates that retain water much of the year. If *Frangula californica* is dominant in upland settings along with *Baccharis pilularis* or other upland plants, key to the *Baccharis* alliance (Section II.7b.)

Vancouverian Lowland Marsh, Wet Meadow & Shrubland Macrogroup

Vancouverian Wet Shrubland Group

***Frangula californica – Rhododendron occidentale – Salix breweri* Alliance**
Frangula californica ssp. *californica* Provisional Association
Frangula californica ssp. *tomentella / Cirsium fontinale var. campylon – Mimulus guttatus* Association
Rhododendron occidentale – Frangula californica ssp. *tomentella* Association

3b. *Baccharis salicifolia, Rosa californica, Salix exigua,* or *S. lasiolepis* dominates or co-dominates along streams banks and benches, rivers, or close to springs.

Warm Desert Lowland Freshwater Marsh & Bosque Macrogroup

North American Warm Desert Riparian Low Bosque & Shrubland Group

3b1. *Salix exigua* dominates along rivers and streams, or close to springs. They are often the first plants to colonize bars and cut banks, followed later by trees such as *Acer* and *Salix* spp.

Salix exigua Alliance
Salix exigua Association

3b2. *Salix lasiolepis* dominates or co-dominates with *Rubus* spp. or *Baccharis pilularis* along stream banks and benches, slope seeps, and drainage stringers. If *Cornus sericea* is co-dominant, key to that alliance. Emergent riparian trees are often present, such as *Acer*, *Alnus*, *Fraxinus*, *Salix,* and others.

***Salix lasiolepis* Alliance**
Salix lasiolepis Association
Salix lasiolepis – Rubus spp. Association
Salix lasiolepis – Salix lucida Association

3b3. *Baccharis salicifolia* dominates or co-dominates in the shrub canopy with *Artemisia californica*, *Baccharis pilularis*, *Rubus* spp., *Salix exigua*, *Salix lasiolepis*, and *Sambucus nigra*. Emergent trees may be present at low cover, including *Pinus sabiniana*, *Platanus racemosa*, *Populus fremontii*, *Quercus* spp. or *Salix* spp.

***Baccharis salicifolia* Alliance**
Baccharis salicifolia Association

3b4. *Rosa californica* dominates or co-dominates in the shrub canopy with *Artemisia californica*, *Baccharis pilularis, Rubus armeniacus, Salix lasiolepis, Salvia mellifera, Sambucus nigra,* and *Symphoricarpos mollis.* Emergent trees may be present at low cover, including *Salix laevigata.*

***Rosa californica* Alliance**
Rosa californica Association

3c. *Sambucus nigra* dominates in the shrub overstory, often preferring stream terraces, bottomlands, and localized areas in uplands, where there was past disturbance.

Western North American Montane Marsh, Wet Meadow & Shrubland Macrogroup

Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland Group

***Rhus trilobata – Crataegus rivularis – Forestiera pubescens* Alliance**
Sambucus nigra Association

3d. *Prunus virginiana* dominates in the shrub overstory, often on steep north-facing slopes.

Cool Interior Chaparral Macrogroup

Western North American Montane Scrub Group

***Ribes quercetorum – Rhus trilobata – Frangula californica* Alliance**
Prunus virginiana Coast Range Association

Section II. Coastal scrub, dune/bluff, and disturbance-following vegetation dominated or co-dominated by drought-deciduous or seral (both deciduous and evergreen) shrubs. Includes *Artemisia californica, Baccharis pilularis*, *Ceanothus thyrsiflorus*, *Corylus cornuta, Ericameria ericoides*, *Ericameria nauseosa, Eriodictyon californicum*, *Eriogonum fasciculatum, Eriogonum wrightii, Frangula californica, Garrya elliptica, Gaultheria shallon*, *Holodiscus discolor, Keckiella corymbosa, Lupinus albifrons*, *Lupinus arboreus*, *Lupinus chamissonis*, *Rubus ursinus*, *Salvia mellifera,* and *Toxicodendron diversilobum*. Resprouting, deep-rooted, sclerophyllous shrubs may at times be characteristic, but not dominant.

4. *Eriogonum wrightii* is dominant in the shrub overstory.

Great Basin-Intermountain Dry Shrubland & Grassland Macrogroup

Mojave Mid-Elevation Mixed Desert Scrub Group

***Eriogonum wrightii – Eriogonum heermannii – Buddleja utahensis* Alliance**
*Eriogonum wrightii (*ssp. *subscaposum,* ssp. *wrightii)* Association

5. *Ericameria nauseosa* is dominant in the shrub overstory. No stands were sampled, but the alliance may occur within the project area.

Intermountain Semi-Desert Steppe & Shrubland Group

Ericameria nauseosa* Alliance

6. *Ericameria ericoides*, *Lupinus arboreus*, and/or *Lupinus chamissonis* are dominant, co-dominant, or characteristic (sometimes with as little as 5% cover) in the shrub overstory on coastal dunes, bluffs, or inland sandy and disturbed soils. A variety of herbs, including many of the following non-natives, may be present with high cover in the understory: *Bromus diandrus*, *Carduus*, *Holcus*, *Rumex acetosella*, and *Vulpia bromoides*.

Pacific Coastal Beach & Dune Macrogroup

Californian Coastal Beach & Dune Group

6a. *Lupinus arboreus* dominates or co-dominates with *Baccharis pilularis* and/or *Rubus ursinus,* often with high cover of grasses including *Bromus diandrus, Holcus lanatus, Lolium perenne*, *Vulpia bromoides*, and other non-native herbaceous species.

***Lupinus arboreus* Alliance**
Lupinus arboreus Association
Baccharis pilularis – Lupinus arboreus Association*

6b. *Ericameria ericoides* and/or *Lupinus chamissonis* dominate as individuals or in combination as co-dominants with *Baccharis pilularis* or *Lupinus arboreus;* occurring along the immediate coast.

***Lupinus chamissonis – Ericameria ericoides* Alliance**
Ericameria ericoides Association
Lupinus chamissonis Association*
Lupinus chamissonis – Ericameria ericoides Association*

6c. *Ericameria ericoides* dominates or co-dominates with other sandhill shrubs such as *Lupinus albifrons* away from the immediate shoreline on sandy soils with recent disturbance typically with other diagnostic “sand hills” herbaceous plants.

Californian Coastal Scrub Macrogroup

Californian Coastal-Foothill Seral Scrub Group

***Lotus scoparius – Lupinus albifrons – Eriodictyon* spp. Alliance**
Lupinus albifrons – Lotus scoparius / Chorizanthe pungens Association

7. Shrublands dominated or co-dominated by native, coastal scrub and disturbance-following shrubs or by naturalized, or planted species, including *Artemisia californica, Baccharis pilularis*, *Ceanothus thyrsiflorus*, *Cistus*, *Cytisus, Eriodictyon californicum*, *Eriogonum fasciculatum, Gaultheria shallon*, *Genista, Heterotheca sessiliflora*, *Lupinus albifrons*, *Rubus parviflorus, Rubus ursinus*, *Toxicodendron diversilobum,* and/or *Ulex europaeus.*

Californian Coastal Scrub Macrogroup

7a. *Diplacus aurantiacus, Eriodictyon californicum*, *Keckiella corymbosa, Lepechinia calycina, Lupinus albifrons, Malacothamnus* spp., or *Prunus emarginata* dominates in the overstory.

Californian Coastal-Foothill Seral Scrub Group

7a1. *Eriodictyon californicum, Lepechinia calycina, Lotus scoparius, Lupinus albifrons,* or *Pickeringia montana,* dominates or co-dominates with other seral scrub, often in stands that are open and/or display recent evidence of fire or other disturbance such as road cuts. Other coastal scrub may be present at lower cover, including *Artemisia californica, Baccharis pilularis,* and *Toxicodendron diversilobum.* The understory may be composed of mixed native and non-native herbs, which sometimes have higher cover than the overstory shrubs.

***Lotus scoparius – Lupinus albifrons – Eriodictyon* spp. Alliance**
Eriodictyon californicum / Herbaceous Association
Lotus scoparius Association
Lupinus albifrons Association*
Lupinus albifrons – Lotus scoparius / Chorizanthe pungens Association

7a2. *Diplacus aurantiacus* strongly dominant, often on steep slopes and ridgetops. Other coastal scrub may be present at lower cover. If *D. aurantiacus* is co-dominant with *Adenostoma fasciculatum* or *Artemisia californica*, see those respective alliances.

***Diplacus aurantiacus* Alliance**
Diplacus (aurantiacus, puniceus) Association

7a3. A species of *Malacothamnus* is dominant or co-dominant in the shrub canopy with *Adenostoma fasciculatum*, *Artemisia californica*, *Cercocarpus montanus*, *Eriogonum fasciculatum*, *Heteromeles arbutifolia*, *Lotus scoparius*, and *Salvia mellifera*. Emergent trees may be present at low cover, including *Platanus racemosa* or *Quercus agrifolia*.

***Malacothamnus fasciculatus – Malacothamnus* spp. Alliance**
Malacothamnus (aboriginum, fremontii, hallii) Provisional Association

7b. *Baccharis pilularis*, *Ceanothus incanus*, *C. thyrsiflorus*, *Corylus cornuta, Frangula californica, Garrya elliptica, Gaultheria shallon*, *Holodiscus discolor, Prunus virginiana, Rubus parviflorus, Rubus ursinus*, and/or *Toxicodendron diversilobum* dominate or co-dominate as shrubs. Shrubs are typically evergreen or winter-deciduous, not sclerophyllous or drought-deciduous species. Found along cool, coastal strips or on sheltered inland draws and lower slopes, where species are tolerant of disturbance and trees tend to be excluded.

Californian North Coastal & Mesic Scrub Group

7b1. *Baccharis pilularis* dominates or co-dominates with *Frangula californica*, *Toxicodendron diversilobum*, or *Rubus* spp. in the shrub overstory. If *Calamagrostis nutkaensis* or *Carex obnupta* have equal or higher cover than *B. pilularis*, key to the *Calamagrostis nutkaensis* Alliance (see Class C, step 9b3). If *Corylus cornuta* is codominant, key to that alliance below. If stands have greater cover of *Ceanothus thyrsiflorus* or *Toxicodendron diversilobum* than *Baccharis pilularis,* key to those respective alliances. Stands that have greater cover of *Artemisia californica,* usually key to that alliance. A variety of native and non-native forbs and grasses may intermix in the herbaceous layer, sometimes with higher cover than *Baccharis* – including *Avena*, *Bromus*, *Danthonia*,

Deschampsia, *Elymus glaucus*, *Eriophyllum staechadifolium, Festuca*, *Hypochaeris*, *Nassella pulchra,* and others.

***Baccharis pilularis* Alliance**
Baccharis pilularis Association
Baccharis pilularis – Artemisia californica Association
Baccharis pilularis – Ceanothus thyrsiflorus Association*
Baccharis pilularis – (Frangula californica) – Rubus spp. Association
Baccharis pilularis – Toxicodendron diversilobum Association
Baccharis pilularis / (Nassella pulchra – Elymus glaucus – Bromus carinatus) Association
Baccharis pilularis / Annual Grass – Herb Association
Baccharis pilularis / Carex obnupta – Juncus patens Association*
Baccharis pilularis / Danthonia californica Association*
Baccharis pilularis / Deschampsia cespitosa Association*
Baccharis pilularis / Eriophyllum staechadifolium Association

7b2. *Frangula californica* dominates or co-dominates with *Baccharis pilularis, Diplacus aurantiacus, Morella californica, Oemleria cerasiformis, Salix lasiolepis, and/or Toxicodendron diversilobum* in the shrub overstory. Stands occur on slopes above salt marsh and in upland coastal bluff on mesic slopes, related to stands of *Baccharis pilularis*. (also see Class B. **3a** above)

***Baccharis pilularis* Alliance**
Frangula californica ssp. *californica – Baccharis pilularis / Scrophularia californica* Association

7b3. *Ceanothus thyrsiflorus* or *C. incanus* dominates in the overstory shrub layer, often with moderately dense cover. Stands are often found in localized patches following fires. *Diplacus aurantiacus*, *Heteromeles*, *Pseudotsuga menziesii*, *Quercus wislizeni*, and other species may intermix as sub-dominants in the shrub and tree layers. If *Baccharis pilularis* is present, *Ceanothus thyrsiflorus* is greater in cover. Stands of *C. incanus* are included in the *C. thyrsiflorus* Alliance since they are more limited in distribution and are ecologically similar to *C. thyrsiflorus*.

***Ceanothus thyrsiflorus* Alliance**
Ceanothus incanus Association
Ceanothus thyrsiflorus – (*Rubus ursinus*) Association
Ceanothus thyrsiflorus – Baccharis pilularis – Toxicodendron diversilobum Association

7b4. *Gaultheria shallon, Holodiscus discolor, Rubus parviflorus,* and/or *Rubus ursinus* dominate or co-dominate with *Baccharis pilularis, Holcus lanatus,* or *Toxicodendron diversilobum* on hillslopes, rock outcrops, coastal bluffs, or flats.

***Gaultheria shallon – Rubus* (*ursinus*) Alliance**
Holodiscus discolor – Baccharis pilularis – Rubus ursinus Association*
Rubus parviflorus Association
Rubus ursinus Association

7b5. *Toxicodendron diversilobum* dominates, sometimes intermixing with sub-dominant *Baccharis pilularis* and *Rubus* spp. If *B. pilularis* is present and greater

than 50% relative cover, key to the *Baccharis pilularis* Alliance (step 5b1). For this project, stands were encountered close to the coast, although they are likely to occur inland as well.

***Toxicodendron diversilobum* Alliance**
Toxicodendron diversilobum – (Baccharis pilularis) Association

7b6. *Corylus cornuta* dominates or co-dominates with *Baccharis pilularis* and other shrubs as a medium-tall scrub on steep concave slopes with northern to eastern exposures surrounded by *Pseudotsuga menziesii*. Other shrubs may include *Baccharis pilularis*, *Frangula californica*, *Rubus ursinus*, *Vaccinium ovatum,* and *Toxicodendron diversilobum*.

***Corylus cornuta* var. *californica* Alliance**
Corylus cornuta / Polystichum munitum Association

7b7. *Garrya elliptica* dominates with other shrubs such as *Baccharis pilularis* and *Toxicodendron diversilobum* as well as herbaceous species such as *Polystichum munitum*. Emergent trees may be present at low cover, including *Umbellularia californica*.

***Baccharis pilularis* Alliance**
Garrya elliptica Provisional Association*

7c. *Artemisia californica* or *Salvia mellifera* dominates and may intermix with *Baccharis pilularis, Diplacus aurantiacus, Eriodictyon californicum,* and/or *Toxicodendron diversilobum*.

Central & Southern Californian Coastal Sage Scrub Group

7c1. *Artemisia californica* dominates and may intermix with *Baccharis pilularis, Diplacus aurantiacus,* and/or *Toxicodendron diversilobum*. If *Baccharis pilularis* is present, *Artemisia californica* is greater in cover for this alliance. If *Adenostoma fasciculatum* is present, it is not co-dominant. If the cover of *Eriophyllum staechadifolium* and the other nominate species in the *Eriophyllum staechadifolium – Erigeron glaucus – Eriogonum latifolium* Alliance is more than twice the cover of *Artemisia*, key to that alliance in the herbaceous part of the key. If *Eriodictyon californicum* or *Diplacus aurantiacus* is co-dominant, key here.

***Artemisia californica – (Salvia leucophylla) A*lliance**
Artemisia californica Association
Artemisia californica – Diplacus aurantiacus Association
Artemisia californica / Nassella (pulchra) Association

7c2. *Salvia mellifera* dominates or co-dominates with *Artemisia californica, Diplacus aurantiacus, Eriogonum fasciculatum,* or *Lotus scoparius*. If *Adenostoma fasciculatum* is present, it is not co-dominant.

***Salvia mellifera – (Artemisia californica) A*lliance**
Salvia mellifera Association
Salvia mellifera – Artemisia californica Association

7c3. *Eriogonum fasciculatum* dominates or co-dominates with *Artemisia californica, Baccharis pilularis, Diplacus aurantiacus, Encelia californica, Encelia farinosa, Isocoma menziesii, Lotus scoparius, Malacothamnus fasciculatus,*

Salvia apiana or *Salvia mellifera.* Emergent trees may be present at low cover including *Juniperus californica.* Mapped but not sampled.

Eriogonum fasciculatum* Alliance
Eriogonum fasciculatum Association*

7d. *Albizia lophantha*, *Cistus* spp.*, Cotoneaster* spp.*, Cytisus scoparius, Echium candicans, Genista monspessulana, Grevillea* spp.*, Helichrysum petiolare, Rosa rubiginosa, Ulex europaeus,* or other Mediterranean shrubs not native to California dominates in naturalized or planted stands. May be found invading disturbed areas, grasslands, or forest openings.

7d1. A non-native *Acacia, Albizia lophantha, Grevillea,* and/or *Leptospermum laevigatum* dominates or co-dominate together in the tall shrub or low tree canopy. If *Acacia melanoxylon* is dominant, key to the *Eucalyptus* spp. – *Ailanthus altissima – Robinia pseudoacacia* Woodland Semi-Natural Alliance.

Californian Ruderal Grassland, Meadow & Scrub Group

***Acacia* spp. – *Grevillea* spp. – *Leptospermum laevigatum* Provisional Semi-Natural Alliance**
Acacia (cyclops, dealbata) Association

7d2. *Myoporum laetum* or *Schinus molle* strongly dominant in open to dense stands.

Californian Ruderal Forest Group

Schinus (molle, terebinthifolius) – Myoporum laetum* Semi-Natural Alliance
Schinus molle Semi-Natural Association*

7d3. *Cistus* spp., *Cotoneaster* spp., *Cytisus scoparius, Genista monspessulana, Hypericum canariense, Ulex europaeus,* or other broom plants strongly dominate in the shrub overstory. Fire promotes broom invasions in woodland settings; however, broom or other non-native Mediterannean scrub may invade coastal grasslands without fire. Also, other non-natives such as *Echium candicans* may be dominant or co-dominant with other non-native shrubs and herbs and key here.

Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group

***Cytisus scoparius – Genista monspessulana – Cotoneaster* spp. Semi-Natural Alliance**
Cotoneaster (lacteus, pannosus) Provisional Semi-Natural Association*
Cytisus scoparius Provisional Semi-Natural Association*
Echium candicans Semi-Natural Association*
Genista monspessulana Semi-Natural Association
Hypericum canariense Provisional Semi-Natural Association*
Spartium junceum Semi-Natural Association
Ulex europaeus Provisional Semi-Natural Association*

7d4. *Helichrysum petiolare, Maytenus boaria, Rosa eglanteria, R. rubiginosa, Pittosporum,* or other non-native shrubs dominant in open to dense stands, where they are often invading coastal grasslands.

Section III. Shrub vegetation dominated by evergreen sclerophyll-leaved species, including many that have developed growth strategies driven by a Mediterranean climate. Most of the core diagnostic species are endemic to California, including *Adenostoma*, *Arctostaphylos*, *Ceanothus cuneatus*, *C. leucodermis, C. oliganthus*, *Cercocarpus montanus*, *Chrysolepis chrysophylla, Quercus berberidifolia*, *Q. durata*, and shrubby *Q. parvula* var. *shrevei* or *Q. wislizeni*.

Californian Chaparral Macrogroup

8. *Arctostaphylos crustacea, A. andersonii, A. glutinosa, A. imbricata, A. sensitiva, A. silvicola, A. uva-ursi, Chrysolepis chrysophylla* var. *minor,* or *Vaccinium ovatum* dominates or co-dominates in maritime chaparral stands.

Californian Maritime Chaparral Group

8a. *Arctostaphylos glutinosa, A. sensitiva, A. uva-ursi, Chrysolepis chrysophylla* var. *minor,* and/or *Vaccinium ovatum* dominates or co-dominates with *Adenostoma fasciculatum, Arctostaphylos crustacea, Ceanothus thyrsiflorus,* or other shrubs. *Pinus attenuata* or *P. muricata* and *Pteridium aquilinum* are often present. Stands are often transitional between forest and chaparral.

***Arctostaphylos* (*nummularia*, *sensitiva*) – *Chrysolepis chrysophylla* Alliance**
Arctostaphylos glutinosa Provisional Association
Arctostaphylos sensitiva Association
Chrysolepis chrysophylla / Vaccinium ovatum Association

8b. *Arctostaphylos crustacea* dominates or co-dominates with *Adenostoma fasciculatum, Arctostaphylos regismontana, Ceanothus cuneatus, C. papillosus, Frangula californica, Heteromeles arbutifolia, Quercus parvula,* or *Q. wislizeni* var. *frutescens.* Trees are often present but at low cover.

***Arctostaphylos* (*crustacea, tomentosa*) Alliance**
Arctostaphylos crustacea Association
Arctostaphylos crustacea – Adenostoma fasciculatum – Ceanothus (cuneatus, papillosus) Association

8c. *Arctostaphylos silvicola* or *Arctostaphylos andersonii* is dominant or co-dominant in the shrub canopy with *Adenostoma fasciculatum*, *Arctostaphylos crustacea*, *Artemisia californica*, *Ceanothus cuneatus*, *Diplacus aurantiacus*, *Ericameria ericoides*, *Eriodictyon californicum*, *Eriophyllum confertiflorum*, *Frangula californica*, *Heteromeles arbutifolia*, *Lupinus albifrons,* and *Vaccinium ovatum*. Emergent trees may be present at low cover, including *Arbutus menziesii*, *Pinus attenuata*, *Pinus ponderosa*, *Pseudotsuga menziesii* or *Quercus agrifolia*. If *Arctostaphylos silvicola* is co-dominant with *A. sensitiva,* key to the *Arctostaphylos* (*nummularia*, *sensitiva*) – *Chrysolepis chrysophylla* Alliance.

***Arctostaphylos* (*crustacea, tomentosa*) Alliance**
Arctostaphylos (*andersonii, pallida)* Provisional Association
Arctostaphylos silvicola Association

9. *Arctostaphylos glandulosa, A. ×campbelliae, Ceanothus ferrisiae, Ceanothus papillosus, Cercocarpus montanus, Heteromeles arbutifolia, Prunus ilicifolia, Ptelea crenulata, Quercus berberidifolia, Quercus wislizeni,* and/or *Quercus durata* dominate or co-dominate with *Adenostoma fasciculatum*. Stands are mostly found inland from the coastal fog belt and are often composed of large shrubs occupying mesic sites such as north-facing slopes, concavities, and toeslopes with well-drained soils.

Californian Mesic & Pre-Montane Chaparral Group

9a. *Cercocarpus montanus (= C. betuloides)* dominates the stand, sometimes with *Adenostoma fasciculatum* or *Prunus ilicifolia* as codominants or subdominants. *Artemisia californica* and *Ribes californicum* are often present.

***Cercocarpus montanus* Alliance**
Cercocarpus montanus – Adenostoma fasciculatum Association
Cercocarpus montanus – Prunus ilicifolia Association
Cercocarpus montanus var. *glaber* Association

9b. *Quercus berberidifolia* dominates or co-dominates with *Adenostoma fasciculatum, Ceanothus cuneatus,* and/or other chaparral shrubs.

***Quercus berberidifolia* Alliance**
Quercus berberidifolia Association
Quercus berberidifolia – Adenostoma fasciculatum Association
Quercus berberidifolia – Arctostaphylos glauca Association
Quercus berberidifolia – Ceanothus cuneatus Association

9c. *Ceanothus ferrisiae, Heteromeles arbutifolia, Prunus ilicifolia,* and/or *Ptelea crenulata* dominate or co-dominate in the shrub layer with *Baccharis pilularis, Rhamnus crocea, R. ilicifolia,* and/or *Toxicodendron diversilobum. Sanicula crassicaulis* and other herbs such as *Clinopodium douglasii* may be present to abundant in the understory.

***Prunus ilicifolia – Heteromeles arbutifolia – Ceanothus spinosus* Alliance**
Ceanothus ferrisiae – Heteromeles arbutifolia Association
Heteromeles arbutifolia Serpentine Association
Prunus ilicifolia ssp*. Ilicifolia – Heteromeles arbutifolia* Association
Prunus ilicifolia – Rhamnus (crocea, ilicifolia) Association
Prunus ilicifolia ssp. Ilicifolia / Sanicula crassicaulis Association

9d. *Quercus durata* dominates or co-dominates with various shrubs including *Adenostoma fasciculatum, Arctostaphylos glauca, Frangula californica ssp. tomentella, Heteromeles arbutifolia* and/or shrubby *Umbellularia californica.* Soils are ultramafic soils (e.g., serpentine, gabbro). Herbaceous layer may be well-developed including *Chlorogalum* spp., *Festuca* spp.. *Lolium perenne,* or *Melica torreyana.*

***Quercus durata* Alliance**
Quercus durata Association
Quercus durata – Adenostoma fasciculatum Provisional Association
Quercus durata – Arctostaphylos glauca – Artemisia californica / Grass Provisional Association

Quercus durata – Arctostaphylos glauca – Garrya congdonii / Melica torreyana Provisional Association
Quercus durata – Frangula californica ssp. tomentella – Arctostaphylos glauca Provisional Association
Quercus durata – Heteromeles arbutifolia – Umbellularia californica Provisional Association

9e. *Arctostaphylos glandulosa* or *A. ×campbelliae* dominates or co-dominates with *Adenostoma fasciculatum, Quercus berberidifolia,* and/or *Quercus wislizeni* on convexities, outcrops, ridges, or slopes. Sometimes *Q. wislizeni* may be a tree, though often it is shrubby in stands sampled. Soils may be derived from sandstone, shale, serpentine, or gabbro. Species commonly found as emergent trees or sub-dominant shrubs include *Arbutus menziesii*, *Arctostaphylos* spp., *Diplacus aurantiacus*, and *Heteromeles arbutifolia*. *A. glandulosa* is found in the Diablo Range and not found in the Santa Cruz Mountains, where *A. crustacea* is the primary burl-forming species.

***Arctostaphylos glandulosa* Alliance**
Arctostaphylos glandulosa Association*
Arctostaphylos glandulosa – Adenostoma fasciculatum Association*
Arctostaphylos glandulosa – Adenostoma fasciculatum – Quercus berberidifolia Association

9f. *Ceanothus papillosus* dominates or co-dominates in the shrub canopy with *Adenostoma fasciculatum*, *Arctostaphylos glandulosa*, *Ceanothus cuneatus*, *Eriodictyon californicum*, *Heteromeles arbutifolia*, *Quercus berberidifolia*, *Quercus wislizeni*, *Salvia mellifera,* and *Toxicodendron diversilobum* in post-fire settings. Emergent trees may be present at low cover, including *Pinus coulteri*, *Pinus ponderosa*, *Quercus agrifolia*, *Quercus chrysolepis,* or *Umbellularia californica*.

***Ceanothus papillosus* Alliance**
Ceanothus papillosus – Adenostoma fasciculatum Association*
Ceanothus papillosus – Eriodictyon californicum Association

10. *Ceanothus leucodermis, C. oliganthus, Quercus wislizeni* var. *frutescens,* and/or *Quercus parvula,* dominate or co-dominate in the shrub overstory. These shrublands are more frost tolerant and typically found at higher, cooler, or more mesic sites than the California Xeric Chaparral Group.

Californian Mesic & Pre-Montane Chaparral Group

10a. *Ceanothus leucodermis* or *Ceanothus oliganthus* dominates in shrublands that are often found in localized patches following fires. If *Quercus wislizeni* is co-dominant, key to the *Quercus wislizeni – Quercus chrysolepis* (shrub) Alliance directly below.

***Ceanothus (oliganthus, tomentosus)* Alliance**
Ceanothus leucodermis Association*
Ceanothus oliganthus Association

10b. *Quercus agrifolia, Q. parvula, Q. wislizeni* or other *Quercus* spp. dominate and/or co-dominate as shrubby regenerating trees or short trees, co-occurring with *Umbellularia*, *Adenostoma*, and a variety of other shrubs that prefer more mesic, northerly exposures. *Quercus parvula* and *Q. wislizeni* are not always

morphologically distinct. When *Q. wislizeni* or *Q. parvula* dominates or co-dominates as an overstory tree, key to the *Quercus wislizeni – Quercus parvula* (tree) Alliance. *Umbellularia californica* is often emergent, while a variety of thick- and soft-leaved shrubs intermix as sub-dominants.

Quercus wislizeni – Quercus chrysolepis* (shrub) Alliance
Quercus agrifolia – Quercus chrysolepis – Quercus parvula (shrub) Provisional Association
Quercus parvula (shrub) Provisional Association*

11. Sclerophyll (i.e., thick-leaved) shrublands dominated by one or more of the following taxa: *Adenostoma fasciculatum*, *Arctostaphylos canescens*, *Arctostaphylos glauca,* or *Ceanothus cuneatus*. Most stands occur on well-drained soils along exposures that are in full sun much of the growing season, including upper slopes, spur ridges, and convexities.

Californian Xeric Chaparral Group

11a. *Arctostaphylos canescens* and/or *A. manzanita* dominate or co-dominate, sometimes with co-dominant *Adenostoma fasciculatum*. *A. canescens* is restricted to Tertiary sandstones and shales in the Santa Cruz Mountains, flanking the San Andreas fault. One alliance is recognized for all three *Arctostaphylos* vegetation types, with associations specific to each species.

***Arctostaphylos* (*canescens*, *manzanita*, *stanfordiana*) Alliance**
Arctostaphylos canescens Provisional Association
Arctostaphylos canescens – Arctostaphylos glandulosa – Adenostoma fasciculatum Provisional Association*
Arctostaphylos manzanita Association*

11b. *Arctostaphylos glauca* is dominant or co-dominant in the shrub canopy with *Adenostoma fasciculatum*, *Arctostaphylos glandulosa*, *Artemisia californica*, *Ceanothus cuneatus*, *Cercocarpus montanus*, *Heteromeles arbutifolia*, *Quercus berberidifolia*, *Quercus durata*, *Quercus wislizeni*, *Rhamnus ilicifolia,* and *Salvia mellifera*. Emergent trees may be present at low cover, including *Quercus agrifolia* or *Quercus wislizeni* var. w*islizeni*. Found typically on volcanic, Franciscan, serpentine, and greenstone substrates.

***Arctostaphylos glauca* Alliance**
Arctostaphylos glauca Association
Arctostaphylos glauca – Adenostoma fasciculatum Association
Arctostaphylos glauca – Artemisia californica – Salvia mellifera Association
Arctostaphylos glauca / Melica torreyana Association

11c. *Ceanothus cuneatus* dominates or co-dominates with *Adenostoma fasciculatum*, often on convexities with westerly exposures. A variety of shrubs may intermix, including *Arctostaphylos* spp., *Baccharis pilularis*, *Eriodictyon*, *Heteromeles*, *Quercus durata,* and others.

***Ceanothus cuneatus* Alliance**
Ceanothus cuneatus – (Arctostaphylos spp.) Maritime Provisional Association
Ceanothus cuneatus – Adenostoma fasciculatum Association

11d. *Adenostoma fasciculatum* dominates or is co-dominant with a scrub species such as *Baccharis pilularis*, soft-leaved *Ceanothus* spp., *Diplacus aurantiacus, Eriodictyon californicum, Eriophyllum confertiflorum*, or *Lupinus albifrons*. If *A. fasciculatum* co-dominates with *Arctostaphylos* spp., *Ceanothus cuneatus*, *Cercocarpus montanus*, *Quercus berberidifolia,* or *Q. durata*, key to one of the latter alliances instead of *A. fasciculatum*.

***Adenostoma fasciculatum* Alliance**
Adenostoma fasciculatum Association
Adenostoma fasciculatum – (Ceanothus cuneatus) Association
Adenostoma fasciculatum – (Lotus scoparius – Eriodictyon spp.*)* Association
Adenostoma fasciculatum – Diplacus aurantiacus Association
Adenostoma fasciculatum – Heteromeles arbutifolia / Melica torreyana Association

11e. *Adenostoma fasciculatum* and *Salvia mellifera* co-dominate.

***Adenostoma fasciculatum – Salvia* spp. Alliance**
Adenostoma fasciculatum – Salvia mellifera Association

Class C. Herbaceous & Sparse Vegetation

Section I. Vegetation of: a) freshwater wetland or riparian settings with water or wet ground present temporarily, seasonally, or throughout the growing season, b) saline or alkaline lowlands where water accumulates in the winter, or c) tidal salt or brackish marshes with seasonal or ephemeral inundations. Includes herbaceous vegetation dominated, co-dominated, or characterized by: *Argentina* (=*Potentilla*), *Azolla, Bidens*, *Baccharis douglasii (= B. glutinosa), Bolboschoenus*, *Carex*, *Ceratophyllum*, *Distichlis*, *Eleocharis macrostachya*, *Grindelia stricta*, *Hydrocotyle, Juncus arcticus*, *J. effusus*, *J. lescurii*, *J. patens*, *Lasthenia glaberrima*, *Lemna*, *Lepidium latifolium*, *Leymus triticoides*, *Ludwigia*, *Mimulus guttatus*, *Nuphar*, *Oenanthe*, *Persicaria*, *Pleuropogon*, *Potamogeton Ruppia, Sarcocornia* (=*Salicornia*), *Schoenoplectus*, *Scirpus*, *Sparganium, Spartina*, *Stuckenia, Typha,* and/or *Xanthium*.

1. Freshwater stands dominated by aquatic, floating or submerged plants, including *Azolla, Ceratophyllum*, *Hydrocotyle, Lemna*, *Ludwigia*, *Nuphar, Potamogeton, Sparganium,* and/or *Stuckenia*. Found along slow-moving streams, still ponds, lakes, or on ground surfaces after water levels have dropped.

Western North American Freshwater Aquatic Vegetation Macrogroup

1a. *Ludwigia hexapetala* or *L. peploides* dominates, creating mats in shallow water or over wet soil. Other aquatic plants such as *Azolla*, *Lemna*, *Myriophyllum aquaticum, Polygonum*, and *Sparganium* may be present.

North American Temperate Ruderal Aquatic Vegetation Group

***Ludwigia* (*hexapetala*, *peploides*) – *Eichhornia crassipes* Semi-Natural Alliance**

Ludwigia (*hexapetala*, *peploides*) Semi-Natural Association

1b. *Azolla filiculoides* or *Azolla microphylla*) dominates or characterizes stands on water or wet ground surfaces. If *Lemna* is co-dominant, key to this alliance.

Western North American Temperate Freshwater Aquatic Vegetation Group

***Azolla* (*filiculoides, microphylla*) Alliance**

Azolla (filiculoides, microphylla) Association

1c. *Ceratophyllum*, *Hydrocotyle, Lemna*, *Nuphar, Potamogeton, Sparganium,* and/or *Stuckenia* dominates in water or on surfaces of streams, ponds or lakes.

Western North American Temperate Freshwater Aquatic Vegetation Group

1c1. *Ceratophyllum demersum* dominates.

***Ceratophyllum demersum* Aquatic Provisional Alliance**

Ceratophyllum demersum Western Provisional Association

1c2. *Nuphar lutea* dominates on the water surface. Algae and a variety of hydrophytes may intermix, including *Alisma*, *Carex*, *Hippuris vulgaris*, *Lemna, Polygonum*, and *Oenanthe*.

Nuphar lutea* Freshwater Aquatic Provisional Alliance

Nuphar lutea ssp. *polysepala* Provisional Association*

1c3. *Hydrocotyle ranunculoides* dominant on the water surface of coastal lagoons and freshwater lakes growing with *Lemna* spp. And *Scirpus microcarpus*.

***Hydrocotyle (ranunculoides, umbellata)* Alliance**
Hydrocotyle ranunculoides Association

1c4. *Sparganium eurycarpum* is dominant in wetlands or freshwater with other forbs including *Agrostis pallens, Oenanthe sarmentosa,* and *Rumex conglomeratus*.

***Sparganium (angustifolium)* Alliance**
Sparganium eurycarpum Provisional Association

1c4. *Potamogeton or Stuckenia* is dominant or co-dominant in freshwater at or near the surface with other aquatic species including *Ceratophyllum demersum* or *Lemna* spp.

***Stuckenia (pectinata) – Potamogeton* spp. Alliance**
Potamogeton spp. Association
Stuckenia pectinata Association

2. Salt and brackish marshes and estuaries dominated or co-dominated by *Atriplex prostrata*, *Bolboschoenus*, *Cotula coronopifolia, Distichlis*, *Lilaeopsis occidentalis*, *Ruppia, Sarcocornia* (=*Salicornia*), *Spartina* and/or *Zostera*. *Argentina egedii* may also be dominant in high tidal salt marsh. May appear as sparsely vegetated mudflats at low tide, or during restoration. Mudflats with trace amounts of cover by herbs are included here (see 2e2).

2a. *Bolboschoenus maritimus*, *Distichlis spicata*, *Frankenia salina*, *Grindelia stricta, Sarcocornia* (=*Salicornia*), *Spartina, Suaeda calceoliformis,* and/or *Triglochin* spp. Dominant or co-dominant tidal salt marshes to brackish marshes. *Argentina egedii* may also be dominant in high tidal salt marsh.

North American Pacific Coastal Salt Marsh Macrogroup

Temperate Pacific Salt Marsh Group

2a1. *Bolboschoenus maritimus* or *B. robustus* dominates or co-dominates with *Sarcocornia* (=*Salicornia*) *pacifica*.

***Bolboschoenus maritimus* Alliance**
Bolboschoenus maritimus Association
Bolboschoenus maritimus – Sarcocornia pacifica Association*

2a2. *Argentina egedii* dominates in high tidal salt marsh with *Distichlis spicata* and other salt-tolerant plants such as *Atriplex prostrata* or *Frankenia salina*.

***Distichlis spicata – Frankenia salina* Coastal Alliance**
Argentina egedii – Distichlis spicata Provisional Association

2a3. *Distichlis spicata* dominates in salty habitats along the coast and in high salt marsh settings, or co-dominates with *Frankenia salina* and/or *Jaumea carnosa*. Non-native grasses including *Avena* spp. And *Bromus hordeaceus* may have high cover and *Sarcocornia pacifica* may be present as a sub-dominant. If *Distichlis spicata* dominates in alkali seeps or other salty habitats without direct

marine influence, key to *Cressa truxillensis – Distichlis spicata* Alliance, see step 5.

***Distichlis spicata – Frankenia salina* Coastal Alliance**
Distichlis spicata Association
Distichlis spicata – Ambrosia chamissonis Association
Distichlis spicata – annual grasses Association*
Distichlis spicata – Frankenia salina – Jaumea carnosa Association
Distichlis spicata – Sarcocornia pacifica Association

2a4. *Frankenia salina* is strongly dominant or codominates with *Grindelia stricta* or *Sarcocornia pacifica* in tidal marsh settings with other salt tolerant plants such as *Limonium californicum* and *L. ramosissimum*. *Sarcocornia pacifica* may be present as a sub-dominant.

***Distichlis spicata – Frankenia salina* Coastal Alliance**
Frankenia salina – Limonium californicum – Monanthochloe littoralis – Sarcocornia pacifica Association

2a5. *Limonium californicum* and *Frankenia salina* are present and in combination are greater than 30% relative cover of the stand. Grasses such as *Hordeum depressum* and *Bromus carinatus* may have higher cover in tidal marsh settings.

***Distichlis spicata – Frankenia salina* Coastal Alliance**
Frankenia salina – Limonium californicum – Monanthochloe littoralis – Sarcocornia pacifica Association

2a6. *Sarcocornia pacifica* dominates or co-dominates with *Atriplex prostrata, Cotula coronopifolia, Distichlis spicata, Jaumea carnosa*, and/or *Lepidium latifolium*. Stands found in coastal salt marshes, alkali flats, and wetland mudflats.

***Sarcocornia pacifica* (*Salicornia depressa*) Alliance**
Sarcocornia pacifica – Atriplex prostrata Association
Sarcocornia pacifica – Cotula coronopifolia Association*
Sarcocornia pacifica – Jaumea carnosa – Distichlis spicata Association
Sarcocornia pacifica – Schoenoplectus americanus Association
Sarcocornia pacifica Tidal Association

2a7. *Spartina foliosa* dominates or co-dominates with *Grindelia stricta* or *Sarcocornia pacifica* on mudflats, banks, berms, and margins of bays and deltas.
***Spartina foliosa* Alliance**
Spartina foliosa Association
Spartina foliosa – Sarcocornia pacifica Association

2a8. *Grindelia stricta* or *Grindelia hirsutula* dominates or co-dominates with *Distichlis spicata, Sarcocornia pacifica,* or non-native herbs such as *Polypogon monspeliensis, Rumex crispus,* and *Bromus diandrus*. If *Spartina foliosa* co-dominates, key to that alliance. Stands may be found on slightly elevated or drier ground adjacent to salt or alkaline marshes, tidal flats, levees, and road margins.

***Distichlis spicata – Frankenia salina* Coastal Alliance**
Grindelia stricta Provisional Association

2b. Non-native species such as *Atriplex prostrata, Cotula coronopifolia, Crypsis* spp*., Cynodon dactylon, Cyperus eragrostis, Mollugo verticillata, Panicum millaceum,* and/or *Paspalum* spp. Dominate in low-lying sloughs and other disturbed alkaline or saline wetlands

Western North American Ruderal Marsh, Wet Meadow & Shrubland Macrogroup

Western North American Ruderal Marsh, Wet Meadow & Shrubland Group

2b1. *Atriplex prostrata* and/or *Cotula coronopifolia* dominates or co-dominates, with overall non-native herbs > 80% relative cover.

***Atriplex prostrata – Cotula coronopifolia* Semi-Natural Alliance**
Atriplex prostrata Semi-Natural Association
Cotula coronopifolia Semi-Natural Association*

2b2. *Crypsis* spp*., Cynodon dactylon, Cyperus eragrostis, Mollugo verticillata, Panicum millaceum, Paspalum* spp*.,* and/or other non-native plants > 80% relative cover individually or collectively in the herbaceous layer.

***Cynodon dactylon – Crypsis* spp. – *Paspalum* spp. Semi-Natural Alliance**
Crypsis (schoenoides, vaginiflora) Semi-Natural Association

2c. *Ruppia* spp. Dominant submersed in brackish to fresh water. Stands are likely in the counties.

Ditchgrass Saline Aquatic Vegetation Macrogroup

Widgeongrass Bed Group

Ruppia (cirrhosa, maritima)* Alliance

2d. *Zostera marina* and/or *Z. pacifica* dominate in tidal and aquatic marine settings.

Temperate Seagrass Aquatic Vegetation Macrogroup

Temperate Pacific Seagrass Bed Group

Zostera* (*marina, pacifica*) Pacific Aquatic Alliance
Zostera marina Association*

2e. Mudflats or dry pond bottoms (sometimes in sites undergoing restoration) with trace amounts of cover by herbs.

Vancouverian Lowland Marsh, Wet Meadow & Shrubland Macrogroup

Temperate Pacific Freshwater Wet Mudflat Group

2e1. *Lilaeopsis occidentalis* dominates in coastal salt marsh settings.

Lilaeopsis occidentalis* Provisional Alliance

2e2. Mudflats or dry pond bottoms (sometimes in sites undergoing restoration) with trace amounts of cover by *Agrostis avenacea, Sarcocornia pacifica, Sesuvium,* and others. Cover by plants is sparse and/or uneven.

Mudflat/Dry Pond Bottom Mapping Unit

3. Freshwater or brackish stands dominated by *Argentina*, *Carex pansa*, *C. obnupta*, *C. praegracilis*, *Juncus effusus*, *J. lescurii*, *J. patens*, *Oenanthe*, *Schoenoplectus*, *Scirpus*

microcarpus, and/or *Typha,* where water is present throughout all or most of the growing season. Soils have high organic content and may be poorly aerated.

3a. *Schoenoplectus* and/or *Typha* dominate in the herbaceous layer. Stands are found along streams, ditches, shores, bars, and channels of river mouth estuaries; around ponds and lakes; and in sloughs, swamps, and freshwater to brackish marshes.

Arid West Interior Freshwater Marsh Macrogroup

Arid West Interior Freshwater Marsh Group

3a1. *Schoenoplectus acutus* or *Schoenoplectus californicus* dominates or co-dominates with other herbs including *Typha* spp. Occurs in both freshwater and tidal marshes, along ponds and lagoons.

***Schoenoplectus* (*acutus, californicus*) Alliance**
Schoenoplectus acutus Association
Schoenoplectus californicus Association
Schoenoplectus californicus – Schoenoplectus acutus Association

3a2. *Schoenoplectus americanus* or *Schoenoplectus pungens* dominates or co-dominates with other herbs. Occurs in fresh or brackish conditions.

***Schoenoplectus americanus* Alliance**
Schoenoplectus americanus Association
Schoenoplectus pungens – Argentina egedii Provisional Association

3a3. *Typha latifolia, T. angustifolia*, and/or *T. domingensis* dominate in semi-permanently flooded freshwater or brackish marshes. If *Schoenoplectus acutus* or *S. californicus* is co-dominant, key to the *Schoenoplectus* Alliance.

***Typha* (*angustifolia*, *domingensis*, *latifolia*) Alliance**
Typha (latifolia, angustifolia) Association
Typha domingensis Association

3b. *Argentina egedii*, *Bolboschoenus maritimus*, *B. robustus, Carex nudata*, *C. obnupta*, *C. praegracilis*, *C. pansa*, *C. subbracteata, Eleocharis macrostachya*, *Juncus covillei, J. effusus*, *J. hesperius, J. lescurii*, *J. patens*, *J. occidentalis*, *J. phaeocephalus*, *J. xiphioides, Oenanthe*, and/or *Scirpus microcarpus* dominate or co-dominate in mesic or wetland settings. *Holcus*, *Hypochaeris*, *Leontodon*, *Rumex* and *Vulpia bromoides* may intermix with similar cover. Stands may be found along seasonally flooded brackish marshes, coastal sand dunes, swales and plains, shallowly inundated woods, meadows, roadside ditches, mudflats, coastal swamps, lakeshores, marshes, and riverbanks.

Vancouverian Lowland Marsh, Wet Meadow & Shrubland Macrogroup

Vancouverian Freshwater Wet Meadow & Marsh Group

3b1. *Carex praegracilis*, *C. pansa*, *C. subbracteata,* or *C. tumulicola* dominates or co-dominates with *Holcus lanatus* or *Lolium perenne*. Stands of *C. praegracilis* are not restricted to the coast and may be found in interior moist meadows and hillside depressions.

***Juncus (effusus, patens) – Carex* (*pansa*, *praegracilis*) Alliance**
Carex pansa Provisional Association*
Carex praegracilis Lowland Provisional Association
Carex tumulicola Provisional Association*

3b2. *Carex obnupta* and/or *Scirpus microcarpus* dominates or co-dominates with other shrubs and herbs including *Argentina egedii, Baccharis pilularis, Juncus effusus, J. patens, Oenanthe sarmentosa, Rubus ursinus,* and *Salix* spp. Across a variety of freshwater and brackish settings near the coast. May grow adjacent to *Schoenoplectus californica* or *Typha* stands.

***Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus* Alliance**
Carex obnupta Association
Carex obnupta – Juncus patens Association*
Scirpus microcarpus Pacific Coast Association*

3b3. *Juncus effusus*, *J. patens*, *J. hesperius, J. occidentalis*, *J. phaeocephalus, J. subbracteata* and/or *J. xiphioides* dominate individually or in combination near the coast or farther inland. Co-dominant species may include *Carex densa*, *Holcus lanatus*, *Hypochaeris radicata*, *Juncus bufonius*, and *Vulpia bromoides*.

***Juncus* (*effusus*, *patens*) – *Carex (pansa, praegracilis)* Alliance**
Juncus effusus Association
Juncus patens Association
Juncus patens – Holcus lanatus Provisional Association*
Juncus patens – Juncus occidentalis Provisional Association*
Juncus phaeocephalus Association
Juncus xiphioides Association

3b4. *Juncus lescurii* dominates or co-dominates with *Argentina egedii*, *Carex obnupta,* or *Distichlis spicata* in slightly brackish marshes or seeps near salt marshes.

***Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus* Alliance**
Juncus lescurii Association*

3b5. *Argentina egedii* (=*A. anserina* or *Potentilla anserina* ssp. *pacifica*) dominates or co-dominates with *Calamagrostis nutkaensis, Carex obnupta, Holcus lanatus*, *Juncus* spp., *Leontodon taraxacoides*, *Lotus corniculatus, Schoenoplectus californicus,* and *Trifolium wormskioldii* in brackish to freshwater marsh habitats. If *Distichlis spicata* is present in a high tidal salt marsh environment, key to the *Distichlis* alliance.

***Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus* Alliance**
Argentina egedii – (Juncus lescurii) Association
Carex obnupta – Argentina egedii Provisional Association*

3b6. *Oenanthe sarmentosa* dominates or co-dominates with *Argentina egedii,* or other herbs in freshwater to slightly brackish marshes.

***Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus* Alliance**
Oenanthe sarmentosa Association

4. Wetland herbaceous vegetation dominated or characterized by *Alisma* spp., *Bidens frondosa*, *Baccharis douglasii (= B. glutinosa), Bolboschoenus glaucus, Carex*

barbarae, *C. densa, C*. *nudata*, *C*. *serratodens*, *Cirsium fontinale, Euthamia occidentalis, Grindelia* spp., *Heterotheca oregona, Hoita orbicularis, Juncus arcticus*, *Lepidium latifolium*, *Leymus triticoides, Mimulus guttatus*, *Persicaria (=Polygonum) lapathifolia*, or *Xanthium strumarium*. Stands occupy settings where saturated soil or standing water throughout the growing season are key characteristics.

4a. Stands dominated or characterized by the species of *Carex*, *Juncus*, *Cirsium,* or *Mimulus* mentioned above.

Vancouverian Lowland Marsh, Wet Meadow & Shrubland Macrogroup

Vancouverian Freshwater Wet Meadow & Marsh Group

4a1. *Carex barbarae* dominates in seasonally or intermittently saturated wetlands.

***Carex barbarae* Alliance**
Carex barbarae Association

4a2. *Carex nudata* dominates with other herbs lower in cover including *Equisetum* spp. Along rocky streams and streambanks.

***Carex nudata* Alliance**
Carex nudata Association

4a3. *Carex.serratodens* dominates or co-dominates with *Agoseris heterophylla*, *Juncus arcticus*, *J. occidentalis, Leymus triticoides,* or *Mimulus guttatus*. Stands are often found in serpentine seeps and meadows.

***Juncus (effusus, patens) – Carex (pansa, praegracilis)* Alliance**
Carex serratodens Association

4a4. *Carex densa* dominates individually or in combination near the coast or farther inland in wet meadows. Co-dominant species may include *Holcus lanatus*, *Mentha pulegium*, *Plantago lanceolatum,* and *Ranunculus californicus*.

***Juncus (effusus, patens) – Carex (pansa, praegracilis)* Alliance**
Carex densa Provisional Association

4a5. *Carex amplifolia* dominates in wet areas with *C. gynodynama* and *Juncus* spp.

***Juncus (effusus, patens) – Carex (pansa, praegracilis)* Alliance**
Carex amplifolia – Carex gynodynama Provisional Association

4a6. *Juncus arcticus* (var. *balticus* or *mexicanus*) dominates in freshwater, brackish, or alkaline settings. *Argentina egedii*, *Carex* spp., *Mentha pulegium* and other hydrophytes may intermix as sub-dominants.

***Juncus arcticus* (var. *balticus*, *mexicanus*) Alliance**
Juncus arcticus var. balticus – (var. mexicanus) Association

4a7. *Mimulus guttatus* or another wetland *Mimulus* species dominates or co-dominates in the herbaceous layer with *Juncus* spp. or non-native grasses such as *Lolium perenne* and *Polypogon monspeliensis*. Stands are found in moist or saturated settings along streams, ephemeral cascades, ditches, fens, seeps, and springs often with high cover of moss.

***Mimulus guttatus – Cirsium* spp. – *Stachys* spp. Alliance**
Mimulus guttatus Association

4a8. *Cirsium fontinale* dominates or it co-dominates with wetland herbs including *Carex, Hemizonia congesta* ssp. *luzulifolia, Lolium perenne,* and others . Stands are found in seeps, springs, and drainages. *C. fontinale* is an indicator of serpentine wetlands in Santa Clara and San Mateo counties.

***Mimulus guttatus – Cirsium* spp. – *Stachys* spp. Alliance**
Cirsium fontinale Association

4b. Stands with *Leymus triticoides* dominant or co-dominant with *Avena, Bromus, Carduus pycnocephalus, Lolium perenne,* or other grasses or forbs. Stands are found on poorly drained floodplains, valley bottoms, and brackish marsh margins.

Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland Macrogroup

North American Desert Alkaline-Saline Marsh & Playa Group

***Leymus cinereus – Leymus triticoides* Alliance**
Leymus triticoides Association
Leymus triticoides – Bromus spp. *– Avena* spp. Association
Leymus triticoides – Lolium perenne Association*

4c. Stands dominated or characterized by non-native, ruderal, or disturbance-adapted taxa: *Alisma* spp., *Bidens frondosa*, *Baccharis douglasii (= B. glutinosa), Cyperus erythrorhizos, Euthamia, Gnaphalium palustre, Hoita, Bolboschoenus glaucus, Lepidium*, *Persicaria*, and/or *Xanthium*.

4c1. *Lepidium latifolium, Dittrichia graveolens, Pseudognaphalium luteoalbum, Xanthium spinosum,* or similar non-native forb dominates in the herbaceous layer along intermittently and seasonally flooded freshwater and brackish marshes and riparian corridors. In alkaline or saline settings, *Distichlis spicata* is commonly present.

Western North American Ruderal Marsh, Wet Meadow & Shrubland Group

***Lepidium latifolium – Lactuca serriola* Semi-Natural Alliance**
Dittrichia graveolens – Pseudognaphalium luteoalbum Provisional Semi-Natural Association
Lepidium latifolium Semi-Natural Association*

4c2. *Persicaria* (= *Polygonum)* spp., *Alisma* spp., *Cyperus erythrorhizos, Gnaphalium palustre,* and/or *Xanthium strumarium* co-dominate or dominate in marshes and regularly disturbed vernally wet ponds, fields, and stream terraces.

Temperate Pacific Freshwater Wet Mudflat Group

***Polygonum lapathifolium – Xanthium strumarium* Alliance**
Alisma (triviale) Provisional Association*
Cyperus erythrorhizos – Gnaphalium palustre Provisional Association
Polygonum (amphibium, lapathifolium) Association
Xanthium strumarium Association

4c3. *Baccharis douglasii (= B. glutinosa), Euthamia occidentalis, Helenium puberulum, Hoita orbicularis, Bidens* spp., and/or the native herb *Ludwigia palustris* dominates or co-dominates in wetlands, riparian areas, and other mesic soils, with emergent shrubs such as *Rubus ursinus*.

Temperate Pacific Freshwater Wet Mudflat Group

***Bidens cernua – Euthamia occidentalis – Ludwigia palustris* Provisional Alliance**
Baccharis douglasii (= B. glutinosa) Provisional Association,
Bidens frondosa Provisional Association*
Euthamia occidentalis Provisional Association

4c4. *Heterotheca oregona* dominates or co-dominates along gravel bars in floodplains, riparian terraces and stream banks.

Temperate Pacific Freshwater Wet Mudflat Group

***Heterotheca (oregona, sessiliflora)* Alliance**
Heterotheca oregona Association

5. Herbaceous stands dominated or characterized by *Centromadia pungens, Cressa truxillensis, Distichlis spicata, Eleocharis macrostachya*, *E. acicularis, Eryngium aristulatum, Lasthenia glaberrima*, *L. fremontii, Limnanthes douglasii, Navarretia leucocephala, Pleuropogon californicus* or *Trifolium variegatum*. In the *Manual of California Vegetation* (Sawyer et al. 2009), these stands are recognized in a macrogroup associated with vernal pools, even though they do not always occur in vernal pool settings. Future versions of the hierarchy will likely split vernal pool and non–vernal pool stands into different alliances, groups, and macrogroups based on ecological and environmental differences. Few true vernal pool types occur in Santa Clara and Santa Cruz Counties.

Western North American Vernal Pool Macrogroup

Californian Vernal Pool / Swale Bottomland Group

5a. *Eryngium aristulatum* is co-dominant in the herbaceous layer with other swale and vernal pool species.

Eryngium aristulatum* Alliance

5b. *Pleuropogon californicus* and/or *Lasthenia glaberrima* are present, sometimes with high cover in the herbaceous layer along with *Limnanthes douglasii, Navarretia leucocephala*, *Eryngium aristulatum*, and/or *Isoetes howellii*. If *Eleocharis macrostachya* or *E. palustris* is present and co-dominant, key to this alliance instead of *Eleocharis*. Stands typically occur in vernal pools or vernally influenced marshes.

Lasthenia glaberrima* Alliance
Lasthenia glaberrima – Pleuropogon californicus Association*

5c. *Eleocharis macrostachya* dominates in the herbaceous layer along lakeshores, streambeds, swales, pastures, ditches, and ponds. *Juncus phaeocephalus* and *J. patens* may also be present. If *Lasthenia glaberrima* or *Pleuropogon californicus* have high cover, key to the *L. glaberrima* Alliance above.

***Eleocharis* (*acicularis*, *macrostachya*) Alliance**
Eleocharis macrostachya Association

5d. *Malvella leprosa* characteristically present with *Eleocharis acicularis* and with salt tolerant species such as *Heliotropium curassavicum* and *Phyla nodiflora* in the herbaceous layer. Not sampled but may occur in Santa Clara and Santa Cruz Counties.

***Eleocharis* (*acicularis*, *macrostachya*) Alliance**

5e. *Trifolium variegatum* dominates or co-dominates in the herbaceous layer with a variety of other native and non-native herbs such as *Bromus* spp., *Juncus bufonius, Lotus* spp., *Plagiobothrys* spp., *Trifolium fucatum,* and others. Stands occur in vernally wet, shallow swales.

***Trifolium variegatum* Alliance**
Trifolium variegatum Association

5f. *Centromadia pungens* co-dominates with *Hordeum marinum* or other herbs. Stands occur in alkaline vernally wet areas such as at Soda Lake in Santa Cruz Co.

***Centromadia (pungens)* Alliance**

5g. Halophytes such as *Cressa truxillensis, Distichlis spicata, Hordeum depressum,* and *Malvella leprosa* characterize the herbaceous layer away from the immediate coast with a variety of other native and non-native herbs such as *Hordeum marinum* and *Frankenia salina*. Stands occur in alkaline vernally wet pools/playa areas such as at Soda Lake in Santa Cruz Co.

***Cressa truxillensis – Distichlis spicata* Alliance**

Section II. Vegetation dominated or characterized by herbaceous species that occupy dry, seasonally moist, and usually well-drained sites that range from interior dry ridges and cliffs to ocean bluffs, dunes, and terraces with cooling summer fog and salty breezes. Stands are not wet or inundated as in Section I above. This group includes native and non-native annual and perennial grasslands, seral herbaceous stands, dry cliff and canyon vegetation, and coastal dune/ bluff vegetation. Dominant, co-dominant, and characteristic taxa include: *Abronia*, *Agrostis gigantea*, *A. stolonifera*, *Allium falcifolium*, *Ambrosia*, *Ammophila*, *Anthoxanthum*, *Avena*, *Brachypodium*, *Brassica*, *Briza*, *Bromus*, *Calamagrostis*, *Carpobrotus*, *Centaurea*, *Cynosurus*, *Danthonia*, *Deschampsia*, *Dudleya, Elymus elymoides*, *E. glaucus*, *E. multisetus*, *E. luteolum*, *E. nudum*, *Erodium*, *Eryngium armatum*, *Eschscholzia*, *Festuca arundinacea*, *F. californica*, *F. idahoensis*, *Hesperolinon, Heterotheca*, *Holcus*, *Hordeum*, *Lasthenia californica*, *Leymus mollis*, *Lolium*, *Melica*, *Mesembryanthemum*, *Nassella*, *Phalaris*, *Plagiobothrys nothofulvus*, *Plantago erecta*, *Pteridium*, *Raphanus*, *Sedum,* and/or *Vulpia*.

6. *Allium falcifolium*, *Dudleya* spp., *E. luteolum*, *E. nudum*, *Polypodium californicum, Sedum spathulifolium, Selaginella bigelovii, Streptanthus glandulosus,* and/or moss and lichen characterize or dominate stands on exposed rock.

Western North American Cliff, Scree & Rock Vegetation Macrogroup

Californian Cliff, Scree & Rock Vegetation Group

6a. Sparsely vegetated herbaceous stands (generally less than 10% absolute cover though may be higher in cover depending on rainfall) characterized by *Allium falcifolium*, *Claytonia exigua, Dudleya* spp.*, Eriogonum luteolum*, *E*. *nudum*, *Hesperolinon* spp., *Plantago erecta,* and/or other native herbs growing on serpentine barrens with exposed gravel and bedrock.

***Allium* spp. – *Streptanthus* spp. – *Hesperolinon* spp. Serpentinite Alliance**
Allium falcifolium – Eriogonum luteolum – Streptanthus (batrachopus, morrisonii) Provisional Association
Streptanthus glandulosus – Dudleya abramsii / Lichen – Moss Association

6b. *Sedum spathulifolium* and/or *Polypodium* spp. dominate or co-dominate in small stands on steep north-facing rock outcrops and vertical cliff faces. Moss and lichen species often have high cover.

Sedum spathulifolium* Provisional Alliance
Sedum spathulifolium – Polypodium californicum / Lichen – Moss Provisional Association*

6c. The native *Dudleya farinosa* or other *Dudleya* spp. is characteristic, dominant, or co-dominant with herbs such as *Eriogonum latifolium, Vulpia bromoides*, and others. Lichen is characteristic and often dominant -- with *Dudleya* sometimes lacking. Often on rocky coastal bluffs, cliffs, headlands, and bedrock outcrops.

Dudleya cymosa – Dudleya lanceolata* / Lichen – Moss Alliance
Dudleya farinosa / Lichen – Moss Provisional Association*

6d. *Selaginella bigelovii* dominates or characterizes small stands on rock outcrops, cliff faces, or skeletal soils over gently to steeply sloping, impervious substrates. Moss and lichen species often intermix. Emergent shrubs may be present.

Selaginella (bigelovii, wallacei)
Selaginella bigelovii / Eriogonum fasciculatum Association

7. Perennial forbs such as *Calyptridium monospermum, Corethrogyne filaginifolia, Eriogonum nudum, Erysimum teretifolium, Heterotheca sessiliflora, Sidalcea malviflora,* or *Viola pedunculata* dominate or co-dominate with other herbs including non-natives, OR two or more of these species (including *Pteridium aquilinum)* are characteristically present in stands, sometimes with high cover of non-native annuals. Habitats include the dry to mesic, sandhills of Santa Cruz Co. and sites recent or seasonal disturbance in both counties. If *Heterotheca sessiliflora* characterizes the stand with mesic herbs such as *Danthonia californica* (which can be at trace cover) and/or non-natives such as *Aira caryophyllea, Briza maxima,* and *Vulpia bromoides,* **see step 9b.**

Californian Annual & Perennial Grassland Macrogroup

Californian Perennial Grassland Group

***Corethrogyne filaginifolia – Eriogonum* (*elongatum*, *nudum*) Alliance**
Chorizanthe pungens – Eriogonum nudum var. *decurrens – Heterotheca sessiliflora* Association
Eriogonum nudum Association
Viola pedunculata – (Eschscholzia californica – Nassella pulchra) Provisional Association

8. Native and non-native annual forb/grass vegetation AND native perennial grasslands growing within the California Mediterranean climate. Stands are generally found in relatively drier sites than those in the Vancouverian Macrogroups which are more common near the coast **(see step 9)**. Includes vegetation characterized by, but not limited to *Amsinckia*, *Avena*, *Brassica*, *Bromus*, *Centaurea*, *Cynosurus*, *Elymus glaucus*, *Eschscholzia*, *Lasthenia californica*, *Lolium*, *Lupinus, Melica*, *Monolopia, Nassella*, *Plagiobothrys nothofulvus, Plantago erecta*, *Pteridium aquilinum*, and *Vulpia microstachys*.

Californian Annual & Perennial Grassland Macrogroup

8a. Herbaceous vegetation dominated, co-dominated or characterized by native annual forbs and grasses such as *Amsinckia, Chorizanthe pungens, Eschscholzia*, *Lasthenia californica*, *Holocarpha, Lupinus*, *Monardella sinuata, Plagiobothrys*, *Plantago erecta*, *Stylocline gnaphaloides*, and *Vulpia microstachys*. Commonly occurring taxa include *Avena*, *Bromus*, *Cryptantha*, *Geranium*, *Dichelostemma*, *Lolium*, and *Vulpia*. Stands are found on upland slopes, flats, and ridges.

8a1. Annual forbs characteristic of sandhills including *Chorizanthe pungens, Monardella sinuata,* and *Stylocline gnaphaloides* dominate or co-dominate with a variety of perennials such as *Calyptridium monospermum, Erysimum teretifolium, Pteridium aquilinum*, OR at least two of the species listed or in the association name are characteristically present. Non-native annuals such *Hypochaeris glabra* and *Vulpia myuros* may be present at high cover.

Californian Perennial Grassland Group

***Corethrogyne filaginifolia – Eriogonum* (*elongatum*, *nudum*) Alliance**
Chorizanthe pungens – Eriogonum nudum var. *decurrens – Heterotheca sessiliflora* Association

Californian Annual Grassland & Forb Meadow Group

8a1. *Eschscholzia californica*, *Lupinus bicolor*, and/or *L. nanus* dominate or co-dominate with a variety of native and non-native forbs and grasses, sometimes on thin soils with buried rocks.

***Eschscholzia* (*californica*) – *Lupinus* (*nanus*) Alliance**
Bromus hordeaceus – Lupinus nanus – Trifolium spp. Association
Eschscholzia californica Association
Lupinus bicolor Provisional Association

8a2. *Plagiobothrys nothofulvus* dominates or characterizes the stand and intermixes with a variety of native and non-native forbs and grasses.

***Plagiobothrys nothofulvus* Alliance**
Plagiobothrys nothofulvus – Castilleja exserta – Lupinus nanus Provisional Association

8a3. *Lasthenia californica*, *Calycadenia* spp., *Hemizonia congesta*, *Hesperevax sparsiflora, Lomatium*, *Lotus humistratus*, *Micropus californicus*, *Plantago erecta*, and/or *Vulpia microstachys* dominate individually or in combination as characteristic plants in the herbaceous layer. *Lasthenia californica*, *Plantago erecta,* and/or *Vulpia microstachys* are often present, sometimes with sparse cover.

***Lasthenia californica – Plantago erecta – Vulpia microstachys* Alliance**
Erigeron glaucus – Lasthenia californica Association*
Hemizonia congesta – Lolium perenne Association
Lasthenia (californica, gracilis) Association
Lasthenia californica – Plantago erecta – Hesperevax sparsiflora Association
Lotus humistratus – Plantago erecta – Lomatium spp. Provisional Association*
Micropus californicus Provisional Association*
Plantago erecta – Lolium perenne lichen-rocky Association
Vulpia microstachys – Plantago erecta Association
Vulpia microstachys – Plantago erecta – Calycadenia (*truncata*, *multiglandulosa*) Association

8a4. *Amsinckia* spp. and/or *Phacelia* spp. dominate or characterize stands with a variety of native and non-native forbs and grasses.

***Amsinckia (menziesii, tessellata) – Phacelia* spp. Alliance**
Amsinckia (intermedia, menziesii) Association

8a5. *Holocarpha heermannii* or *Holocarpha virgata* characteristically present to co-dominant in the herbaceous layer; native herbs typically > 10% relative cover.

***Holocarpha (heermannii, virgata)* Alliance**
Holocarpha heermannii Association*
Holocarpha virgata Association

8a6. A species of *Monolopia* seasonally dominant to co-dominant in the herbaceous layer.

Monolopia (lanceolata) – Coreopsis (calliopsidea)* Alliance

8b. *Elymus elymoides*, *E. multisetus, Melica* spp., and/or *Nassella* spp., all native perennial grasses, are dominant or characteristic in stands, sometimes with equal or greater cover of non-native herbs.

Californian Perennial Grassland Group

8b1. *Elymus elymoides* or *E. multisetus* dominates or co-dominates in stands on serpentine soils, often on southerly exposures. Stands of *Elymus multisetus* with *Eschscholzia californica* and/or *Plantago erecta* were encountered most often in the sites visited for this project; *Dichelostemma capitatum*, *Eriogonum nudum*, *Lotus humistratus*, and *Minuartia douglasii* were also commonly present.

***Nassella* spp. – *Melica* spp. Alliance**
Elymus multisetus – (*Eschscholzia californica – Plantago erecta*) Association

8b2. *Melica californica, M. torreyana,* and/or *Nassella* spp. are dominant, co-dominant or characteristic in stands. *Avena*, *Bromus*, *Hemizonia congesta*, *Lolium perenne*, *Plantago erecta P. lanceolata.* and/or *Trifolium* spp. intermix as

dominant, co-dominant or characteristic taxa in associations of this alliance. If *Danthonia californica* or *Festuca idahoensis* is co-dominant or characteristic with *Nassella pulchra,* then key to the *Festuca idahoensis* – *Danthonia* alliance.

***Nassella* spp. – *Melica* spp. Alliance**
Melica californica Association
Melica torreyana Association
Nassella lepida Provisional Association
Nassella pulchra Association
Nassella pulchra – Avena spp. – *Bromus* spp. Association
Nassella pulchra – Corethrogyne filaginifolia Association
Nassella pulchra – Hemizonia congesta Association
Nassella pulchra – Lolium perenne – (Trifolium spp.*)* Association
Nassella pulchra – Lolium perenne – Plantago erecta Serpentine Association
Nassella pulchra – Melica californica – annual grass Association

8c. Herbaceous vegetation strongly dominated (typically >85% relative cover) by non-native grasses and forbs such as *Aegilops, Avena*, *Brachypodium*, *Brassica*, *Briza*, *Bromus*, *Carduus pycnocephalus, Centaurea*, *Cynosurus*, *Danthonia pilosa (Rytidosperma penicillatum)*, *Erodium*, *Lolium, Nassella manicata, Pennisetum,* and *Raphanus*. Native herbaceous species have insignificant cover in these stands, especially during the active growing season. Stands are found in foothills, rangelands, fallow fields, woodland openings, riparian areas, and disturbed settings.

Californian Ruderal Grassland, Meadow & Scrub Group

8c1. *Avena*, *Brachypodium*, *Briza*, *Bromus*, *Erodium* and/or *Hypochaeris* dominate individually or in combination, with overall non-native herbs > 80% relative cover. If *Elymus caput-medusae* is co-dominant with *Avena* and/or *Bromus* spp., those stands can also key here. If *Lolium perenne* is co-dominant key to that alliance.

***Avena* spp. – *Bromus* spp. Semi-Natural Alliance**
Avena barbata – Avena fatua Semi-Natural Association
Avena barbata – Bromus hordeaceus Semi-Natural Association
Brachypodium distachyon Semi-Natural Association
Briza maxima Provisional Semi-Natural Association*
Bromus diandrus Semi-Natural Association
Bromus diandrus – Avena spp. Semi-Natural Association
Bromus hordeaceus – Erodium botrys Semi-Natural Association

8c2. *Brassica nigra*, *Raphanus sativus, Carduus pycnocephalus, Carthamus lanatus, Centaurea solstitialis, Pichris echioides, Silybum marianum,* or another non-native forb dominates in the herbaceous layer, often in old or active agriculture lands. Overall non-native herbs >80% relative cover.

***Brassica nigra* – *Centaurea* (*solstitialis*, *melitensis*) Semi-Natural Alliance**
Brassica nigra Semi-Natural Association*
Carduus pycnocephalus – Silybum marianum Provisional Semi-Natural Association
Carthamus lanatus Provisional Semi-Natural Association*
Centaurea solstitialis Semi-Natural Association
Raphanus sativus Semi-Natural Association

8c3. *Cynosurus echinatus*, *Danthonia pilosa (Rytidosperma penicillatum)*, and/or *Nassella manicata* dominate or co-dominate in the herbaceous layer. *Anagallis*, *Avena*, *Lolium*, *Plantago lanceolata*, *Rumex*, and *Vulpia bromoides* are often present.

Cynosurus echinatus – Arrhenatherum elatius* Semi-Natural Alliance
Cynosurus echinatus – (*Danthonia pilosa – Nassella manicata*) Provisional Semi-Natural Association*

8c4. *Lolium perenne* dominates or co-dominates with *Avena* spp., *Bromus* spp., *Hordeum marinum*, *H. murinum*, *Medicago*, *Trifolium subterraneum, Elymus caput-medusa,* and other non-natives in the herbaceous layer. Native species are typically less than 10% relative cover. These invaded stands are often found on moist or poorly drained sites, on or off serpentine.

***Lolium perenne* Semi-Natural Alliance**
Lolium perenne Semi-Natural Association
Lolium perenne – Bromus hordeaceus Semi-Natural Association
Lolium perenne – Hordeum marinum – Ranunculus californicus Semi-Natural Association*
Lolium perenne – Lotus corniculatus Semi-Natural Association*

8c5. *Aegilops triuncialis* dominates or co-dominates with *Avena barbata*, *Bromus hordeaceus*, *Lolium perenne,* and other non-natives in herbaceous stands. Often found on dry grasslands with serpentinite parent material.

***Lolium perenne* Semi-Natural Alliance**
Aegilops triuncialis – Hemizonia congesta Provisional Semi-Natural Association

9. Herbaceous vegetation dominated, co-dominated, or characterized by native or non-native perennial grasses. Stands are generally found in moister settings than those in the California Annual and Perennial Grassland Macrogroup **(see step 8)** and are often coastal. The grasses included are: *Agrostis gigantea*, *A. stolonifera*, *Anthoxanthum*, *Calamagrostis nutkaensis*, *Cortaderia, Danthonia californica*, *Deschampsia cespitosa*, *Elymus elymoides*, *E. multisetus*, *Festuca arundinacea*, *F. idahoensis*, *Holcus*, *Hordeum brachyantherum* and/or *Phalaris aquatica*. Note: stands dominated by *Lolium perenne* key out in step 8 above.

9a. *Agrostis*, *Anthoxanthum*, *Cortaderia* spp., *Festuca arundinacea*, *Holcus*, and/or *Phalaris* are dominant, co-dominant, or characteristic in herbaceous stands.

9a1. Non-native, mesic to wet, disturbed pasturelands dominated or co-dominated by the following perennial grasses: *Agrostis gigantea*, *A. stolonifera*, *Festuca arundinacea*, and/or *Phalaris*. If native species are present and co-dominant, key to an alliance dominated or characterized by natives. Found in wet settings, including brackish marshes, meadows, stream terraces, wet pastures, agricultural wetlands, or tidal zones.

Western North American Ruderal Marsh, Wet Meadow & Shrubland Macrogroup

Western North American Ruderal Marsh, Wet Meadow & Shrubland Group

9a1a. *Agrostis gigantea*, *A. stolonifera*, and/or *Festuca arundinacea* dominate or co-dominate in the herbaceous layer. The stands encountered for this

project were dominated by *F. arundinacea*, though stands dominated by *Agrostis* may be present in Santa Clara and Santa Cruz Counties.

***Poa pratensis – Agrostis gigantea – Agrostis stolonifera* Semi-Natural Alliance**
Festuca arundinacea Provisional Semi-Natural Association

9a1b. *Phalaris aquatica* dominates in naturalized or planted stands. Other non-native herbs, such as *Avena barbata* and *Hypochaeris glabra* may be present with low cover.

***Phalaris aquatica – Phalaris arundinacea* Semi-Natural Alliance**
Phalaris aquatica Provisional Semi-Natural Association

9a2. Non-native, slightly mesic, disturbed herblands dominated or co-dominated by the following perennial grasses: *Anthoxanthum*, *Cortaderia,* and/or *Holcus,* and/or the following forbs: *Ageratina adenophora, Conium maculatum, Dipsacus fullonum, Dipsacus sativus,* or *Foeniculum vulgare*. If native species are present and co-dominant, key to an alliance dominated or characterized by natives. Found in meadows, moist pastures, agricultural areas, coastal terraces, or coastal bluffs.

Western North American Ruderal Grassland & Shrubland Macrogroup

Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group

9a2a. *Holcus lanatus* and/or *Anthoxanthum odoratum* dominate individually or in combination. Other co-dominants may include *Briza maxima*, *Lolium perenne*, *Plantago lanceolata, Rumex acetosella*, and *Vulpia bromoides*.

***Holcus lanatus – Anthoxanthum odoratum* Semi-Natural Alliance**
Holcus lanatus Semi-Natural Association
Holcus lanatus – Anthoxanthum odoratum Semi-Natural Association*

9a2b. *Conium maculatum, Ageratina adenophora, Dipsacus fullonum, D. sativus,* or *Foeniculum vulgare* dominates herbaceous stands, though various other taxa are likely present.

***Conium maculatum – Foeniculum vulgare* Semi-Natural Alliance**
Conium maculatum Semi-Natural Association
Foeniculum vulgare Semi-Natural Association*
Dipsacus (fullonum, sativus) Provisional Semi-Natural Association

9a2c. *Cortaderia jubata* or *Cortaderia selloana* dominates in naturalized stands, sometimes in dense clumps; or other non-native herbs co-dominant with *Cortaderia jubata.* Overall non-native herbs is > 80% relative cover. Stands occur but were not sampled in Santa Cruz Co.

Cortaderia (jubata, selloana)* Semi-Natural Alliance
Cortaderia (jubata, selloana) Provisional Semi-Natural Association*

9b. Native, mesic to moist, primarily coastal grasslands dominated, co-dominated, or characterized by *Bromus carinatus*, *Calamagrostis nutkaensis*, *Deschampsia cespitosa*, *Danthonia californica*, *Elymus glaucus, Eryngium armatum, Festuca californica, F. idahoensis, Heterotheca sessiliflora, Hordeum brachyantherum,* and/or *Pteridium aquilinum*. Other species such as *Baccharis pilularis*, *Briza maxima*, *Holcus*

lanatus, *Nassella pulchra*, and/or *Vulpia bromoides* commonly intermix in stands. Found in a variety of settings, including dunes, bluffs, meadows, valley bottoms, alluvial slopes, terraces, meadows, and seasonally flooded areas with moderate salinity.

9b1. *Deschampsia cespitosa*, *Danthonia californica*, *Iris douglasiana,* and/or *Eryngium armatum* dominate or co-dominate individually or in combination (if *Holcus lanatus* has the highest cover, but these three species have at least 10% combined cover, key to *Deschampsia*). Settings range from coastal dunes and bluffs to inland plains (e.g., Santa Rosa Plain) to montane meadows.

Vancouverian Lowland Marsh, Wet Meadow & Shrubland Macrogroup

Vancouverian Freshwater Wet Meadow & Marsh Group

***Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica* Alliance**

Deschampsia cespitosa – Danthonia californica Association
Deschampsia cespitosa – Eryngium armatum Association*
Deschampsia cespitosa – Iris douglasiana Association*
Deschampsia (cespitosa, holciformis) Association*

9b2. *Hordeum brachyantherum* dominates or co-dominates with *Achillea millefolium, Distichlis spicata, Holcus lanatus*, *Hordeum marinum, Lolium perenne*, and/or *Lotus corniculatus* in moist meadows, along stream terraces and coastal bluffs, and near seeps and springs.

Vancouverian Lowland Marsh, Wet Meadow & Shrubland Macrogroup

Vancouverian Freshwater Wet Meadow & Marsh Group

***Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica* Alliance**

Hordeum brachyantherum Lowland Association

9b3. *Calamagrostis nutkaensis* dominates or co-dominates with *Baccharis pilularis*. Other species such as *Carex obnupta, Heracleum maximum*, *Holcus lanatus*, *Juncus* spp., *Pteridium aquilinum,* and/or *Rubus ursinus* often intermix in stands.

Southern Vancouverian Lowland Grassland & Shrubland Macrogroup

Southern Vancouverian Shrub & Herbaceous Bald, Bluff & Prairie Group

***Calamagrostis nutkaensis* Alliance**

Calamagrostis nutkaensis Association*
Calamagrostis nutkaensis – Carex (obnupta) – Juncus (patens) Association
Calamagrostis nutkaensis / *Baccharis pilularis* Association*

9b4. *Festuca idahoensis, F. californica, F. rubra* and/or *Danthonia californica* dominate or characterize stands. *Nassella pulchra* may be co-dominant. *Bromus carinatus*, *Elymus glaucus*, *Plantago erecta,* and a variety of native and non-native forbs and grasses may intermix as sub-dominants. *Festuca*, *Danthonia* or *Perideridia kelloggii* and other native species share at least 10% relative cover in the herb layer, with other non-native grasses and forbs sometimes having higher cover (e.g., *Briza maxima, Cynosurus echinatus*, *Hypochaeris radicata, Plantago lanceolata, and Vulpia bromoides*). Occasionally, the larger *Festuca californica* may

replace *F. idahoensis* in somewhat shadier or less exposed sites, or occasionally *Heterotheca sessiliflora* may be dominant and/or co-dominant with other forbs and grasses including mesic herbs such as *Danthonia californica* (which can be at trace cover) and/or non-natives such as *Aira caryophyllea, Briza maxima,* and *Vulpia bromoides*.

***Festuca idahoensis – Danthonia californica* Alliance**
Danthonia californica – Nassella pulchra Association
Perideridia kelloggii – Danthonia californica Provisional Association
Danthonia californica Coastal Association
Festuca californica Association*
Festuca idahoensis – (Danthonia californica – Koeleria macrantha) Association
Festuca idahoensis – Nassella pulchra Provisional Association*
Festuca idahoensis Ultramafic Provisional Association*
Festuca rubra Association*
Heterotheca sessiliflora – Danthonia californica Provisional Association*

9b5. *Bromus carinatus*, *Elymus glaucus, Pteridium aquilinum* and/or *Thermopsis californica* dominate or co-dominate near meadows, in forested openings, and on elevated flats. *Achillea millefolium*, *Bromus hordeaceus*, *Geranium dissectum*, *Rumex acetosella*, and *Vulpia bromoides* are often present.

***Bromus carinatus – Elymus glaucus* Alliance**
Bromus carinatus Association
Elymus glaucus Association
Pteridium aquilinum – Grass Association
Thermopsis californica – Bromus carinatus – Annual Brome Association*

10. Coastal dune, bluff, meadow, cliffs, rock outcrops, and other vegetation dominated by herbaceous species such as *Abronia*, *Ambrosia*, *Ammophila*, *Armeria maritima, Artemisia pycnocephala, Carpobrotus*, *Dudleya, Erigeron glaucus, Eriogonum latifolium, Eriophyllum staechadifolium, Fragaria chiloensis, Leymus mollis*, and *Mesembryanthemum*.

10a. Native species, including *Abronia latifolia*, *Ambrosia chamissonis*, *Artemisia pycnocephala*, *Leymus mollis, Lathyrus littoralis,* and/or other herbs, are characteristic to dominant on dunes or coastal bluffs. Plants are adapted to salt spray, wind and shifting sands and are thus capable of colonizing relatively unstable and sterile substrates.

Pacific Coastal Beach & Dune Macrogroup

10a1. *Leymus mollis* dominates or is characteristically present in the herbaceous layer. *Abronia*, *Ambrosia chamissonis Artemisia pycnocephala*, *Cakile*, and other herbaceous species may be present as sub-dominants.

North Pacific Maritime Dune & Coastal Beach Group

***Leymus mollis* Alliance**
Leymus mollis – Abronia latifolia – (*Cakile* spp.) Association

10a2. *Abronia latifolia, Abronia umbellata, Ambrosia chamissonis, Calystegia soldanella,* and/or *Lathyrus littoralis* are characteristically present to dominant, sometimes with *Armeria maritima, Camissonia cheiranthifolia, Cardionema*

ramosissimum, Poa douglasii, or *Polygonum paronychia* occurring as associated species. Non-native species such as *Cakile maritima*, *Carpobrotus* spp., and *Ammophila arenaria* may also be present.

Californian Coastal Beach & Dune Group

***Abronia latifolia – Ambrosia chamissonis* Alliance**
Ambrosia chamissonis Association
Ambrosia chamissonis – Abronia umbellata Association
Abronia latifolia – Calystegia soldanella – Lathyrus littoralis Association

10a3. *Armeria maritima, Artemisia pycnocephala, Erigeron glaucus, Eriophyllum staechadifolium, Eriogonum latifolium,* and/or *Fragaria chiloensis* dominate or characterize stabilized dunes, sea bluffs and exposed coastal terraces. Shrubs such as *Baccharis pilularis*, *Lupinus arboreus*, *L. versicolor*, and *Rubus ursinus* may be present at low cover. Other native forbs and grasses may be present including *Achillea millefolium, Angelica hendersonii, Bromus carinatus, Daucus pusillus* and/or *Dudleya* spp.

Californian Coastal Beach & Dune Group

***Eriophyllum staechadifolium – Erigeron glaucus – Eriogonum latifolium* Alliance**
Armeria maritima – Plantago (maritima) Provisional Association*
Artemisia pycnocephala Association
Erigeron glaucus – Fragaria chiloensis Association
Eriogonum parvifolium Association*
Eriophyllum staechadifolium – Eriogonum latifolium Association

10a4. *Ericameria ericoides, Lupinus chamissonis,* and/or other coastal bluff scrub are dominant or subdominant in the shrub layer, while psammophytic herbs as noted in 10a above are also often present.

***Lupinus chamissonis – Ericameria ericoides* Alliance**
Lupinus chamissonis Association
Lupinus chamissonis – Ericameria ericoides Association

10b. Open rocky coastal bluffs and cliffs where native *Dudleya farinosa* or other *Dudleya* spp. and/or lichen or moss characteristic, dominant or co-dominant with herbs such as *Eriogonum latifolium, Vulpia bromoides*, and others.

Western North American Cliff, Scree & Rock Vegetation Macrogroup

Californian Cliff, Scree & Rock Vegetation Group

Dudleya cymosa – Dudleya lanceolata* / Lichen – Moss Alliance
Dudleya farinosa / Lichen – Moss Provisional Association*

10c. Non-natives, including *Ammophila*, *Cakile, Carpobrotus*, and/or *Mesembryanthemum* strongly dominate at >80% relative cover on dunes, bluffs, or disturbed lands. Emergent shrubs such as *Baccharis pilularis* or *Lupinus arboreus* may be present.

North Pacific Coastal Ruderal Grassland & Shrubland Macrogroup

North Pacific Maritime Coastal Ruderal Dune Group

10c1. *Ammophila arenaria* is strongly dominant in the herbaceous layer, and there is little native cover (<20% relative cover).

***Ammophila arenaria* Semi-Natural Alliance**
Ammophila arenaria Semi-Natural Association
Baccharis pilularis / Ammophila arenaria Semi-Natural Association*

10c2. *Carpobrotus* and/or *Mesembryanthemum* dominate on bluffs, dunes, or disturbed lands, often forming impenetrable mats that prevent natives from establishing.

***Mesembryanthemum* spp. – *Carpobrotus* spp. Semi-Natural Alliance**
Carpobrotus (*edulis*) Semi-Natural Association

10c3. *Cakile edentula* and/or *C. maritima* are strongly dominant along active beaches at the debris line, and overall non-native cover > 90% relative cover.

***Cakile (edentula, maritima)* Provisional Semi-Natural Alliance**
Cakile (edentula, maritima) Provisional Semi-Natural Association

Appendix D

Vegetation Descriptions

See separate electronic file for the local Alliance and Association descriptions for Santa Clara and Santa Cruz Counties.