Vegetation Classification of Alliances and Associations in San Mateo County, California

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Photos on Cover:

Top Left: *Schoenoplectus californicus* Herbaceous Association at Pescadero Marsh (photo by Julie Evens)

Top Right: *Arctostaphylos sensitiva* Shrubland Association at Welden Parcel, Sempervirens Fund, above Gazos Creek (photo by Neal Kramer)

Bottom: *Arbutus menziesii* Woodland & Forest Alliance at Wunderlich County Park (photo by GGNRA staff)

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Abstract

This report describes approximately 90 alliances and 200 associations that occur in San Mateo County, 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 Golden Gate National Parks Conservancy, National Park Service, Tukman Geospatial LLC, and other partners of the San Mateo Countywide Vegetation Map and Landscape Database Project. Vegetation ecologists from the California Native Plant Society analyzed species data from 6,425 field surveys collected between 1992 and 2019. The data included 394 new surveys collected in 2019 through funding provided specifically for this classification effort. Additional surveys were compiled for the analysis from previous sampling efforts in San Mateo (746), San Francisco (6), and from nearby counties (5,279) to provide a broader, regional understanding. A total of 27 tree-overstory, 24 shrubland, and 37 herbaceous alliances are described, with 64 tree-overstory, 54 shrubland, and 78 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

The land area of San Mateo County encompasses about 116,000 hectares (290,000 acres) of diverse plant community assemblages representing a varied set of habitats including redwood groves, Douglas-fir forests, oak woodlands, willow and alder riparian stringers, maritime chaparral, coastal and dune scrub, coastal prairie, serpentine grasslands, freshwater and brackish marshes, and tidal marshes. The county is part of the San Francisco Peninsula, bounded by the Pacific Ocean to the west, with San Francisco Bay to the east, and is both topographically and geologically diverse. The Santa Cruz Mountains run the length of the peninsula, dividing the county into watersheds that drain into either the Bay or the Pacific. The National Park lands in adjacent San Francisco County, which is about one tenth of the size of San Mateo, are lumped in with the sampling and mapping effort. Figure 1 illustrates the county boundary with eleven watershed units used to divide the two counties into regions (CalWater 2004).

San Mateo County is nearly three-quarters open space or agriculture. It includes almost 93 km (58 miles) of coastline, with sand dunes merging to low sloping marine terraces, along with most of the northern portion of the Santa Cruz Mountains, sometimes called the Sierra Morena. To the north, the hills of San Francisco and San Bruno Mountain are separate from the main body of the Santa Cruz Mountains whose crests form a straight line, which is parallel to the San Andreas Fault (Thomas 1961). The highest point in the county is along Long Ridge near the boundary with Santa Cruz County, at almost 800 m (2600 ft) in elevation. Rivers and streams are at more or less right angles with the crest of the mountains, with those on the west-facing slopes being perennial most years, and those on the east-facing slopes drying up before the rainy season (Thomas 1961).

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). San Mateo County contains ten different geologic assemblages, large fault-bounded blocks with unique stratigraphic sequences (Brabb et al. 1998).

The typical Mediterranean climate of warm dry summers and cool rainy winters is moderated by the Pacific Ocean, the San Francisco Bay, and fog. Amount of fog also varies greatly between the two sides of the crest, with the limit of well-developed redwood forests coinciding with the limit of summer coastal fogs (Thomas 1961). For example, fog and cloud cover data for August 2009 shows average hours per day of fog or clouds to vary from 2 hrs to 13.5 hours per day depending on

location within the county (Torregrosa et al. 2016). Rainfall averages vary across the county (41 – 114 cm, or 16 – 45 inches) with a strong difference between the humid coastal belt of redwood and Douglas-fir forests and the drier inland portions of grasslands, oak savannah / woodlands, and rocky chaparral (PRISM 2012). Average annual maximum temperature varies from 62 to 74° F (16-23° C) across the county (PRISM 2006a). Average maximum temperature for the month of August varies from 65 to 87° F (18 to 31° C; per PRISM 2006b). Average minimum temperature for the month of January varies less, with 37 to 44° F (3 to 7° C; per PRISM 2006b)

Figure 1. Eleven watershed units as defined by CalWater (2004) in San Mateo and adjacent San Francisco Counties. These units divide the counties into regions and are noted as sample locations in the vegetation descriptions.

In 2018, a collaborative group of agencies and partners formed the San Mateo Countywide Vegetation Map and Landscape Database Project initiated by the Golden Gate National Parks Conservancy to map the county's topography, physical and biotic features, and diverse plant communities. The foundation for the map is the standard vegetation classification approach 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 San Mateo County.

CNPS uses an integrated set of steps for classification compliant with *A Manual of California Vegetation* (CNPS 2021) and the United States National Vegetation Classification System (FGDC 2008). The field key and descriptions of the vegetation for San Mateo County 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 San Mateo County 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 San Mateo County 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, Golden Gate National Parks Conservancy (Parks Conservancy), 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 agency partners helped identify locations and provide land access for sampling. Parks Conservancy project manager (Danny Franco) additionally coordinated land access, which assisted in spatially expanding the sampling effort on public and private lands.

Parks Conservancy field staff (namely, Patrick Furtado, Rosie Frederick, and Brittany Burnett) and the field coordinator (Neal Kramer) sampled vegetation across the spring–summer of 2019. At the same time, a team from UC Santa Cruz Arboretum, led by Brett Hall and Lucy Ferneyhough, coordinated their own sampling to contribute to the effort. Staff were guided by a preliminary sample allocation by Tukman Geospatial LLC, though they also opportunistically sampled priority vegetation types during peak plant phenology with oversight from the field coordinator, especially for herbaceous types.

Parks Conservancy staff and contractors 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 being trained by CNPS staff. Protocols comply with state and national standards as defined by the Survey of California Vegetation (VegCAMP 2020) and the US National Vegetation Classification (USNVC 2021) 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. Percent cover estimates were recorded for all species listed in relevés and RAs. All data were recorded on paper field forms; spatial information and a subset of the data included on the forms 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 2019 and 2020. Prior to analysis, scientific names of all taxa were first converted to standard alpha-numeric codes used by the PLANTS Database (USDA NRCS 2021). A prefix of "2" was applied to codes for taxa recognized by the Jepson eFlora (Jepson Flora Project 2021) or A Manual of California Vegetation (CNPS 2021), 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). For both the woody and herbaceous analyses, 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. Outlier and cluster analyses were conducted on each subset and 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 46), 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).

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 2021) and the USNVC (FGDC 2008, USNVC 2021). 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.

A summary of the analysis and classification process is provided in 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. Based on cluster group results in step 4, break the dataset up into smaller units for subsequent analyses
6. Repeat steps 1–4 for each subset of data generated from step 5
7. 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)
8. Use ISA to settle on the final representative grouping variable for each cluster analysis for preliminary labeling
9. Determine preliminary alliance and association names for each of the samples based on cluster membership, species constancy, abundance, and existing classifications
10. 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
11. 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.

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 (Patrick McIntyre). 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 2021). 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 (including other 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 slight 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 San Mateo County. CNPS office staff (namely, Kendra Sikes, Savannah Vu, Kelsey Guest, 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 San Mateo 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 2021).

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 San Mateo County (<3), related surveys from surrounding counties are included in the data summaries if there are <5 of them from the other county. 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 394 surveys in 375 stands of vegetation were sampled in the spring–summer of 2019 through funding provided specifically for this classification effort, including 307 rapid assessment (RA), 80 relevé, and 7 reconnaissance surveys (Figure 2). Additional surveys that were compiled for the analysis from previous sampling efforts in San Mateo County (746) and from adjacent coastal counties (5,285, including 6 surveys from San Francisco County) provided a broader, regional understanding of vegetation types with overlapping floristic and ecological characteristics (Figure 3).

The compiled data were collected between 1992 and 2019 with the majority of the surveys coming from Marin and Sonoma Counties (see Buck-Diaz et al. 2021). Data specifically from San Mateo County 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 utilities upon project completion.

Species names were entered in the survey database as they were recorded in the field, yet the PLANTS Database (USDA NRCS 2021) 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 codes based on the Jepson eFlora (Jepson Flora Project 2021).

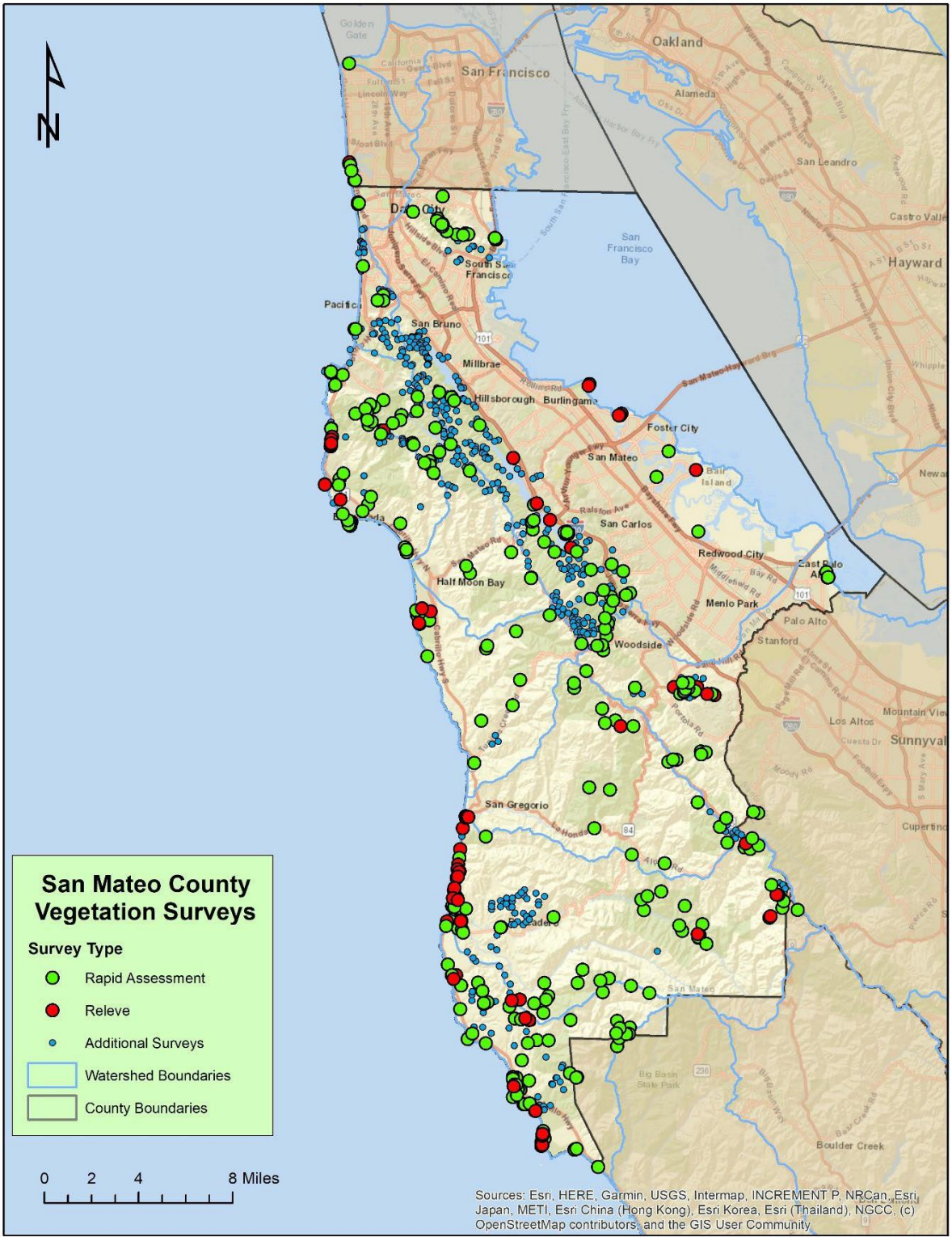

Figure 2. Locations of vegetation survey points in San Mateo County. The red and green points show surveys collected in 2019 specifically for this project. The smaller blue points show surveys compiled from other projects in San Mateo County and included in the classification.

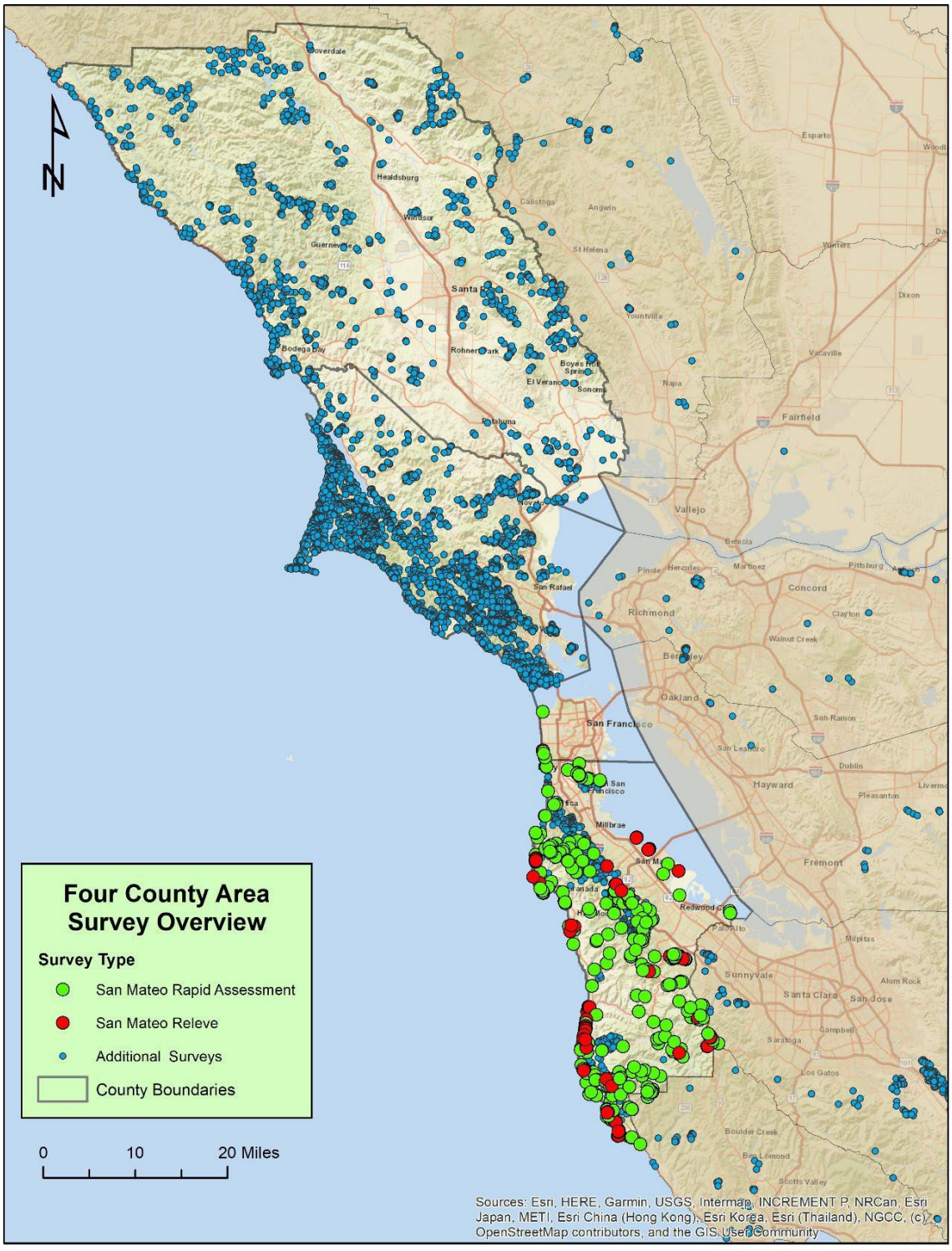

Figure 3. Locations of survey points in four Bay Area counties. The red and green points show surveys collected in San Mateo County during 2019 for this project. The smaller blue points show surveys included in the classification analyses from other projects in adjacent coastal counties.

Table 2. Compilation of vegetation classification samples by focal area and entity within San Mateo or San Francisco Counties. The first 2 rows are the surveys done specifically for this project.

Focus/Location of sampling	Entity	Type of survey	# of samples
San Mateo County	Golden Gate National Parks Conservancy / D. Franco	Rapid assessments, Relevés	349
San Mateo County	UC Santa Cruz Arboretum / B. Hall	Rapid assessments, Relevés, Reconnaissance	38
Golden Gate National Recreation Area	National Park Service	Relevés, Accuracy Assessment	399
Rangeland Management	Point Blue Conservation Science	Transects	124
Grasslands, Central Coast	San Jose State University / Cort Johnson Thesis	Point-Intercept Transect	67
San Francisco Watershed Lands	San Francisco Public Utilities Commission / B. Leitner	Relevés	67
Northern Coastal Scrub	San Francisco State / E. Wrubel	Rapid assessments, Relevés	46
Jasper Ridge Reserve	CNPS Sampling Workshops	Rapid assessments	24
Rare Plant Communities	CNPS & CA Dept. Fish & Wildlife	Line Intercept	13
Maritime chaparral	UC Santa Cruz /B. Hall & San Francisco State /M. Vasey	Relevés	7
San Mateo County	NPS San Francisco Bay Area Network / E. Wrubel	Nested permanent plots, Transects	5
		Total	**1139**

Classification

Vegetation rapid assessment and relevé data were analyzed by CNPS in 2019 and 2020. An additional 5,285 surveys from neighboring counties were included to provide a broader, regional understanding of vegetation types with overlapping floristic and ecological characteristics (Figure 3). The dataset was partitioned into five subsets during analysis that broadly corresponded to patterns of redwoods, other trees, chaparral, other shrub/herbs, and saline/riparian. Cluster and Indicator Species Analyses were conducted on each of the five 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.

After CNPS produced a draft classification, VegCAMP and NatureServe ecologists reviewed it and provided feedback for additional refinement. The floristic vegetation classification resulted in approximately 90 alliances and 200 associations within San Mateo County: 27 tree-overstory, 24 shrubland, and 37 herbaceous/grassland alliances (Table 3); and 64 tree-overstory, 54 shrubland, and 78 herbaceous/grassland associations (Appendix B, Table 4). Of the types classified, 16 alliances and 24 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 vegetation types of San Mateo County (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. The vegetation key was field tested in collaboration with the mapping team during field reconnaissance in June 2020. Both the field key and descriptions contain membership rules for each alliance in the classification. Upon establishing these membership rules, all outliers removed from the initial analysis were subsequently classified to alliance and association. While 6,425 surveys were included in the comprehensive vegetation classification analysis, mainly those located in San Mateo or San Francisco Counties (1,139 surveys) are included in the descriptions, unless otherwise noted in the classification comments (when sample size was low). In addition, 131 surveys were excluded from the descriptions because they were within 200 m of a survey of the same alliance or were return visits to the same plot location.

Additionally, Table 5 in Appendix B represents the classification list of alliances and associations in San Mateo County nested within the USNVC hierarchy. The classification names for each field survey are located in a survey database. The survey data will be publicly available upon project completion through CDFW’s Biogeographic Information and Observation System (BIOS).

Table 3. Alliance list with sample size (n) for surveys collected in San Mateo and San Francisco Counties, California. An asterisk (*) denotes alliances that are likely present or known to be present but do not have classification surveys in the County.

Lifeform	Alliance Name	n
Forest and Woodland	*Acer macrophyllum – Alnus rubra* Alliance	12
	Acer negundo Alliance	4
	Aesculus californica Alliance	10
	Alnus rhombifolia Alliance	3
	Arbutus menziesii Alliance	7
	Eucalyptus spp. *– Ailanthus altissima – Robinia pseudoacacia* Semi-Natural Alliance	11
	Fraxinus latifolia Alliance*	0
	Hesperocyparis (pigmaea, abramsiana, macrocarpa, goveniana) Alliance	1
	Hesperocyparis macrocarpa – Pinus radiata Semi-Natural Alliance	8
	Notholithocarpus densiflorus Alliance	10
	Pinus attenuata Alliance	2
	Pinus muricata – Pinus radiata Alliance	1
	Platanus racemosa – Quercus agrifolia Alliance	1
	Populus fremontii – Fraxinus velutina – Salix gooddingii Alliance	1
	Populus trichocarpa Alliance	2
	Pseudotsuga menziesii – (Notholithocarpus densiflorus – Arbutus menziesii) Alliance	55
	Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni) Alliance	2
	Quercus agrifolia Alliance	37
	Quercus chrysolepis (tree) Alliance	4
	Quercus douglasii Alliance	3
	Quercus kelloggii Alliance	1
	Quercus lobata Alliance	3
	Quercus lobata Riparian Alliance*	0
	Quercus wislizeni – Quercus parvula (tree) Alliance	4
	Salix gooddingii – Salix laevigata Alliance	5
	Salix lucida ssp. lasiandra Alliance	7
	Schinus (molle, terebinthifolius) – Myoporum laetum Semi-Natural Alliance	1
	Sequoia sempervirens Alliance	60
	Umbellularia californica Alliance	16
Shrubland	*Acacia* spp*. – Grevillea* spp*. – Leptospermum laevigatum* Provisional Semi-Natural Alliance	3
	Adenostoma fasciculatum Alliance	9
	Arctostaphylos (crustacea, tomentosa) Alliance	16
	Arctostaphylos (nummularia, sensitiva) – Chrysolepis chrysophylla Alliance	22
	Artemisia californica – (Salvia leucophylla) Alliance	14
	Baccharis pilularis Alliance	235

Lifeform	Alliance Name	n
	Ceanothus (oliganthus, tomentosus) Alliance*	0
	Ceanothus cuneatus Alliance	4
	Ceanothus thyrsiflorus Alliance	17
	Cercocarpus montanus Alliance	2
	Cornus sericea Alliance	6
	Corylus cornuta var. californica Alliance	6
	Cytisus scoparius – Genista monspessulana – Cotoneaster spp. Semi-Natural Alliance	5
	Diplacus aurantiacus Alliance	1
	Frangula californica – Rhododendron occidentale – Salix breweri Alliance*	0
	Gaultheria shallon – Rubus (ursinus) Alliance	20
	Lotus scoparius – Lupinus albifrons – Eriodictyon spp. Alliance	4
	Lupinus arboreus Alliance	5
	Lupinus chamissonis – Ericameria ericoides Alliance	8
	Prunus ilicifolia – Heteromeles arbutifolia – Ceanothus spinosus Alliance	27
	Quercus berberidifolia Alliance*	0
	Quercus durata Alliance	5
	Quercus wislizeni – Quercus chrysolepis (shrub) Alliance*	0
	Rhus trilobata – Crataegus rivularis – Forestiera pubescens Alliance*	0
	Rubus armeniacus – Sesbania punicea – Ficus carica Semi-Natural Alliance*	0
	Rubus spectabilis – Morella californica Alliance	7
	Salix exigua Alliance	2
	Salix hookeriana – Salix sitchensis – Spiraea douglasii Alliance	1
	Salix lasiolepis Alliance	29
	Toxicodendron diversilobum Alliance	29
Herbaceous	*Abronia latifolia – Ambrosia chamissonis* Alliance	4
	Ammophila arenaria Semi-Natural Alliance	2
	Amsinckia (menziesii, tessellata) – Phacelia spp. Alliance*	0
	Atriplex prostrata – Cotula coronopifolia Semi-Natural Alliance	1
	Avena spp. – *Bromus* spp. Semi-Natural Alliance	6
	Azolla (filiculoides, microphylla) Alliance*	0
	Bidens cernua – Euthamia occidentalis – Ludwigia palustris Provisional Alliance	2
	Bolboschoenus maritimus Alliance	3
	Brassica nigra – Centaurea (solstitialis, melitensis) Semi-Natural Alliance	5
	Bromus carinatus – Elymus glaucus Alliance	21
	Cakile (edentula, maritima) Provisional Semi-Natural Alliance	1
	Calamagrostis nutkaensis Alliance	8
	Carex barbarae Alliance*	0
	Carex nudata Alliance	1
	Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus Alliance	10
	Ceratophyllum demersum Aquatic Provisional Alliance*	0

Lifeform	Alliance Name	n
	Conium maculatum – Foeniculum vulgare Semi-Natural Alliance*	0
	Corethrogyne filaginifolia – Eriogonum (elongatum, nudum) Alliance*	0
	Cortaderia (jubata, selloana) Semi-Natural Alliance	1
	Cynodon dactylon – Crypsis spp. – Paspalum spp. Semi-Natural Alliance*	0
	Cynosurus echinatus – Arrhenatherum elatius Semi-Natural Alliance*	0
	Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica Alliance	8
	Distichlis spicata Alliance	7
	Eichhornia crassipes – Ludwigia (hexapetala, peploides) Provisional Semi-Natural Alliance	1
	Eleocharis (acicularis, macrostachya) Alliance	2
	Eriophyllum staechadifolium – Erigeron glaucus – Eriogonum latifolium Alliance	32
	Eryngium aristulatum Alliance*	0
	Eschscholzia (californica) – Lupinus (nanus) Alliance*	0
	Festuca idahoensis – Danthonia californica Alliance	35
	Grindelia (stricta) Provisional Alliance	6
	Holcus lanatus – Anthoxanthum odoratum Semi-Natural Alliance	1
	Hydrocotyle (ranunculoides, umbellata) Alliance*	0
	Juncus arcticus (var. balticus, mexicanus) Alliance*	0
	Juncus (effusus, patens) – Carex (pansa, praegracilis) Alliance	9
	Lasthenia californica – Plantago erecta – Vulpia microstachys Alliance	7
	Lasthenia glaberrima Alliance	1
	Lepidium latifolium – (Lactuca serriola) Semi-Natural Alliance*	0
	Leymus cinereus – Leymus triticoides Alliance	2
	Leymus mollis Alliance	7
	Lilaeopsis occidentalis Provisional Alliance*	0
	Lolium perenne Semi-Natural Alliance	6
	Mesembryanthemum spp. – *Carpobrotus* spp. Semi-Natural Alliance	4
	Mimulus (guttatus) Alliance	3
	Nassella spp. – *Melica* spp. Alliance	26
	Nuphar lutea Freshwater Aquatic Provisional Alliance*	0
	Phalaris aquatica – Phalaris arundinacea Semi-Natural Alliance	3
	Plagiobothrys nothofulvus Alliance*	0
	Poa pratensis – Agrostis gigantea – Agrostis stolonifera Semi-Natural Alliance*	0
	Polygonum lapathifolium – Xanthium strumarium Alliance	2
	Ruppia (cirrhosa, maritima) Alliance*	0
	Sarcocornia pacifica (Salicornia depressa) Alliance	16
	Schoenoplectus (acutus, californicus) Alliance	8
	Sedum spathulifolium Provisional Alliance	2
	Sparganium (angustifolium) Alliance	1
	Spartina foliosa Alliance*	0
	Trifolium variegatum Alliance*	0
	Typha (angustifolia, domingensis, latifolia) Alliance	4

Lifeform	Alliance Name	n
	Zostera (marina, pacifica) Alliance*	0
Sparsely Vegetated	*Allium* spp. – *Streptanthus* spp. – *Hesperolinon* spp. Serpentinite Alliance*	0
	Dudleya cymosa – *Dudleya lanceolata* / Lichen – Moss Alliance*	0

Discussion

San Mateo and San Francisco counties combined are very similar in size to Marin County, where a classification was recently completed (Buck-Diaz et al. 2021). The San Mateo classification is somewhat less diverse than that of Marin, with 82% of the alliances and 71% of the associations. The difference in numbers of vegetation types may partially be due to less data available for San Mateo Co. In San Mateo there was 1 survey for every 280 acres, while Marin had about 1 survey for every 100 acres because previous vegetation mapping efforts contributed to the data available.

Still San Mateo County does have a great diversity of habitats. Over 30 associations were documented in San Mateo that were not present in Marin County. Of these, 8 associations were newly described, including for maritime chaparral (*Arctostaphylos montaraensis – Arctostaphylos imbricata* Association) and pine woodland (*Pinus attenuata / Arctostaphylos (crustacea)* Association). Some of the alliance additions to the *Manual of California Vegetation* for Marin County were also documented in San Mateo, including coastal beach scrub (*Eriophyllum staechadifolium – Erigeron glaucus – Eriogonum latifolium* Alliance), coastal bluff scrub (*Gaultheria shallon – Rubus (ursinus)* Alliance), and non-native coastal conifer stands (*Hesperocyparis macrocarpa – Pinus radiata* Semi-Natural Alliance). The *Pseudotsuga menziesii – (Notholithocarpus densiflorus – Arbutus menziesii)* Alliance has been newly defined based on the earlier accepted *Pseudotsuga menziesii* and *Pseudotsuga menziesii-Notholithocarpus densiflorus* alliances, since Douglas-fir stands in the region generally have a hardwood component.

Upon conferring with the USNVC, a few alliances from the *Manual* have been split at a finer-scale such as differentiating a riparian valley oak forest (*Quercus lobata* Riparian Alliance) from upland stands, while other alliances that are localized along the coast and Greater Bay Area have been merged together into broader concepts including maritime chaparral (*Arctostaphylos (nummularia, sensitiva) – Chrysolepis chrysophylla* Alliance) and coniferous forest (*Hesperocyparis (pigmaea, abramsiana, macrocarpa, goveniana)* Alliance). Other more broadly distributed types from western North America have been combined together from previously separate alliances based on overlapping lowland and coastal plant assemblages, yet they are separated from similar montane assemblages, including wet meadows (e.g.,

Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica Alliance), moist meadows (e.g., *Festuca idahoensis – Danthonia californica* Alliance), and riparian scrub (e.g., *Frangula californica – Rhododendron occidentale – Salix breweri* Alliance). Additionally, ruderal or seral scrub types have been simplified into broader concepts (e.g., *Cytisus scoparius – Genista monspessulana – Cotoneaster* spp. Semi-Natural Alliance*, Lotus scoparius – Lupinus albifrons – Eriodictyon* spp. Alliance).

A few types in the USNVC are being split and/or recognized at the Alliance level, pending either review by western regional ecologists 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 are 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, in which we are still gathering input and analysis from California to Washington and east to Colorado. Other pending decisions include the placement of some alliances in the USNVC hierarchy, including the placement of *Eleocharis (macrostachya, acicularis)* Alliance at the Group level. These and future revisions will be forthcoming in the *Manual of California Vegetation* and the USNVC, and 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 2021), except in two cases: When a more current name has been assigned in the Jepson eflora (Jepson Flora Project 2021), 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 2021) 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.
    - A rarity rank with a question mark (e.g., S3?) denotes a degree of uncertainty in the ranking. It is an estimated rank that is lacking some information on necessary inputs of ranking such as range, extent, area of occupancy, threats, and short/long-term trends. Reasons for low confidence include a lack of sampling or mapping in large parts of the expected range of a vegetation type.
- **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.
  - **San Mateo 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 San Mateo County 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 San Mateo and San Francisco Counties (number of surveys in column Co), 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	Co	All	Stat
Forest and Woodland					
	Acer macrophyllum – Alnus rubra				
		Acer macrophyllum – Pseudotsuga menziesii / Polystichum munitum	1	2	
		Acer macrophyllum / (Rubus ursinus)	1	10	rev
		Alnus rubra / Rubus spectabilis – Sambucus racemosa	3	43	
		Alnus rubra / Salix lasiolepis – Rubus spp.	5	45	rev
		Umbellularia californica – Acer macrophyllum	2	24	rev
	Acer negundo				
		Acer negundo / (Rubus ursinus)			
	Aesculus californica				
		Aesculus californica – Umbellularia californica	3	10	rev
		Aesculus californica / Toxicodendron diversilobum / Moss	7	14	
	Alnus rhombifolia				
		Alnus rhombifolia – Umbellularia californica – (Quercus chrysolepis)	2	8	rev
		Alnus rhombifolia / Carex (nudata)	1	13	rev
	Arbutus menziesii				
		Arbutus menziesii – (Quercus agrifolia)	5	43	rev
		Arbutus menziesii – Umbellularia californica	2	29	
	Eucalyptus* spp. – *Ailanthus altissima* – *Robinia pseudoacacia				

Lifeform	Alliance	Association	Co	All	Stat
		Acacia melanoxylon	3	3	new
		Eucalyptus (globulus, camaldulensis)	8	12	
	Hesperocyparis (pigmaea, abramsiana, macrocarpa, goveniana)				
		Hesperocyparis abramsiana / Arctostaphylos (crustacea, silvicola)	1	3	new
	Hesperocyparis macrocarpa – Pinus radiata				**new**
		Hesperocyparis macrocarpa Ruderal	5	16	rev
		Pinus radiata plantations	3	13	
	Notholithocarpus densiflorus				
		Notholithocarpus densiflorus – Arbutus menziesii	6	31	
		Notholithocarpus densiflorus / Vaccinium ovatum	4	7	
	Pinus attenuata				
		Pinus attenuata / Arctostaphylos (crustacea)	2	8	new
	Pinus muricata – Pinus radiata				
		Pinus radiata / Toxicodendron diversilobum	1	1	
	Platanus racemosa – Quercus agrifolia				
		Quercus agrifolia / Salix lasiolepis	1	4	
	Populus fremontii – Fraxinus velutina – Salix gooddingii				
		Populus fremontii / Baccharis salicifolia	1	1	
	Populus trichocarpa				
		Populus trichocarpa / Cornus sericea /	2	2	rev

Lifeform	Alliance	Association	Co	All	Stat
		Carex obnupta			
	Pseudotsuga menziesii – (Notholithocarpus densiflorus – Arbutus menziesii)				**rev**
		Pseudotsuga menziesii – (Umbellularia californica) / Frangula californica	2	22	
		Pseudotsuga menziesii – Arbutus menziesii	4	16	
		Pseudotsuga menziesii – Chrysolepis chrysophylla – Notholithocarpus densiflorus	4	7	
		Pseudotsuga menziesii – Notholithocarpus densiflorus / Vaccinium ovatum	5	6	rev
		Pseudotsuga menziesii – Quercus agrifolia	16	47	
		Pseudotsuga menziesii – Quercus chrysolepis	1	21	
		Pseudotsuga menziesii – Umbellularia californica /	4	55	rev
		Pseudotsuga menziesii – Umbellularia californica / Polystichum munitum	4	23	
		Pseudotsuga menziesii / (Toxicodendron diversilobum)	2	16	rev
		Pseudotsuga menziesii / Baccharis pilularis	8	48	
		Pseudotsuga menziesii / Corylus cornuta / Polystichum munitum	4	8	rev
	Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni)				
		Quercus douglasii – Quercus lobata – Quercus agrifolia / Toxicodendron diversilobum	2	3	
	Quercus agrifolia				
		Quercus agrifolia – Arbutus menziesii – Umbellularia californica	9	57	

Lifeform	Alliance	Association	Co	All	Stat
		Quercus agrifolia – Arbutus menziesii / Corylus cornuta – Rubus spp.	1	6	
		Quercus agrifolia – Quercus kelloggii	1	4	
		Quercus agrifolia / Arctostaphylos (crustacea)	2	4	new
		Quercus agrifolia / grass	2	41	
		Quercus agrifolia / Toxicodendron diversilobum	22	63	
	***Quercus chrysolepis* (tree)**				
		Quercus chrysolepis – Umbellularia californica	3	14	
		Quercus chrysolepis / Quercus (wislizeni, parvula)	1	3	
	Quercus douglasii				
		Quercus douglasii – Quercus agrifolia	2	7	rev
		Quercus douglasii / Mixed herbaceous	1	10	rev
	Quercus kelloggii				
		Quercus kelloggii – Arbutus menziesii – Quercus agrifolia	1	20	
	Quercus lobata				
		Quercus lobata / grass	3	18	
	***Quercus wislizeni – Quercus parvula* (tree)**				
		Quercus (parvula, wislizeni) – Arbutus menziesii / Toxicodendron diversilobum	4	23	rev
	Salix gooddingii – Salix laevigata				
		Salix laevigata / (Cornus sericea – Ribes spp.*) / Scirpus microcarpus – Carex* spp.	3	5	rev
		Salix laevigata / Salix lasiolepis	1	7	
	Salix lucida* ssp. *lasiandra				
		Salix lucida ssp. *lasiandra*	7	21	

Lifeform	Alliance	Association	Co	All	Stat
	Schinus (molle, terebinthifolius) – Myoporum laetum		**1**	**1**	
	Sequoia sempervirens				
		Sequoia sempervirens – Acer macrophyllum – Umbellularia californica	2	36	
		Sequoia sempervirens – Arbutus menziesii / Vaccinium ovatum	4	21	rev
		Sequoia sempervirens – Chrysolepis chrysophylla / Arctostaphylos glandulosa	1	9	
		Sequoia sempervirens – Notholithocarpus densiflorus / Vaccinium ovatum	26	78	
		Sequoia sempervirens – Pseudotsuga menziesii – Notholithocarpus densiflorus	13	47	
		Sequoia sempervirens – Pseudotsuga menziesii – Umbellularia californica	1	17	
		Sequoia sempervirens – Umbellularia californica	6	38	
		Sequoia sempervirens / (Pteridium aquilinum) – Woodwardia fimbriata	3	16	
		Sequoia sempervirens / Polystichum munitum	2	10	
	Umbellularia californica				
		Umbellularia californica	1	48	
		Umbellularia californica – Quercus agrifolia / Toxicodendron diversilobum	12	131	rev
		Umbellularia californica / Polystichum munitum	3	53	
Shrubland					
	Acacia* spp. – *Grevillea* spp. – *Leptospermum laevigatum				**new**
		Acacia (cyclops, dealbata)	1	1	new

Lifeform	Alliance	Association	Co	All	Stat
	Adenostoma fasciculatum				
		Adenostoma fasciculatum	6	28	
		Adenostoma fasciculatum – Diplacus aurantiacus	2	35	
	Arctostaphylos (crustacea, tomentosa)				
		Arctostaphylos crustacea	12	14	
		Arctostaphylos crustacea – Adenostoma fasciculatum – Ceanothus (cuneatus, papillosus)	4	7	
	Arctostaphylos (nummularia, sensitiva) – Chrysolepis chrysophylla				**new**
		Arctostaphylos montaraensis – Arctostaphylos imbricata	12	12	new
		Arctostaphylos sensitiva	4	39	rev
		Chrysolepis chrysophylla / Vaccinium ovatum	6	24	
	Artemisia californica – (Salvia leucophylla)				
		Artemisia californica	6	34	
		Artemisia californica – Diplacus aurantiacus	5	31	
		Artemisia californica / Nassella (pulchra)	3	16	
	Baccharis pilularis				
		Baccharis pilularis	3	32	
		Baccharis pilularis – (Frangula californica) – Rubus spp.	55	188	rev
		Baccharis pilularis – Artemisia californica	24	83	
		Baccharis pilularis – Ceanothus thyrsiflorus	9	18	
		Baccharis pilularis – Toxicodendron diversilobum	57	115	

Lifeform	Alliance	Association	Co	All	Stat
		Baccharis pilularis / (Nassella pulchra – Elymus glaucus – Bromus carinatus)	8	88	
		Baccharis pilularis / Annual grass – herb	15	58	
		Baccharis pilularis / Carex obnupta – Juncus patens	4	47	
		Baccharis pilularis / Danthonia californica	18	60	
		Baccharis pilularis / Eriophyllum staechadifolium	19	28	
		Frangula californica ssp. *californica – Baccharis pilularis / Scrophularia californica*	14	32	rev
		Garrya elliptica	2	6	rev
	Ceanothus cuneatus				
		Ceanothus cuneatus – Adenostoma fasciculatum	3	18	
	Ceanothus (oliganthus, tomentosus)		**0**	**1**	
	Ceanothus thyrsiflorus				
		Ceanothus thyrsiflorus – (Rubus ursinus)	4	31	
		Ceanothus thyrsiflorus – Baccharis pilularis – Toxicodendron diversilobum	13	27	
	Cercocarpus montanus				
		Cercocarpus montanus – Prunus ilicifolia	2	2	
	Cornus sericea				
		Cornus sericea / Salix (lasiolepis, exigua)	6	7	rev
	Corylus cornuta* var. *californica				
		Corylus cornuta / Polystichum munitum	6	30	
	***Cytisus scoparius – Genista monspessulana – Cotoneaster* spp.**				

Lifeform	Alliance	Association	Co	All	Stat
		Cotoneaster (lacteus, pannosus)	0	2	
		Genista monspessulana	2	21	
		Hypericum canariense	2	2	new
		Ulex europaeus	5	7	rev
	Diplacus aurantiacus				
		Diplacus (aurantiacus, puniceus)	1	3	
	Frangula californica – Rhododendron occidentale – Salix breweri		**0**	**17**	
	Gaultheria shallon – Rubus (ursinus)				**new**
		Holodiscus discolor – Baccharis pilularis – Rubus ursinus	4	14	rev
		Rubus parviflorus	5	8	rev
		Rubus ursinus	11	40	
	***Lotus scoparius – Lupinus albifrons – Eriodictyon* spp.**				
		Eriodictyon californicum / herbaceous	2	8	
		Lotus scoparius	2	7	
	Lupinus arboreus				
		Baccharis pilularis – Lupinus arboreus	1	8	rev
		Lupinus arboreus	4	44	
	Lupinus chamissonis – Ericameria ericoides				
		Lupinus chamissonis	2	6	
		Lupinus chamissonis – Ericameria ericoides	6	43	
	Prunus ilicifolia – Heteromeles arbutifolia – Ceanothus spinosus				
		Prunus ilicifolia ssp. *Ilicifolia – Heteromeles*	10	11	

Lifeform	Alliance	Association	Co	All	Stat
		arbutifolia			
		Prunus ilicifolia ssp. *Ilicifolia / Sanicula crassicaulis*	13	14	
	Quercus berberidifolia		**0**	**9**	
	Quercus durata				
		Quercus durata	2	3	
		Quercus durata – Adenostoma fasciculatum	3	19	
	Quercus wislizeni - Quercus chrysolepis (shrub)		**0**	**33**	
	Rubus armeniacus – Sesbania punicea – Ficus carica		**0**	**4**	
		Delairea odorata	0	0	
		Rubus armeniacus	0	4	
	Rubus spectabilis – Morella californica				
		Morella californica – Rubus spp.	5	27	
		Sambucus racemosa – (Rubus ursinus)	2	6	new
	Salix exigua				
		Salix exigua	2	7	
	Salix hookeriana – Salix sitchensis – Spiraea douglasii				
		Salix sitchensis	1	10	
	Salix lasiolepis				
		Salix lasiolepis	6	18	
		Salix lasiolepis – Rubus spp.	22	87	rev
		Salix lasiolepis – Salix lucida	1	10	
	Toxicodendron diversilobum				
		Toxicodendron diversilobum – (Baccharis	29	53	rev

Lifeform	Alliance	Association	Co	All	Stat
		pilularis)			
Herbaceous					
	Abronia latifolia – Ambrosia chamissonis				
		Abronia latifolia – Calystegia soldanella – Lathyrus littoralis	2	5	
		Ambrosia chamissonis	1	10	
	Ammophila arenaria				
		Ammophila arenaria	2	12	
	Atriplex prostrata – Cotula coronopifolia				
		Atriplex prostrata	1	1	
	***Avena* spp. – *Bromus* spp.**				
		Avena barbata – Avena fatua	1	42	
		Brachypodium distachyon	1	17	
		Bromus hordeaceus – Erodium botrys	2	12	
	Bidens cernua – Euthamia occidentalis – Ludwigia palustris				
		Euthamia occidentalis	1	1	
	Bolboschoenus maritimus				
		Bolboschoenus maritimus	2	7	
		Bolboschoenus maritimus – Sarcocornia pacifica	1	3	
	Brassica nigra – Centaurea (solstitialis, melitensis)				
		Carduus pycnocephalus – Silybum marianum	1	3	new
		Centaurea solstitialis	2	3	
		Raphanus sativus	1	9	

Lifeform	Alliance	Association	Co	All	Stat
	Bromus carinatus – Elymus glaucus				
		Bromus carinatus	10	58	
		Elymus glaucus	9	23	
		Pteridium aquilinum – Grass	2	37	
	Cakile (edentula, maritima)				
		Cakile (edentula, maritima)	1	2	
	Calamagrostis nutkaensis				
		Calamagrostis nutkaensis	1	7	
		Calamagrostis nutkaensis / Baccharis pilularis	7	33	
	Carex nudata				
		Carex nudata	1	5	
	Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus				
		Argentina egedii – (Juncus lescurii)	1	10	rev
		Carex obnupta	2	41	
		Juncus lescurii	2	14	
		Scirpus microcarpus Pacific Coast	4	19	rev
	Conium maculatum – Foeniculum vulgare		**0**	**4**	
	Cortaderia (jubata, selloana)				
		Cortaderia (jubata, selloana)	1	2	
	Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica				
		Deschampsia (cespitosa, holciformis)	1	7	rev
		Deschampsia cespitosa – Danthonia californica	1	42	

Lifeform	Alliance	Association	Co	All	Stat
		Deschampsia cespitosa – Eryngium armatum	3	30	rev
		Hordeum brachyantherum Lowland	3	19	rev
	Distichlis spicata				
		Distichlis spicata – (Sarcocornia pacifica)	2	11	rev
		Distichlis spicata – Frankenia salina – Jaumea carnosa	1	24	
	Eichhornia crassipes – Ludwigia (hexapetala, peploides)				
		Ludwigia (hexapetala, peploides)	1	6	
	Eleocharis (acicularis, macrostachya)				
		Eleocharis macrostachya	2	16	
	Eriophyllum staechadifolium – Erigeron glaucus – Eriogonum latifolium				**new**
		Artemisia pycnocephala	5	23	
		Erigeron glaucus – Fragaria chiloensis	15	31	new
		Eriogonum parvifolium	1	1	new
		Eriophyllum staechadifolium – Eriogonum latifolium	11	30	new
	Festuca idahoensis – Danthonia californica				
		Danthonia californica – Nassella pulchra	9	90	
		Danthonia californica Coastal	14	35	rev
		Festuca californica	2	11	
		Festuca idahoensis – (Danthonia californica – Koeleria macrantha)	7	65	rev
		Festuca idahoensis – Nassella pulchra	2	21	new
		Perideridia kelloggii – Danthonia californica	1	6	new
	Grindelia (stricta)				**rev**

Lifeform	Alliance	Association	Co	All	Stat
		Grindelia stricta	6	16	
	Holcus lanatus – Anthoxanthum odoratum				
		Holcus lanatus	1	34	
	Juncus (effusus, patens) – Carex (pansa, praegracilis)				
		Carex serratodens	1	10	
		Juncus effusus	4	61	
		Juncus phaeocephalus	3	37	
	Lasthenia californica – Plantago erecta – Vulpia				
		Erigeron glaucus – Lasthenia californica	1	7	
		Hemizonia congesta – Lolium perenne	1	30	
		Lasthenia (californica, gracilis)	1	7	
		Lasthenia californica – Plantago erecta – Hesperevax sparsiflora	2	30	
		Vulpia microstachys – Plantago erecta – Calycadenia (truncata, multiglandulosa)	1	19	
	Lasthenia glaberrima				
		Lasthenia glaberrima – Pleuropogon californicus	1	3	
	Leymus cinereus – Leymus triticoides				
		Leymus triticoides	2	18	
	Leymus mollis				
		Leymus mollis – Abronia latifolia – (Cakile sp.*)*	7	14	
	Lolium perenne				
		Lolium perenne	2	44	
		Lolium perenne – Lotus corniculatus	3	8	

Lifeform	Alliance	Association	Co	All	Stat
	***Mesembryanthemum* spp. – *Carpobrotus* spp.**				
		Carpobrotus (edulis)	4	14	
	Mimulus (guttatus)				
		Cirsium fontinale	2	23	rev
		Mimulus guttatus	1	5	
	***Nassella* spp. – *Melica* spp.**				
		Elymus multisetus – (Eschscholzia californica – Plantago erecta)	3	27	rev
		Melica californica	4	46	
		Nassella lepida	5	16	
		Nassella pulchra – Avena spp. *– Bromus* spp.	4	84	
		Nassella pulchra – Hemizonia congesta	1	40	
		Nassella pulchra – Lolium perenne – (Trifolium spp.*)*	1	17	
		Nassella pulchra – Lolium perenne – Plantago erecta Serpentine	8	55	
	Phalaris aquatica – Phalaris arundinacea				
		Phalaris aquatica	3	16	
	Polygonum lapathifolium – Xanthium strumarium				
		Polygonum (amphibium, lapathifolium)	2	4	
	Sarcocornia pacifica (Salicornia depressa)				
		Frankenia salina – Limonium californicum – Monanthochloe littoralis – Sarcocornia pacifica	3	4	rev
		Sarcocornia pacifica – Jaumea carnosa –	5	66	

Lifeform	Alliance	Association	Co	All	Stat
		Distichlis spicata			
		Sarcocornia pacifica Tidal	8	37	
	Schoenoplectus (acutus, californicus)				
		Schoenoplectus acutus	3	10	
		Schoenoplectus californicus	5	18	
	Sedum spathulifolium				
		Sedum spathulifolium – Polypodium californicum / Lichen – Moss	2	6	rev
	Sparganium (angustifolium)				
		Sparganium eurycarpum	1	5	rev
	Typha (angustifolia, domingensis, latifolia)				
		Typha (latifolia, angustifolia)	4	10	
	Zostera (marina, pacifica)		0	0	

Table 5. Vegetation classification at the Alliance level organized within the current USNVC hierarchy for San Mateo County. Two status notes are listed in parenthesis after Alliance when applicable for the National Vegetation Classification (NVC) and for the Manual of California Vegetation (MCV). These 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 (exp) 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 County.

Level	**Example**
Level 1 Class	1. Forest & Woodland
Level 2 Subclass	1.B. Temperate & Boreal Forest & Woodland
Level 3 Formation	1.B.1. Warm Temperate Forest & Woodland
Level 4 Division	1.B.1.Nc. Californian Forest & Woodland
Level 5 Macrogroup	M009 Californian Forest & Woodland
Level 6 Group	G195 Californian Broadleaf Forest & Woodland
Level 7 Alliance	Aesculus californica

1. Forest & Woodland
   1.B. Temperate & Boreal Forest & Woodland
   1.B.1. Warm Temperate Forest & Woodland
      i. 1.B.1.Nc. Californian Forest & Woodland
         a. M009 Californian Forest & Woodland
            1. G195 Californian Broadleaf Forest & Woodland
               i. Aesculus californica
               ii. Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni)
               iii. Quercus agrifolia
               iv. Quercus chrysolepis (tree)
               v. Quercus douglasii
               vi. Quercus kelloggii
               vii. Quercus lobata
               viii. Quercus wislizeni – Quercus parvula (NVC-exp)(MCV-exp)
               ix. Umbellularia californica (NVC-new-s)
            2. G198 Californian Conifer Forest & Woodland
               i. Hesperocyparis (pigmaea, abramsiana, macrocarpa,

goveniana)(NVC-new-m)
ii. Pinus attenuata
iii. Pinus muricata – Pinus radiata

b. M513 Californian Ruderal Forest

1. G678 Californian Ruderal Forest

i. Eucalyptus spp. – Ailanthus altissima – Robinia pseudoacacia (NVC-exp)
ii. Hesperocyparis macrocarpa – Pinus radiata (NVC-new)(MCV-new)
iii. Schinus (molle, terebinthifolius) – Myoporum laetum*

1.B.2. Cool Temperate Forest & Woodland

ii. 1.B.2.Nd. Vancouverian Forest & Woodland

a. M024 Vancouverian Coastal Rainforest

1. G235 Californian Coastal Redwood Forest

i. Sequoia sempervirens

b. M886 Southern Vancouverian Dry Foothill Forest & Woodland

1. G208 Californian Moist Coastal Mixed Evergreen Forest

i. Pseudotsuga menziesii – (Notholithocarpus densiflorus – Arbutus menziesii) (NCV-new-m)
ii. Notholithocarpus densiflorus (NVC-new-s)
iii. Arbutus menziesii (NVC-new-s)

1.B.3. Temperate Flooded and Swamp Forest

iii. 1.B.3.Nd. Western North American Interior Flooded Forest

1. M036 Interior Warm & Cool Desert Riparian Forest

1. G797 Western Interior Riparian Forest & Woodland

i. Acer negundo
ii. Platanus racemosa – Quercus agrifolia
iii. Populus fremontii – Fraxinus velutina – Salix gooddingii
iv. Quercus lobata Riparian (MCV-new-s)
v. Salix gooddingii – Salix laevigata

b. M298 Interior West Ruderal Flooded & Swamp Forest & Woodland

1. G510 Interior West Ruderal Riparian Forest & Scrub

i. Rubus armeniacus - Sesbania punicea - Ficus carica*

iv. 1.B.3.Ng. Vancouverian Flooded & Swamp Forest

a. M035 Vancouverian Flooded & Swamp Forest

1. G851 North-Central Pacific Lowland Riparian Forest
    i. Acer macrophyllum – Alnus rubra (MCV-new-m)
    ii. Alnus rhombifolia
    iii. Fraxinus latifolia*
    iv. Populus trichocarpa
    v. Salix lucida ssp. lasiandra

2. Shrub & Herb Vegetation
2.B. Temperate & Boreal Grassland & Shrubland
2.B.1. Mediterranean Scrub & Grassland
i. 2.B.1.Na. Californian Scrub & Grassland
a. M043 Californian Chaparral
1. G257 Californian Xeric Chaparral
    i. Adenostoma fasciculatum
    ii. Ceanothus cuneatus
2. G258 Californian Maritime Chaparral
    i. Arctostaphylos (crustacea, tomentosa) (NVC-expand)
    ii. Arctostaphylos (nummularia, sensitiva) – Chrysolepis chrysophylla (MCV-new-m)
3. G261 Californian Mesic & Pre-montane Chaparral
    i. Ceanothus (oliganthus, tomentosus)*
    ii. Cercocarpus montanus*
    iii. Prunus ilicifolia – Heteromeles arbutifolia – Ceanothus spinosus
    iv. Quercus berberidifolia*
    v. Quercus durata
    vi. Quercus wislizeni – Quercus chrysolepis (shrub)* (NVC-new-s) (MCV-new-m)
b. M044 Californian Coastal Scrub
1. G264 Central & Southern Californian Coastal Sage Scrub
    i. Artemisia californica – (Salvia leucophylla) (NVC-revise)
2. G662 Californian North Coastal & Mesic Scrub
    i. Baccharis pilularis
    ii. Ceanothus thyrsiflorus
    iii. Corylus cornuta var. californica
    iv. Toxicodendron diversilobum

3. G782 Californian Coastal-Foothill Seral Scrub
    i. Diplacus aurantiacus (NVC-revise)
    ii. Lotus scoparius – Lupinus albifrons – Eriodictyon spp. (NVC-revise) (MCV-new-m)

c. M045 Californian Annual & Perennial Grassland
1. G496 Californian Perennial Grassland
    i. Corethrogyne filaginifolia – Eriogonum (elongatum, nudum)*
    ii. Nassella spp. – Melica spp. (NVC-new-m)
2. G766 Californian Annual Grassland & Forb Meadow
    i. Amsinckia (menziesii, tessellata) – Phacelia spp.*
    ii. Eschscholzia (californica) – Lupinus (nanus)*
    iii. Lasthenia californica – Plantago erecta – Vulpia microstachys

d. M046 Californian Ruderal Grassland, Meadow & Scrub
1. G497 Californian Ruderal Grassland, Meadow & Scrub
    i. Acacia spp. – Grevillea spp. – Leptospermum laevigatum (NVC-new) (MCV-new)
    ii. Avena spp. – Bromus spp.
    iii. Brassica nigra – Centaurea (solstitialis, melitensis) (NVC-revise)
    iv. Lolium perenne

2.B.2. Temperate Grassland & Shrubland
ii. 2.B.2.Nf. Western North American Grassland & Shrubland

a. M493 Western North American Ruderal Grassland & Shrubland
1. G648 Southern Vancouverian Lowland Ruderal Grassland & Shrubland
    i. Conium maculatum – Foeniculum vulgare* (NVC-revise)
    ii. Cortaderia (jubata, selloana)
    iii. Cynosurus echinatus – Arrhenatherum elatius* (NVC-new) (MCV-exp)
    iv. Cytisus scoparius – Genista monspessulana – Cotoneaster spp. (NVC-exp) (MCV-exp)
    v. Holcus lanatus – Anthoxanthum odoratum

b. M050 Southern Vancouverian Lowland Grassland & Shrubland
1. G488 Southern Vancouverian Shrub & Herbaceous Bald, Bluff & Prairie
    i. Bromus carinatus – Elymus glaucus
    ii. Calamagrostis nutkaensis

iii. Festuca idahoensis – Danthonia californica (MCV-new-m)
iv. Gaultheria shallon – Rubus (ursinus) (NCV-new) MCV-new)

2.B.4. Temperate to Polar Scrub & Herb Coastal Vegetation

iii. 2.B.4.Nb. Pacific North American Coastal Scrub & Herb Vegetation

a. M059 Pacific Coastal Beach & Dune

1. G498 North Pacific Maritime Dune & Coastal Beach

i. Leymus mollis

2. G663 Californian Coastal Beach & Dune

i. Abronia latifolia – Ambrosia chamissonis
ii. Eriophyllum staechadifolium – Erigeron glaucus – Eriogonum latifolium (NVC-new-s) (MCV-new-s)
iii. Lupinus arboreus
iv. Lupinus chamissonis – Ericameria ericoides (NVC-new-s)

b. M511 North Pacific Coastal Ruderal Grassland & Shrubland

1. G647 North Pacific Maritime Coastal Ruderal Dune

i. Ammophila arenaria
ii. Cakile (edentula, maritima) (NVC-new)
iii. Mesembryanthemum spp. – Carpobrotus spp.

2.C. Shrub & Herb Wetland

2.C.4. Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland

iv. 2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

a. M073 Vancouverian Lowland Marsh, Wet Meadow & Shrubland

1. G322 Vancouverian Wet Shrubland

i. Cornus sericea
ii. Frangula californica – Rhododendron occidentale – Salix breweri* (NVC-new) (MCV-new-m)
iii. Rubus spectabilis – Morella californica (NVC-exp) (MCV-new-m)
iv. Salix hookeriana – Salix sitchensis – Spiraea douglasii (MCV-new-m)

b. M073 Vancouverian Lowland Marsh, Wet Meadow & Shrubland

1. G517 Vancouverian Freshwater Wet Meadow & Marsh

i. Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica (NVC-exp) (MCV-new-m)

ii. Carex barbarae* (NVC-new)
iii. Carex nudata (NVC-new)
iv. Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus (NVC-new-m) (MCV-new-m)
v. Juncus (effusus, patens) – Carex (pansa, praegracilis) (NVC-new-m) (MCV-new-m)
vi. Mimulus (guttatus) (NVC-new-s) (MCV-new-s)

2. G525 Temperate Pacific Freshwater Wet Mudflat
i. Bidens cernua – Euthamia occidentalis – Ludwigia palustris (NVC- exp) (MCV-new)
ii. Polygonum lapathifolium – Xanthium strumarium (NVC-new)

c. M074 Western North American Vernal Pool
1. G530 Californian Vernal Pool
i. Eleocharis (acicularis, macrostachya) (NVC-revise) (MCV-new-m)
ii. Eryngium aristulatum*
iii. Lasthenia glaberrima
iv. Trifolium variegatum*

d. M301 Western North American Ruderal Marsh, Wet Meadow & Shrubland
1. G524 Western North American Ruderal Marsh, Wet Meadow & Shrubland
i. Atriplex prostrata – Cotula coronopifolia (NVC-new)
ii. Cynodon dactylon-Crypsis spp.-Paspalum spp.* (NVC-exp) (MCV-new)
iii. Lepidium latifolium – (Lactuca serriola) (MCV-exp)
iv. Phalaris aquatica – Phalaris arundinacea (NVC-exp)
v. Poa pratensis – Agrostis gigantea – Agrostis stolonifera*

e. M888 Arid West Interior Freshwater Marsh
1. G531 Arid West Interior Freshwater Marsh
i. Schoenoplectus (acutus, californicus)
ii. Typha (angustifolia, domingensis, latifolia)

f. M893 Western North American Montane Marsh, Wet Meadow & Shrubland
1. G526 Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland
i. Rhus trilobata – Crataegus rivularis – Forestiera pubescens* (NVC-exp) (MCV-exp)

v. 2.C.4.Nc. Southwestern North American Warm Desert Freshwater Marsh & Bosque

a. M076 Warm Desert Lowland Freshwater Marsh, Wet Meadow & Shrubland
1. G533 North American Warm Desert Riparian Low Bosque & Shrubland
i. Salix lasiolepis
ii. Salix exigua

2.C.5. Salt Marsh

vi. 2.C.5.Nc. Temperate and Boreal Pacific Coastal Salt Marsh
a. M081 North American Pacific Coastal Salt Marsh
1. G499 Temperate Pacific Salt Marsh
i. Bolboschoenus maritimus
ii. Distichlis spicata (MCV-new-s)
iii. Grindelia (stricta)
iv. Sarcocornia pacifica (Salicornia depressa)
v. Spartina foliosa* (NVC-new-s)

vii. 2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
a. M082 Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland
1. G538 North American Desert Alkaline-Saline Marsh & Playa
i. Leymus cinereus – Leymus triticoides

5. Aquatic Vegetation

5.A. Saltwater Aquatic Vegetation

5.A.3. Benthic Vascular Saltwater Vegetation

viii. 5.A.3.We. Temperate Seagrass Aquatic Vegetation
a. M184 Temperate Pacific Seagrass Intertidal Vegetation
1. G373 Temperate Pacific Seagrass Bed
i. Zostera (marina, pacifica) Pacific Aquatic* (MVC-exp) (MCV-new)

5.B. Freshwater Aquatic Vegetation

5.B.2. Temperate to Polar Freshwater Aquatic Vegetation

ix. 5.B.2.Na. North American Freshwater Aquatic Vegetation
a. M109 Western North American Freshwater Aquatic Vegetation
1. G544 Western North American Temperate Freshwater Aquatic Vegetation
i. Azolla (filiculoides, microphylla)*
ii. Ceratophyllum demersum Aquatic*
iii. Hydrocotyle (ranunculoides, umbellata)*
iv. Nuphar lutea*
v. Sparganium (angustifolium)

b. M401 North American Temperate Ruderal Aquatic Vegetation
1. GXXX North American Temperate Ruderal Aquatic Vegetation (NVC-new)
i. Eichhornia crassipes-Ludwigia (hexapetala, peploides) (NVC-new)

6. Open Rock Vegetation
6.B. Temperate & Boreal Open Rock Vegetation
6.B.1. Temperate & Boreal Cliff, Scree & Other Rock Vegetation
x. 6.B.1.Nb. Western North American Temperate Cliff, Scree & Rock Vegetation
a. M887 Western North American Cliff, Scree & Rock Vegetation
1. G563 Californian Cliff, Scree & Rock Vegetation
i. Allium spp. – Streptanthus spp. – Hesperolinon spp. Serpentinite* (MCV-new)
ii. Dudleya cymosa – Dudleya lanceolata – Lichen/Moss*
iii. Sedum spathulifolium

Appendix C

Vegetation Field Key for San Mateo County

This field key is for the vegetation types, including alliances and associations, found in San Mateo County, 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 2021). 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 2021, CNPS 2021).

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 San Mateo County, California.

Due to a high diversity of the vegetation types in the county, 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 San Mateo County 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 2021) 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 2021), 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 13% shrub cover), technically only the *Baccharis* (5/13 = 39% relative cover) and the *Frangula* (4/13 = 31% relative cover) would be co-dominant because *Rubus* would only have 23% relative cover (3/13 = 23%).

Characteristic/Diagnostic species: Should be 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, since an even distribution of the diagnostic species is a much better indicator than overall cover. Characteristic species that are evenly distributed are better indicators of a type than species with higher cover and patchy distribution.

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 (ramified 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. It behooves one to memorize which species are “traditionally” placed in one life-form or another. We use the accepted lifeforms in the USNVC or the PLANTS Database (USDA NRCS 2021) 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: In the USNVC, 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: In the USNVC, 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, individual *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*, *Fremontodendron californicum*, *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**

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**

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**

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 in maritime climates with summertime fog.

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, along all slopes and aspects, or on ridges. Associated trees include *Acer macrophyllum*, *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*, and *Woodwardia fimbriata* may intermix in the understory.

***Sequoia sempervirens* Alliance**

- *Sequoia sempervirens – Acer macrophyllum – Umbellularia californica* Association
- *Sequoia sempervirens – Alnus rubra / Rubus spectabilis* Association*
- *Sequoia sempervirens – Arbutus menziesii / Vaccinium ovatum* Association
- *Sequoia sempervirens – Chrysolepis chrysophylla / Arctostaphylos glandulosa* Association
- *Sequoia sempervirens – Notholithocarpus densiflorus / Carex globosa – Iris douglasiana* 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. Cool-temperate coniferous forests and woodlands influenced by warm, relatively dry summers and cool rainy winters. Stands are dominated or co-dominated by *Pseudotsuga menziesii,* or *P*. *menziesii* in combination with hardwoods in the tree overstory.

Southern Vancouverian Dry Foothill Forest & Woodland Macrogroup

Californian Moist Coastal Mixed Evergreen Forest Group

2a. Vegetation characterized by a mixture of *Pseudotsuga menziesii* and *Notholithocarpus densiflorus* in the canopy. *Pseudotsuga* is typically dominant to co-dominant with *Notholithocarpus* but may occasionally be slightly sub-dominant. Stands sampled in San Mateo County within 5-10 km of the coast.

Pseudotsuga menziesii – (Notholithocarpus densiflorus – Arbutus menziesii) **Alliance**

- *Pseudotsuga menziesii – Notholithocarpus densiflorus – Umbellularia californica / Toxicodendron diversilobum* Association*
- *Pseudotsuga menziesii – Notholithocarpus densiflorus / Vaccinium ovatum* Association

2b. *Pseudotsuga menziesii* not as above, but instead *P. menziesii* is dominant or is co-dominant with *Arbutus menziesii*, *Quercus agrifolia*, *Q*. *chrysolepis*, or *Umbellularia californica*. When *P*. *menziesii* co-dominates with hardwoods, key to *P*. *menziesii*, except when with *Quercus kelloggii* (*Q. kelloggii* Alliance (step 5c4) below).

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 – Quercus agrifolia* Association *Pseudotsuga menziesii – Quercus chrysolepis* 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. Closed-cone or xerophyllic conifers, including *Hesperocyparis* spp., *Pinus attenuata*, *Pinus muricata*, or *Pinus radiata* is dominant or co-dominant in the overstory.

Californian Forest & Woodland Macrogroup

Californian Conifer Forest & Woodland Group

3a. *Hesperocyparis abramsiana* dominates on slopes of sandstone or other substrates. *Adenostoma fasciculatum*, *Arctostaphylos* spp., and *Quercus parvula* or *Quercus wislizeni* are commonly found in stands.

Hesperocyparis (pigmaea, abramsiana, macrocarpa, goveniana) **Alliance**

Hesperocyparis abramsiana / Arctostaphylos (crustacea, silvicola) Association

3b. *Pinus attenuata* dominates or co-dominates with *Quercus chrysolepis* in the tree overstory, often with moderately dense cover of shrubs such as *Arctostaphylos* spp. and *Vaccinium ovatum* in the understory.

Pinus attenuata **Alliance**

Pinus attenuata / Arctostaphylos (crustacea) Association

3c. Naturally occurring stands of *Pinus radiata* or *Pinus muricata* dominant, co-dominant with conifers, or 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 San Mateo County are planted or naturalized except for a limited area between Ano Nuevo and Santa Cruz County.

Pinus muricata – Pinus radiata **Alliance**

- *Pinus muricata* Provisional Association*
- *Pinus muricata* **–** *(Arbutus menziesii – Notholithocarpus densiflorus) / Vaccinium ovatum* Association*
  - *Pinus muricata / Ceanothus thyrsiflorus – Baccharis pilularis* Association*
  - *Pinus radiata – Quercus agrifolia / Toxicodendron diversilobum* Association*
    - *Pinus radiata / Toxicodendron diversilobum* Association

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

Californian Ruderal Forest Macrogroup

Californian Ruderal Forest Group

Hesperocyparis macrocarpa – Pinus radiata **Semi-Natural Alliance**

3b2. *Pinus radiata* dominates the conifer canopy. Planted stands of *Pinus radiata* are found along roadsides or on slopes where they were introduced (not native to San Mateo Co.).

Pinus radiata plantations Provisional Semi-Natural Association

3a1. 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.

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: *Acer macrophyllum*, *Arbutus menziesii*, *Chrysolepis chrysophylla,* or *Notholithocarpus densiflorus*.

4a. Broadleaf trees such as *Arbutus menziesii*, *Chrysolepis chrysophylla,* 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 *Arbutus menziesii* or *Umbellularia californica*.

***Notholithocarpus densiflorus* Alliance**

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

4a3. *Chrysolepis chrysophylla* is strongly dominant in dense, clonal stands occurring on upper slopes and ridges, often transitional between forest and chaparral.

Californian Chaparral Macrogroup

Californian Maritime Chaparral Group

***Arctostaphylos* (*nummularia*, *sensitiva*) – *Chrysolepis chrysophylla* Alliance**

Chrysolepis chrysophylla / Vaccinium ovatum Association

4b. *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 *Rhododendron occidentale,* are sometimes present.

Vancouverian Flooded & Swamp Forest Macrogroup

Vancouverian Flooded & Swamp Forest Group

***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*

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

5b. *Umbellularia californica* is either dominant or co-dominant with *Quercus agrifolia* in open to dense woodlands. 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 – Notholithocarpus densiflorus* Association*
- *Umbellularia californica – Quercus agrifolia / Toxicodendron diversilobum* Association
- *Umbellularia californica – Quercus wislizeni* Association*
- *Umbellularia californica / Polystichum munitum* Association

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

5c1. *Quercus agrifolia*, *Quercus douglasii*, and/or *Quercus lobata* are present and these oak species typically co-dominate. Other oaks such as *Q*. *chrysolepis* and *Q*. *kelloggii* may also be present. This mixed type is for stands where multiple *Quercus* tree species intermix (at least three) and it is difficult to assign to an alliance defined by one oak species – read steps to key to individual oak

alliances below.

***Quercus* (*agrifolia*, *douglasii*, *garryana*, *kelloggii*, *lobata*, *wislizeni*) Alliance**

Quercus douglasii – Quercus lobata – Quercus agrifolia / Toxicodendron iversilobum 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 / Quercus (wislizeni, parvula)* Association

5c3. *Quercus douglasii* dominates or co-dominates with *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 – Quercus agrifolia* Association
- *Quercus douglasii* / Mixed herbaceous Association

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

***Quercus kelloggii* Alliance**

- *Quercus kelloggii – Arbutus menziesii – Quercus agrifolia* Association
- *Quercus kelloggii – Pseudotsuga menziesii – Umbellularia californica* Association*

5c5. *Quercus lobata* dominates or co-dominates with *Fraxinus latifolia, Quercus agrifolia, 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 – Fraxinus latifolia / Vitis californica* Association*
- *Quercus lobata / Rubus ursinus – Rosa californica* Provisional Association*
- *Quercus lobata – Salix lasiolepis* Association*

5c6. *Quercus lobata* dominates or co-dominates with *Quercus agrifolia* 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.

***Quercus lobata* Alliance**

- *Quercus lobata* – *Quercus agrifolia* / Grass Association*
- *Quercus lobata* / Grass Association

5c7. *Quercus agrifolia, Q. parvula, Q. wislizeni* or other *Quercus* spp. dominates and/or co-dominates as a shrub or regenerating tree, 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*

5c8. 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 and in step 8b.

***Quercus wislizeni – Quercus parvula* (tree) Alliance**

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

5c9. *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 *Umbellularia californica* is co-dominant to dominant, key to one of these other alliances instead of *Q*. *agrifolia*. The understory herbaceous layer often contains a mixture of native and non-native herbs and/or shrubs.

***Quercus agrifolia* Alliance**

- *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 / Arctostaphylos (crustacea)* Association
- *Quercus agrifolia / Adenostoma fasciculatum – (Salvia mellifera)* Association*
- *Quercus agrifolia* / grass Association
- *Quercus agrifolia / Toxicodendron diversilobum* Association

6. *Acer negundo*, *Juglans hindsii*, *Populus fremontii*, *Quercus agrifolia,* 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, often along major streams and rivers, with other riparian plants such as *Fraxinus*, *Populus*, *Rubus*, and *Salix*. 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. Associated trees and shrubs include *Alnus rhombifolia*, *Populus fremontii*, *Quercus agrifolia*, *Rubus*, *Salix*, and others.

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

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

6c. *Populus fremontii* dominates or co-dominates with *Acer negundo*, *Juglans*, and/or *Salix*, sometimes with *Populus* having as little as 5% absolute cover. If *Juglans hindsii* is 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 / Baccharis salicifolia Association

6d. *Quercus agrifolia* dominates in a riparian setting, often with *Salix* spp. and *Toxicodendron diversilobum.*

***Platanus racemosa – Quercus agrifolia* Alliance**

Quercus agrifolia / Salix lasiolepis Association

7. *Alnus rhombifolia*, *Alnus rubra, Acer macrophyllum, Fraxinus latifolia*, *Populus trichocarpa, Quercus lobata,* 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 Southwestern North American Riparian, Flooded and Swamp Forest Macrogroup 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* 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 / Cornus sericea / Carex obnupta Association

7b. *Alnus rhombifolia* dominates or co-dominates with *Acer macrophyllum* 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 – Umbellularia californica – (Quercus chrysolepis)* Association
- *Alnus rhombifolia – Acer macrophyllum* 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 *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 *Alnus rhombifolia* or *Umbellularia californica* in the tree overstory. Stands not sampled but likely to occur in San Mateo County.

Fraxinus latifolia* Alliance

7g. *Quercus lobata* dominates or co-dominates with *Fraxinus latifolia, Quercus agrifolia, 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 – Fraxinus latifolia / Vitis californica* Association*
- *Quercus lobata / Rubus ursinus – Rosa californica* Association*

- *Quercus lobata – Salix lasiolepis* Association*

8. 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 in San Mateo County. For tall shrubby species of *Acacia*, see the Californian Ruderal Grassland, Meadow & Scrub Group in Section II, 5d.

Californian Ruderal Forest Macrogroup and Group

***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

Section I. Riparian or moist hillside settings with vegetation dominated or co-dominated by the following shrubs: *Frangula californica* (including all subspecies), *Lonicera involucrata, Morella californica*, *Rhododendron occidentale*, *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*, *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.5b.)

Vancouverian Lowland Marsh, Wet Meadow & Shrubland Macrogroup

Vancouverian Wet Shrubland Group

Frangula californica – Rhododendron occidentale – Salix breweri* Alliance

Rhododendron occidentale – Frangula californica ssp. *Tomentella* Provisional Association*

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

Southwestern North American Warm Desert Freshwater Marsh & Bosque Macrogroup

Warm Desert Lowland Freshwater Marsh, Wet Meadow & 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* along stream banks and benches, slope seeps, and drainage stringers. 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

3c. *Sambucus nigra* dominates in the shrub overstory, often preferring stream terraces, bottomlands, and localized areas in uplands, where there was past disturbance. One stand was encountered for this project, in the bottom of a ravine.

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*

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*, *Eriodictyon californicum*, *Eriogonum fasciculatum, Frangula californica, Garrya elliptica, Gaultheria shallon*, *Holodiscus discolor, Lupinus albifrons*, *L. arboreus*, *L. chamissonis*, *Rubus ursinus*, and *Toxicodendron diversilobum*. Resprouting, deep-rooted, sclerophyllous shrubs may at times be characteristic, but not dominant.

4. *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 or bluffs. 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

4a. *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*

4b. *Ericameria ericoides* and/or *Lupinus chamissonis* dominate as individuals or in combination as co-dominants with *Baccharis pilularis* or *Lupinus arboreus*.

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

- *Ericameria ericoides* Association*
- *Lupinus chamissonis* Association
- *Lupinus chamissonis – Ericameria ericoides* Association

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

Californian Coastal Scrub Macrogroup

5a. *Diplacus aurantiacus, Eriodictyon californicum*, or *Lupinus albifrons* dominates in the overstory.

Californian Coastal-Foothill Seral Scrub Group

5a1. *Eriodictyon californicum, Lotus scoparius, Pickeringia montana,* or *Lupinus albifrons* 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*

5a2. *Diplacus aurantiacus* dominates 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

5b. *Baccharis pilularis*, *Ceanothus incanus*, *C*. *thyrsiflorus*, *Corylus cornuta, Frangula californica, Garrya elliptica, Gaultheria shallon*, *Holodiscus discolor, 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

5b1. *Baccharis pilularis* dominates or co-dominates with *Frangula californica*, *Toxicodendron diversilobum*, or *Rubus* spp. in the shrub overstory. If *Calamagrostis nutkaensis* or *Carex obnupta* is co-dominant with *B*. *pilularis*, key to the *C*. *nutkaensis* Alliance (see Class C, step 9b3). If stands have greater cover of *Artemisia californica, Ceanothus thyrsiflorus* or *Toxicodendron diversilobum* than *Baccharis pilularis,* key to those respective alliances. 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*, *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* Provisional Association
- *Baccharis pilularis / Danthonia californica* Association
- *Baccharis pilularis / Deschampsia cespitosa* Association*
- *Baccharis pilularis / Eriophyllum staechadifolium* Association

5b2. *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

5b3. *Ceanothus thyrsiflorus* or *C. incanus* dominates in the overstory shrub layer, often with moderately dense cover. *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 thyrsiflorus* – (*Rubus ursinus*) Association
- *Ceanothus thyrsiflorus – Baccharis pilularis – Toxicodendron diversilobum* Association
- *Ceanothus thyrsiflorus – Vaccinium ovatum – Rubus parviflorus* Association*

5b4. *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**

- *Gaultheria shallon – Vaccinium ovatum /*
  - *Pteridium aquilinum* Association*
- *Holodiscus discolor – Baccharis pilularis – Rubus ursinus* Association
  - *Rubus parviflorus* Association
  - *Rubus ursinus* Association

5b5. *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

5b6. *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

5b6. *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

5c. *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.

Central & Southern Californian Coastal Sage Scrub Group

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

5d. *Albizia lophantha*, *Cistus, Cotoneaster, Cytisus scoparius, Genista monspessulana, Grevillea, Helichrysum petiolare, Rosa rubiginosa, Ulex,* or other Mediterranean shrubs not native to San Mateo County dominates in naturalized or planted stands. May be found invading disturbed areas, grasslands, or forest openings.

5d1. 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

5d2. *Myoporum laetum* dominant in open to dense stands.

Californian Ruderal Forest Group

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

5d3. *Cistus* spp., *Cotoneaster* spp., *Cytisus scoparius, Genista monspessulana, Hypericum canariense, Ulex europaeus,* or other broom plants 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.

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*
- *Genista monspessulana* Semi-Natural Association
- *Hypericum canariense* Provisional Semi-Natural Association
- *Ulex europaeus* Provisional Semi-Natural Association

5d4. *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.

Californian Ruderal Grassland, Meadow & Scrub Group Scrub Group (key to group level only)

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. oliganthus*, *Cercocarpus montanus*, *Chrysolepis chrysophylla, Quercus berberidifolia*, *Q. durata*, and shrubby *Q. wislizeni*.

Californian Chaparral Macrogroup

6. *Arctostaphylos crustacea, A. imbricata, A. montaraensis, A. sensitiva, A. uva-ursi, A. virgata, Chrysolepis chrysophylla* var. *minor,* or *Vaccinium ovatum* dominates or co-dominates in maritime chaparral stands.

Californian Maritime Chaparral Group

6a. *Arctostaphylos imbricata, A. montaraensis, A. sensitiva, A. uva-ursi, A. virgata, Chrysolepis chrysophylla* var. *minor,* and/or *Vaccinium ovatum* dominates or co-dominates with *Adenostoma fasciculatum, Ceanothus thyrsiflorus,* or other shrubs. *Pinus muricata* and *Pteridium aquilinum* are often present. Stands are often transitional between forest and chaparral.

***Arctostaphylos* (*nummularia*, *sensitiva*) – *Chrysolepis chrysophylla* Alliance**

- *Arctostaphylos montaraensis – Arctostaphylos imbricata* Provisional Association
- *Arctostaphylos sensitiva* Association
- *Chrysolepis chrysophylla / Vaccinium ovatum* Association

6b. *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

7. *Cercocarpus montanus, Prunus ilicifolia, Prunus virginiana, Quercus berberidifolia* 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

7a. *Cercocarpus montanus* dominates with *Prunus ilicifolia, Artemisia californica* and *Ribes californicum* often present.

***Cercocarpus montanus* Alliance**

7b. *Quercus berberidifolia* dominates or co-dominates with *Adenostoma fasciculatum, Cercocarpus montanus* and/or other chaparral shrubs.

Quercus berberidifolia* Alliance

7c. *Heteromeles arbutifolia, Prunus ilicifolia,* and/or *Prunus virginiana,* dominate or co-dominate in the shrub layer with *Baccharis pilularis,* 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**

- *Prunus ilicifolia* ssp*. Ilicifolia – Heteromeles arbutifolia* Association
- *Prunus ilicifolia ssp. Ilicifolia / Sanicula crassicaulis* Association

7d. *Quercus durata* dominates or co-dominates with *Adenostoma fasciculatum*on ultramafic soils (e.g., serpentine, gabbro). *Heteromeles arbutifolia* and/or *Umbellularia californica* are often present in stands.

***Quercus durata* Alliance**

- *Quercus durata* Association
- *Quercus durata – Adenostoma fasciculatum* Provisional Association

8. *Ceanothus 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

8a. *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

8b. *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*

9. Sclerophyll (i.e., thick-leaved) shrublands dominated by one or more of the following taxa: *Adenostoma*, *Arctostaphylos canescens*, 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

9a. *Ceanothus cuneatus* dominates or co-dominates with *Adenostoma fasciculatum*, often on convexities with westerly exposures. A variety of shrubs may intermix, including *Arctostaphylos*, *Baccharis*, *Eriodictyon*, *Heteromeles*, *Quercus durata,* and others.

***Ceanothus cuneatus* Alliance**

- *Ceanothus cuneatus* Association
- *Ceanothus cuneatus – Adenostoma fasciculatum* Association

9b. *Adenostoma fasciculatum* dominates, often with sub-dominant shrubs such as *Diplacus aurantiacus*. 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 – Diplacus aurantiacus* 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*, *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*, *Ruppia, Sarcocornia* (=*Salicornia*), *Schoenoplectus*, *Scirpus*, *Sparganium, Spartina*, *Typha,* and/or *Xanthium*.

1. Freshwater stands dominated by aquatic, floating or submerged plants, including *Azolla, Ceratophyllum*, *Hydrocotyle, Lemna*, *Ludwigia*, *Nuphar,* and/or *Sparganium*. 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

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

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

1b. *Azolla filiculoides* or *Azolla mexicana* (=*A. 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,* or *Sparganium* dominates on or in water surfaces of streams, ponds or lakes.

Western North American Temperate Freshwater Aquatic Vegetation Group

1c1. *Ceratophyllum demersum* dominates. Stands are likely to occur in the county.

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*. Stands are likely in the County.

Hydrocotyle (ranunculoides, umbellata)* Alliance

Hydrocotyle ranunculoides Association*

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

***Sparganium (angustifolium)* Alliance**

Sparganium eurycarpum Provisional 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*. May appear as sparsely vegetated mudflats at low tide, or during restoration (as along San Pablo Bay). Mudflats with trace amounts of cover by herbs are included here (see 2i).

2a. *Bolboschoenus maritimus*, *Distichlis spicata*, *Frankenia salina*, *Grindelia stricta, Sarcocornia* (=*Salicornia*), *Spartina* and/or *Triglochin* spp. dominant or co-dominant tidal salt marshes to brackish marshes.

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. *Distichlis spicata* dominates 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.

***Distichlis spicata* Alliance**

- *Distichlis spicata – annual grasses* Association*
- *Distichlis spicata – Frankenia salina – Jaumea carnosa*
- Association *Distichlis spicata – (Sarcocornia pacifica)* Association

2a3. *Frankenia salina* is strongly dominant 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.

***Sarcocornia pacifica* (*Salicornia depressa*) Alliance**

Frankenia salina – Limonium californicum – Monanthochloe littoralis – Sarcocornia pacifica Association

2a4. *Sarcocornia pacifica* dominates or co-dominates with *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 – Cotula coronopifolia* Association*
- *Sarcocornia pacifica – Jaumea carnosa – Distichlis spicata* Association
- *Sarcocornia pacifica* Tidal Association

2a5. *Spartina foliosa* dominates on mudflats, banks, berms, and margins of bays and deltas.

Spartina foliosa* Alliance

Spartina foliosa Association*

2a6. *Grindelia stricta* dominates or co-dominates with natives such as *Sarcocornia pacifica, Distichlis spicata,* and/or *Frankenia salina* or non-native herbs such as *Polypogon monspeliensis, Rumex crispus,* and *Bromus diandrus*. Stands may be found on slightly elevated or drier ground adjacent to salt or alkaline marshes, tidal flats, levees, and road margins.

***Grindelia (stricta)* Provisional Alliance**

Grindelia stricta Provisional Association

2b. Non-native species such as *Atriplex prostrata, Cotula coronopifolia, Crypsis* spp*., Cynodon dactylon, Cyperus eragrostis, 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.

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

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

2b2. *Crypsis* spp*., Cynodon dactylon, Cyperus eragrostis, 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 Semi-Natural Association*

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

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 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

3a2. *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, Distichlis spicata*, *Eleocharis macrostachya*, *Festuca rubra, Juncus covillei, J. effusus*, *J. hesperius, J*. *lescurii*, *J*. *patens*, *J*. *occidentalis*, *J*. *phaeocephalus*, *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 interior in the county in moist meadows and hillside depressions.

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

- *Carex pansa* Provisional Association*
- *Carex praegracilis* Coastal 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. covillei, J. hesperius, J*. *occidentalis*, *J*. *phaeocephalus,* and/or *J. subbracteata* 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 covillei* Provisional Association*
- *Juncus effusus* Association
- *Juncus patens* Association*
- *Juncus patens – Holcus lanatus* Provisional Association*
- *Juncus patens – Juncus occidentalis* Provisional Association*
- *Juncus phaeocephalus* 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.

***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*, *Bolboschoenus glaucus, Carex barbarae*, *C. densa, C*. *nudata*, *C*. *serratodens*, *Cirsium fontinale, Euthamia occidentalis, Grindelia* spp., *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*, *Leymus*, 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* or *Leymus triticoides*. 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. *Leymus triticoides* dominates or co-dominates with *Lolium perenne* or other non-native grasses or forbs. Stands are found on poorly drained floodplains, valley bottoms, and brackish marsh margins.

Leymus cinereus – Leymus triticoides **Alliance**
Leymus triticoides Association

4a8. *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*) Alliance**
Mimulus guttatus Association

4a9. *Cirsium fontinale* dominates with other wetland species such as *Carex* spp. and *Mimulus guttatus* or co-dominates with other herbs such as *Hemizonia congesta* ssp. *luzulifolia* in the herbaceous layer. Stands are found seeps, springs, and drainages.

Mimulus (guttatus) **Alliance**
Cirsium fontinale Association

4b. Stands dominated or characterized by non-native, ruderal, or disturbance-adapted taxa: *Alisma* spp., *Bidens frondosa*, *Euthamia, Hoita, Bolboschoenus glaucus, Lepidium*, *Persicaria*, and/or *Xanthium*.

4b1. *Lepidium latifolium* 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***
Lepidium latifolium Semi-Natural Association*

4b2. *Persicaria* (= *Polygonum)* spp., *Alisma* spp., 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*
Polygonum (amphibium, lapathifolium) Association
Xanthium strumarium Association*

4b3. *Euthamia occidentalis, Hoita orbicularis, Bidens* spp., and/or the native herb *Ludwigia palustris* dominates or co-dominates in wetlands with emergent shrubs such as *Rubus ursinus*. *Baccharis glutinosa* (= *B. douglasii)* is often present.

Temperate Pacific Freshwater Wet Mudflat Group

Bidens cernua – Euthamia occidentalis – Ludwigia palustris **Provisional Alliance**
- *Bidens frondosa* Provisional Association*

- *Euthamia occidentalis* Provisional Association

5. Herbaceous stands dominated or characterized by *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 San Mateo County.

Western North American Vernal Pool Macrogroup

Californian Vernal Pool / Swale Bottomland Group

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

Eryngium aristulatum* Alliance
Hemizonia congesta Association*

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 San Mateo County.

***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*

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*, *E. luteolum*, *E. nudum*, *Polypodium californicum, Sedum spathulifolium,* and/or *Streptanthus glandulosus* 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 2% 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 herbsgrowing on steep serpentine barrens with exposed gravel and bedrock.

Allium* spp. – *Streptanthus* spp. – *Hesperolinon* spp. Serpentinite Alliance
Allium falcifolium – Eriogonum luteolum – Streptanthus (batrachopus, morrisonii) 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*

7. *Corethrogyne filaginifolia* or *Eriogonum nudum* dominates or co-dominates with non-native herbs in stands with recent or seasonal disturbance.

Californian Annual & Perennial Grassland Macrogroup

Californian Perennial Grassland Group

7a. *Eriogonum nudum* or *Corethrogyne filaginifolia* co-dominates with *Bromus diandrus*, *Erodium botrys*, *Vulpia bromoides,* and others in herbaceous stands often occupying steep slopes and exposed convexities.

Corethrogyne filaginifolia – Eriogonum* (*elongatum*, *nudum*) Alliance

Eriogonum nudum 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 Western North American Temperate Grassland and Meadow Macrogroup, which is 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*, *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, Eschscholzia*, *Lasthenia californica*, *Lupinus*, *Plagiobothrys*, *Plantago erecta*, and *Vulpia microstachys*. Commonly occurring taxa include *Avena*, *Bromus*, *Cryptantha*, *Geranium*, *Dichelostemma*, *Lolium*, and *Vulpia*. Stands are found on upland slopes, flats, and ridges.

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.

Eschscholzia* (*californica*) – *Lupinus* (*nanus*) Alliance

- *Bromus hordeaceus – Lupinus nanus – Trifolium* spp. Association*
- *Eschscholzia californica* Association*
- *Lupinus bicolor* Provisional Association*

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

Plagiobothrys nothofulvus* Alliance

Plagiobothrys nothofulvus – Daucus pusillus – Trifolium microcephalum 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 – Calycadenia* (*truncata*, *multiglandulosa*) Association

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

Amsinckia (menziesii, tessellata) – Phacelia* spp. 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* of *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 – Hemizonia congesta* Association
- *Nassella pulchra – Lolium perenne – (Trifolium* spp.*)* Association
- *Nassella pulchra – Lolium perenne – Plantago erecta* Serpentine 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. If *Elymus caput-medusa* 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
- *Brachypodium distachyon* Semi-Natural Association
- *Briza maxima* Provisional Semi-Natural Association*
- *Bromus diandrus*. Semi-Natural Association*
- *Bromus hordeaceus – Erodium botrys* Semi-Natural Association

8c2. *Brassica nigra*, *Raphanus sativus, Carduus pycnocephalus, Carthamus lanatus, Centaurea solstitialis, Silybum marianum,* or another non-native forb dominates in the herbaceous layer, often in old or active agriculture lands.

***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 – 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 San Mateo County.

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
- *Phalaris aquatica – Avena barbata* 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, Echium candicans,* 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 such as *Echium candicans* dominant or co-dominant with *Cortaderia jubata*.

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

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

- *Seschampsia 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, 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

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. *Bromus carinatus*, *Elymus glaucus*, *Nassella pulchra, 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., *Cynosurus echinatus*, *Hypochaeris radicata, and Vulpia bromoides*). Occasionally, the larger *Festuca californica* may replace *F. idahoensis* in somewhat shadier or less exposed sites.

***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*, *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, 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
- *Abronia latifolia – Calystegia soldanella – Lathyrus littoralis* Association

10a3. *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**

- *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 annuals such as noted in 10a.1 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.

***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.

***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 San Mateo County.