Classification of the Vegetation Alliances and Associations of Sonoma County, California

Volume 1 of 2 – Introduction, Methods, and Results

California Department of Fish and Wildlife Vegetation Classification and Mapping Program

California Native Plant Society Vegetation Program

For:

The Sonoma County Agricultural Preservation and Open Space District

The Sonoma County Water Agency

Authors:

Anne Klein, Todd Keeler-Wolf, and Julie Evens

December 2015

ABSTRACT

This report describes 118 alliances and 212 associations that are found in Sonoma 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 is the basis for an integrated, countywide vegetation map that the Sonoma County Vegetation Mapping and Lidar Program expects to complete in 2017. Ecologists with the California Department of Fish and Wildlife and the California Native Plant Society analyzed species data from 1149 field surveys collected in Sonoma County between 2001 and 2014. The data include 851 surveys collected in 2013 and 2014 through funding provided specifically for this classification effort. An additional 283 surveys that were conducted in adjacent counties are included in the analysis to provide a broader, regional understanding. A total of 34 tree-overstory, 28 shrubland, and 56 herbaceous alliances are described, with 69 tree-overstory, 51 shrubland, and 92 herbaceous associations.

This report is divided into two volumes. Volume 1 (this volume) is composed of the project introduction, methods, and results. It includes a floristic key to all vegetation types, a table showing the full local classification nested within the USNVC hierarchy, and a crosswalk showing the relationship between this and other classification systems. Volume 2 provides descriptions of all vegetation alliances and associations. It summarizes distributional, structural, environmental, and plant species data for each type.

CONTRIBUTORS

This vegetation classification report represents the hard work of many people and organizations. Special acknowledgements are offered to funders, landowners who provided access to their properties, project advisors, field staff, and data analysts.

Funding for the classification effort was provided by:

The Sonoma County Agricultural Preservation and Open Space District
The Sonoma County Water Agency
The California Department of Fish and Wildlife (in-kind)
Save the Redwoods League

Landowners who granted access to their land for field sampling

Audubon Canyon Ranch
California Department of Fish and Wildlife
California Department of Parks and Recreation
California State University, Sonoma
Casini Ranch
The Cedars
City of Petaluma
City of Santa Rosa
Crawford Cooley
Duncans Mills Redwood Forest Enterprise
Pat and Ted Eliot
Fred Euphrat
Alexandra and Ken Genetti
Gualala Ranch Association
Steve Maffia
Mendocino Redwood Company
Steve Miller
Monkey Rock Ranch
Monte Rio School District
MXB Family Partnership
Pepperwood Foundation
Rips Redwoods
Save the Redwoods League
Sea Ranch
Sonoma County Agricultural Preservation and Open Space District
Sonoma County Regional Parks
Sonoma County Valley Sanitation District
Sonoma County Water Agency
Sonoma Developmental Center
Sonoma Land Trust
Speedway Sonoma
Nancy Summers
SYAR Industries
Kim Thompson
Joe Tremari
Kathleen Tresch
United States Army Corps of Engineers
United States Bureau of Land Management
United States Fish and Wildlife Service
Carol Vellutini
Bill Walton
Wheeler Ranch

Field/Office Staff and Data Analysts

Shelly Benson
Rachelle Boul
Eric Cecil
Jim Coleman
Mary Jo Colletti
Gene Cooley
Joslyn Curtis
Julie Evens
Melanie Gogol-Prokurat
Sarah Gordon
Michelle Halbur
Chris Heinzelman
Diana Hickson
Todd Keeler-Wolf
Anne Klein
Jim McCrumb
Aicha Ougzin
Gina Radieve
Robert Raiche
Jaime Ratchford
Tom Robinson
Ramona Robison
Joan Schwan
Jake Schweitzer
Kendra Sikes
Sara Taylor
Mark Tukman
Rosie Yacoub

Sonoma County Vegetation Classification Project Advisors/Collaborators

California Department of Fish and Wildlife
California Native Plant Society
Kass Green and Associates
The Local Ecology and Botany Advisory Group
Prunuske Chatham Inc.
Sonoma County Agricultural Preservation and Open Space District
Tukman Geospatial LLC
Brian Schmitt

Field staff, collaborators, and volunteers who contributed data from other efforts:
Ayzik Solomeshch and accompanying field technicians
Various CNPS and CDFW Vegetation Staff
Dorothy King Young Chapter of CNPS
Milo Baker Chapter of CNPS

This report was edited and assembled by Mary Jo Colletti.

We apologize to anyone we may have left off this list unintentionally.

CONTENTS

FIGURES

TABLES

APPENDICES

INTRODUCTION

Sonoma County encompasses over 1.1 million acres and is comprised of natural landscapes representing mixed conifer and hardwood forests, redwood groves, oak woodlands, riparian systems, chaparral, coastal scrub, serpentine-endemic vegetation, wetlands, freshwater and brackish marshes, and others. As with other areas bounded by the ocean to the west and low mountains along other borders, Sonoma County has a great degree of climatic variation, representing microclimates that range from marine at the coast, to coastal cool, then coastal warm moving inland. This climatic variation combines with diverse topographic and geologic environments to create multiple ecological zones. Figure 1 shows the four US Department of Agriculture (USDA) ecological subsections found within the county boundary, as refined from Miles and Goudey (1997).

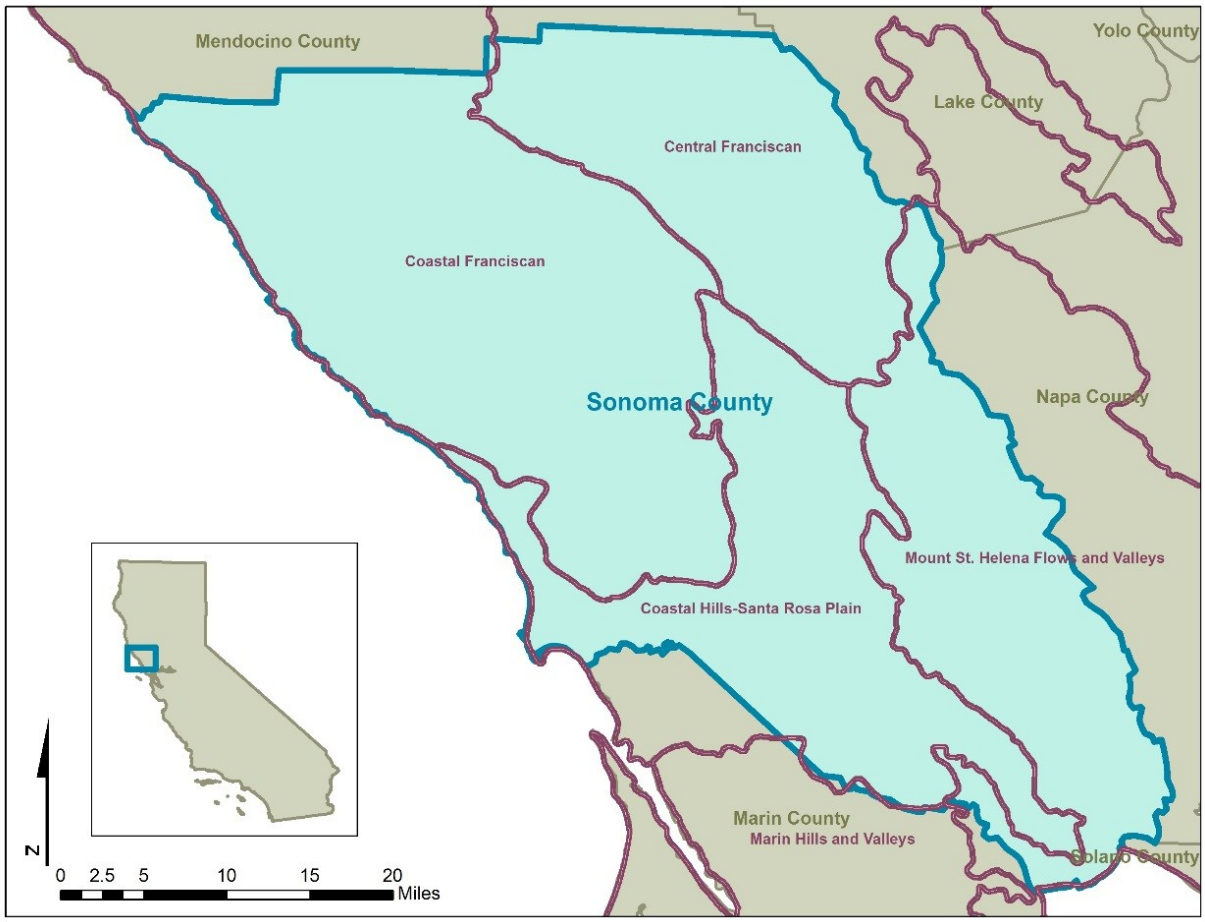

Figure 1. The four USDA ecological subsections in Sonoma County: Central Franciscan, Coastal Franciscan, Coastal Hills–Santa Rosa Plain, and Mount St. Helena Flows and Valleys.

In December 2012, the Sonoma County Vegetation Mapping Program assembled the Vegetation Mapping and Remote Sensing Advisory Committee to provide guidance and expertise on a five-year effort to map the county's topography, physical and biotic features, and diverse plant communities and habitats (http://sonomavegmap.org/). As the foundation for the map, the committee decided to use a standard vegetation classification approach supported by the California Department of Fish and Wildlife's (CDFW) Vegetation Classification and Mapping Program (VegCAMP) and the California Native Plant Society Vegetation Program (CNPS). This report summarizes the methods and results of the classification effort completed by VegCAMP and CNPS, and describes the vegetation types found across Sonoma County.

VegCAMP uses an integrated series of steps for both classification and mapping as defined by the Survey of California Vegetation (SCV; VegCAMP 2015). This document focuses specifically on the vegetation classification step of the SCV process, which is compliant with the *Manual of California Vegetation* (Sawyer et al. 2009) and the United States National Vegetation Classification System (FGDC 2008). Intended users of this report include vegetation ecologists, biologists, botanists, photo-interpreters, land managers, regional planners, geographers, wildlife biologists interested in habitat, and anyone else who benefits from using a standardized vegetation classification.

A floristic key and descriptions of all vegetation types described in Sonoma County are included herein, as well as a table showing the hierarchical relationship of the full local classification to the USNVC. Tukman Geospatial LLC and Kass Green and Associates, who are leading the Sonoma Veg Map (SVM) effort, recently developed a rule-based mapping classification and key consistent with this floristic classification. A fine-scale vegetation map based upon the mapping classification is scheduled to be completed in 2017, and will be available with a county-wide LIDAR dataset. More details on the SVM approach are provided at: http://sonomavegmap.org/.

The USNVC hierarchy is composed of eight levels, organized into three upper, three middle, and two lower levels as shown below:

Level	**Example**
Upper	
Level 1 - Formation Class	Mesomorphic Tree Vegetation (Forest and Woodland)
Level 2 - Formation Subclass	Temperate Forest
Level 3 - Formation	Cool Temperate Forest
Middle	
Level 4 - Division	Western North America Cool Temperate Forest
Level 5 - Macrogroup	Californian–Vancouverian Montane and Foothill Forest
Level 6 - Group	Vancouverian Evergreen Broadleaf and Mixed Forest
Lower	
Level 7 - Alliance	*Quercus garryana* (tree) Woodland Alliance
Level 8 - Association	*Quercus garryana - Umbellularia californica - Quercus* (*agrifolia*, *kelloggii*) Provisional Association

The Sonoma 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). Unlike alliances, associations often recognize two or more diagnostic species found in different vegetation layers (Sawyer et al. 2009).

The SCV considers the *stand* to be 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 something as small as a vernal pool, or something quite expansive, such as a Douglas-fir forest occupying several hundred acres.

Accessible stands throughout Sonoma County were strategically sampled using vegetation survey protocols consistent with the SCV. The resulting samples were analyzed with other overlapping datasets to produce the final classification, which describes 118 alliances and 212 associations, including some dominated by non-native plant species. While this document represents the most comprehensive vegetation classification of Sonoma County to date, further refinement and discovery of types is expected with additional data collection, future changes to vegetation due to disturbance (e.g., fire, drought, and climate change), and natural successional shifts that occur across a landscape over time.

METHODS

Sample Allocation Method and Field Sampling

Prior to field sampling, a Generalized Random Tessellation Stratified (GRTS) survey design was generated using GIS software to balance three goals: 1) generating a target number of samples based on workload predictions for staff conducting the field surveys; 2) distributing samples among the types so that both rare and common types are represented; and, 3) facilitating access to sites based on land ownership and proximity to roads or trails. This approach, in combination with subjective identification of stands across a landscape through reconnaissance, maximized the number of samples per vegetation type collected during the 2013 and 2014 field seasons.

The Calveg (Calveg 2002) vegetation dataset produced in 2002 was used as the basis for generating sample target points in Sonoma County using the GRTS survey design. First, Calveg polygons falling in publicly owned lands, conservation easements, or large parcels owned by likely cooperators were identified and summarized in a GIS layer. Each vegetation type within this layer was assigned a target number of samples, then these targets were used for GRTS sampling and the statistical package R (R Core Team 2013) was employed to allocate the locations of field sample points. A total of 223 sample points were allocated.

The goal for field staff was to use GPS systems to navigate to an allocated point location, find a desirable stand within 50 meters of the point, and set up a bounded plot to conduct a relevé survey. Because navigating to the allocated points and setting up plots in woody vegetation proved to be very time-consuming, the approach was modified so that plot-based relevés were only conducted in herbaceous vegetation types; rapid assessments were conducted in tree- and shrub-dominated types. Opportunistic sampling where points had not been allocated was encouraged in order to compensate for allocated points which could not be reached.

For this project, 851 stands of vegetation were sampled in the summer-fall of 2013 and spring-summer of 2014 using the “Combined Vegetation Rapid Assessment and Relevé Field Form” and the “Sonoma County Protocol for Combined Vegetation Rapid Assessment and Relevé Sampling Field Form” (see Appendix A). A total of 644 rapid assessment (RA) and 207 relevé surveys were collected during both field seasons (Figure 2). 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 RA 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 (Trimble “Junos” or “Geo XHs,” or F4Devices “Flints”). Spatial data were stored in an Esri geodatabase feature class. Survey data from field forms and field devices were entered into an SCV-compliant Microsoft Access database by CDFW and CNPS staff, and were quality-controlled for accuracy.

A total of 719 field reconnaissance surveys were taken during the two field seasons using the “Recon Field Form – Sonoma” (see Appendix B). These short surveys include the date of sampling, GPS location, field-assessed vegetation type, descriptive comments, and an abbreviated species list containing only the most dominant/diagnostic vegetation at each site. Reconnaissance data were not included in this classification project, but the surveys will be used to support the mapping effort or to suggest locations for future detailed surveys.

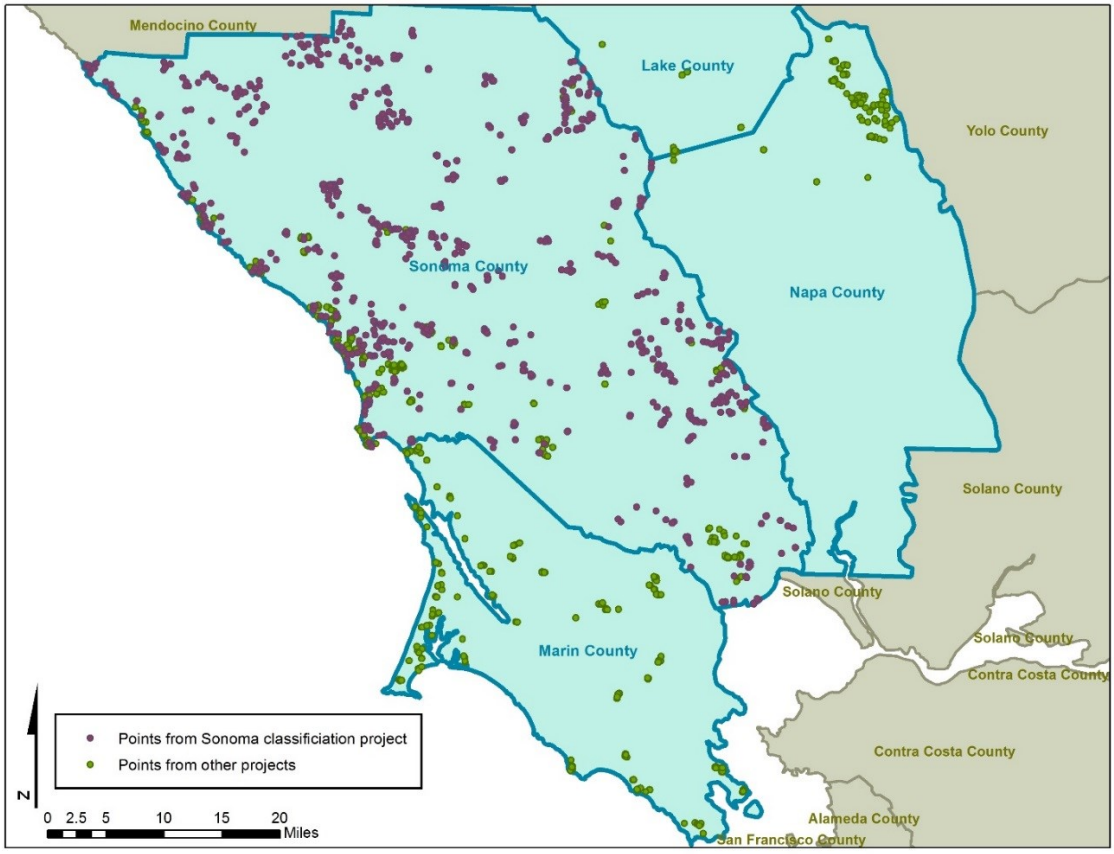

Figure 2. Locations of RA and relevé survey points used in this classification project. The purple points show the surveys collected in 2013 and 2014 specifically for this project. The green points show surveys taken for other projects, but included in the classification. Eleven additional surveys (from Tehama, Glenn, and Colusa Counties) were used in the classification, but are not shown on this map.

Data Analysis and Classification

Vegetation RA and relevé data were analyzed by VegCAMP in 2014 and 2015. In early 2014, 536 RA and 61 relevé surveys collected in 2013 by CNPS, Prunuske and Chatham, Inc., and VegCAMP were included in a preliminary analysis. In the fall and winter of 2014–2015, the 2013 surveys were re-analyzed with an additional 835 surveys from other projects, collected using SCV-compliant protocols. The additional surveys were 236 RAs and 599 relevés collected between 2001 and 2014 by CNPS, the Dorothy King Young and Milo Baker Chapters of CNPS, Prunuske and Chatham, Inc., Solomeshch et al., and VegCAMP in Sonoma, Colusa, Glenn, Lake, Marin, Napa, and Tehama Counties. Ayzik Solomeshch et al. contributed a significant amount of data (421 surveys) that was part of an extensive effort to sample and classify coastal grasslands of Sonoma and Marin Counties between 2010 and 2012[1]. Little effort was

[1] Solomeshch et al. of the Plant Sciences Department, UC Davis, collected 421 Relevé samples on an array of private and public lands in a belt of grasslands that ranged from the immediate coast to approximately 12 miles inland (in Figure 2, Solomeshch surveys are among the green points). The project was established to produce a thorough classification of all vegetation considered to be grassland, i.e. stands dominated by native or non-native annual or perennial grasses, graminoids and/or forbs, but with less than about 10% evenly distributed woody vegetation. The effort involved a cooperative venture between local botanists, the UC Davis Bodega Reserve, and the UC Davis Center for Spatial Technologies. 330 relevés were sampled in the spring and summer of 2010 and, following an interim classification analysis, an additional 91 were collected in the spring-summer of 2011. A final analysis and classification was not produced, but in 2012 the coastal grassland landscape was mapped using non–SCV-compliant remote sensing techniques with Landsat satellite imagery.

put into additional sampling of grasslands in the western portion of Sonoma County because of the extent of Solomeshch et al.'s work, which contributed substantially to the grassland classification represented in the western portion of Sonoma County. Out of 1432 total surveys included in the final analysis, 1149 were conducted in Sonoma County. The additional 283 surveys from other counties (all located less than 70 miles from the Sonoma County boundary) were included to provide a broader, regional understanding of vegetation types with overlapping floristic and ecological characteristics.

VegCAMP analyzed the species cover data using the PC-Ord 6.08 cluster analysis software. Scientific names of all taxa were first converted to standard alpha-numeric codes used by the PLANTS Database (USDA NRCS 2015). Taxa that could not be found in the PLANTS Database were assigned codes based on *The Jepson Manual, second edition* (Baldwin et al. 2012). 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 all surveys and species greater than three standard deviations away from the mean were removed. The final cluster analysis used the Sorensen 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 preliminary and final analyses, VegCAMP 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 (as described above) 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 59), 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 vegetation types 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 the *Manual of California Vegetation* (Sawyer et al., 2009) and the USNVC (FGDC 2008). 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 and 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, and 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 1, 2, 3, etc. surveys. Determine the coefficient of variation (CV), and species and plot outliers for each output. Use an output with a CV between 150-175%, 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 the Sorensen Distance Measure.
4. Run cluster analysis on the chosen output after outliers are removed 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.
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.

RESULTS

Sample Allocations and Field Sampling

Of the 223 GRTS points allocated, 112 were sampled. A total of 47 RAs and 49 relevés were conducted at GRTS targets, while reconnaissance surveys were performed at the other 16. Some allocation points were discarded because permission was not granted to parcels originally believed to be promising for gaining access. For others, field staff were simply not able to get to the locations because of impenetrable vegetation, steep slopes, or other obstacles.

A total of 1210 plant taxa were recorded in all 1432 field surveys and are listed in Appendix C. Species names were entered in the survey database as they were recorded in the field, but the PLANTS Database (USDA NRCS 2015) was used as the standard for nomenclature (both botanical names and accompanying codes) for the final classification. A prefix of "2" was applied to codes for taxa recognized by *The Jepson Manual, second edition* (Baldwin et al. 2012) or the *Manual of California Vegetation* (Sawyer et al. 2009), but not the PLANTS Database. General vegetation types, such as moss and lichen, also have codes beginning with the number 2 (e.g., 2MOSS). Of the 1210 recorded taxa, 24 are considered "noteworthy." These species are considered rare in California; the degree of scarcity is indicated by the CA rare plant rank and the NatureServe global/state rank (see Appendix D).

Data Analysis and Classification

The intermediate classification, based on the full dataset from 2013, was developed by partitioning all 597 samples into four subsets based on the initial cluster analysis and then running additional Cluster and Indicator Species Analyses on each subset. A total of 35 tree-overstory, 33 shrubland, and 26 herbaceous alliances were derived from the classification analysis and most were typed further to association. The intermediate classification is not included in this report because all of the 2013 surveys were reanalyzed and classified with the complete dataset in 2014 and 2015.

In 2015, a final classification was developed based on 772 RAs and 660 relevés. The initial cluster analysis was conducted on all 1432 surveys, and species occurring in fewer than 5 surveys were removed to achieve a coefficient of variation (CV) of 164.1%. Two species outliers (*Achillea millefolium* and *Ranunculus californicus*) and three surveys with no taxa left after the previous step was completed (SONO0123, SONO0428, SONO2185) were removed and the dataset was partitioned into six subsets. The top six species indicators for each subset, as determined by indicator species analysis, are summarized as follows:

A. 395 surveys – *Rubus ursinus, Equisetum* spp., *Salix lasiolepis, Rubus armeniacus, Juncus effusus,* and *Salix laevigata.*
B. 230 surveys – *Plantago lanceolata, Hypochaeris radicata, Rumex acetosella, Danthonia californica, Linum bienne,* and *Bromus carinatus.*

C. 244 surveys – *Hemizonia congesta, Nassella pulchra, Lotus wrangelianus, Lactuca saligna, Hypochaeris glabra,* and *Dichelostemma capitatum.*
D. 211 surveys – *Adenostoma fasciculatum, Quercus durata, Heteromeles arbutifolia, Ceanothus jepsonii, Pinus sabiniana ,* and *Eriodictyon californicum.*
E. 270 surveys – *Quercus agrifolia, Umbellularia californica, Quercus garryana, Toxicodendron diversilobum, Quercus kelloggii,* and *Arbutus menziesii.*
F. 79 surveys – *Sequoia sempervirens, Notholithocarpus densiflorus, Polystichum munitum, Pseudotsuga menziesii, Vaccinium ovatum,* and *Prosartes hookeri.*

Taxa occurring in two surveys or less were removed from subsets A, B, and C above, three or less from D and F, and four or less from E in order to attain CVs close to 150%. CVs ranged from 147.9% to 164.9% for subsets A through E; the lowest CV attained for subset F without removing taxa in more than three surveys was 175.1%. A total of five surveys from subset E (KNOX0127, KNOX1102, SERP0029, SONO0200, SONO0223), and six species from subset A (*Achillea millefolium*, *Aira caryophyllea*, *Anagallis arvensis*, *Briza minor*, *Sisyrinchium bellum*, and *Sonchus asper*) were flagged as outliers and removed. As mentioned above, three surveys (SONO0123, SONO0428, SONO2185) were excluded because no taxa were left after removing taxa occurring in a small number of surveys. Cluster and Indicator Species Analyses were then conducted on each of the six 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. See Figures 3 and 4 for example dendrograms that resulted from the cluster analysis of oak woodland samples.

After VegCAMP had produced the final classification, CNPS Vegetation Director Julie Evens reviewed it and provided feedback. Modifications that we acceptable to CNPS and VegCAMP were made, and the classification was finalized in the summer of 2015. Data from four previous vegetation projects along the North Coast were then compared with the Sonoma dataset in an effort to enhance the understanding of vegetation types across the broader ecoregion. These projects are:

1. Golden Gate National Recreation Area (Schirokauer et al. 2003),
2. Marin Municipal Water District (Evens and Kentner 2006),
3. Marin Open Space District (Buck and Evens 2010), and
4. Point Reyes National Seashore (Schirokauer et al. 2003).

After the classification was finalized, the Hierarchical Field Key was developed (see Appendix E). The field key is organized by vegetation layer (tree-overstory, shrubland, herbaceous) and then in order of the USNVC hierarchy. It contains the membership rules for each alliance in the classification. Once these membership rules were established, all outliers or other surveys removed from the analysis were classified to alliance and association.

While 1432 surveys were included in the final vegetation classification analysis, only those located in Sonoma County (1149 surveys) are included in this report. A total of 464 tree-overstory, 233 shrubland, and 440 herbaceous/grassland surveys are summarized in the final vegetation descriptions; 12 surveys were excluded because they were classified above alliance level, to group or macrogroup.

The final classification includes: 34 tree-overstory, 28 shrubland, and 56 herbaceous alliances; and 69 tree-overstory, 51 shrubland, and 92 herbaceous associations. Of these, 17 alliances and 21 associations are considered “Semi-Natural” because they are dominated or characterized by non-native plants. Table 1 represents the final classification and shows how each vegetation type nests within the USNVC hierarchy. Appendix F is a crosswalk showing the relationship between the alliances of the Sonoma vegetation classification and two other classification systems: the California Wildlife Habitat Relationships (CWHR) and the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg). A table containing final classification names for each field survey is located in the final survey database, which is available from VegCAMP.

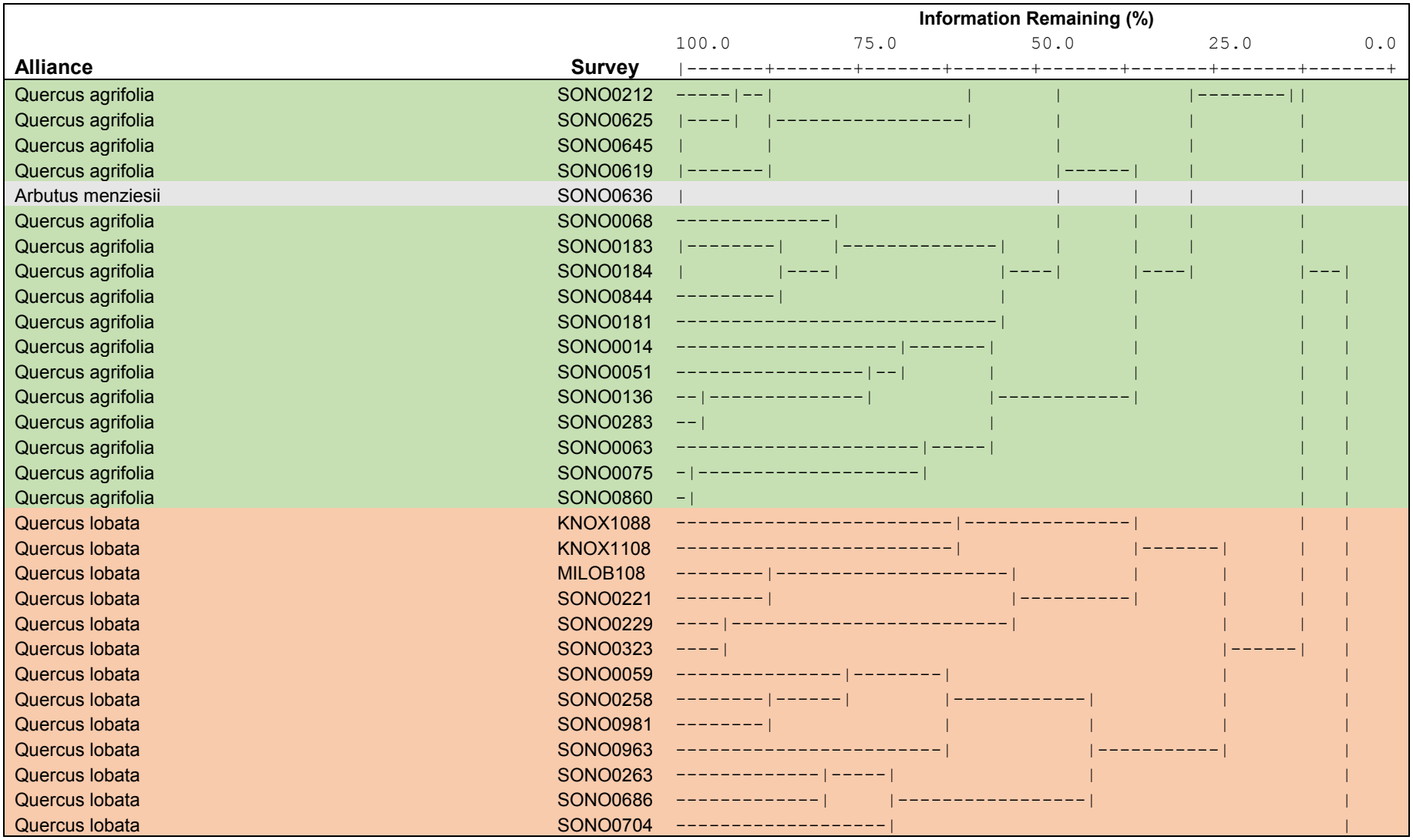

Figure 3. Example diagram showing the arrangement of samples from the cluster analysis in a subset of oak woodland surveys. Each colored group represents a different alliance. Surveys that group to the left (with more information remaining) have more overlap than those that group to the right. Survey SONO0636 was typed as *Arbutus menziesii* instead of *Quercus agrifolia* based on the dominance rules developed for differentiating between the two alliances.

Association	Survey	Information Remaining (%) 100.0 75.0 50.0 25.0 0.0
Quercus agrifolia - Arbutus menziesii - Umbellularia californica	SONO0212	
Quercus agrifolia - Arbutus menziesii - Umbellularia californica	SONO0625	
Quercus agrifolia / Grass	SONO0645	
Quercus agrifolia - Arbutus menziesii - Umbellularia californica	SONO0619	
Arbutus menziesii - Quercus agrifolia	SONO0636	
Quercus agrifolia / Grass	SONO0068	
Quercus agrifolia / Toxicodendron diversilobum	SONO0183	
Quercus agrifolia / Grass	SONO0184	
Quercus agrifolia / Toxicodendron diversilobum	SONO0844	
Quercus agrifolia / Toxicodendron diversilobum	SONO0181	
Quercus agrifolia / Toxicodendron diversilobum	SONO0014	
Quercus agrifolia / Grass	SONO0051	
Quercus agrifolia / Grass	SONO0136	
Quercus agrifolia / Grass	SONO0283	
Quercus agrifolia / Grass	SONO0063	
Quercus agrifolia / Grass	SONO0075	
Quercus agrifolia / Grass	SONO0860	
Quercus lobata / Rubus ursinus - Rosa californica	KNOX1088	
Quercus lobata / Rubus ursinus - Rosa californica	KNOX1108	
Quercus lobata / Rubus ursinus - Rosa californica	MILOB108	
Quercus lobata / Rubus ursinus - Rosa californica	SONO0221	
Quercus lobata - Fraxinus latifolia / (Vitis californica)	SONO0229	
Quercus lobata - Fraxinus latifolia / (Vitis californica)	SONO0323	
Quercus lobata / Grass	SONO0059	
Quercus lobata / Grass	SONO0258	
Quercus lobata / Grass	SONO0981	
Quercus lobata / Grass	SONO0963	
Quercus lobata - Quercus agrifolia / Grass	SONO0263	
Quercus lobata - Quercus agrifolia / Grass	SONO0686	
Quercus lobata - Quercus agrifolia / Grass	SONO0704	

Figure 4. Example diagram showing the same portion of the cluster analysis dendrogram as in Figure 3, but using more closely linked groups to help guide the classification of surveys to association. Each colored group indicates a different association.

Table 1. Final Vegetation Classification for Sonoma County, California. Hierarchical list of all alliances and associations classified in Sonoma County, organized within the USNVC structure. This hierarchy is consistent with the version of the USNVC used in the second edition of the *Manual of California Vegetation* (Sawyer et al. 2009) except where indicated with an asterisk (*). In some cases, the asterisk denotes an entirely new vegetation type; in others, it indicates a new compound type that has been formed by a combination of old, or old and new, types. A double asterisk (**) marks an existing association that has been moved into a different alliance or an existing alliance that has been moved into a different group. Sample size is the number of surveys collected for each alliance and association.

Description	Sample Size
Mesomorphic Tree Vegetation (Forest and Woodland) Formation Class	
Temperate Forest Formation Subclass	
Warm Temperate Forest Formation	
Madrean Forest and Woodland Division	
California Forest and Woodland Macrogroup	
Californian Broadleaf Forest and Woodland Group	
Aesculus californica Alliance	**3**
Aesculus californica / Toxicodendron diversilobum / Moss Association	3
Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni) Alliance	**15**
Quercus agrifolia – Quercus garryana – Quercus kelloggii Provisional Association*	15
Quercus agrifolia Alliance	**26**
Quercus agrifolia – Arbutus menziesii – Umbellularia californica Association	7
Quercus agrifolia / Grass Association	13
Quercus agrifolia / Toxicodendron diversilobum Association	6
Quercus chrysolepis (tree) Alliance	**5**
Quercus chrysolepis – Arbutus menziesii Provisional Association*	3
Quercus chrysolepis – Quercus wislizeni Association	1
Quercus douglasii Alliance	**14**
Quercus ×eplingii / Grass Provisional Association*	4
Quercus douglasii – Quercus agrifolia Association	2
Quercus douglasii / Arctostaphylos manzanita / Herbaceous Association	2
Quercus douglasii / Grass Association	6
Quercus kelloggii Alliance	**13**
Quercus kelloggii – Arbutus menziesii – Quercus agrifolia Association	4
Quercus kelloggii – Pseudotsuga menziesii – Umbellularia californica Association	9

Description	Sample Size
Quercus lobata Alliance	**15**
Quercus lobata – Fraxinus latifolia / (Vitis californica) Association	4
Quercus lobata – Quercus agrifolia / Grass Association	4
Quercus lobata / Grass Association	5
Quercus lobata / Rubus ursinus – Rosa californica Provisional Association*	2
Quercus parvula var. *shrevei* Provisional Alliance	**1**
Quercus wislizeni (tree) Alliance	**8**
Quercus wislizeni – Arbutus menziesii / Toxicodendron diversilobum Association	7
Umbellularia californica Alliance	**31**
Umbellularia californica – Acer macrophyllum Association	4
Umbellularia californica – Notholithocarpus densiflorus Association	1
Umbellularia californica – Pseudotsuga menziesii / Rhododendron occidentale Association	2
Umbellularia californica – Quercus agrifolia Provisional Association*	6
Umbellularia californica (Pure – Coastal) Provisional Association*	10
Umbellularia californica / Polystichum munitum Association	4
Californian Evergreen Coniferous Forest and Woodland Group	
Hesperocyparis macnabiana Alliance	**2**
Hesperocyparis macnabiana / Arctostaphylos viscida Association	1
Hesperocyparis macrocarpa Special Stands and Semi-Natural Alliance	1
Hesperocyparis macrocarpa Provisional Semi-Natural Association*	1
Hesperocyparis sargentii Alliance	**21**
Hesperocyparis sargentii / Ceanothus jepsonii – Arctostaphylos spp. Provisional Association*	9
Hesperocyparis sargentii / Quercus durata (Mesic) Provisional Association*	11
Hesperocyparis sargentii Riparian Association	1
Pinus attenuata Alliance	**12**
Pinus attenuata / Arctostaphylos (manzanita, canescens) Provisional Association*	8
Pinus attenuata / Arctostaphylos viscida Association	2
Pinus muricata Alliance	**11**
Pinus muricata – Hesperocyparis pigmaea Provisional Association	3
Pinus muricata / Vaccinium ovatum Provisional Association*	4
Pinus muricata Provisional Association*	4

Description	Sample Size
Pinus radiata Alliance	**2**
Pinus radiata Provisional Semi-Natural Association*	2
Pinus sabiniana Alliance	**9**
Pinus sabiniana / Quercus durata Provisional Association*	6
Pinus sabiniana / Arctostaphylos viscida Association	1
Cool Temperate Forest Formation	
Western North America Cool Temperate Forest Division	
Californian–Vancouverian Montane and Foothill Forest Macrogroup	
Vancouverian Evergreen Broadleaf and Mixed Forest Group	
Arbutus menziesii Alliance	**23**
Arbutus menziesii – Quercus agrifolia Association	8
Arbutus menziesii – Umbellularia californica – Quercus kelloggii Association	3
Arbutus menziesii – Umbellularia californica Provisional Association*	11
Notholithocarpus densiflorus Alliance	**16**
Notholithocarpus densiflorus – Arbutus menziesii Association	6
Notholithocarpus densiflorus Provisional Association*	10
Pseudotsuga menziesii – Notholithocarpus densiflorus Alliance	**13**
Pseudotsuga menziesii – Notholithocarpus densiflorus Association	13
Quercus garryana (tree) Alliance	**49**
Quercus garryana – Umbellularia californica – Quercus (agrifolia, kelloggii) Provisional Association*	27
Quercus garryana / (Cynosurus echinatus – Festuca californica) Provisional Association*	21
Upland Vancouverian Mixed Woodland and Forest Group	
Acer macrophyllum Alliance	**5**
Acer macrophyllum Association	5
Pinus ponderosa – Pseudotsuga menziesii Alliance	**2**
Pinus ponderosa – Pseudotsuga menziesii Association	2
Pseudotsuga menziesii Alliance	**42**
Pseudotsuga menziesii – Arbutus menziesii Association	3
Pseudotsuga menziesii – Quercus agrifolia Association	7
Pseudotsuga menziesii – Quercus chrysolepis Association	11
Pseudotsuga menziesii – Umbellularia californica / Polystichum munitum Association	3

Description	Sample Size
Pseudotsuga menziesii – Umbellularia californica Association	17
Vancouverian Rainforest Macrogroup	
Vancouverian Hypermaritime Lowland Rainforest Group	
Abies grandis Alliance	**1**
Sequoia sempervirens Alliance	**59**
Sequoia sempervirens – Acer macrophyllum – Umbellularia californica Association	9
Sequoia sempervirens – Notholithocarpus densiflorus / Vaccinium ovatum Association	11
Sequoia sempervirens – Pseudotsuga menziesii – Notholithocarpus densiflorus Provisional Association*	18
Sequoia sempervirens – Pseudotsuga menziesii – Umbellularia californica Association	5
Sequoia sempervirens – Umbellularia californica Association	5
Sequoia sempervirens / Oxalis oregana Association	3
Sequoia sempervirens / Woodwardia fimbriata Riparian Provisional Association*	6
North American Introduced Evergreen Broadleaf and Conifer Forest Division	
Introduced North American Mediterranean Woodland and Forest Macrogroup	
Introduced North American Mediterranean Woodland and Forest Group	
Eucalyptus (globulus, camaldulensis) Semi-Natural Alliance	**0**
Temperate Flooded and Swamp Forest Formation	
Western North America Flooded and Swamp Forest Division	
Western Cordilleran Montane–Boreal Riparian Scrub Macrogroup	
Vancouverian Coastal Riparian Scrub Group	
Morella californica – Rubus spectabilis Provisional Alliance*	**11**
Morella californica – Rubus spp. Provisional Association*	6
Rubus parviflorus Association**	2
Rubus spectabilis Association**	2
Salix sitchensis Provisional Alliance	**8**
Salix sitchensis Provisional Association*	8
Vancouverian Riparian Deciduous Forest Group	
Alnus rhombifolia Alliance	**21**
Alnus rhombifolia – Acer macrophyllum Association	8
Alnus rhombifolia / Carex (nudata) Association	11
Alnus rhombifolia Association	2

Description	Sample Size
Alnus rubra Alliance**	**14**
Alnus rubra / Rubus spp. Provisional Association*	14
Fraxinus latifolia Alliance	**6**
Fraxinus latifolia – Alnus rhombifolia Association	1
Fraxinus latifolia Association	5
Salix lucida Alliance	**6**
Salix lucida ssp. *lasiandra* Association	6
Western North America Warm Temperate Flooded and Swamp Forest Division	
Southwestern North American Riparian, Flooded and Swamp Forest Macrogroup	
Southwestern North American Riparian Evergreen and Deciduous Woodland Group	
Acer negundo Alliance	**3**
Juglans hindsii and Hybrids Special Stands and Semi-Natural Alliance	**3**
Populus fremontii Alliance	**7**
Populus fremontii – Acer negundo Association	6
Populus fremontii / Salix exigua Association	1
Salix laevigata Alliance	**5**
Salix laevigata / Salix lasiolepis Association	5
Southwestern North American Riparian/Wash Scrub Group	
Frangula californica – Rhododendron occidentale Provisional Alliance*	**7**
Frangula californica ssp. *californica* Provisional Association*	1
Rhododendron occidentale – Frangula californica ssp. *tomentella* Provisional Association*	5
Salix breweri Alliance	**1**
Salix breweri Provisional Association*	1
Salix exigua Alliance	**4**
Salix exigua – Salix melanopsis Association	1
Salix exigua Association	3
Salix lasiolepis Alliance	**15**
Salix lasiolepis – Rubus spp. Association	15
Sambucus nigra Alliance	**1**
Sambucus nigra Association	1

Description	Sample Size
Mesomorphic Shrub and Herb Vegetation (Shrubland and Grassland) Formation Class	
Mediterranean Scrub and Grassland Formation Subclass	
Mediterranean Scrub Formation	
California Scrub Division	
California Chaparral Macrogroup	
Californian Xeric Chaparral Group	
Adenostoma fasciculatum Alliance	**31**
Adenostoma fasciculatum – Arctostaphylos manzanita Association	6
Adenostoma fasciculatum – Arctostaphylos stanfordiana / Salvia sonomensis Provisional Association*	12
Adenostoma fasciculatum – Diplacus aurantiacus Association	1
Adenostoma fasciculatum Association	8
Adenostoma fasciculatum Serpentine Association	1
Arctostaphylos (canescens, manzanita, stanfordiana) Provisional Alliance*	**25**
Arctostaphylos canescens Provisional Association*	5
Arctostaphylos manzanita Provisional Association*	11
Arctostaphylos stanfordiana Provisional Association*	8
Arctostaphylos glandulosa Alliance**	**5**
Arctostaphylos glandulosa – Adenostoma fasciculatum Association	3
Arctostaphylos glandulosa Association	2
Arctostaphylos viscida Alliance	**7**
Arctostaphylos viscida – Ceanothus jepsonii Provisional Association*	7
Ceanothus cuneatus Alliance	**7**
Ceanothus cuneatus – Adenostoma fasciculatum Association	7
Californian Maritime Chaparral Group	
Arctostaphylos (nummularia, sensitiva) Alliance	**1**
Arctostaphylos nummularia ssp. *nummularia* Provisional Association*	1
Californian Mesic Chaparral Group	
Cercocarpus montanus Alliance	**2**
Cercocarpus montanus – Adenostoma fasciculatum Association	2
Quercus berberidifolia – Adenostoma fasciculatum Alliance	**2**
Quercus berberidifolia – Adenostoma fasciculatum Association	2

Description	Sample Size
Quercus berberidifolia Alliance	**4**
Quercus berberidifolia – Cercocarpus montanus Association	1
Quercus berberidifolia Association	3
Californian Serpentine Chaparral Group	
Arctostaphylos (bakeri, montana) Provisional Alliance*	**9**
Arctostaphylos bakeri Provisional Association*	9
Quercus durata Alliance	**20**
Quercus durata – Adenostoma fasciculatum Provisional Association*	3
Quercus durata – Ceanothus jepsonii Provisional Association*	12
Quercus durata – Heteromeles arbutifolia / Umbellularia californica Association	4
Californian Pre-Montane Chaparral Group	
Ceanothus oliganthus Alliance	**1**
Ceanothus oliganthus Association	1
Quercus wislizeni (shrub) Alliance	**6**
Quercus wislizeni – Ceanothus oliganthus Provisional Association*	2
Quercus wislizeni var. *frutescens* Provisional Association*	4
California Coastal Scrub Macrogroup	
Central and South Coastal Californian Coastal Sage Scrub Group	
Artemisia californica Alliance	**0**
Central and South Coastal California Seral Scrub Group	
Eriodictyon californicum – Lupinus albifrons Provisional Alliance*	**9**
Eriodictyon californicum / Herbaceous Association**	5
Lupinus albifrons Association**	4
Eriogonum (elongatum, nudum) Provisional Alliance*	**1**
Eriogonum nudum Provisional Association*	1
Heterotheca (oregona, sessiliflora) Provisional Alliance	**3**
Heterotheca oregona Provisional Association*	3
California North Coastal & Mesic Scrub Group*	
Baccharis pilularis Alliance**	**30**
Baccharis pilularis – Frangula californica – Rubus spp. Provisional Association*	5
Baccharis pilularis – Toxicodendron diversilobum Association	2

Description	Sample Size
Baccharis pilularis / Annual Grass – Herb Association	12
Baccharis pilularis / Danthonia californica Association	1
Baccharis pilularis / Deschampsia cespitosa Association	1
Baccharis pilularis / Nassella pulchra Association	1
Baccharis pilularis / Native Grass (Mixed) Association	3
Ceanothus thyrsiflorus Alliance**	**3**
Ceanothus incanus Provisional Association*	3
Gaultheria shallon – Rubus (ursinus) Provisional Alliance*	**7**
Gaultheria shallon – Rubus spp. Provisional Association*	2
Rubus ursinus Association**	5
Toxicodendron diversilobum Alliance**	**2**
Toxicodendron diversilobum – Baccharis pilularis Provisional Association	2
Mediterranean Grassland and Forb Meadow Formation	
California Grassland and Meadow Division	
California Annual and Perennial Grassland Macrogroup	
California Annual Herb/Grass Group	
Eschscholzia (californica) – Lupinus (nanus) Provisional Alliance*	**6**
Bromus hordeaceus – Lupinus nanus – Trifolium spp. Association**	2
Eschscholzia californica Association**	4
Lasthenia californica – Plantago erecta – Vulpia microstachys Alliance	**38**
Erigeron glaucus – Lasthenia californica Provisional Association*	14
Hemizonia congesta – Lolium perenne Provisional Association*	3
Lotus humistratus – Plantago erecta – Lomatium spp. Provisional Association*	1
Micropus californicus Provisional Association*	6
Vulpia microstachys – Plantago erecta – Calycadenia (truncata, multiglandulosa) Association	1
Plagiobothrys nothofulvus Alliance	**2**
Plagiobothrys nothofulvus – Daucus pusillus – Trifolium microcephalum Provisional Association*	2
California Perennial Grassland Group	
Elymus glaucus – Bromus carinatus Provisional Alliance*	**31**
Bromus carinatus Provisional Association*	10
Elymus glaucus Association**	6

Description	Sample Size
Pteridium aquilinum Provisional Association*	14
Nassella spp. – *Melica* spp. Provisional Alliance*	**40**
Melica californica Provisional Association*	1
Nassella pulchra – Achnatherum lemmonii Provisional Association*	2
Nassella pulchra – Avena spp. – *Bromus* spp. Association**	9
Nassella pulchra – Hemizonia congesta Provisional Association*	5
Nassella pulchra – Lolium perenne – Plantago erecta Serpentine Provisional Association*	13
Nassella pulchra – Melica californica – Annual Grass Association**	2
Nassella pulchra – Plantago lanceolata Provisional Association*	7
Nassella pulchra Association**	1
Mediterranean California Naturalized Annual and Perennial Grassland Group	
Avena spp. – *Bromus* spp. Provisional Semi-Natural Alliance*	**34**
Avena barbata Semi-Natural Association**	16
Brachypodium distachyon Semi-Natural Association**	3
Briza maxima Provisional Semi-Natural Association*	5
Bromus diandrus – Avena spp. Semi-Natural Association**	4
Bromus hordeaceus – Erodium botrys Semi-Natural Association**	5
Brassica nigra and Other Mustards Semi-Natural Alliance	**2**
Brassica nigra Semi-Natural Association	1
Raphanus sativus Semi-Natural Association	1
Centaurea (solstitialis, melitensis) Semi-Natural Alliance	**1**
Centaurea solstitialis Semi-Natural Association	1
Cynosurus echinatus Semi-Natural Alliance	**15**
Cynosurus echinatus – (Danthonia pilosa – Nassella manicata) Provisional Semi-Natural Association*	12
Lolium perenne Semi-Natural Alliance	**23**
Lolium perenne Semi-Natural Association	21
Temperate and Boreal Shrubland and Grassland Subclass	
Temperate Grassland, Meadow, and Shrubland Formation	
Vancouverian and Rocky Mountain Grassland and Shrubland Division	
Western Cordilleran Montane-Boreal Wet Meadow Macrogroup	
Western Cordilleran Montane-Boreal Mesic Wet Meadow Group	

Description	Sample Size
Deschampsia cespitosa Alliance	**31**
Deschampsia cespitosa – Danthonia californica Association	2
Deschampsia cespitosa – Eryngium armatum Provisional Association*	10
Deschampsia cespitosa – Holcus lanatus Provisional Association*	19
Western North American Temperate Grassland and Meadow Macrogroup	
Western Dry Upland Perennial Grassland Group	
Elymus (elymoides, multisetus) Provisional Alliance*	**8**
Elymus multisetus – (Eschscholzia californica – Plantago erecta) Provisional Association*	7
Festuca idahoensis Alliance	**15**
Festuca californica Provisional Association*	1
Festuca idahoensis – Bromus carinatus Association	2
Festuca idahoensis – Danthonia californica Provisional Association*	8
Festuca idahoensis Ultramafic Provisional Association*	4
Vancouverian and Rocky Mountain Naturalized Perennial Grassland Group	
Agrostis (gigantea, stolonifera) – Festuca arundinacea Semi-Natural Alliance	**1**
Festuca arundinacea Provisional Semi-Natural Association*	1
Holcus lanatus – Anthoxanthum odoratum Semi-Natural Alliance	**15**
Holcus lanatus – Anthoxanthum odoratum Semi-Natural Association	7
Holcus lanatus Semi-Natural Association	8
Phalaris aquatica Semi-Natural Alliance	**2**
Phalaris aquatica Provisional Semi-Natural Association	2
Western Cordilleran Montane Shrubland and Grassland Macrogroup	
Western Cordilleran Montane Moist Graminoid Meadow Group	
Hordeum brachyantherum Alliance	**5**
Hordeum brachyantherum Association	5
Vancouverian Lowland Grassland and Shrubland Macrogroup	
Vancouverian Coastal Grassland Group	
Calamagrostis nutkaensis Alliance	**9**
Calamagrostis nutkaensis / Baccharis pilularis Association	8
Danthonia californica Alliance	**22**
Danthonia californica – (Briza maxima – Vulpia bromoides) Provisional Association*	11

Description	Sample Size
Danthonia californica – Nassella pulchra Provisional Association*	10
Naturalized Non-native Deciduous Scrub Group	
Rubus armeniacus Semi-Natural Alliance	**4**
Rubus armeniacus Semi-Natural Association	4
Temperate and Boreal Scrub and Herb Coastal Vegetation Formation	
Pacific Coast Scrub and Herb Littoral Vegetation Division	
Vancouverian Coastal Dune and Bluff Macrogroup	
California Coastal Evergreen Bluff and Dune Scrub Group	
Lupinus arboreus Alliance and Semi-Natural Alliance	**10**
Lupinus arboreus Association	10
Lupinus chamissonis – Ericameria ericoides Alliance	**1**
Lupinus chamissonis – Ericameria ericoides Association	1
Vancouverian/Pacific Dune Mat Group	
Abronia latifolia – Ambrosia chamissonis Alliance	**7**
Ambrosia chamissonis Provisional Association*	4
Artemisia pycnocephala – Calystegia soldanella Association	1
Artemisia pycnocephala – Polygonum paronychia Association	1
Leymus mollis Alliance	**1**
Leymus mollis – Abronia latifolia – (Cakile spp.*)* Association	1
California–Vancouverian Semi-Natural Littoral Scrub and Herb Vegetation Group	
Ammophila arenaria Semi-Natural Alliance	**4**
Ammophila arenaria Semi-Natural Association	4
Mesembryanthemum spp. – *Carpobrotus* spp. Provisional Semi-Natural Alliance*	**1**
Carpobrotus (edulis) Provisional Semi-Natural Association*	1
Temperate and Boreal Freshwater Marsh Formation	
Western North American Freshwater Marsh Division	
Western North American Freshwater Marsh Macrogroup	
Arid West Freshwater Emergent Marsh Group	
Schoenoplectus acutus Alliance	**4**
Schoenoplectus acutus Association	4
Schoenoplectus californicus Alliance	**3**

Description	Sample Size
Schoenoplectus californicus Association	3
Typha (angustifolia, domingensis, latifolia) Alliance	**2**
Typha domingensis Association	1
Typha latifolia Association	1
Vancouverian Coastal/Tidal Marsh and Meadow Group	
Argentina egedii Alliance	**4**
Argentina egedii Association	3
Carex (pansa, praegracilis) Provisional Alliance*	**5**
Carex praegracilis Provisional Association*	3
Carex obnupta Alliance	**10**
Carex obnupta Association	10
Juncus (effusus, patens) Provisional Alliance*	**24**
Juncus effusus Association**	2
Juncus patens – Holcus lanatus Provisional Association*	3
Juncus patens – Juncus occidentalis Provisional Association*	7
Juncus patens Provisional Association*	3
Juncus phaeocephalus Provisional Association*	8
Juncus lescurii Alliance	**3**
Juncus lescurii Association	3
Oenanthe sarmentosa Alliance	**1**
Oenanthe sarmentosa Association	1
Scirpus microcarpus Alliance	**3**
Scirpus microcarpus Association	3
Western North America Vernal Pool Macrogroup	
Californian Mixed Annual/Perennial Freshwater Vernal Pool / Swale Bottomland Group	
Eleocharis (acicularis, macrostachya) Provisional Alliance*	**3**
Eleocharis macrostachya Association**	2
Grindelia (stricta) Provisional Alliance	**2**
Grindelia stricta Provisional Association*	2
Lasthenia glaberrima Alliance	**1**
Lasthenia glaberrima – Pleuropogon californicus Association	1

Description	Sample Size
Western North America Wet Meadow and Low Shrub Carr Macrogroup	
Californian Warm Temperate Marsh/Seep Group	
Carex barbarae Alliance	**1**
Carex barbarae Association	1
Carex nudata Alliance	**2**
Carex nudata Association	2
Carex serratodens Provisional Alliance	**4**
Carex serratodens Provisional Association*	4
*Juncus arcticus (*var. *balticus, mexicanus)* Alliance	**3**
*Juncus arcticus (*var. *balticus, mexicanus)* Association	2
Leymus triticoides Alliance	**5**
Leymus triticoides – Lolium perenne Association	2
Leymus triticoides Association	3
Mimulus (guttatus) Alliance	**2**
Mimulus guttatus Association	2
Naturalized Warm-Temperate Riparian and Wetland Group	
Lepidium latifolium Semi-Natural Alliance	**1**
Lepidium latifolium – Distichlis spicata Semi-Natural Association	1
Persicaria lapathifolia – Xanthium strumarium Provisional Alliance	**1**
Bidens frondosa Provisional Association*	1
Temperate and Boreal Salt Marsh Formation	
Temperate and Boreal Pacific Coastal Salt Marsh Division	
North American Pacific Coastal Salt Marsh Macrogroup	
Temperate Pacific Tidal Salt and Brackish Meadow Group	
Bolboschoenus maritimus Alliance	**5**
Bolboschoenus maritimus – Sarcocornia pacifica Association*	2
Bolboschoenus maritimus Association	3
Distichlis spicata Alliance	**2**
Distichlis spicata – Frankenia salina – Jaumea carnosa Association	1
Sarcocornia pacifica (Salicornia depressa) Alliance	**11**
Sarcocornia pacifica – Jaumea carnosa – Distichlis spicata Association	1

Description	Sample Size
Sarcocornia pacifica – Lepidium latifolium Association	1
Sarcocornia pacifica Association	8
Spartina foliosa Alliance	**2**
Spartina foliosa Association	2
Hydromorphic Vegetation (Aquatic Vegetation) Formation Class	
Freshwater Aquatic Vegetation Formation Subclass	
Freshwater Aquatic Vegetation Formation	
North American Freshwater Aquatic Vegetation Division	
Western North American Freshwater Aquatic Vegetation Macrogroup	
Temperate Pacific Freshwater Aquatic Bed Group	
Ceratophyllum demersum Provisional Alliance*	**1**
Ceratophyllum demersum Western Provisional Association*	1
Nuphar spp. – *Potamogeton* spp. – *Lemna* spp. Freshwater Aquatic Provisional Alliance*	**3**
Brasenia shreberi Provisional Association*	1
Nuphar lutea ssp. *polysepela* Provisional Association*	2
Temperate Freshwater Floating Mat Group	
Azolla (filiculoides, mexicana) Provisional Alliance	**1**
Naturalized Temperate Pacific Freshwater Vegetation Group	
Ludwigia (hexapetala, peploides) Provisional Semi-Natural Alliance	**3**
Ludwigia (hexapetala, peploides) Provisional Semi-Natural Association*	3
Lithomorphic Vegetation (Nonvascular and Sparse Vascular Rock Vegetation) Formation Class	
Mediterranean, Temperate, and Boreal Nonvascular and Sparse Vegetation Formation Subclass	
Mediterranean Cliff, Scree, and Rock Vegetation Formation	
Mediterranean California Cliff, Scree & Rock Vegetation Division	
California Cliff, Scree, and Other Rock Vegetation Macrogroup	
Central California Coast Ranges Cliff and Canyon Group	
Allium falcifolium – Eriogonum spp. – *Streptanthus* spp. Provisional Alliance*	**7**
Eriogonum luteolum – Streptanthus morrisonii Provisional Association*	7
Selaginella wallacei Alliance	**4**

LITERATURE CITED

Baldwin, B.G, D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti and D.H. Wilken, editors. 2012. The Jepson manual: vascular plants of California, second edition. University of California Press, Berkeley.

Braun-Blanquet, J. 1932. Plant Sociology: The Study of Plant Communities. (Translated by G.D. Fuller and H.S. Conard). McGraw-Hill, New York and London.

Buck, J. and J. Evens. 2010. Classification of Vegetation Associations from the Marin County Open Space District in Marin County, California. California Native Plant Society, Sacramento, CA. Available: http://cnps.org/cnps/vegetation/pdf/marin_co_open_sp-vegreport.pdf

Calveg. 2002. Vegetation Classification & Mapping. USDA Forest Service - Pacific Southwest Region - Remote Sensing Lab. Available: http://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192. Accessed 2012.

Dufrêne, M., and P. Legendre.1997. Species assemblages and indicator species: the need for a flexible asymmetrical approach. Ecological Monographs 67:345-366.

Evens, J. M., and E. Kentner. 2006. Classification of Vegetation Associations from the Mount Tamalpais Watershed, Nicasio Reservoir, and Soulajule Reservior in Marin County, California. California Native Plant Society, Sacramento, CA.
Available: http://cnps.org/cnps/vegetation/pdf/mmwd_vegetation_report_2006_06.pdf

Faber-Langendoen D, Keeler-Wolf T, Meidinger D, Tart D, Hoagland B, Josse C, Navarro G, Ponomarenko S, Saucier J, Weakley A, and Comer P. 2014. EcoVeg: a new approach to vegetation description and classification. Ecological Monographs 84:533–561.

Federal Geographic Data Committee (FGDC). 2008. National Vegetation Classification Standard, Version 2 FGDC-STD-005-2008. Vegetation Subcommittee, FGDC Secretariat, U.S. Geological Survey. Reston, VA. 55 pp. + Appendices.

Jennings M.D., D. Faber-Langendoen, O.L. Loucks, R.K. Peet, and D. Roberts. 2009. Standards for associations and alliances of the US National Vegetation Classification. Ecological Monographs 79:173–199.

McCune, B., and J.B. Grace. 2002. Analysis of ecological communities. MjM Software Design, Glenedon Beach, OR.

McCune, B., and M.J. Mefford. 1997. Multivariate analysis of ecological data. MjM Software. Glenedon Beach, OR.

Miles, S.R., and C.B. Goudey. 1997. Ecological subregions of California. Technical Report R5-EM-TP-005. USDA Forest Service, Pacific Southwest Research Station, San Francisco, CA.

R Core Team. 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Available: http://www.R-project.org/

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evens. 2009. A Manual of California Vegetation, Second Edition. California Native Plant Society, Sacramento. 1300 pp.

Schirokauer, D., T. Keeler-Wolf, J. Meinke, and P. van der Leeden. 2003. Plant Community Classification and Mapping Project Final Report: Point Reyes National Seashore, Golden Gate National Recreation Area, San Francisco Water Department Watershed Lands, Mount Tamalpais, Tomales Bay, and Samuel P. Taylor State Parks.
Available: http://science.nature.nps.gov/im/inventory/veg/project.cfm?ReferenceCode=2165650

USDA NRCS. 2015. The PLANTS Database (http://plants.usda.gov, 4 June 2015). National Plant Data Team, US Department of Agriculture, Natural Resources Conservation Service, Greensboro, NC 27401-4901 USA.

Vegetation Classification and Mapping Program (VegCAMP), California Department of Fish and Wildlife. 2015. Survey of California Vegetation Classification and Mapping Standards. 6/30/2015. Available from: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=102342

APPENDIX A

Combined Vegetation Rapid Assessment and Relevé Field Form

and

Sonoma County Protocol for
Combined Vegetation Rapid Assessment and Relevé Field Form

Combined Vegetation Rapid Assessment and Relevé Field Form

(Revised February 27, 2014 for Sonoma County)

For Office Use Final database #:	Final vegetation type: Alliance_____ Association

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Database #:	Date:	Name of recorder:
SONO		Other surveyors:

Allocation UID: _____ **GPS name:** _____ For Relevé: **Bearing°,** left axis at ID point_____ of **Long / Short** side

UTME ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___ **Zone: 10 NAD83 PDOP**_____

GPS within stand? Yes / No If No, cite from GPS to stand: distance (m) _____ bearing ° _____ inclination ° _____
and record projected UTMs: UTME ____ ____ ____ ____ ____ ____ UTMN ____ ____ ____ ____ ____ ____

Camera Name: **Cardinal photos at ID point:**

2nd point name: **Cardinal photos at 2nd point:**

Other photos:

Stand Size (acres)**: <1, 1-5, >5 | Plot Size (m²): 10 / 100 / 500 / 1000 | Plot Shape** ___ **x**___ m **| RA Radius**____ m

Exposure, Actual °: _____ **NE NW SE SW Flat Variable | Steepness, Actual °:** _____ **0° 1-5° 5-25° > 25**

Topography: Macro: top upper mid lower bottom | Micro: convex flat concave undulating

Geology code: _____ **Soil Texture code:** _____ **| Upland** or **Wetland/Riparian** (circle one)

% Surface cover: (Incl. outcrops) (>60cm diam) (25-60cm) (7.5-25cm) (2mm-7.5cm) (Incl sand, mud)

H20: BA Stems: Litter: Bedrock: Boulder: Stone: Cobble: Gravel: Fines: =100%

% Current year bioturbation _____ **Past bioturbation present? Yes / No | % Hoof punch** _____

Fire evidence: Yes / No (circle one) If yes, describe in Site history section, including date of fire, if known.

Site history, stand age, comments:

Disturbance code / Intensity (L,M,H): _____/____ _____/____ _____/____ _____/____ _____/____ **"Other"** _____ / ____

II. HABITAT DESCRIPTION

Tree DBH : T1 (<1" dbh), **T2** (1-6" dbh), **T3** (6-11" dbh), **T4** (11-24" dbh), **T5** (>24" dbh), **T6** multi-layered (T3 or T4 layer under T5, >60% cover)

Shrub: S1 seedling (<3 yr. old), **S2** young (<1% dead), **S3** mature (1-25% dead), **S4** decadent (>25% dead)

Herbaceous: H1 (<12" plant ht.), **H2** (>12" ht.)

III. INTERPRETATION OF STAND

Field-assessed vegetation alliance name: _____

Field-assessed association name (optional): _____

Adjacent alliances/direction: _____/_____, _____/_____

Confidence in alliance identification: L M H Explain: _____

Phenology (E,P,L**): Herb Shrub Tree Other identification or mapping information:**

Combined Vegetation Rapid Assessment and Relevé Field Form

(Revised February 27, 2014 for Sonoma County)

Database #: _____ SPECIES SHEET

IV. VEGETATION DESCRIPTION

% NonVasc cover:____ Total % Vasc Veg cover:_____

% Cover - Conifer tree / Hardwood tree: _____/_____ Regenerating Tree: _____ Shrub: _____ Herbaceous: _____

Height Class - Conifer tree / Hardwood tree: _____/_____ Regenerating Tree: _____ Shrub: _____ Herbaceous: _____

Height classes: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

Stratum categories: T=Tree, S = Shrub, H= Herb, E = SEedling, A = SApling, N= Non-vascular/ **For relevés**: r=trace, + = <1%

Strata	Species	% cover	C	Final species determination

Unusual species: _____

SONOMA COUNTY PROTOCOL FOR COMBINED VEGETATION RAPID ASSESSMENT AND RELEVÉ SAMPLING FIELD FORM

(April 24, 2014)

Introduction

This protocol describes the methodology for both the relevé and rapid assessment vegetation sampling techniques as recorded in the combined relevé and rapid assessment field survey form for the Sonoma County Project. The same environmental data are collected for both techniques. However, the relevé sample is plot-based, with each species in the plot and its cover being recorded. The rapid assessment sample is not based on a plot, but for this project is based on a visually estimated circular area within a representative portion of the entire stand, with up to 20 of the dominant or characteristic species and their cover values recorded. For more background on the relevé and rapid assessment sampling methods, see the relevé and rapid assessment protocols at www.cnps.org.

For this project, we collect relevés at allocated sample locations and opportunistic rapid assessments in woody vegetation and opportunistic relevés in herbaceous vegetation.

During the initial (2013) field season, it became apparent that some of our sampling techniques were very time-consuming, reducing the efficiency of data collection, while not increasing the quality of the data collected. For that reason, several changes were made to the processes documented below. We are no longer performing plot-based relevés on woodland or shrub stands; these are now stand-based rapid assessments. Relevés are collected on herbaceous stands. For relevés at allocated points, we continue to take GPS points at all four corners and take two sets of photos in the cardinal directions. For opportunistic relevés, only a single GPS point and one set of cardinal-direction photos are taken. Plot location maps are not drawn for any surveys.

Defining a Stand:

A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small, such as a portion of a vernal pool, and some may be several square kilometers in size, such as forest types. All samples must be in stands that meet the minimum mapping unit of 1 acre for upland and 0.5 acre for special stands such as small wetlands, riparian and serpentine barrens.

A stand is defined by two main unifying characteristics:

1) 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 indistinct.
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, 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 structural and compositional features of a stand are often combined into a term called homogeneity. For an area of vegetated ground to meet the requirements of a stand, it must be homogeneous (uniform in structure and composition throughout).

Selecting a bounded plot (Relevé) or unbounded area (Rapid Assessment) to sample within a stand:

In all cases, determine if what you are going to sample is needed based on target sample size by referring to the alliance tracking sheet.

Because many stands are large, it may be difficult to summarize the species composition, cover, and structure of an entire stand. We are also usually trying to capture the most information as efficiently as possible. Thus, we are typically forced to select a representative portion to sample.

When sampling a stand of vegetation, the main point is to select a sample that, in as many ways possible, is representative of that stand. This means that you are not randomly selecting a plot; on the contrary, you are actively using your own best judgment to find a representative example of the stand.

Selecting a plot requires that you see enough of the stand you are sampling to feel comfortable in choosing a representative plot location. Take a brief walk through the stand and look for variations in species composition and in stand structure. In many cases in hilly or mountainous terrain look for a vantage point from which you can get a representative view of the whole stand. Variations in vegetation that are repeated throughout the stand should be included in your plot. Once you assess the variation within the stand, attempt to find an area that captures the stand's common species composition and structural condition to sample.

In rapid assessments, you will collect data based on a visually estimated circular area with a minimum radius of 20 meters. If the shape of a stand is constrained as in a narrow riparian stringer or meadow, the dimensions of the focused assessment area may only approximate the maximum width of the stand (*e.g.,* only 5 or 10 m radius circle).

Selecting plots to avoid spatial autocorrelation:

When possible, do not sample adjacent stands. Do not sample vegetation types of the same type within the same sub-watershed. Exceptions can be made due to limited access to private lands.

Determining Plot Location for Allocated (GRTS) Points:

For all plots related to allocated points, you may adjust the orientation and dimensions of the plot to incorporate the best approximation of stand homogeneity as long as the nearest portion of the plot is no more than 50 m away from the allocated GRTS point.

Navigate to the GPS point.

If the point is in the allocated type (as indicated in the UID name), then find a homogeneous, representative area of the allocated type in which to set up a plot.

If the point is on a boundary of one or more types that you need, then determine if any of the types are the allocated type. If so, proceed to sample the allocated type. If not, choose to sample a type that most closely matches the allocated type (*e.g.,* group, life form).

If no needed types are within 50 meters, the point is labeled "unusable" using your gps unit. You may be able to do an opportunistic rapid assessment or herbaceous relevé if a needed type is outside of the 50 meter limit. You may also do a recon.

Plot Size:

For this project, relevé plot sizes are as follows:

Herbaceous communities: 100 m^2
Special herbaceous communities, such as vernal pools, fens: 10 m^2
Shrublands, riparian forest/woodland, upland forest/woodland communities: 500 m^2

Plot Shape:

A relevé has no fixed shape, though plot shape should reflect the character of the stand and are either squares or rectangles. Adjust the orientation and dimensions of the plot to incorporate the best approximation of stand homogeneity. If the stand is about the same size as a relevé, the plot boundaries may be similar to that of the entire stand. If we are sampling streamside riparian or other linear communities, our plot dimensions should not go beyond the community's natural ecological boundaries. Thus, a relatively long, narrow plot capturing the vegetation within the stand, but not outside it would be appropriate. Species present along the edges of the plot that are clearly part of the adjacent stand should be excluded from the plot.

Location of GPS Points:

For relevés for allocated points, one corner will be considered the plot Identifier Point and should be in the SW corner, if possible. This point will be associated with the SONOXXXX number from a series of provided numbered stickers. Points should be taken at all four corners, if possible. Other corners are numbered SONOXXXXa, SONOXXXXXb, SONOXXXXXc in a clockwise direction from the identifier point. For opportunistic points, only one GPS point is needed and it should be located in the SW corner if possible. If it is taken in another corner, this should be noted in the Site history section.

For rapid assessment, the point should be taken at the center of the assessed circular area.

Definitions of fields in the protocol

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Database #: Place a SONOXXXX sticker in this field for all relevé (including allocated and opportunistic plots) and rapid assessments. Use the sticker number in the GPS Waypoint ID field.

Date: Date of the sampling.

Name of recorder: The full name of the recorder should be provided for the first field form for the day. On successive forms, initials can be recorded.

Other Surveyors: The full names of each person assisting should be provided for the first field form for the day. On successive forms, initials of each person assisting can be recorded.

Allocation UID: Indicate the allocation point UID found on the GPS Unit or paper map.

GPS name: The name/number assigned to each GPS unit. This can be the serial number if another number is not assigned.

Bearing°, left axis at ID point of Long / Short side: Fill this in for relevés only. For square or rectangular plots: from the Identifier Point corner, looking towards the plot, record the bearing of the axis to your left. If the plot is a rectangle, indicate whether the left side of the plot is the long or short side of the rectangle by circling "long" or "short" side (no need to circle anything for square plots). If there are no stand constraints, set up the plot with boundaries running in the cardinal directions and place the Identifier Point in the SW corner.

UTM coordinates: Easting (UTME) and northing (UTMN) location coordinates using the Universal Transverse Mercator (UTM) grid. Record the information from your GPS unit. These coordinates are always the base point of the survey. Soil samples and photos are taken from this point, and exposure, steepness, topography, etc. are measured here. If the GPS is not within the stand (ie: the point is projected), these are the UTMs of the base point.

For relevé plots, take the waypoint in the southwest corner of the plot whenever possible or in the center of a circular plot.

PDOP: Record the PDOP from the GPS unit.

Is GPS within stand? Yes / No Circle"Yes" to denote that the GPS waypoint was taken directly within or at the edge of the stand being assessed for a rapid assessment, or circle "No" if the waypoint was taken at a distance from the stand (such as with a binocular view of the stand). If the point is taken at the edge of the stand, note the direction to the stand.

If No, cite from GPS to stand: distance (m), bearing°, inclination°: From the base GPS point, measure the distance to the projected point using a range finder. Record the compass bearing from the base point to the projected point; record the inclination if the base and projected points are not at the same elevation.

and record projected UTMs: These are the coordinates of the projected point, or the point being surveyed. They are generated in the field if the GPS units have the ability to calculate projected points. If the GPS unit does not have this capability, make a note to that effect and leave these fields blank.

Camera Name: Write the camera name.

Cardinal photos at ID point: Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the Identifier Point and record the jpeg numbers here. Try to include the horizon in at least some of these photos. If this is a distance survey to a projected point, take the four cardinal photos at the base point and at least one photo of the stand.

2nd Point name: If this is a relevé associated with an allocated point, take four more photos in the cardinal directions from at least one of the other corner points. Choose the other corner(s) based on the best location to capture stand vegetation and the location of the plot for future relocation. Record the SONOXXXXy, where "y" is the corner letter a, b or c as counted clockwise from the Identifier Point.

Cardinal photos at 2nd Point: Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north from the 2nd point and record the jpeg numbers here. Try to include the horizon in at least some of these photos.

Other photos: This may include cardinal photos at additional corners or other relevant photos. Notes regarding photo locations or subjects can go here.

Stand Size: Estimate the size of the entire stand in which the sample is taken. As a measure, one acre is about 4000 square meters (approximately 64 x 64 m), or 208 feet by 208 feet. One acre is similar in size to a football field.

Plot Size: If this is a relevé, circle the size of the plot.

Plot Shape: Record the length and width of the plot in meters.

RA Radius: Enter radius of visually estimated sample area for rapid assessments (should be a 20 meter radius minimum)

Exposure: (Enter actual º and circle general category): While facing in the general downhill direction, read degrees of the compass for the aspect or the direction you are standing, using degrees from north, adjusted for declination. Average the reading over the entire stand, even if you are sampling a relevé plot, since your plot is representative of the stand. If estimating the exposure, write "N/A" for the actual

degrees, and circle the general category chosen. "Variable" may be selected if the same, homogenous stand of vegetation occurs across a varied range of slope exposures.

Steepness: (Enter actual º and circle general category): Read degree slope from your compass. If estimating, write "N/A" for the actual degrees, and circle the general category chosen. Make sure to average the reading across the entire stand even if you are sampling in a relevé plot.

Topography: First assess the broad (**Macro**) topographic feature or general position of the stand in the surrounding watershed, that is, the stand is at the top, upper (1/3 of slope), middle (1/3 of slope), lower (1/3 of slope), or bottom. **Circle *all* of the positions that apply for macrotopography.**

Then assess the local (**Micro**) topographic features or the lay of the area (*e.g.,* surface is flat or concave). **Circle only *one* of the microtopographic descriptors**.

Geology code: Geological parent material of site. If exact type is unknown, use a more general category (*e.g.,* igneous, metamorphic, sedimentary). *See code list for types*.

Soil Texture code: Record soil texture that is characteristic of the site (*e.g.,* coarse loamy sand, sandy clay loam). *See soil texture key and code list for types.*

Upland or Wetland/Riparian : Indicate if the stand is in upland or a wetland/riparian. (Wetland and riparian are one category.) Note that a site need not be officially delineated as a wetland to qualify as such in this context (*e.g.,* seasonally wet meadow).

% Surface cover (abiotic substrates). The total should sum to 100%. It is helpful to imagine "mowing off" all of the live vegetation at the base of the plants and removing it – you will be estimating what is left covering the surface. Note that non-vascular cover (lichens, mosses, cryptobiotic crusts) is not estimated in this section.

% Water:	Percent surface cover of running or standing water, ignoring the substrate below the water.
% BA Stems:	Percent surface cover of the basal area of stems at the ground surface. For most vegetation types, BA is 1-3% cover.
% Litter:	Percent surface cover of litter, duff, or wood on the ground.
% Bedrock:	Percent surface cover of bedrock.
% Boulders:	Percent surface cover of rocks > 60 cm in diameter.
% Stone:	Percent surface cover of rocks 25-60 cm in diameter.
% Cobble:	Percent surface cover of rocks 7.5 to 25 cm in diameter.
% Gravel:	Percent surface cover of rocks 2 mm to 7.5 cm in diameter.
% Fines:	Percent surface cover of bare ground and fine sediment (*e.g.,* dirt) < 2 mm in diameter.

% Current year bioturbation: Estimate the percent of the sample or stand exhibiting soil disturbance by any organism that lives underground. Do not include disturbance by ungulates. Note that this is a separate estimation from surface cover.

Past bioturbation present? Circle Yes if there is evidence of bioturbation from previous years.

% Hoof punch: Note the percent of the sample or stand surface that has been punched down by hooves (cattle or native grazers) in wet soil.

Fire Evidence: Circle Yes if there is visible evidence of fire, and note the type of evidence in the "Site history, stand age and comments section," for example, "charred dead stems of *Quercus berberidifolia* extending 2 feet above resprouting shrubs." If you are certain of the year of the fire, put this in the Site history section.

Site history, stand age, and comments: Briefly describe the stand age/seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors, such as distribution of species. Examples of disturbance history: fire, landslides, avalanching, drought, flood, animal burrowing, or pest outbreak. Also, try to estimate year or frequency of disturbance. Examples of land use: grazing, timber harvest, or mining. Examples of other site factors: exposed rocks, soil with fine-textured sediments, high litter/duff build-up, multi-storied vegetation structure, or other stand dynamics.

Disturbance code / Intensity (L,M,H): List codes for potential or existing impacts on the stability of the plant community. See code list for impacts and definitions of levels of disturbance. Characterize each impact each as **L** (=Light), **M** (=Moderate), or **H** (=Heavy). Disturbance is evaluated on a stand basis.

II. HABITAT AND VEGETATION DESCRIPTION

California Wildlife-Habitat Relationships (CWHR)

For CWHR, identify the size/height class of the stand using the following tree, shrub, and/or herbaceous categories. These categories are based on functional life forms.

Tree DBH: Circle one of the tree size classes provided when the tree canopy closure exceeds 10% of the total cover, or if young tree density indicates imminent tree dominance. Size class is based on the average diameter at breast height (dbh) of each trunk (standard breast height is 4.5ft or 137cm). When marking the main size class, make sure to estimate the mean diameter of all trees over the entire stand, and weight the mean toward the larger tree dbh's. The "**T6 multi-layered**" dbh size class contains a multi-layered tree canopy (with a size class T3 and/or T4 layer growing under a T5 layer and a distinct height separation between the classes) exceeding 60% total cover. Stands in the T6 class need also to contain at least 10% cover of size class 5 (>24" dbh) trees growing over a distinct layer with at least 10% combined cover of trees in size classes 3 or 4 (>11-24" dbh).

Shrub: Circle one of the shrub size classes provided when shrub canopy closure exceeds 10% (except in desert types) by recording which class is predominant in the survey. Shrub size class is based on the average amount of crown decadence (dead standing vegetation on live shrubs when looking across the crowns of the shrubs).

Herb: Circle one of the herb height classes when herbaceous cover exceeds 2% by recording the predominant class in the survey. Note*: This height class is based on the average plant height at maturity, not necessarily at the time of observation.*

INTERPRETATION OF STAND

Field-assessed vegetation alliance name: Enter the name of alliance following the *Manual of California Vegetation, 2nd Edition* (Sawyer, Keeler-Wolf and Evens 2009). Please use scientific nomenclature, *e.g., Quercus agrifolia* forest. An alliance is based on the dominant or diagnostic species of the stand, and is usually of the uppermost and/or dominant height stratum. A dominant species covers the greatest area. A diagnostic species is consistently found in some vegetation types but not others.

The field-assessed alliance name may not exist in the present classification, in which case you can provide a new alliance name in this field. If this is the case, also make sure to state that it is not in the MCV under the explanation for "Confidence in alliance identification."

Field-assessed association name (optional): Enter the name of the species in the alliance and additional dominant/diagnostic species from any strata. In following naming conventions, species in differing strata are separated with a slash, and species in the uppermost stratum are listed first (*e.g., Quercus douglasii/Toxicodendron diversilobum*). Species in the same stratum are separated with a dash (*e.g., Quercus lobata-Quercus douglasii)*.

The field-assessed association name may not exist in the present classification, in which you can provide a new association name in this field.

Adjacent Alliances/direction: Identify other vegetation types that are directly adjacent to the stand being assessed by noting the dominant species (or known type). Also note the distance away in meters from the GPS waypoint and the direction in degrees aspect that the adjacent alliance is found (e.g., *Amsinckia tessellata* / 50m, 360° N *Eriogonum fasciculatum* /100m, 110°).

Confidence in Identification: (L, M, H) With respect to the "field-assessed alliance name," note whether you have L (=Low), M (=Moderate), or H (=High) confidence in the interpretation of this alliance name.

Explain: Please elaborate if your "Confidence in Identification" is low or moderate. Low confidence can occur from such things as a poor view of the stand, an unusual mix of species that does not meet the criteria of any described alliance, or a low confidence in your ability to identify species that are significant members of the stand.

Phenology: Indicate early (E), peak (P) or late (L) phenology for each of the strata. For herbs, this generally indicates if species are in flower and/or fruit and are therefore identifiable. For shrubs and trees, this attribute generally refers to cover, e.g., a tree that is fully leafed out will be considered peak (P) even if it is not in flower. Phenology is useful for cover estimation and species identification issues, and should be elaborated upon in the next field.

Other identification problems or mapping issues: Discuss any further problems with the identification of the assessment or issues that may be of interest to mappers.

Overall Cover of Vegetation

Provide an estimate of cover for the life-form categories below. Record a specific number for the total aerial cover or "bird's-eye view" looking from above for each category, estimating cover for the living plants only. Litter/duff should not be included in these estimates.

The porosity of the vegetation should be taken into consideration when estimating percent foliar cover for all categories below: consider how much of the sky you can see when you are standing under the canopy of a tree, or how much light passes through the canopy of the shrub layer to help you estimate foliar cover.

% NonVasc cover: The total cover of all lichens, bryophytes (mosses, liverworts, hornworts), and cryptogamic crust on substrate surfaces including downed logs, rocks and soil, but not on standing or inclined trees or vertical rock surfaces.

% Vasc Veg cover: The total cover of all vascular vegetation taking into consideration the porosity, or the holes, in the vegetation, and disregarding overlap[1] of the various tree, shrub, and/or herbaceous layers and species.

% Cover by Layer

% Conifer Tree /Hardwood Tree: The total foliar cover (considering porosity) of all live tree species, disregarding overlap[1] of individual trees. Estimate conifer and hardwood covers separately.

Please note: These cover values should not include the coverage of regenerating tree species (i.e., tree seedlings and saplings).

[1] Porosity reduces the total cover of the canopy. Overlapping strata should not be included in the total cover percent; for instance, if a shrub is growing under a tree, only the cover of the tree will be added into the total; the cover of the shrub will be disregarded, except for the amount by which it fills in the porosity of the tree canopy.

% Regenerating Tree: The total foliar cover of seedlings and saplings, disregarding overlap[1] of individual recruits. See seedling and sapling definitions below.

%Shrub: The total foliar cover (considering porosity) of all live shrub species disregarding overlap[1] of individual shrubs.

%Herbaceous: The total cover (considering porosity) of all herbaceous species, disregarding overlap[1] of individual herbs.

Height Class by Layer

Modal height for conifer tree /hardwood tree, shrub, and herbaceous categories: Record an average height value per each category by estimating the mean height for each group. Please use the following height intervals to record a height class: 01 = <1/2 m, 02 = 1/2-1 m, 03 = 1-2 m, 04 = 2-5 m, 05 = 5-10 m, 06 = 10-15 m, 07 = 15-20 m, 08 = 20-35 m, 09 = 35-50 m, 10 => 50 m. Note: *For the herbaceous layer height, this height class is based on the average plant height at the time of observation, as opposed to how this is recorded in the CWHR section (at maturity).*

Species List and Coverage

For rapid assessments, list up to 20 species that are dominant or that are characteristically consistent throughout the stand. These species may or may not be abundant, but they should be constant representatives in the survey. When different layers of vegetation occur in the stand, make sure to list species from each stratum. As a general guide, make sure to list at least 1-2 of the most abundant species per stratum.

For relevés, list all species present in the plot, using the second species list page if necessary.

For both sample types, provide the stratum:

T = Tree. A woody perennial plant that has a single trunk.
S = Shrub. A perennial, woody plant, that is multi-branched and doesn't die back to the ground every year.
H = Herb. An annual or perennial that dies down to ground level every year.
E = SEedling. A tree species clearly of a very young age that is < 1" dbh or has not reached breast height. Applies only to trees propagating from seed; resprouts are not recorded here even if they meet the size requirements.
A = SApling. 1" - <6" dbh and young in age, OR small trees that are <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 >6" dbh, then the re-sprouts would be recorded under the "Tree" stratum.
N = Non-vascular. Includes moss, lichen, liverworts, hornworts, cryptogammic crust, and algae.

Be consistent and don't break up a single species into two separate strata. The only time it would be appropriate to do so is when one or more tree species are regenerating, in which case the Seedling and/or Sapling strata should be recorded for that species. These may be noted on the same line, *e.g.:*

Strata	Species	%Cover	C
T/E/A	Quercus douglasii	40/<1/<1	

If you're unsure of the strata for a species, call it what it is called in the MCV or, as a second choice, the *Jepson Manual*.

Note: *Quercus wislizeni* tree vs. shrub. *Quercus wislizeni* occurs in two genetically distinct subspecies, var. *wislizeni* which is the tree form, and var. *frutescens* which is the shrub form. Both subspecies occur in the Sonoma county study area. When the tree has been burned or cut, it will resprout from the base and takes on a shrubby form, although it is still genetically the tree variety. For this project, *Quercus wislizeni* in the shrub form will be recorded as follows:

- If there is evidence of fire and there are dead, burned *Q. wislizeni* tree snags present, report the shrubby *Q. wislizeni* as resprouting trees.
- If there is no evidence of the tree form having been present at this site, report *Q. wislizeni* shrubs.

C: If a species collection is made, it should be indicated in the collection column with a "C" (for collected). If the species is later keyed out, cross out the species name or description and write the keyed species name in pen on the data sheet. Do not erase what was written in the field, because this information can be used if specimens get mixed up later. If the specimen is then thrown out, the "C" in the collection column should crossed out. If the specimen is kept but is still not confidently identified, add a "U" to the "C" in the collection column (CU = collected and unconfirmed). In this case the unconfirmed species epithet should be put in parentheses [*e.g., Hordeum (murinum)*]. If the specimen is kept and is confidently identified, add a "C" to the existing "C" in the collection column (CC = Collected and confirmed).

Use *Jepson Manual* nomenclature. Write out the genus and species of the plant. Do not abbreviate except for dominant species that do not have ambiguous codes. If you aren't sure there aren't duplicate codes, don't use a code. When uncertain of an identification (which you intend to confirm later) use parentheses to indicate what part of the determination needs to be confirmed. For example, you could write out *Brassica* (*nigra*) if you are sure it is a *Brassica* but you need further clarification on the specific epithet.

Provide the % absolute foliar cover for each species listed considering porosity. When estimating, it is often helpful to think of coverage in terms of the following cover intervals at first:

<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%.

Keeping these classes in mind, then refine your estimate to a specific percentage. All species percent covers may total over 100% because of overlap.

Include the percent cover of snags (standing dead) of trees and shrubs. Use the code "SNAG." Note their species, if known, in the "Species" column (i.e., SNAG – Quercus wislizeni).

For rapid assessments, make sure that the major non-native species occurring in the stand also are listed in the space provided in the species list with their strata and % cover. For relevés, all non-native species should be included in the species list.

Also for relevés, record the <1% cover in one of two categories: r = trace (i.e., rare in plot, or solitary individuals) and + = <1% (few individuals at < 1% cover, but common in the plot).

Unusual species: List species that are locally or regionally rare, endangered, or atypical (*e.g.,* range extension or range limit) within the stand. This field will be useful to the Program for obtaining data on regionally or locally significant populations of plants.

Plot Location Map*:

Database #: Put the SONOXXXX number here.

Plot dimensions: Indicate plot dimensions in meters.

Bearing of left axis at ID point: Again, for square or rectangular plots, from the Identifier Point corner looking towards the plot, record the bearing in degrees of the axis to your left.

Plot grid: Circle the scale at which your map of the plot is drawn or indicate a custom scale.

North arrow: insert a north arrow for your drawing in the circle at the lower left in the grid.

Plot map: Draw the bounds of your plot to scale. Indicate which corner the Identifier Point was taken with "IP." Draw any features in or around the plot that could help relocate the plot, for example, large boulders, trails, identifying trees, or large patches of shrubs.

Location Description

Directions to plot, plot location description: Note the trails or roads used to access the plot and any other information that could be useful to help relocate the plot. Include proximity to roads or streams, cliffs, etc. and explain here what prevented you from taking GPS points at all four corners if applicable.

* This map page was used for a small number of plots at the beginning of the first sampling season, but was discontinued due to time constraints.

APPENDIX B

Reconnaissance Field Form

RECON FIELD FORM – SONOMA (July 30, 2013)

Date: | **Surveyors (circle recorder):** | **Return?** ☐

Waypoint ID:

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

Base UTMs / projected UTMs (circle one)

UTME ___ ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/-

Camera/Photos:

Field alliance name:

Comments:

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

Date: | **Surveyors (circle recorder):** | **Return?** ☐

Waypoint ID:

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

Base UTMs / projected UTMs (circle one)

UTME ___ ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/-

Camera/Photos:

Field alliance name:

Comments:

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

Date: | **Surveyors (circle recorder):** | **Return?** ☐

Waypoint ID:

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

Base UTMs / projected UTMs (circle one)

UTME ___ ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/-

Camera/Photos:

Field alliance name:

Comments:

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

APPENDIX C

Plant Taxa Included in Sonoma Vegetation Surveys

A total of 1210 plant taxa were recorded in the 1432 field surveys considered in this classification project. All species are listed here; they are grouped by layer and then ordered alphabetically by species name. Codes beginning with "2JM" denote species names derived from *The Jepson Manual, second edition* (Baldwin et al. 2012). Codes for snags or non-vascular categories, such as moss and lichen, have codes beginning with "2" (e.g., 2MOSS, 2SNAG).

Layer	Code	Taxon Name
Non-vascular	2ALGA	Alga
	2CRYPTO	Cryptogammic crust
	2LICHN	Lichen
	2LW	Liverwort
	2MOSS	Moss
Tree	ABGR	*Abies grandis*
	ACMA3	*Acer macrophyllum*
	ACNE2	*Acer negundo*
	AECA	*Aesculus californica*
	ALRH2	*Alnus rhombifolia*
	ALRU2	*Alnus rubra*
	ARME	*Arbutus menziesii*
	CORNU	*Cornus*
	EUCAL	*Eucalyptus*
	EUGL	*Eucalyptus globulus*
	FRLA	*Fraxinus latifolia*
	HEMA21	*Hesperocyparis macnabiana*
	HEMA22	*Hesperocyparis macrocarpa*
	HEPI11	*Hesperocyparis pigmaea*
	HESA17	*Hesperocyparis sargentii*
	JUGLA	*Juglans*
	JUHI	*Juglans hindsii*
	JURE80	*Juglans regia*
	NODE3	*Notholithocarpus densiflorus*
	PINUS	*Pinus*
	PIAT	*Pinus attenuata*
	PILA	*Pinus lambertiana*
	PIMU	*Pinus muricata*
	PIPO	*Pinus ponderosa*
	PIRA2	*Pinus radiata*
	PISA2	*Pinus sabiniana*
	POFR2	*Populus fremontii*
	PRUNU	*Prunus*
	PRCE2	*Prunus cerasifera*

Layer	Code	Taxon Name
Tree	PSME	*Pseudotsuga menziesii*
	PYRUS	*Pyrus*
	QUERC	*Quercus*
	QUEP	*Quercus ×eplingii*
	QUMO2	*Quercus ×moreha*
	QUAG	*Quercus agrifolia*
	QUCH2	*Quercus chrysolepis*
	QUDO	*Quercus douglasii*
	QUGA4	*Quercus garryana*
	QUKE	*Quercus kelloggii*
	QULO	*Quercus lobata*
	QUPAS2	*Quercus parvula* var. *shrevei*
	QUWI2	*Quercus wislizeni*
	SALIX	*Salix*
	SALA3	*Salix laevigata*
	SALUL	*Salix lucida* ssp. *lasiandra*
	SESE3	*Sequoia sempervirens*
	SEGI2	*Sequoiadendron giganteum*
	2SNAG	Standing snag
	TOCA	*Torreya californica*
	TSHE	*Tsuga heterophylla*
	UMCA	*Umbellularia californica*
Shrub	ADFA	*Adenostoma fasciculatum*
	AMAL2	*Amelanchier alnifolia*
	AMCA5	*Amorpha californica*
	ARCTO3	*Arctostaphylos*
	ARBA4	*Arctostaphylos bakeri*
	ARBAB	*Arctostaphylos bakeri* ssp. *bakeri*
	ARBAS	*Arctostaphylos bakeri* ssp. *sublaevis*
	ARCA5	*Arctostaphylos canescens*
	ARCAC7	*Arctostaphylos canescens* ssp. *canescens*
	ARCO3	*Arctostaphylos columbiana*
	ARGL3	*Arctostaphylos glandulosa*
	ARGLG3	*Arctostaphylos glandulosa* ssp. *glandulosa*
	ARHI5	*Arctostaphylos hispidula*
	ARMA	*Arctostaphylos manzanita*
	ARMAG	*Arctostaphylos manzanita* ssp. *glaucescens*
	ARMAM2	*Arctostaphylos manzanita* ssp. *manzanita*
	ARNU3	*Arctostaphylos nummularia*
	ARST	*Arctostaphylos stanfordiana*
	ARSTD4	*Arctostaphylos stanfordiana* ssp. *decumbens*
	ARSTR	*Arctostaphylos stanfordiana* ssp. *raichei*
	ARSTS	*Arctostaphylos stanfordiana* ssp. *stanfordiana*

Layer	Code	Taxon Name
Shrub	ARVI4	*Arctostaphylos viscida*
	ARVIP2	*Arctostaphylos viscida* ssp. *pulchella*
	ARCA10	*Aristolochia californica*
	ARCA11	*Artemisia californica*
	BACCH	*Baccharis*
	BAPI	*Baccharis pilularis*
	BASA4	*Baccharis salicifolia*
	BRCA3	*Brickellia californica*
	CAOC5	*Calycanthus occidentalis*
	CEANO	*Ceanothus*
	CECO6	*Ceanothus confusus*
	CECU	*Ceanothus cuneatus*
	CEFO	*Ceanothus foliosus*
	CEFOF3	*Ceanothus foliosus* var. *foliosus*
	CEGLE	*Ceanothus gloriosus* var. *exaltatus*
	CEGR2	*Ceanothus griseus*
	CEIN	*Ceanothus incanus*
	CEIN3	*Ceanothus integerrimus*
	CEJE	*Ceanothus jepsonii*
	CELE2	*Ceanothus leucodermis*
	CEOL	*Ceanothus oliganthus*
	CEPA3	*Ceanothus parryi*
	CEPU2	*Ceanothus purpureus*
	CESO	*Ceanothus sonomensis*
	CESO2	*Ceanothus sorediatus*
	CETH	*Ceanothus thyrsiflorus*
	CERCO	*Cercocarpus*
	CEMOG	*Cercocarpus montanus* var. *glaber*
	CHAL7	*Chenopodium album*
	CHCHM	*Chrysolepis chrysophylla* var. *minor*
	CIIN80	*Cistus incanus*
	CLEMA	*Clematis*
	CLLA3	*Clematis lasiantha*
	CONU4	*Cornus nuttallii*
	COSE16	*Cornus sericea*
	COCOC	*Corylus cornuta* var. *californica*
	COTON	*Cotoneaster*
	COLA18	*Cotoneaster lacteus*
	COPA14	*Cotoneaster pannosus*
	CRATA	*Crataegus*
	CRDO2	*Crataegus douglasii*
	CYSC4	*Cytisus scoparius*
	DERI	*Dendromecon rigida*

Layer	Code	Taxon Name
Shrub	DIAU	*Diplacus aurantiacus* ssp. *aurantiacus*
	ERICA2	*Ericameria*
	ERAR27	*Ericameria arborescens*
	ERER11	*Ericameria ericoides*
	ERIOD	*Eriodictyon*
	ERCA6	*Eriodictyon californicum*
	ERIOG	*Eriogonum*
	ERST9	*Eriophyllum stoechadifolium*
	EUOCO	*Euonymus occidentalis* var. *occidentalis*
	FICA	*Ficus carica*
	FRANG	*Frangula*
	FRCA12	*Frangula californica*
	FRCAC5	*Frangula californica* ssp. *californica*
	FRCAT2	*Frangula californica* ssp. *tomentella*
	FRPU7	*Frangula purshiana*
	GARRY	*Garrya*
	GACO9	*Garrya congdonii*
	GAEL	*Garrya elliptica*
	GAFR	*Garrya fremontii*
	GAULT	*Gaultheria*
	GASH	*Gaultheria shallon*
	GENIS	*Genista*
	GEMO2	*Genista monspessulana*
	HEHE	*Hedera helix*
	HETER5	*Heteromeles*
	HEAR5	*Heteromeles arbutifolia*
	HOLOD	*Holodiscus*
	HODI	*Holodiscus discolor*
	2JMHODUC	*Holodiscus dumosus* var. *cedrorum*
	ILAQ80	*Ilex aquifolium*
	KECO2	*Keckiella corymbosa*
	KELE	*Keckiella lemmonii*
	LEGL	*Ledum glandulosum*
	LEPEC	*Lepechinia*
	LONIC	*Lonicera*
	LOHI2	*Lonicera hispidula*
	LOIN4	*Lonicera interrupta*
	LOINL	*Lonicera involucrata* var. *ledebourii*
	LOJA	*Lonicera japonica*
	LOTUS	*Lotus*
	LOSC2	*Lotus scoparius*
	LUPIN	*Lupinus*
	LUAL4	*Lupinus albifrons*

Layer	Code	Taxon Name
Shrub	LUAR	*Lupinus arboreus*
	LUCH	*Lupinus chamissonis*
	MAPIP2	*Mahonia pinnata* ssp. *pinnata*
	MOCA6	*Morella californica*
	PARTH3	*Parthenocissus*
	PHORA	*Phoradendron*
	PHDE14	*Phoradendron densum*
	PHMA18	*Phoradendron macrophyllum*
	PHVI9	*Phoradendron villosum*
	PHYSO	*Physocarpus*
	PHCA11	*Physocarpus capitatus*
	PIMOM	*Pickeringia montana* var. *montana*
	QUERC	*Quercus*
	QUBE5	*Quercus berberidifolia*
	QUDU4	*Quercus durata*
	QUWIF	*Quercus wislizeni* var. *frutescens*
	RHCR	*Rhamnus crocea*
	RHIL	*Rhamnus ilicifolia*
	RHMA3	*Rhododendron macrophyllum*
	RHOC	*Rhododendron occidentale*
	RIBES	*Ribes*
	RICA	*Ribes californicum*
	RIDIP2	*Ribes divaricatum* var. *pubiflorum*
	RIME	*Ribes menziesii*
	RISA	*Ribes sanguineum*
	ROSA5	*Rosa*
	ROCA2	*Rosa californica*
	ROGY	*Rosa gymnocarpa*
	RORU82	*Rosa rubiginosa*
	RUBUS	*Rubus*
	RUAR9	*Rubus armeniacus*
	RULE	*Rubus leucodermis*
	RUPA	*Rubus parviflorus*
	RUSP	*Rubus spectabilis*
	RUUR	*Rubus ursinus*
	SALIX	*Salix*
	SABR2	*Salix breweri*
	SAEX	*Salix exigua*
	SAHO	*Salix hookeriana*
	SALA6	*Salix lasiolepis*
	SAME2	*Salix melanopsis*
	SASC	*Salix scouleriana*
	SASI2	*Salix sitchensis*

Layer	Code	Taxon Name
Shrub	SAMBU	*Sambucus*
	SANIC5	*Sambucus nigra* ssp. *cerulea*
	SARAR3	*Sambucus racemosa* var. *racemosa*
	2SNAG	Standing snag
	SYMPH	*Symphoricarpos*
	SYAL	*Symphoricarpos albus*
	SYMO	*Symphoricarpos mollis*
	TODI	*Toxicodendron diversilobum*
	VAOV2	*Vaccinium ovatum*
	VAPA	*Vaccinium parvifolium*
	VICA5	*Vitis californica*
Herb	ABLA2	*Abronia latifolia*
	ABUM	*Abronia umbellata*
	ACNO7	*Acaena novae-zelandiae*
	ACPIC2	*Acaena pinnatifida* var. *californica*
	ACHIL	*Achillea*
	ACMI2	*Achillea millefolium*
	ACTR	*Achlys triphylla*
	ACLE8	*Achnatherum lemmonii*
	ACMO2	*Achyrachaena mollis*
	ADBI	*Adenocaulon bicolor*
	ADIAN	*Adiantum*
	ADAL	*Adiantum aleuticum*
	ADCA	*Adiantum capillus-veneris*
	ADJO	*Adiantum jordanii*
	AETR	*Aegilops triuncialis*
	AGOSE	*Agoseris*
	AGAP2	*Agoseris apargioides*
	AGAPA	*Agoseris apargioides* var. *apargioides*
	AGGR	*Agoseris grandiflora*
	AGHE2	*Agoseris heterophylla*
	AGROS2	*Agrostis*
	AGAV	*Agrostis avenacea*
	AGBL	*Agrostis blasdalei*
	AGCA5	*Agrostis capillaris*
	AGDE7	*Agrostis densiflora*
	AGEX	*Agrostis exarata*
	AGHA2	*Agrostis hallii*
	AGOR	*Agrostis oregonensis*
	AGPA8	*Agrostis pallens*
	AGST2	*Agrostis stolonifera*
	AIRA	*Aira*
	AICA	*Aira caryophyllea*

Layer	Code	Taxon Name
Herb	AIPR	*Aira praecox*
	ALISM	*Alisma*
	ALLA2	*Alisma lanceolatum*
	ALLIU	*Allium*
	ALDI2	*Allium dichlamydeum*
	ALFA3	*Allium falcifolium*
	ALSA2	*Allium sativum*
	ALGE2	*Alopecurus geniculatus*
	ALPR3	*Alopecurus pratensis*
	AMCH4	*Ambrosia chamissonis*
	AMCO	*Ammannia coccinea*
	AMAR4	*Ammophila arenaria*
	AMSIN	*Amsinckia*
	AMLY	*Amsinckia lycopsoides*
	AMMEI2	*Amsinckia menziesii* var. *intermedia*
	AMMEM2	*Amsinckia menziesii* var. *menziesii*
	AMSP3	*Amsinckia spectabilis*
	AMTE3	*Amsinckia tessellata*
	ANAGA	*Anagallis*
	ANAR	*Anagallis arvensis*
	ANMI4	*Anagallis minima*
	ANMA	*Anaphalis margaritacea*
	ANFI3	*Ancistrocarphus filagineus*
	ANGEL	*Angelica*
	ANHE	*Angelica hendersonii*
	ANTO	*Angelica tomentosa*
	ANCO2	*Anthemis cotula*
	ANTHO	*Anthoxanthum*
	ANAR7	*Anthoxanthum aristatum*
	ANOD	*Anthoxanthum odoratum*
	ANTHR	*Anthriscus*
	ANCA14	*Anthriscus caucalis*
	APAR2	*Aphanes arvensis*
	APIUM	*Apium*
	APGR2	*Apium graveolens*
	AQEX	*Aquilegia eximia*
	AQFO	*Aquilegia formosa*
	ARCA2	*Aralia californica*
	AREG	*Argentina egedii*
	AROL	*Aristida oligantha*
	ARIST2	*Aristolochia*
	ARMAC2	*Armeria maritima* ssp. *californica*
	ARDO3	*Artemisia douglasiana*

Layer	Code	Taxon Name
Herb	ARPY3	*Artemisia pycnocephala*
	ARDO4	*Arundo donax*
	ASCA2	*Asarum caudatum*
	ASHA	*Asarum hartwegii*
	ASSO	*Asclepias solanoana*
	ASPID2	*Aspidotis*
	ASCA5	*Aspidotis californica*
	ASDE6	*Aspidotis densa*
	ASGA	*Astragalus gambelianus*
	ATFI	*Athyrium filix-femina*
	ATPU	*Athysanus pusillus*
	ATRIP	*Atriplex*
	ATPR	*Atriplex prostrata*
	ATSE	*Atriplex semibaccata*
	AVENA	*Avena*
	AVBA	*Avena barbata*
	AVFA	*Avena fatua*
	AZOLL	*Azolla*
	AZFI	*Azolla filiculoides*
	BADO	*Baccharis douglasii*
	BAOR	*Barbarea orthoceras*
	BESY	*Beckmannia syzigachne*
	BETR	*Bellardia trixago*
	BEPE2	*Bellis perennis*
	BETE	*Bergia texana*
	BIFR	*Bidens frondosa*
	BLSP	*Blechnum spicant*
	BOMA7	*Bolboschoenus maritimus*
	BRDI2	*Brachypodium distachyon*
	BRSC	*Brasenia schreberi*
	BRASS2	*Brassica*
	BRNI	*Brassica nigra*
	BRRAR	*Brassica rapa* var. *rapa*
	BRMA	*Briza maxima*
	BRMI2	*Briza minor*
	BRODI	*Brodiaea*
	BRCAL3	*Brodiaea californica* ssp. *leptandra*
	BRCO3	*Brodiaea coronaria*
	BRELE	*Brodiaea elegans* ssp. *elegans*
	BRTET	*Brodiaea terrestris* ssp. *terrestris*
	BROMU	*Bromus*
	BRAR5	*Bromus arvensis*
	BRCA5	*Bromus carinatus*

Layer	Code	Taxon Name
Herb	BRDI3	*Bromus diandrus*
	BRHO2	*Bromus hordeaceus*
	BRLA3	*Bromus laevipes*
	BRMA3	*Bromus madritensis*
	BRMA5	*Bromus maritimus*
	BRRA2	*Bromus racemosus*
	BRTE	*Bromus tectorum*
	BRVU	*Bromus vulgaris*
	CAMA	*Cakile maritima*
	CALAM	*Calamagrostis*
	CANU	*Calamagrostis nutkaensis*
	CAOP2	*Calamagrostis ophitidis*
	CACI2	*Calandrinia ciliata*
	CACR29	*Calliscirpus criniger*
	CALOC	*Calochortus*
	CAAM3	*Calochortus amabilis*
	CALU9	*Calochortus luteus*
	CAMI	*Calochortus minimus*
	CARA16	*Calochortus raichei*
	CAUN	*Calochortus uniflorus*
	CALYC	*Calycadenia*
	CAMU3	*Calycadenia multiglandulosa*
	CAPA6	*Calycadenia pauciflora*
	CABU	*Calypso bulbosa*
	CALYS	*Calystegia*
	CACO35	*Calystegia collina*
	CACOC2	*Calystegia collina* ssp. *collina*
	CAPU18	*Calystegia purpurata*
	CAPUS	*Calystegia purpurata* ssp. *saxicola*
	CASO2	*Calystegia soldanella*
	CASUS2	*Calystegia subacaulis* ssp. *subacaulis*
	CAMIS	*Camissonia*
	CACH13	*Camissonia cheiranthifolia*
	CAMI22	*Camissonia micrantha*
	CAOV4	*Camissonia ovata*
	CACA7	*Campanula californica*
	CARDA	*Cardamine*
	CACA39	*Cardamine californica*
	CAOC	*Cardamine occidentalis*
	CAOL	*Cardamine oligosperma*
	CARA3	*Cardionema ramosissimum*
	CARDU	*Carduus*
	CAPY2	*Carduus pycnocephalus*

Layer	Code	Taxon Name
Herb	CATE2	*Carduus tenuiflorus*
	CAREX	*Carex*
	CAAB2	*Carex abrupta*
	CABA4	*Carex barbarae*
	CABO2	*Carex bolanderi*
	CABR8	*Carex brevicaulis*
	CADE8	*Carex densa*
	CAGL7	*Carex globosa*
	CAGY3	*Carex gynodynama*
	CALE24	*Carex leptopoda*
	CALU6	*Carex luzulifolia*
	CAME5	*Carex mendocinensis*
	CAMU5	*Carex multicaulis*
	CANU5	*Carex nudata*
	CAOB3	*Carex obnupta*
	CAOV8	*Carex ovalis*
	CAPR5	*Carex praegracilis*
	CARO5	*Carex rossii*
	CASE2	*Carex serratodens*
	CASP4	*Carex specifica*
	CASU4	*Carex subbracteata*
	CATU3	*Carex tumulicola*
	CARPO	*Carpobrotus*
	CACH38	*Carpobrotus chilensis*
	CAED3	*Carpobrotus edulis*
	CASTI2	*Castilleja*
	CAAF	*Castilleja affinis*
	CAAFA2	*Castilleja affinis* ssp. *affinis*
	CAAM32	*Castilleja ambigua*
	CAAMA3	*Castilleja ambigua* ssp. *ambigua*
	CAAMI2	*Castilleja ambigua* ssp. *insalutata*
	CAAPM	*Castilleja applegatei* ssp. *martinii*
	CAAT25	*Castilleja attenuata*
	CADED3	*Castilleja densiflora* ssp. *densiflora*
	CAEX14	*Castilleja exserta*
	CARUL	*Castilleja rubicundula* ssp. *lithospermoides*
	CASUF2	*Castilleja subinclusa* ssp. *franciscana*
	CENTA	*Centaurea*
	CECA2	*Centaurea calcitrapa*
	CEME2	*Centaurea melitensis*
	CESO3	*Centaurea solstitialis*
	CENTA2	*Centaurium*
	CEDA	*Centaurium davyi*

Layer	Code	Taxon Name
Herb	CEMU2	*Centaurium muehlenbergii*
	CERAS	*Cerastium*
	CEAR4	*Cerastium arvense*
	CEGL2	*Cerastium glomeratum*
	CEDE4	*Ceratophyllum demersum*
	CHBE4	*Chenopodium berlandieri*
	CHLOR3	*Chlorogalum*
	CHAN2	*Chlorogalum angustifolium*
	CHPO3	*Chlorogalum pomeridianum*
	CHPOD	*Chlorogalum pomeridianum* var. *divaricatum*
	CHPOP4	*Chlorogalum pomeridianum* var. *pomeridianum*
	CHME2	*Chorizanthe membranacea*
	CIQU3	*Cicendia quadrangularis*
	CIIN	*Cichorium intybus*
	CIRSI	*Cirsium*
	CIAR4	*Cirsium arvense*
	CIDO2	*Cirsium douglasii*
	CIOC	*Cirsium occidentale*
	CIQU2	*Cirsium quercetorum*
	CIVU	*Cirsium vulgare*
	CIMA4	*Cistanthe maritima*
	CLARK	*Clarkia*
	CLAMA	*Clarkia amoena* ssp. *amoena*
	CLDA	*Clarkia davyi*
	CLPUQ	*Clarkia purpurea* ssp. *quadrivulnera*
	CLAYT	*Claytonia*
	CLEX2	*Claytonia exigua*
	CLEXE2	*Claytonia exigua* ssp. *exigua*
	CLGY2	*Claytonia gypsophiloides*
	CLPA5	*Claytonia parviflora*
	CLPE	*Claytonia perfoliata*
	CLPEP	*Claytonia perfoliata* ssp. *perfoliata*
	CLDO2	*Clinopodium douglasii*
	CLINT	*Clintonia*
	CLAN2	*Clintonia andrewsiana*
	COLLI	*Collinsia*
	COSP	*Collinsia sparsiflora*
	COLLO	*Collomia*
	CONIU	*Conium*
	COMA2	*Conium maculatum*
	CONVO	*Convolvulus*
	COAR4	*Convolvulus arvensis*
	CONYZ	*Conyza*

Layer	Code	Taxon Name
Herb	COCA5	*Conyza canadensis*
	COMA25	*Corallorhiza maculata*
	COST19	*Corallorhiza striata*
	CORDY	*Cordylanthus*
	COPI2	*Cordylanthus pilosus*
	COTEC	*Cordylanthus tenuis* ssp. *capillaris*
	CORTA	*Cortaderia*
	COJU2	*Cortaderia jubata*
	COSE4	*Cortaderia selloana*
	COTUL	*Cotula*
	COCO7	*Cotula coronopifolia*
	CRASS	*Crassula*
	CRCO34	*Crassula connata*
	CREPI	*Crepis*
	CRSE11	*Croton setigerus*
	CRSC	*Crypsis schoenoides*
	CRYPT	*Cryptantha*
	CRFL4	*Cryptantha flaccida*
	CUSCU	*Cuscuta*
	CUCAB	*Cuscuta californica* var. *breviflora*
	CUPE3	*Cuscuta pentagona*
	CUSA	*Cuscuta salina*
	CUSAM	*Cuscuta salina* var. *major*
	CYDA	*Cynodon dactylon*
	CYGR	*Cynoglossum grande*
	CYNOS2	*Cynosurus*
	CYCR	*Cynosurus cristatus*
	CYEC	*Cynosurus echinatus*
	CYPER	*Cyperus*
	CYER	*Cyperus eragrostis*
	CYNI2	*Cyperus niger*
	CYOD	*Cyperus odoratus*
	CYCA4	*Cypripedium californicum*
	DAGL	*Dactylis glomerata*
	DAAE	*Dactyloctenium aegyptium*
	DANTH	*Danthonia*
	DACA3	*Danthonia californica*
	DAGL2	*Datisca glomerata*
	DACA6	*Daucus carota*
	DAPU3	*Daucus pusillus*
	DEOD	*Delairea odorata*
	DELPH	*Delphinium*
	DENU	*Delphinium nudicaule*

Layer	Code	Taxon Name
Herb	DEBE2	*Deschampsia beringensis*
	DECE	*Deschampsia cespitosa*
	DEDA	*Deschampsia danthonioides*
	DICHE2	*Dichelostemma*
	DICAC5	*Dichelostemma capitatum* ssp. *capitatum*
	DICO19	*Dichelostemma congestum*
	DIDO3	*Dichondra donelliana*
	DIPSA	*Dipsacus*
	DISP	*Distichlis spicata*
	DIGR3	*Dittrichia graveolens*
	DODEC	*Dodecatheon*
	DOHE	*Dodecatheon hendersonii*
	DOCO2	*Downingia concolor*
	DRYOP	*Dryopteris*
	DRAR3	*Dryopteris arguta*
	DUDLE	*Dudleya*
	DUCY	*Dudleya cymosa*
	DUFA	*Dudleya farinosa*
	DYAM	*Dysphania ambrosioides*
	EHER	*Ehrharta erecta*
	ELEOC	*Eleocharis*
	ELAC	*Eleocharis acicularis*
	ELMA5	*Eleocharis macrostachya*
	ELPA3	*Eleocharis palustris*
	ELYMU	*Elymus*
	ELCA10	*Elymus californicus*
	ELEL5	*Elymus elymoides*
	ELELC2	*Elymus elymoides* ssp. *californicus*
	ELGL	*Elymus glaucus*
	ELGLG	*Elymus glaucus* ssp. *glaucus*
	ELGLV	*Elymus glaucus* ssp. *virescens*
	ELMU3	*Elymus multisetus*
	EPILO	*Epilobium*
	EPBR3	*Epilobium brachycarpum*
	EPCA3	*Epilobium canum*
	EPCI	*Epilobium ciliatum*
	EPCIC	*Epilobium ciliatum* ssp. *ciliatum*
	EPCIG	*Epilobium ciliatum* ssp. *glandulosum*
	EPCIW	*Epilobium ciliatum* ssp. *watsonii*
	EPDE4	*Epilobium densiflorum*
	EPFO	*Epilobium foliosum*
	EPMI	*Epilobium minutum*
	EPTO4	*Epilobium torreyi*

Layer	Code	Taxon Name
Herb	EPGI	*Epipactis gigantea*
	EPHE	*Epipactis helleborine*
	EQUIS	*Equisetum*
	EQAR	*Equisetum arvense*
	EQHY	*Equisetum hyemale*
	EQLA	*Equisetum laevigatum*
	EQTEB	*Equisetum telmateia* var. *braunii*
	ERECH	*Erechtites*
	ERGL11	*Erechtites glomeratus*
	ERMI8	*Erechtites minimus*
	ERIGE2	*Erigeron*
	ERGL3	*Erigeron glaucus*
	ERPHP	*Erigeron philadelphicus* var. *philadelphicus*
	ERREA	*Erigeron reductus* var. *angustatus*
	ERSE8	*Erigeron serpentinus*
	ERIOG	*Eriogonum*
	2JMERCE	*Eriogonum cedrorum*
	ERLA5	*Eriogonum latifolium*
	ERLU5	*Eriogonum luteolum*
	ERLUC	*Eriogonum luteolum* var. *caninum*
	ERLUL	*Eriogonum luteolum* var. *luteolum*
	ERNU3	*Eriogonum nudum*
	ERNUA	*Eriogonum nudum* var. *auriculatum*
	ERNUO	*Eriogonum nudum* var. *oblongifolium*
	ERIOP2	*Eriophyllum*
	ERCO25	*Eriophyllum confertiflorum*
	ERLA6	*Eriophyllum lanatum*
	ERLAA3	*Eriophyllum lanatum* var. *arachnoideum*
	ERODI	*Erodium*
	ERBO	*Erodium botrys*
	ERBR14	*Erodium brachycarpum*
	ERCI6	*Erodium cicutarium*
	ERMO7	*Erodium moschatum*
	ERAR11	*Eryngium aristulatum*
	ERAR12	*Eryngium armatum*
	ERFR3	*Erysimum franciscanum*
	ESCA	*Eschscholzia caespitosa*
	ESCA2	*Eschscholzia californica*
	EUPHO	*Euphorbia*
	EULA4	*Euphorbia lathyris*
	EUOB4	*Euphorbia oblongata*
	EUPE6	*Euphorbia peplus*
	EUSP	*Euphorbia spathulata*

Layer	Code	Taxon Name
Herb	EURA11	*Eurybia radulina*
	EUOC4	*Euthamia occidentalis*
	FESTU	*Festuca*
	FEAR3	*Festuca arundinacea*
	FECA	*Festuca californica*
	FEID	*Festuca idahoensis*
	FEOC	*Festuca occidentalis*
	FERU2	*Festuca rubra*
	FOVU	*Foeniculum vulgare*
	FRAGA	*Fragaria*
	FRCH	*Fragaria chiloensis*
	FRVE	*Fragaria vesca*
	FRSA	*Frankenia salina*
	FRITI	*Fritillaria*
	FRAF2	*Fritillaria affinis*
	FRRE	*Fritillaria recurva*
	FUCHS	*Fuchsia*
	GALIU	*Galium*
	GAAP2	*Galium aparine*
	GACAC	*Galium californicum* ssp. *californicum*
	GADI	*Galium divaricatum*
	GAMU4	*Galium murale*
	GANU	*Galium nuttallii*
	GAPA5	*Galium parisiense*
	GAPO	*Galium porrigens*
	GAPOP	*Galium porrigens* var. *porrigens*
	GATRC	*Galium trifidum* ssp. *columbianum*
	GATR3	*Galium triflorum*
	GAPU3	*Gamochaeta purpurea*
	GAUS	*Gamochaeta ustulata*
	GASTR	*Gastridium*
	GAPH2	*Gastridium phleoides*
	GERAN	*Geranium*
	GECA5	*Geranium carolinianum*
	GEDI	*Geranium dissectum*
	GEMO	*Geranium molle*
	GEPO	*Geranium potentilloides*
	GERE	*Geranium retrorsum*
	GILIA	*Gilia*
	GIAC2	*Gilia achilleifolia*
	GIACM	*Gilia achilleifolia* ssp. *multicaulis*
	GICA5	*Gilia capitata*
	GICAT2	*Gilia capitata* ssp. *tomentosa*

Layer	Code	Taxon Name
Herb	GITR2	*Gilia tricolor*
	GISP3	*Githopsis specularioides*
	GNAPH	*Gnaphalium*
	GOODY	*Goodyera*
	GOOB2	*Goodyera oblongifolia*
	GRIND	*Grindelia*
	GRCA	*Grindelia camporum*
	GRHI	*Grindelia hirsutula*
	GRST3	*Grindelia stricta*
	GRSTA2	*Grindelia stricta* var. *angustifolia*
	GRSTP2	*Grindelia stricta* var. *platyphylla*
	HECR2	*Hedypnois cretica*
	HEBI	*Helenium bigelovii*
	HEPU2	*Helenium puberulum*
	HELIA	*Helianthella*
	HESC2	*Helianthemum scoparium*
	HELIA3	*Helianthus*
	HEMIZ	*Hemizonia*
	HECO7	*Hemizonia congesta*
	HECOC2	*Hemizonia congesta* ssp. *congesta*
	HECOL3	*Hemizonia congesta* ssp. *luzulifolia*
	HEMA80	*Heracleum maximum*
	HESPE10	*Hesperevax*
	HESP9	*Hesperevax sparsiflora*
	HESPB	*Hesperevax sparsiflora* var. *brevifolia*
	HESPS2	*Hesperevax sparsiflora* var. *sparsiflora*
	HESPE7	*Hesperolinon*
	HECA11	*Hesperolinon californicum*
	HECO12	*Hesperolinon congestum*
	HEMI9	*Hesperolinon micranthum*
	HESP5	*Hesperolinon spergulinum*
	HEOR2	*Heterotheca oregona*
	HESEB2	*Heterotheca sessiliflora* ssp. *bolanderi*
	HEUCH	*Heuchera*
	HEMI7	*Heuchera micrantha*
	HIERA	*Hieracium*
	HIAL2	*Hieracium albiflorum*
	HIERO	*Hierochloe*
	HIOC	*Hierochloe occidentalis*
	HIVU2	*Hippuris vulgaris*
	HIIN3	*Hirschfeldia incana*
	HOMA4	*Hoita macrostachya*
	HOLCU	*Holcus*

Layer	Code	Taxon Name
Herb	HOLA	*Holcus lanatus*
	HOMO	*Holcus mollis*
	HORDE	*Hordeum*
	HOBR2	*Hordeum brachyantherum*
	HOBRC2	*Hordeum brachyantherum* ssp. *californicum*
	HODE2	*Hordeum depressum*
	HOJU	*Hordeum jubatum*
	HOMAG	*Hordeum marinum* ssp. *gussonianum*
	HOMU	*Hordeum murinum*
	HOMUG	*Hordeum murinum* ssp. *glaucum*
	HOMUL	*Hordeum murinum* ssp. *leporinum*
	HORKE	*Horkelia*
	HYPER	*Hypericum*
	HYAN2	*Hypericum anagalloides*
	HYCA10	*Hypericum calycinum*
	HYCO3	*Hypericum concinnum*
	HYPE	*Hypericum perforatum*
	HYPOC	*Hypochaeris*
	HYGL2	*Hypochaeris glabra*
	HYRA3	*Hypochaeris radicata*
	IRIS	*Iris*
	IRDO	*Iris douglasiana*
	IRFE	*Iris fernaldii*
	IRMA	*Iris macrosiphon*
	IRPS	*Iris pseudacorus*
	IRPU	*Iris purdyi*
	ISNU	*Isoetes nuttallii*
	ISOLE	*Isolepis*
	ISCA6	*Isolepis carinata*
	ISCE	*Isolepis cernua*
	JACA4	*Jaumea carnosa*
	JUNCU	*Juncus*
	JUAR2	*Juncus arcticus*
	JUBO	*Juncus bolanderi*
	JUBU	*Juncus bufonius*
	JUCA5	*Juncus capitatus*
	JUEFP	*Juncus effusus* var. *pacificus*
	JUKE	*Juncus kelloggii*
	JULE	*Juncus lesueurii*
	JUOC2	*Juncus occidentalis*
	JUOX	*Juncus oxymeris*
	JUPA2	*Juncus patens*
	JUPH	*Juncus phaeocephalus*

Layer	Code	Taxon Name
Herb	JUPHP	*Juncus phaeocephalus* var. *paniculatus*
	JUPHP2	*Juncus phaeocephalus* var. *phaeocephalus*
	JUTE	*Juncus tenuis*
	JUXI	*Juncus xiphioides*
	KICKX	*Kickxia*
	KIEL	*Kickxia elatine*
	KOELE	*Koeleria*
	KOMA	*Koeleria macrantha*
	LACTU	*Lactuca*
	LACA	*Lactuca canadensis*
	LASA	*Lactuca saligna*
	LASE	*Lactuca serriola*
	LAOV	*Lagurus ovatus*
	LAAU	*Lamarckia aurea*
	LASTH	*Lasthenia*
	LACA7	*Lasthenia californica*
	LAGL3	*Lasthenia glaberrima*
	LATHY	*Lathyrus*
	LAAN3	*Lathyrus angulatus*
	LAHI2	*Lathyrus hirsutus*
	LAJEC	*Lathyrus jepsonii* ssp. *californicus*
	LALA4	*Lathyrus latifolius*
	LAPA4	*Lathyrus palustris*
	LAVE2	*Lathyrus vestitus*
	LAVEV	*Lathyrus vestitus* ssp. *vestitus*
	LAYIA	*Layia*
	LAPL	*Layia platyglossa*
	LEOR	*Leersia oryzoides*
	LEMNA	*Lemna*
	LEMI3	*Lemna minor*
	LEVA	*Lemna valdiviana*
	LETA	*Leontodon taraxacoides*
	LEPID	*Lepidium*
	LELA2	*Lepidium latifolium*
	LENI	*Lepidium nitidum*
	LEPTO22	*Leptosiphon*
	LEAN19	*Leptosiphon androsaceus*
	LEBI8	*Leptosiphon bicolor*
	LEJE	*Leptosiphon jepsonii*
	LEPA51	*Leptosiphon parviflorus*
	LESSI	*Lessingia*
	LERA3	*Lessingia ramulosa*
	LEYMU	*Leymus*

Layer	Code	Taxon Name
Herb	LEMOM2	*Leymus mollis* ssp. *mollis*
	LEPA12	*Leymus pacificus*
	LETR5	*Leymus triticoides*
	LIAP	*Ligusticum apiifolium*
	LISC4	*Lilaea scilloides*
	LILIU	*Lilium*
	LIPA	*Lilium pardalinum*
	LIPAP5	*Lilium pardalinum* ssp. *pitkinense*
	LINAN2	*Linanthus*
	LIDI2	*Linanthus dichotomus*
	LIMA2	*Linanthus maculatus*
	LINUM	*Linum*
	LIBI5	*Linum bienne*
	LITR4	*Linum trigynum*
	LIUS	*Linum usitatissimum*
	LITHO2	*Lithophragma*
	LIAF	*Lithophragma affine*
	LIHE	*Lithophragma heterophyllum*
	LOCA19	*Logfia californica*
	LOGA2	*Logfia gallica*
	LOPE	*Lolium perenne*
	LOTE2	*Lolium temulentum*
	LOMAT	*Lomatium*
	LOCA5	*Lomatium caruifolium*
	LODA	*Lomatium dasycarpum*
	LODIM	*Lomatium dissectum* var. *multifidum*
	LOMA3	*Lomatium macrocarpum*
	LORE2	*Lomatium repostum*
	LOTR2	*Lomatium triternatum*
	LOUT	*Lomatium utriculatum*
	LOTUS	*Lotus*
	LOAN2	*Lotus angustissimus*
	LOCO6	*Lotus corniculatus*
	LOFO2	*Lotus formosissimus*
	LOGRM	*Lotus grandiflorus* var. *macranthus*
	LOHE	*Lotus heermannii*
	LOHU2	*Lotus humistratus*
	LOMI	*Lotus micranthus*
	LOUNU	*Lotus unifoliolatus* var. *unifoliolatus*
	LOWR2	*Lotus wrangelianus*
	LUDWI	*Ludwigia*
	2JMLUHE	*Ludwigia hexapetala*
	LUPIN	*Lupinus*

Layer	Code	Taxon Name
Herb	LUBI	*Lupinus bicolor*
	LUFOF	*Lupinus formosus* var. *formosus*
	LUNA3	*Lupinus nanus*
	LUVE	*Lupinus versicolor*
	LUZUL	*Luzula*
	LUCO6	*Luzula comosa*
	LYTHR	*Lythrum*
	LYHY3	*Lythrum hyssopifolium*
	MADIA	*Madia*
	MAAN2	*Madia anomala*
	MAEL	*Madia elegans*
	MAEX	*Madia exigua*
	MAGR3	*Madia gracilis*
	MASA	*Madia sativa*
	MAIAN	*Maianthemum*
	MADI	*Maianthemum dilatatum*
	MARA7	*Maianthemum racemosum*
	MAST4	*Maianthemum stellatum*
	MALE3	*Malvella leprosa*
	MARAH	*Marah*
	MAFA3	*Marah fabaceus*
	MAOR3	*Marah oreganus*
	MEDIC	*Medicago*
	MEAR	*Medicago arabica*
	MEPO3	*Medicago polymorpha*
	MELIA	*Melia*
	MELIC	*Melica*
	MEBU	*Melica bulbosa*
	MECA2	*Melica californica*
	MEGE	*Melica geyeri*
	MEHA2	*Melica harfordii*
	MEIM	*Melica imperfecta*
	METO	*Melica torreyana*
	MELIL	*Melilotus*
	MEIN2	*Melilotus indicus*
	MEOF	*Melilotus officinalis*
	MEOF2	*Melissa officinalis*
	MENTH	*Mentha*
	MEAR4	*Mentha arvensis*
	MEPU	*Mentha pulegium*
	MELA2	*Mentzelia laevicaulis*
	MICRO5	*Micropus*
	MICA	*Micropus californicus*

Layer	Code	Taxon Name
Herb	MICRO6	*Microseris*
	MIAC	*Microseris acuminata*
	MIBI	*Microseris bigelovii*
	MIDO	*Microseris douglasii*
	MILI5	*Microseris lindleyi*
	MIGR	*Microsteris gracilis*
	MIPI5	*Mimetanthe pilosa*
	MIMUL	*Mimulus*
	MICA3	*Mimulus cardinalis*
	MIGU	*Mimulus guttatus*
	MINUA	*Minuartia*
	MICA7	*Minuartia californica*
	MIDO3	*Minuartia douglasii*
	MOER	*Moenchia erecta*
	MONAR2	*Monardella*
	MOPU2	*Monardella purpurea*
	MOSH	*Monardella sheltonii*
	MOVI2	*Monardella villosa*
	MOVIV	*Monardella villosa* ssp. *villosa*
	MOVI3	*Monardella viridis*
	MOFO	*Montia fontana*
	MUAN	*Muhlenbergia andina*
	MYOSO	*Myosotis*
	MYDI	*Myosotis discolor*
	MYLA4	*Myosotis latifolia*
	MYAQ2	*Myriophyllum aquaticum*
	NASSE	*Nassella*
	NALE2	*Nassella lepida*
	NAMA7	*Nassella manicata*
	NAPU4	*Nassella pulchra*
	NAOF	*Nasturtium officinale*
	NAVAR	*Navarretia*
	NAIN2	*Navarretia intertexta*
	NASQ	*Navarretia squarrosa*
	NEHE	*Nemophila heterophylla*
	NEME	*Nemophila menziesii*
	NEMEM	*Nemophila menziesii* var. *menziesii*
	NULUP	*Nuphar lutea* ssp. *polysepala*
	OESA	*Oenanthe sarmentosa*
	ORCA2	*Orobanche californica*
	ORFA	*Orobanche fasciculata*
	OSMOR	*Osmorhiza*
	OSBE	*Osmorhiza berteroi*

Layer	Code	Taxon Name
Herb	OXALI	*Oxalis*
	OXALP	*Oxalis albicans* ssp. *pilosa*
	OXCO	*Oxalis corniculata*
	OXOR	*Oxalis oregana*
	PANIC	*Panicum*
	PAAN4	*Panicum antidotale*
	PACA6	*Panicum capillare*
	PAVI3	*Parentucellia viscosa*
	PACA18	*Parnassia californica*
	PAPA8	*Parnassia palustris*
	PASPA2	*Paspalum*
	PEDE	*Pedicularis densiflora*
	PELLA	*Pellaea*
	PEAN2	*Pellaea andromedifolia*
	PEMU	*Pellaea mucronata*
	PEAU3	*Pentachaeta aurea*
	PETR7	*Pentagramma triangularis*
	PERID	*Perideridia*
	PEGA3	*Perideridia gairdneri*
	PEKE	*Perideridia kelloggii*
	PEFRP	*Petasites frigidus* var. *palmatus*
	PETRO	*Petrorhagia*
	PEDU2	*Petrorhagia dubia*
	PENA2	*Petrorhagia nanteuilii*
	PEPR4	*Petrorhagia prolifera*
	PHACE	*Phacelia*
	PHCA	*Phacelia californica*
	PHCO3	*Phacelia corymbosa*
	PHDI	*Phacelia distans*
	PHIM	*Phacelia imbricata*
	PHALA2	*Phalaris*
	PHAQ	*Phalaris aquatica*
	PHAR3	*Phalaris arundinacea*
	PHPA5	*Phalaris paradoxa*
	PHLOX	*Phlox*
	PIEC	*Picris echioides*
	PIPER2	*Piperia*
	PILE3	*Piperia leptopetala*
	PLAGI	*Plagiobothrys*
	PLBR	*Plagiobothrys bracteatus*
	PLCOC	*Plagiobothrys collinus* var. *californicus*
	PLGR	*Plagiobothrys greenei*
	PLNO	*Plagiobothrys nothofulvus*

Layer	Code	Taxon Name
Herb	PLRE	*Plagiobothrys reticulatus*
	PLANT	*Plantago*
	PLCO3	*Plantago coronopus*
	PLEL	*Plantago elongata*
	PLER3	*Plantago erecta*
	PLLA	*Plantago lanceolata*
	PLMA2	*Plantago major*
	PLMA3	*Plantago maritima*
	PLOV	*Plantago ovata*
	PLSU2	*Plantago subnuda*
	PLCA5	*Platystemon californicus*
	PLECT	*Plectritis*
	PLCO4	*Plectritis congesta*
	PLMA4	*Plectritis macrocera*
	PLCA6	*Pleuropogon californicus*
	POA	*Poa*
	POAN	*Poa annua*
	PODO	*Poa douglasii*
	POKE	*Poa kelloggii*
	POPR	*Poa pratensis*
	POSE	*Poa secunda*
	POTR2	*Poa trivialis*
	POUN	*Poa unilateralis*
	POGOG	*Pogogyne*
	PODO2	*Pogogyne douglasii*
	POTET2	*Polycarpon tetraphyllum* ssp. *tetraphyllum*
	POLYG	*Polygala*
	POCA5	*Polygala californica*
	POLYG4	*Polygonum*
	POAME	*Polygonum amphibium* var. *emersum*
	POHY2	*Polygonum hydropiperoides*
	POLA4	*Polygonum lapathifolium*
	POPA7	*Polygonum paronychia*
	POPE2	*Polygonum pensylvanicum*
	POPUP4	*Polygonum punctatum* var. *punctatum*
	POLYP	*Polypodium*
	POCA12	*Polypodium californicum*
	POCA26	*Polypodium calirhiza*
	POGL8	*Polypodium glycyrrhiza*
	POSC4	*Polypodium scouleri*
	POLYP2	*Polypogon*
	POMO5	*Polypogon monspeliensis*
	POLYS	*Polystichum*

Layer	Code	Taxon Name
Herb	POCA25	*Polystichum californicum*
	POMU	*Polystichum munitum*
	PONA4	*Potamogeton natans*
	POTEN	*Potentilla*
	POGL9	*Potentilla glandulosa*
	POGLG4	*Potentilla glandulosa* ssp. *glandulosa*
	PROSA	*Prosartes*
	PRHO2	*Prosartes hookeri*
	PRSM	*Prosartes smithii*
	PRUNE	*Prunella*
	PRVU	*Prunella vulgaris*
	PRVUL2	*Prunella vulgaris* ssp. *lanceolata*
	PSEUD43	*Pseudognaphalium*
	PSCA13	*Pseudognaphalium californicum*
	PSCAB	*Pseudognaphalium canescens* ssp. *beneolens*
	PSLU6	*Pseudognaphalium luteoalbum*
	PSRA5	*Pseudognaphalium ramosissimum*
	PSST7	*Pseudognaphalium stramineum*
	PTERI	*Pteridium*
	PTAQP2	*Pteridium aquilinum* var. *pubescens*
	PTDR	*Pterostegia drymarioides*
	PTTEC2	*Pteryxia terebinthina* var. *californica*
	PYROL	*Pyrola*
	PYPI2	*Pyrola picta*
	RACA	*Rafinesquia californica*
	RANUN	*Ranunculus*
	RAAR3	*Ranunculus arvensis*
	RACA2	*Ranunculus californicus*
	RAHE	*Ranunculus hebecarpus*
	RAMU2	*Ranunculus muricatus*
	RAOC	*Ranunculus occidentalis*
	RAOR3	*Ranunculus orthorhynchus*
	RARE3	*Ranunculus repens*
	RAPHA	*Raphanus*
	RARA2	*Raphanus raphanistrum*
	RASA2	*Raphanus sativus*
	RILE2	*Rigiopappus leptocladus*
	RORO	*Romulea rosea*
	RORIP	*Rorippa*
	RUMEX	*Rumex*
	RUAC3	*Rumex acetosella*
	RUCO2	*Rumex conglomeratus*
	RUCR	*Rumex crispus*

Layer	Code	Taxon Name
Herb	RUPU3	*Rumex pulcher*
	RYPI	*Rytidosperma pilosum*
	SAGIN	*Sagina*
	SAAP	*Sagina apetala*
	SATR12	*Salsola tragus*
	SALVI	*Salvia*
	SASO	*Salvia sonomensis*
	SAMIB2	*Sanguisorba minor* ssp. *balearica*
	SANIC	*Sanicula*
	SAAR9	*Sanicula arctopoides*
	SABI2	*Sanicula bipinnata*
	SABI3	*Sanicula bipinnatifida*
	SACR2	*Sanicula crassicaulis*
	SALA7	*Sanicula laciniata*
	SARCO5	*Sarcocornia*
	SAPA30	*Sarcocornia pacifica*
	SAME7	*Saxifraga mertensiana*
	SCAND	*Scandix*
	SCPE	*Scandix pecten-veneris*
	SCHOE6	*Schoenoplectus*
	SCAC3	*Schoenoplectus acutus*
	SCCA11	*Schoenoplectus californicus*
	SCIRP	*Scirpus*
	SCMI2	*Scirpus microcarpus*
	SCBI	*Scoliopus bigelovii*
	SCBO	*Scribneria bolanderi*
	SCCA2	*Scrophularia californica*
	SESP	*Sedum spathulifolium*
	SELAG	*Selaginella*
	SEWA	*Selaginella wallacei*
	SEVU	*Senecio vulgaris*
	SESUV	*Sesuvium*
	SHERA	*Sherardia*
	SHAR2	*Sherardia arvensis*
	SIDAL	*Sidalcea*
	SIDI	*Sidalcea diploscypha*
	SIMA2	*Sidalcea malviflora*
	SIMAP2	*Sidalcea malviflora* ssp. *purpurea*
	SIMAR2	*Sidalcea malviflora* ssp. *rostrata*
	SILEN	*Silene*
	SICA4	*Silene californica*
	SIGA	*Silene gallica*
	SIMA3	*Silybum marianum*

Layer	Code	Taxon Name
Herb	SIOF	*Sisymbrium officinale*
	SISYR	*Sisyrinchium*
	SIBE	*Sisyrinchium bellum*
	SICA8	*Sisyrinchium californicum*
	SOLAN	*Solanum*
	SOAM	*Solanum americanum*
	SONI	*Solanum nigrum*
	SOLID	*Solidago*
	SOCA5	*Solidago californica*
	SOCA6	*Solidago canadensis*
	SOSE2	*Soliva sessilis*
	SONCH	*Sonchus*
	SOAS	*Sonchus asper*
	SOOL	*Sonchus oleraceus*
	SPARG	*Sparganium*
	SPEU	*Sparganium eurycarpum*
	SPFO	*Spartina foliosa*
	SPAR	*Spergula arvensis*
	SPMA	*Spergularia macrotheca*
	SPRU	*Spergularia rubra*
	STACH	*Stachys*
	STAJ	*Stachys ajugoides*
	STAL	*Stachys albens*
	STBU	*Stachys bullata*
	STCH	*Stachys chamissonis*
	STRI	*Stachys rigida*
	STRIQ2	*Stachys rigida* var. *quercetorum*
	STRIR3	*Stachys rigida* var. *rigida*
	STELL	*Stellaria*
	STBOS	*Stellaria borealis* ssp. *sitchana*
	STME2	*Stellaria media*
	STVI2	*Stephanomeria virgata*
	STREP2	*Streptanthus*
	STBA3	*Streptanthus barbiger*
	STBR4	*Streptanthus brachiatus*
	STGL8	*Streptanthus glandulosus*
	STGLG	*Streptanthus glandulosus* ssp. *glandulosus*
	STGLS	*Streptanthus glandulosus* ssp. *secundus*
	STMO3	*Streptanthus morrisonii*
	SYMPH4	*Symphyotrichum*
	SYCH4	*Symphyotrichum chilense*
	SYVO	*Systenotheca vortriedei*
	TACA8	*Taeniatherum caput-medusae*

Layer	Code	Taxon Name
Herb	TAOF	*Taraxacum officinale*
	THPO7	*Thinopyrum ponticum*
	THCU	*Thysanocarpus curvipes*
	THRA	*Thysanocarpus radians*
	TITRU	*Tiarella trifoliata* var. *unifoliata*
	TOLMI	*Tolmiea*
	TORIL	*Torilis*
	TOAR	*Torilis arvensis*
	TONO	*Torilis nodosa*
	TOPA6	*Torreyochloa pallida*
	TRLA4	*Trichostema lanceolatum*
	TRLA5	*Trichostema laxum*
	TRMI3	*Trichostema micranthum*
	TROV	*Trichostema ovatum*
	TRIEN	*Trientalis*
	TRBOL	*Trientalis borealis* ssp. *latifolia*
	TRIFO	*Trifolium*
	TRAL5	*Trifolium albopurpureum*
	TRBA	*Trifolium barbigerum*
	TRBI	*Trifolium bifidum*
	TRCA5	*Trifolium campestre*
	TRCE9	*Trifolium cernuum*
	TRCI	*Trifolium ciliolatum*
	TRDE	*Trifolium depauperatum*
	TRDI6	*Trifolium dichotomum*
	TRDU2	*Trifolium dubium*
	TRFR2	*Trifolium fragiferum*
	TRFU	*Trifolium fucatum*
	TRGL4	*Trifolium glomeratum*
	TRGR2	*Trifolium gracilentum*
	TRHI4	*Trifolium hirtum*
	TRMA2	*Trifolium macraei*
	TRMI4	*Trifolium microcephalum*
	TRMI5	*Trifolium microdon*
	TROL	*Trifolium oliganthum*
	TROL2	*Trifolium olivaceum*
	TRRE3	*Trifolium repens*
	TRSU3	*Trifolium subterraneum*
	TRVA	*Trifolium variegatum*
	TRWI3	*Trifolium willdenovii*
	TRWO	*Trifolium wormskioldii*
	TRILL	*Trillium*
	TRCH2	*Trillium chloropetalum*

Layer	Code	Taxon Name
Herb	TROV2	*Trillium ovatum*
	TRIPH3	*Triphysaria*
	TRERR	*Triphysaria eriantha* ssp. *rosea*
	TRMI16	*Triphysaria micrantha*
	TRPU16	*Triphysaria pusilla*
	TRVEF	*Triphysaria versicolor* ssp. *faucibarbatus*
	TRVEV	*Triphysaria versicolor* ssp. *versicolor*
	TRISE	*Trisetum*
	TRUN6	*Tristagma uniflorum*
	TRITE	*Triteleia*
	TRHY3	*Triteleia hyacinthina*
	TRLA16	*Triteleia laxa*
	TRPE10	*Triteleia peduncularis*
	TRITI	*Triticum*
	TYPHA	*Typha*
	TYDO	*Typha domingensis*
	TYLA	*Typha latifolia*
	URTIC	*Urtica*
	URDI	*Urtica dioica*
	UTMA	*Utricularia macrorhiza*
	VAHE	*Vancouveria hexandra*
	VAPL	*Vancouveria planipetala*
	VEFI2	*Veratrum fimbriatum*
	VERBA	*Verbascum*
	VEBL	*Verbascum blattaria*
	VETH	*Verbascum thapsus*
	VERON	*Veronica*
	VEAM2	*Veronica americana*
	VEPEX2	*Veronica peregrina* ssp. *xalapensis*
	VICIA	*Vicia*
	VIAMA3	*Vicia americana* ssp. *americana*
	VIBE	*Vicia benghalensis*
	VIHI	*Vicia hirsuta*
	VILA2	*Vicia lathyroides*
	VINIG	*Vicia nigricans* ssp. *gigantea*
	VISA	*Vicia sativa*
	VITE	*Vicia tetrasperma*
	VIVI	*Vicia villosa*
	VIMA	*Vinca major*
	VIOLA	*Viola*
	VIAD	*Viola adunca*
	VIGL	*Viola glabella*
	VIOC	*Viola ocellata*

Layer	Code	Taxon Name
Herb	VIPE3	*Viola pedunculata*
	VIPU4	*Viola purpurea*
	VISE3	*Viola sempervirens*
	VULPI	*Vulpia*
	VUBR	*Vulpia bromoides*
	VUMI	*Vulpia microstachys*
	VUMY	*Vulpia myuros*
	WAME	*Watsonia meriana*
	WHMO	*Whipplea modesta*
	WOODW	*Woodwardia*
	WOFI	*Woodwardia fimbriata*
	WYETH	*Wyethia*
	WYAN	*Wyethia angustifolia*
	WYGL	*Wyethia glabra*
	XAST	*Xanthium strumarium*
	XETE	*Xerophyllum tenax*
	ZIGAD	*Zigadenus*
	ZIFR	*Zigadenus fremontii*
	ZIMI2	*Zigadenus micranthus*

APPENDIX D

Noteworthy Taxa

Of the 1210 recorded taxa, 24 are considered "noteworthy," or rare in California. The degree of scarcity is indicated by the CA rare plant rank and the NatureServe global/state rank, as defined below.

CA Rare Plant Rank – a code assigned to a taxon based on its rarity in California. Lower numbers and letters indicate increased rarity. The California Rare Plant Ranking System is described at this website: http://www.cnps.org/cnps/rareplants/ranking.php.

NatureServe Global/State Rank – the conservation status assigned to a species by the NatureServe organization. "G" indicates the taxon's rarity and threat globally, and "S" indicates the taxon's rarity and threat in California. The rankings range from possibly extinct (H) to critically imperiled (1) to secure (5). See http://www.natureserve.org/conservation-tools/conservation-status-assessment for a description of NatureServe conservation status assessment.

Taxon Name	CA Rare Plant Rank	NatureServe Global/State Rank
Agrostis blasdalei	1B.2	G2/S2
Arctostaphylos bakeri ssp. *bakeri*	1B.1	G2T1/S1
Arctostaphylos bakeri ssp. *sublaevis*	1B.2	G2T2/S2
Arctostaphylos stanfordiana ssp. *decumbens*	1B.1	G3T1/S1
Calochortus raichei	1B.2	G2/S2
Calystegia collina ssp. *oxyphylla*	4.2	G4T3/S3
Calystegia purpurata ssp. *saxicola*	1B.2	G4T2T3/S2S3
Campanula californica	1B.2	G3/S3
Ceanothus confusus	1B.1	G1/S1
Ceanothus purpureus	1B.2	G2/S2
Ceanothus sonomensis	1B.2	G2/S2
Cordylanthus tenuis ssp. *capillaris*	1B.2	G4G5T1/S1
Erigeron serpentinus	1B.3	G2/S2
Eriogonum cedrorum	1B.3	G1/S1
Gilia capitata ssp. *tomentosa*	1B.1	G5T2/S2
Hemizonia congesta ssp. *congesta*	1B.2	G5T1T2/S1S2
Hesperevax sparsiflora var. *brevifolia*	1B.2	G4T3/S2
Horkelia marinensis	1B.2	G2/S2
Lasthenia californica ssp. *bakeri*	1B.2	G3TH/SH
Layia septentrionalis	1B.2	G2/S2
Lilium pardalinum ssp. *pitkinense*	1B.1	G5T1/S1
Sidalcea calycosa ssp. *rhizomata*	1B.2	G5T2/S2
Sidalcea malviflora ssp. *purpurea*	1B.2	G5T1/S1
Streptanthus morrisonii ssp. *morrisonii*	1B.2	G2T2/S2

APPENDIX E

Hierarchical Field Key to the Vegetation Alliances of Sonoma County

This key is for the vegetation types found in Sonoma County, based on the classification developed by analyzing survey data collected for this and other relevant projects. It 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) as of the publication of the *Manual of California Vegetation* (Sawyer et al., 2009). The USNVC hierarchy is promoted by the Survey of California Vegetation (SCV), Federal Geographic Data Committee (FGDC) and the Ecological Society of America's Vegetation Panel (FGDC 2008, Faber-Langendoen et al. 2014).

This key lists vegetation types starting at the USNVC macrogroup level and proceeding down to the association level. The complete hierarchy for this classification is listed in Table 1, Final Vegetation Classification for Sonoma County, California.

Due to the high diversity of the vegetation types in the area, this is a complex key. Follow the instructions in a section carefully and sequentially to arrive at the correct vegetation type. You will need to collect or refer to plant composition data that includes not only those species that are dominant but 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 and Concepts 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 Sonoma County Vegetation Map (SVM), map classes are typically at the alliance level of the USNVC hierarchy.

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 SVM map classes are not typically defined to the association level.

Plant community nomenclature: Species separated by "–" are within the same stratum; species 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. It 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 mapping 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 of the survey that is 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 within a survey area that is covered either by one species relative to other species within the same physiognomic stratum (tree, shrub, herbaceous) or one stratum relative to the total vegetation cover in a 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. 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 2015) 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.

Botanical nomenclature: We use the PLANTS database (USDA NRCS 2015) as our standard for botanical names, except in two cases. When a more current name has been assigned in *The Jepson Manual, second edition* (Baldwin et al. 2012), that name is frequently used and a code beginning with "2JM" is assigned. General vegetation types, such as moss and lichen, have codes beginning with the number 2 (e.g., 2MOSS).

KEY TO NATURAL AND SEMI-NATURAL VEGETATION OF SONOMA COUNTY

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 5% 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 5% of the vegetation cover. Trees, if present, generally comprise less than 5% cover **= Herbaceous Vegetation**

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

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

1. Temperate rainforest dominated or co-dominated by *Sequoia sempervirens* or *Abies grandis*. Found in maritime climates with summertime fog.

Vancouverian Rainforest Macrogroup

Vancouverian Hypermaritime Lowland Rainforest 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 – Notholithocarpus densiflorus / Vaccinium ovatum Association
Sequoia sempervirens – Pseudotsuga menziesii – Notholithocarpus densiflorus Provisional Association
Sequoia sempervirens -– Pseudotsuga menziesii – Umbellularia californica Association
Sequoia sempervirens -– Umbellularia californica Association
Sequoia sempervirens / Oxalis oregana Association
Sequoia sempervirens / Woodwardia fimbriata Riparian Provisional Association

1b. *Abies grandis* has strong dominance in the tree overstory, with *Pinus muricata* and *Sequoia sempervirens* intermixing locally as sub-dominants. Stands are rare in the county. One stand, found on a convexity running along a middle slope up to the ridgetop, was sampled for this project

***Abies grandis* Alliance**

2. Cool-temperate coniferous forests and woodlands influenced by warm, relatively dry summers and cool rainy winters. Stands are dominated or co-dominated by *Pinus ponderosa*, *Pseudotsuga menziesii,* or *P. menziesii* in combination with *Notholithocarpus densiflorus* in the tree overstory.

Californian–Vancouverian Montane and Foothill Forest Macrogroup

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.

Vancouverian Evergreen Broadleaf and Mixed Forest Group

***Pseudotsuga menziesii – Notholithocarpus densiflorus* Alliance**
Pseudotsuga menziesii – Notholithocarpus densiflorus Association

2b. Vegetation characterized by *Pinus ponderosa* and/or *Pseudotsuga menziesii*. If *Notholithocarpus densiflorus* is present, it is sub-dominant with relatively low cover.

Upland Vancouverian Mixed Woodland and Forest Group

2b1. *Pinus ponderosa* is dominant to co-dominant with *Pseudotsuga menziesii*. Stands with significant *Pinus ponderosa* were only encountered twice for this project – in the higher elevation, eastern portion of the county in The Geysers. In both instances, *Arbutus menziesii*, *Arctostaphylos manzanita* and *Quercus chrysolepis* were present.

***Pinus ponderosa – Pseudotsuga menziesii* Alliance**
Pinus ponderosa – Pseudotsuga menziesii Association

2b2. *Pseudotsuga menziesii* not as above, but instead dominant or 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 garryana, Q. kelloggii,* or *Notholithocarpus densiflorus* (see *Q. garryana* (step 4a3) or *Q. kelloggii* Alliance (step 5c4) below, or *P. menziesii – N. densiflorus* Alliance above, step 2a).

***Pseudotsuga menziesii* Alliance**
Pseudotsuga menziesii – Arbutus menziesii Association
Pseudotsuga menziesii – Quercus agrifolia Association
Pseudotsuga menziesii – Quercus chrysolepis Association
Pseudotsuga menziesii – Umbellularia californica Association
Pseudotsuga menziesii – Umbellularia californica / Polystichum munitum Association

3. Closed-cone or xerophyllic conifers, including *Hesperocyparis* spp., *Pinus attenuata*, *Pinus muricata*, *Pinus radiata*, or *Pinus sabiniana* is dominant, co-dominant, or characteristic in the overstory.

California Forest and Woodland Macrogroup

Californian Evergreen Coniferous Forest and Woodland Group

3a. Stands dominated by a native or planted species of *Hesperocyparis*.

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.

***Hesperocyparis macrocarpa* Special Stands and Semi-Natural Alliance**
Hesperocyparis macrocarpa Provisional Semi-Natural Association

3a2. A native cypress species, *Hesperocyparis macnabiana* or *H. sargentii*, dominates or characterizes stands on serpentine, volcanic, or other ultramafic substrates. *Adenostoma fasciculatum*, *Arctostaphylos* spp., *Ceanothus jepsonii*, and *Quercus durata* are commonly found in stands

3a2a. *Hesperocyparis macnabiana* characterizes the tree canopy (sometimes with <10% cover) and may be similar in height to surrounding shrubs. Found on open slopes and ridges and only known locally in the eastern part of the county.

***Hesperocyparis macnabiana* Alliance**
Hesperocyparis macnabiana / Arctostaphylos viscida Association

3a2b. *Hesperocyparis sargentii* dominates on slopes, ridges, or along stream benches and terraces. Sites known near Harrison Grade or The Cedars.

***Hesperocyparis sargentii* Alliance**
Hesperocyparis sargentii / Ceanothus jepsonii – Arctostaphylos spp. Provisional Association
Hesperocyparis sargentii / *Quercus durata* (mesic) Provisional Association
Hesperocyparis sargentii Riparian Association

3b. Stands dominated by *Pinus attenuata*, *P. muricata*, *P. radiata*, or *P. sabiniana*.

3b1. *Pinus attenuata* dominates in the tree overstory, sometimes with moderately dense cover of shrubs such as *Adenostoma fasciculatum*, *Arctostaphylos* spp., and *Ceanothus cuneatus* in the understory.

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

3b2. *Pinus muricata* is the sole dominant or may co-dominate with *Hesperocyparis pigmaea* in the tree overstory. The understory may include moderate to dense cover of shrubs such as *Arctostaphylos nummularia*, *Gaultheria shallon*, and *Vaccinium ovatum*.

***Pinus muricata* Alliance**
Pinus muricata Provisional Association
Pinus muricata – Hesperocyparis pigmaea Provisional Provisional Association
Pinus muricata / Vaccinium ovatum Provisional Association

3b3. *Pinus sabiniana* dominates or co-dominates with *Umbellularia californica* in the tree overstory. *Adenostoma fasciculatum*, *Arctostaphylos viscida*, *Quercus durata*, and other shrubs may exceed *P. sabiniana* in cover.

***Pinus sabiniana* Alliance**
Pinus sabiniana / Quercus durata Provisional Association
Pinus sabiniana /Arctostaphylos viscida Association

3b4. Planted stands of *Pinus radiata* are found along roadsides or on slopes where they were introduced after fires in the 1960's.

***Pinus radiata* Alliance**
Pinus radiata Provisional Semi-Natural Association

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

4. Vegetation dominated, co-dominated, or characterized by one or more of the following broadleaf trees: *Acer macrophyllum*, *Arbutus menziesii*, *Notholithocarpus densiflorus*, or *Quercus garryana*.

Californian-Vancouverian Montane and Foothill Forest Macrogroup

4a. Broadleaf trees such as *Arbutus menziesii*, *Notholithocarpus densiflorus*, or *Quercus garryana* dominate, co-dominate, or characterize moist, coastal, mixed evergreen forests and woodlands. Stands of *Quercus garryana* may also occur in more interior settings, where the winters are cooler and the summers are warmer.

Vancouverian Evergreen Broadleaf and Mixed Forest Group

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*.

***Arbutus menziesii* Alliance**
Arbutus menziesii – Quercus agrifolia Association
Arbutus menziesii – Umbellularia californica Provisional Association
Arbutus menziesii – Umbellularia californica – Quercus kelloggii Association

4a2. *Notholithocarpus densiflorus* is strongly dominant in the tree canopy or co-occurs with sub-dominant to co-dominant *Arbutus menziesii*.

***Notholithocarpus densiflorus* Alliance**
Notholithocarpus densiflorus Provisional Association
Notholithocarpus densiflorus – Arbutus menziesii Association

4a3. *Quercus garryana* dominates or co-dominates with other broadleaf trees or *Pseudotsuga menziesii*. Stands are of two types: 1) relatively dense woodlands without a significant understory herb component or 2) open woodlands over moderate to dense native and non-native herbs (e.g., *Cynosurus echinatus* and *Festuca californica*). *Pseudotsuga menziesii*, *Umbellularia californica*, *Quercus agrifolia*, and/or *Q. kelloggii* commonly intermix, typically as sub-dominants. If two or more species of *Quercus* are present and, collectively, they are dominant or co-dominant with *Q. garryana*, key to the *Quercus* (*agrifolia*, *douglasii*, *garryana*, *kelloggii*, *lobata*, *wislizeni*) Alliance (step 5c1).

***Quercus garryana* (tree) Alliance**
Quercus garryana – Umbellularia californica – Quercus (*agrifolia*, *kelloggii*) Provisional Association
Quercus garryana / (*Cynosurus echinatus – Festuca californica*) Provisional Association

4b. *Acer macrophyllum* dominates or co-dominates with *Umbellularia californica* or, occasionally, *Fraxinus latifolia* in riparian or, occasionally, upland stands. *Pseudotsuga menziesii*, *Quercus agrifolia* and *Q. chrysolepis* may intermix. *Acer* stands were found farther than 15 miles from the coast or closer to the eastern boundary of the county, usually in low-lying, rocky, steep canyons.

Upland Vancouverian Mixed Woodland and Forest Group

***Acer macrophyllum* Alliance**
Acer macrophyllum 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* var. *shrevei*, *Q. wislizeni*, and/or *Umbellularia californica*.

California Forest and Woodland Macrogroup

Californian Broadleaf Forest and 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 / 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 settings, such as streamsides, valley bottoms, coastal bluffs, inland ridges, steep north-facing slopes, rocky outcrops and post-fire landscapes. If *U. californica* is co-dominant with *Arbutus*, *Acer*, *or Pinus sabiniana* on serpentine, or *Pseudotsuga menziesii*, *Quercus garryana*, *Q. kelloggii*, or *Sequoia*, key to one of these other hardwood or conifer alliances instead.

***Umbellularia californica* Alliance**
Umbellularia californica – Acer macrophyllum Association
Umbellularia californica – Notholithocarpus densiflorus Association
Umbellularia californica – Pseudotsuga menziesii / Rhododendron occidentale Association
Umbellularia californica – Quercus agrifolia Provisional Association
Umbellularia californica (Pure – Coastal) Provisional Association
Umbellularia californica / Polystichum munitum Association

5c. One or more species of *Quercus* listed above (step 5), other than *Quercus garryana* (step 4a3), dominates or co-dominates in the tree overstory OR *Quercus garryana* co-dominates with two other oak species.

5c1. *Quercus agrifolia*, *Quercus garryana*, and/or *Quercus kelloggii* are present and at least two of the oak species co-dominate. Other oaks such as *Q. chrysolepis*, *Q. douglasii*, and *Q. lobata* may also be present. This mixed type is for stands where multiple *Quercus* tree species intermix 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 agrifolia – Quercus garryana – Quercus kelloggii Provisional Association

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

***Quercus chrysolepis* (tree) Alliance**
Quercus chrysolepis – Arbutus menziesii Provisional Association
Quercus chrysolepis – Quercus wislizeni Association

5c3. *Quercus douglasii* or *Quercus ×eplingii* (the hybrid between *Q. douglasii and Q. garryana*) 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 × eplingii / Grass Provisional Association
Quercus douglasii – Quercus agrifolia Association
Quercus douglasii / Arctostaphylos manzanita / Herbaceous Association
Quercus douglasii / Grass Association

5c4. *Quercus kelloggii* 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 Sonoma County are found inland, above maritime influence, on northern exposures.

***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* and/or *Quercus agrifolia* in the tree overstory. Stands are typically found along valley bottoms, lower slopes, and summit valleys on seasonally saturated soils that may flood intermittently. Common understory shrubs include *Rosa californica*, *Rubus* spp., and *Toxicodendron diversilobum*.

***Quercus lobata* Alliance**
Quercus lobata – Fraxinus latifolia / (*Vitis californica*) Association
Quercus lobata – Quercus agrifolia / Grass Association
Quercus lobata / Grass Association
Quercus lobata / Rubus ursinus – Rosa californica Provisional Association

5c6. *Quercus parvula* var. *shrevei* dominates as a tree or shrubby regenerating tree, co-occurring with *Umbellularia*, *Adenostoma*, and a variety of other shrubs that prefer more mesic, northerly exposures. One stand was sampled and classified in Sonoma County, and likely further variation will be seen.

***Quercus parvula* var. *shrevei* Provisional Alliance**

5c7. The tree form of *Quercus wislizeni* dominates or co-dominates in the tree canopy, often with *Arbutus menziesii*, *Pseudotsuga menziesii*, and/or *Umbellularia californica*. If *Q. wislizeni* has a shrubby habit, or is a regenerating tree intermixing with a variety of other shrub species, key to the *Quercus wislizeni* (shrub) Alliance, step 9b.

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

5c8. *Quercus agrifolia* dominates or co-dominates with *Arbutus menziesii* in the canopy. If *Q. douglasii* (or hybrid *Q.* ×*eplingii*), *Q. lobata*, or *Umbellularia californica* is co-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 / Grass Association
Quercus agrifolia / Toxicodendron *diversilobum* Association

6. *Acer negundo*, *Juglans hindsii*, *Populus fremontii*, 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.

Southwestern North American Riparian, Flooded and Swamp Forest Macrogroup

Southwestern North American Riparian Evergreen and Deciduous 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**

6b. *Juglans hindsii* or hybrids dominate in naturalized stands along riparian corridors, floodplains, stream banks, and terraces. Other riparian species may be present, including *Acer*, *Fraxinus*, and *Rubus*.

***Juglans hindsii* and Hybrids Special Stands and Semi-Natural Alliance**

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* Alliance**
Populus fremontii – Acer negundo Association
Populus fremontii / Salix exigua Association

6d. *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 laevigata* Alliance**
Salix laevigata / Salix lasiolepis Association

7. *Alnus rhombifolia*, *Fraxinus latifolia*, 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

Western Cordilleran Montane–Boreal Riparian Scrub Macrogroup

Vancouverian Riparian Deciduous Forest Group

7a. *Alnus rhombifolia* dominates or co-dominates with *Acer macrophyllum* or *Umbellularia californica* in the tree overstory. 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 *Carex*, *Rubus*, *Toxicodendron*, *Xerophyllum,* and *Woodwardia*. Careful identification of alder stands closer to the coast is necessary to differentiate from *A. rubra* stands.

***Alnus rhombifolia* Alliance**
Alnus rhombifolia Association
Alnus rhombifolia – Acer macrophyllum Association
Alnus rhombifolia / Carex (*nudata*) Association

7b. *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*, which may exceed *Alnus* in cover. *Alnus rubra* stands were encountered usually less than 10 miles from the coast in riparian or swampy bottomlands, but can occur along rocky streambeds in similar settings to *A. rhombifolia* stands. Careful identification of the species of Alnus is important closer to the coast.

***Alnus rubra* Alliance**[1]
Alnus rubra / Rubus spp. Provisional Association

7c. *Fraxinus latifolia* dominates or co-dominates with *Alnus rhombifolia* or *Umbellularia californica* in the tree overstory. Stands for this project were encountered and surveyed in the southern half of Sonoma County.

***Fraxinus latifolia* Alliance**
Fraxinus latifolia Association
Fraxinus latifolia – Alnus rhombifolia Association

7d. *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*. Adjacent stands may be dominated by *Alnus* spp., *Quercus agrifolia* or conifers.

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

8. A tree species of *Eucalyptus* dominates in planted or naturalized stands. Often found in groves, windbreaks, uplands, and along stream courses. Stands were observed, but not sampled for this project.

Introduced North American Mediterranean Woodland and Forest Macrogroup and Group

***Eucalyptus* (*globulus*, *camaldulensis*) Semi-Natural Alliance**

[1] The *Alnus rubra* Alliance is placed in the Upland Vancouverian Mixed Woodland and Forest Group of the USNVC. It will likely be incorporated under the Vancouverian Riparian Deciduous Forest Group in the future as it has been for this project.

Class B. Shrubland Vegetation

Section I. Riparian or moist hillside settings with vegetation dominated or co-dominated by the following shrubs: *Frangula californica* (including all subspecies), *Morella californica*, *Rhododendron occidentale*, *Rubus armeniacus*, *R. spectabilis*, *Salix breweri*, *S. exigua*, *S. lasiolepis*, *S. melanopsis*, *S. sitchensis*, and/or *Sambucus nigra*.
***Note: if *Rubus ursinus* dominates, key to the *Gaultheria shallon – Rubus* (*ursinus*) Alliance in Section II below (step 5b3).**

1. *Rubus armeniacus*, a non-native from Europe, is strongly dominant in riparian sites, mesic clearings, disturbed areas and stock ponds.

Vancouverian Lowland Grassland and Shrubland Macrogroup

Naturalized Non-Native Deciduous Scrub Group

***Rubus armeniacus* Semi-Natural Alliance**
Rubus armeniacus Semi-Natural Association

2. *Morella californica*, *Rubus parviflorus*, *R. spectabilis* and/or *Salix sitchensis* dominate or co-dominate with *Rubus* spp.

Western Cordilleran Montane–Boreal Riparian Scrub Macrogroup

Vancouverian Coastal Riparian Scrub Group

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

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

2b. *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 *Acer*, *Alnus*, *Fraxinus*, *Salix*, and *Rubus*.

***Salix sitchensis* Provisional 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.

Southwestern North American Riparian, Flooded and Swamp Forest Macrogroup

Southwestern North American Riparian/Wash Scrub Group

3a. *Frangula californica* and/or *Rhododendron occidentale* dominate or co-dominate with *Baccharis pilularis* or *Rubus*. Stands are found along springs, seeps, ravines and hillslopes, often on sedimentary and serpentine substrates that retain water much of the year.

***Frangula californica – Rhododendron occidentale* Provisional Alliance**
Frangula californica ssp. *californica* Provisional Association
Rhododendron occidentale – Frangula californica ssp. *tomentella* Provisional Association

3b. *Salix breweri* dominates along creeks and stream terraces, on serpentine-derived alluvium. Locally present along streams on serpentine in The Cedars area. Commonly found with other moisture loving plants, such as *Alnus rhombifolia*, *Baccharis salicifolia*, *Rubus*, and *Stachys albens*.

***Salix breweri* Alliance**
Salix breweri Provisional Association

3c. *Salix exigua* or *Salix melanopsis* 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 *Populus* and *Salix* spp.

***Salix exigua* Alliance**
Salix exigua Association
Salix exigua – Salix melanopsis Association

3d. *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, along a draw that was burned.

***Sambucus nigra* Alliance**
Sambucus nigra Association

3e. *Salix lasiolepis* dominates or co-dominates with *Rubus* along stream banks and benches, slope seeps, and drainage stringers. If *S. sitchensis* is co-dominant, key to the *S. sitchensis* Alliance instead (step 2b). Emergent riparian trees are often present, such as *Acer*, *Alnus*, *Fraxinus*, *Salix,* and others.

***Salix lasiolepis* Alliance**
Salix lasiolepis / Rubus spp. 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*, *Ericameria ericoides*, *Eriodictyon californicum*, *Eriogonum fasciculatum, Gaultheria shallon*, *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*.

Vancouverian Coastal Dune and Bluff Macrogroup

California Coastal Evergreen Bluff and Dune Scrub Group

4a. *Lupinus arboreus* dominates or co-dominates with *Baccharis pilularis*, and may co-occur with high cover by *Vulpia bromoides*, *Festuca perennis*, *Bromus diandrus* and other non-native grasses.

***Lupinus arboreus* Alliance and Semi-Natural Alliance**
Lupinus arboreus Association

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

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

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

California Coastal Scrub Macrogroup

5a. *Eriodictyon californicum*, *Heterotheca oregana*, or *Lupinus albifrons* dominates in the overstory.

Central and South Coastal California Seral Scrub Group

5a1. *Eriodictyon californicum* or *Lupinus albifrons* dominates, often in stands that are open and/or display recent evidence of fire or other disturbance. The understory may be composed of mixed native and non-native herbs, which sometimes have higher cover than the overstory shrubs.

***Eriodictyon californicum – Lupinus albifrons* Provisional Alliance**
Eriodictyon californicum / Herbaceous Association
Lupinus albifrons Association

5a2. *Heterotheca oregona*, a perennial herb that acts like a short-lived shrub, dominates herbaceous stands that have seasonal hydrologic disturbance. Found along sunny, rocky stream terraces, seasonally dry streambeds, sandbars in river drainages, and cobbled gravel bars in floodplains.

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

5b. *Baccharis pilularis*, *Ceanothus incanus*, *C. thyrsiflorus*, *Gaultheria shallon*, *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 ravines and lower slopes, where species are tolerant of disturbance and tend to be over-topped and excluded by trees.

California 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* is co-dominant with *B. pilularis*, key to the *C. nutkaensis* Alliance (see Class C, step 9c3a). 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 – Frangula californica – Rubus spp. Provisional Association
Baccharis pilularis – Toxicodendron diversilobum Association
Baccharis pilularis / Annual Grass – Herb Association
Baccharis pilularis / Danthonia californica Association
Baccharis pilularis / Deschampsia cespitosa Association
Baccharis pilularis / Nassella pulchra Association
Baccharis pilularis / Native Grass (Mixed) Association

5b2. *Ceanothus incanus or C. thyrsiflorus* 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. Stands of *C. incanus* are included in the *C. thyrsiflorus* Alliance since they are more limited in distribution and are ecologically similar to *C. thyrsiflorus*.

***Ceanothus thyrsiflorus* Alliance**
Ceanothus incanus Provisional Association

5b3. *Gaultheria shallon* and/or *Rubus ursinus* dominate or co-dominate with *Anthoxanthum odoratum*, *Holcus lanatus,* or *Toxicodendron diversilobum* on hillslopes, rock outcrops, coastal bluffs, or flats. If *Arctostaphylos nummularia* is co-dominant with *Gaultheria*, key to the *Arctostaphylos* (*nummularia*, *sensitiva*) Alliance below (step 6).

***Gaultheria shallon – Rubus* (*ursinus*) Provisional Alliance**
Gaultheria shallon – Rubus spp. Provisional Association
Rubus ursinus Association

5b4. *Toxicodendron diversilobum* dominates, sometimes intermixing with sub-dominant *Baccharis pilularis* and *Rubus* spp. If *B. pilularis* is present and co-dominant, 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 Provisional Association

5c. *Artemisia californica* dominates and may intermix with *Baccharis pilularis, Diplacus aurantiacus,* and others. One stand, which may represent the northernmost occurrence of *A. californica* in the state, was encountered during field reconnaissance along Highway 1, approximately two miles southeast of Fort Ross.

Central and South Coastal Californian Coastal Sage Scrub Group

***Artemisia californica* Alliance** (no description provided)

5d. *Cistus, Eriogonum fasciculatum, Genista, Ulex,* or other Mediterranean shrubs not native to Sonoma County dominates in naturalized or planted stands. May be found invading disturbed areas, grasslands, or forest openings.

Naturalized Non-Native Mediterranean Scrub Group

5d1. *Genista monspessulana, Ulex europaeus,* or other broom species/hybrids dominate in the shrub overstory. Fire promotes broom invasions in woodland setttings, however broom may invade coastal grasslands without fire.

Broom (*Cytisus scoparius* and Others) Semi-Natural Alliance

5d2. *Cistus, Eriogonum fasciculatum* or other naturalized/planted species dominates in the shrub overstory. *Eriogonum fasciculatum,* while native to other parts of California, does not occur naturally in Sonoma County. *E. fasciculatum* is often chosen for erosion control and slope stabilization projects because it grows relatively quickly, spreads well, and maintains a nice appearance year-round. One stand was observed during field reconnaissance near Lake Sonoma, though other stands may be found elsewhere in the County. Planted stands do not fit under the *Eriogonum fasciculatum* Alliance, which is reserved for native vegetation.

Naturalized Non-Native Mediterranean 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*, *Quercus berberidifolia*, *Q. durata*, and shrubby *Q. wislizeni*.

California Chaparral Macrogroup

6. *Arctostaphylos nummularia* ssp. *nummularia* dominates or co-dominates with *Gaultheria shallon* or *Vaccinium ovatum* in maritime chaparral stands. *Arctostaphylos columbiana*, *Chrysolepis chrysophylla* var. *minor*, *Pinus muricata*, and *Pteridium aquilinum* are often present.

Californian Maritime Chaparral Group

***Arctostaphylos* (*nummularia*, *sensitiva*) Alliance**
Arctostaphylos nummularia ssp. *nummularia* Provisional Association

7. *Cercocarpus montanus* and/or *Quercus berberidifolia* 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 Chaparral Group

7a. *Cercocarpus montanus* dominates or co-dominates with *Adenostoma fasciculatum*. *Diplacus aurantiacus* and *Toxicodendron diversilobum* are often present. Stands are frequently found on rocky, north-facing slopes, though they can occur on all aspects.

***Cercocarpus montanus* Alliance**
Cercocarpus montanus – Adenostoma fasciculatum Association

7b. *Quercus berberidifolia* dominates or co-dominates with *Cercocarpus montanus*. Stands are found primarily on north-facing, steep slopes with well-drained soils. If *Adenostoma fasciculatum* is co-dominant with *Q. berberidifolia*, key to the mixed *Quercus berberidifolia-Adenostoma fasciculatum* Alliance directly below.

***Quercus berberidifolia* Alliance**
Quercus berberidifolia Association
Quercus berberidifolia – Cercocarpus montanus Association

7c. *Quercus berberidifolia* and *Adenostoma fasciculatum* co-dominate and often occupy ecological interfaces between mesic sites that *Quercus* prefers and xeric sites that *Adenostoma* prefers. A variety of shrubs may intermix as sub-dominants.

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

8. *Arctostaphylos bakeri*, *Ceanothus jepsonii*, and/or *Quercus durata* dominate or co-dominate in shrub vegetation restricted to or adapted to ultramafic soils and substrates (e.g., serpentine, gabbro).

Californian Serpentine Chaparral Group

8a. *Arctostaphylos bakeri*, a serpentine endemic, dominates or co-dominates with *Quercus durata* in the shrub overstory, often on upper slopes, flats and ridges. *Ceanothus jepsonii*, *Hesperocyparis sargentii*, *Heteromeles arbutifolia*, and *Melica torreyana* are commonly present.

***Arctostaphylos* (*bakeri*, *montana*) Provisional Alliance**
Arctostaphylos bakeri Provisional Association

8b. *Quercus durata* dominates or co-dominates with *Adenostoma fasciculatum* or *Ceanothus jepsonii* on ultramafic soils. *Heteromeles arbutifolia* and/or *Umbellularia californica* are often present in stands.

***Quercus durata* Alliance**
Quercus durata – Adenostoma fasciculatum Provisional Association
Quercus durata – Ceanothus jepsonii Provisional Association
Quercus durata – Heteromeles arbutifolia / Umbellularia californica Association

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

Californian Pre-Montane Chaparral Group

9a. *Ceanothus oliganthus* dominates in shrublands that are often found in localized patches following fires. If *Quercus wislizeni* is co-dominant, key to the *Q. wislizeni* (shrub) Alliance directly below.

***Ceanothus oliganthus* Alliance**
Ceanothus oliganthus Association

9b. Regenerating or shrubby *Quercus wislizeni* (var. *frutescens*) dominates or co-dominates with *Ceanothus oliganthus*. Stands that represent the possibly distinct *Q. wislizeni* var. *frutescens* and those with *Q. wislizeni* having shorter stature due to factors that limit height (e.g., fire) are included in this alliance. When *Q. wislizeni* dominates or co-dominates as an overstory tree, key to the *Q. wislizeni* (tree) Alliance. *Umbellularia californica* is often emergent, while a variety of thick- and soft-leaved shrubs intermix as sub-dominants.

***Quercus wislizeni* (shrub) Alliance**
Quercus wislizeni var. *frutescens* Provisional Association
Quercus wislizeni – Ceanothus oliganthus Provisional Association

10. Sclerophyll (i.e., thick-leaved) shrublands dominated by one or more of the following taxa: *Adenostoma*, *Arctostaphylos canescens*, *A. glandulosa, A. manzanita*, *A. stanfordiana*, *A. viscida*, 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

10a. *Arctostaphylos canescens*, *A. manzanita* and/or *A. stanfordiana* dominate or co-dominate, sometimes with co-dominant *Adenostoma fasciculatum*. Found typically on volcanic, Franciscan, and greenstone substrates. One alliance is recognized for all three *Arctostaphylos* vegetation types, with associations specific to each species.

***Arctostaphylos* (*canescens*, *manzanita*, *stanfordiana*) Provisional Alliance**
Arctostaphylos canescens Provisional Association
Arctostaphylos manzanita Provisional Association
Arctostaphylos stanfordiana Provisional Association

10b. *Arctostaphylos glandulosa* dominates or co-dominates with *Adenostoma fasciculatum* on convexities, outcrops, ridges, or slopes. Soils may be derived from serpentine or gabbro. Species commonly found as emergent trees or sub-dominant shrubs include *Arbutus menziesii*, *Arctostaphylos* spp., *Diplacus aurantiacus*, and *Heteromeles arbutifolia*.

***Arctostaphylos glandulosa* Alliance**[2]
Arctostaphylos glandulosa Association
Arctostaphylos glandulosa – Adenostoma fasciculatum Association

10c. *Arctostaphylos viscida* (e.g., *A. viscida* ssp. *pulchella*) dominates or co-dominates with *Ceanothus jepsonii* on serpentine substrates. *Ceanothus jepsonii* may occasionally exceed *A. viscida* in cover when present.

***Arctostaphylos viscida* Alliance**
Arctostaphylos viscida – Ceanothus jepsonii Provisional Association

10d. *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 – Adenostoma fasciculatum Association

10e. *Adenostoma fasciculatum* dominates, often with sub-dominant shrubs such as *Arctostaphylos manzanita*, *A. stanfordiana*, or *Diplacus aurantiacus*. *Salvia sonomensis*, an understory shrub, may have higher cover than *Adenostoma*. 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 – Arctostaphylos manzanita Association
Adenostoma fasciculatum – Arctostaphylos stanfordiana / Salvia sonomensis Provisional Association
Adenostoma fasciculatum – Diplacus aurantiacus Association
Adenostoma fasciculatum Serpentine Association

[2] The *Arctostaphylos glandulosa* Alliance is placed in the Pre-Montane Chaparral Group of the USNVC. For this project, it fits better under the Xeric Chaparral Group because stands occupy relatively dry, southerly-facing sites with shallow soils and are more similar ecologically to other xeric chaparral alliances of Sonoma County. Future versions of the USNVC may include an alliance of *A. glandulosa* under the Xeric Chaparral Group.

Class C. Herbaceous 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*, *Azolla, Bidens*, *Bolboschoenus*, *Brasenia*, *Carex*, *Ceratophyllum*, *Distichlis*, *Eleocharis macrostachya*, *Grindelia stricta*, *Juncus arcticus*, *J. effusus*, *J. lescurii*, *J. patens*, *Lasthenia glaberrima*, *Lemna*, *Lepidium latifolium*, *Leymus triticoides*, *Ludwigia*, *Mimulus guttatus*, *Nuphar*, *Oenanthe*, *Persicaria*, *Pleuropogon*, *Sarcocornia* (=*Salicornia*), *Schoenoplectus*, *Scirpus*, *Spartina*, *Typha,* and/or *Xanthium*.

1. Freshwater stands dominated by aquatic, floating or submerged plants, including *Azolla, Brasenia*, *Ceratophyllum*, *Lemna*, *Ludwigia*, and/or *Nuphar*. 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*, *Polygonum*, and *Sparganium* may be present.

Naturalized Temperate Pacific Freshwater Vegetation Group

***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.

Temperate Freshwater Floating Mat Group

***Azolla* (*filiculoides, mexicana*) Alliance**

1c. *Brasenia*, *Ceratophyllum*, *Lemna*, or *Nuphar* dominates on water surfaces of streams, ponds or lakes.

Temperate Pacific Freshwater Aquatic Bed Group

1c1. *Ceratophyllum demersum* dominates. One stand was encountered for this project, near the eastern border of Sonoma County in a dammed pond. Other stands are likely to occur in the county.

***Ceratophyllum demersum* Provisional Alliance**
Ceratophyllum demersum Western Provisional Association

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

***Nuphar* spp. – *Potamogeton* spp. – *Lemna* spp. Freshwater Aquatic Provisional Alliance**
Brasenia schreberi Provisional Association
Nuphar lutea ssp. *polysepala* Provisional Association

2. 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.

Western North American Freshwater Marsh Macrogroup

2a. *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 Freshwater Emergent Marsh Group

2a1. *Schoenoplectus acutus* dominates or co-dominates with a species of *Typha*.

***Schoenoplectus acutus* Alliance**
Schoenoplectus acutus Association

2a2. *Schoenoplectus californicus* dominates or co-dominates with a species of *Typha*.

***Schoenoplectus californicus* Alliance**
Schoenoplectus californicus Association

2a3. *Typha angustifolia*, *T. domingensis*, and/or *T. latifolia* dominate in semi-permanently flooded freshwater or brackish marshes. If *Schoenoplectus acutus* or *S. californicus* is co-dominant, key to the appropriate *Schoenoplectus* Alliance.

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

2b. *Argentina egedii*, *Bolboschoenus maritimus*, *Carex nudata*, *C. obnupta*, *C. praegracilis*, *C. pansa*, *Distichlis spicata*, *Eleocharis macrostachya*, *Juncus effusus*, *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 Coastal/Tidal Marsh and Meadow Group

2b1. *Argentina egedii* (=*A. anserina* or *Potentilla anserina* ssp. *pacifica*) dominates or co-dominates with *Bolboschoenus maritimus*, *Carex nudata*, *Distichlis spicata*, *Eleocharis macrostachya*, *Holcus lanatus*, *Juncus lescurii*, *Leontodon taraxacoides*, and *Rumex acetosella*. If *Oenanthe sarmentosa* is co-dominant, key to the *O. sarmentosa* Alliance below.

***Argentina egedii* Alliance**
Argentina egedii Association

2b2. *Carex praegracilis*, *C. pansa*, or *C. tumulicola* dominates or co-dominates with *Holcus lanatus* or *Lolium perenne*. Stands of *C. praegracilis* are not restricted to the coast. One stand was sampled near the eastern boundary of the county in a moist depression on a hillside.

***Carex* (*pansa*, *praegracilis*) Provisional Alliance**
Carex praegracilis Provisional Association

2b3. *Carex obnupta* dominates in the herbaceous layer in a variety of freshwater and brackish settings near the coast.

***Carex obnupta* Alliance**
Carex obnupta Association

2b4. *Juncus effusus*, *J. patens*, *J. occidentalis*, and/or *J. phaeocephalus* 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*) Provisional Alliance**
Juncus effusus Association
Juncus patens Provisional Association
Juncus patens – Holcus lanatus Provisional Association
Juncus patens – Juncus occidentalis Provisional Association
Juncus phaeocephalus Provisional Association

2b5. *Juncus lescurii* dominates or co-dominates with *Agrostis stolonifera*, *Argentina egedii*, *Eleocharis macrostachya*, or *Juncus phaeocephalus* in slightly brackish marshes or seeps near salt marshes.

***Juncus lescurii* Alliance**
Juncus lescurii Association

2b6. *Oenanthe sarmentosa* dominates or co-dominates with *Argentina egedii* in freshwater to slightly brackish marshes.

***Oenanthe sarmentosa* Alliance**
Oenanthe sarmentosa Association

2b7. *Scirpus microcarpus* dominates in marshes, roadside ditches, and along stream banks. Larger forbs such as *Conium maculatum*, *Oenanthe*, *Heracleum maximum*, *and Urtica dioica* may be present as sub-dominants.

***Scirpus microcarpus* Alliance**
Scirpus microcarpus Association

3. Salt and brackish marshes dominated or co-dominated by *Bolboschoenus*, *Distichlis*, *Sarcocornia* (=*Salicornia*), and/or *Spartina*. 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 3e).

North American Pacific Coastal Salt Marsh Macrogroup

Temperate Pacific Tidal Salt and Brackish Meadow Group

3a. *Bolboschoenus maritimus* dominates or co-dominates with *Sarcocornia* (=*Salicornia*) *pacifica*.

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

3b. *Distichlis spicata* dominates or co-dominates with *Frankenia salina* and/or *Jaumea carnosa*. *Sarcocornia pacifica* may present as a sub-dominant.

***Distichlis spicata* Alliance**
Distichlis spicata – Frankenia salina – Jaumea carnosa Association

3c. *Sarcocornia pacifica* dominates or co-dominates with *Jaumea carnosa*, *Distichlis spicata*, and/or *Lepidium latifolium*.

***Sarcocornia pacifica* (*Salicornia depressa*) Alliance**
Sarcocornia pacifica Association
Sarcocornia pacifica – Jaumea carnosa – Distichlis spicata Association
Sarcocornia pacifica – Lepidium latifolium Association

3d. *Spartina foliosa* dominates on mudflats, banks, berms, and margins of bays and deltas.

***Spartina foliosa* Alliance**
Spartina foliosa Association

3e. 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 so sparse and/or uneven that stands are not recognized by the USNVC.

Mudflat/Dry Pond Bottom Mapping Unit

4. Herbaceous stands dominated or characterized by *Eleocharis macrostachya*, *Grindelia stricta*, *Lasthenia glaberrima*, or *Pleuropogon californicus*. 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. Many true vernal pool types occur in Sonoma County, but are not treated in this report[3].

Western North America Vernal Pool Macrogroup

Californian Mixed Annual/Perennial Freshwater Vernal Pool / Swale Bottomland Group

4a. *Pleuropogon californicus* and/or *Lasthenia glaberrima* are present with high cover in the herbaceous layer. 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

4b. *Eleocharis macrostachya* dominates in the herbaceous layer along lakeshores, streambeds, swales, vernal pools, pastures, ditches, and ponds. If *Lasthenia glaberrima* or *Pleuropogon californicus* is present with high cover, key to the *L. glaberrima* Alliance above.

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

4c. *Grindelia stricta* dominates or co-dominates with non-native herbs such as *Raphanus sativus*, *Vulpia bromoides*, and *Bromus diandrus*. Stands may be found on slightly elevated or drier ground adjacent to coastal dunes, salt or alkaline marshes, or on bluffs, levees, and road margins.

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

5. Wetland herbaceous vegetation dominated or characterized by *Bidens frondosa*, *Carex barbarae*, *C. nudata*, *C. serratodens*, *Juncus arcticus*, *Lepidium latifolium*, *Leymus triticoides, Mimulus guttatus*, *Persicaria lapathifolia*, or *Xanthium strumarium*. Stands occupy settings where saturated soil or standing water throughout the growing season are key characteristics.

Western North America Wet Meadow and Low Shrub Carr Macrogroup

5a. Stands dominated or characterized by the species of *Carex*, *Juncus*, *Leymus*, or *Mimulus* mentioned above.

Californian Warm Temperate Marsh/Seep Group

5a1. *Carex barbarae* dominates in seasonally or intermittently saturated wetlands.

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

5a2. *Carex nudata* dominates along rocky creeks and streams below the high water mark. If *Argentina egedii* is co-dominant, key to the *A. egedii* Alliance (see 2b1).

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

5a3. *Carex serratodens* dominates or co-dominates with *Agoseris heterophylla*, *Juncus arcticus*, or *Leymus triticoides*. Stands are often found on serpentine substrates.

***Carex serratodens* Provisional Alliance**
Carex serratodens Provisional Association

[3] Vernal pool data collected from over 100 relevés in the Santa Rosa Plain from 2007–2009 have not been completely analyzed. The final classification and mapping will be treated under a separate vernal pool phase of the Sonoma County vegetation project. The vernal pool stands studied so far appear to fall largely within the *Lasthenia glaberrima* Alliance, but new associations may be defined and some samples may represent other alliances.

5a4. *Juncus arcticus* (var. *balticus* or *mexicanus*) dominates in freshwater, brackish, or alkaline settings. *Mentha pulegium*, *Poa pratensis,* and other hydrophytes may intermix as sub-dominants.

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

5a5. *Leymus triticoides* dominates or co-dominates with *Briza maxima*, *Lolium perenne,* or other non-native grasses or forbs. Stands are found on poorly drained floodplains, valley bottoms, and brackish marsh margins.

***Leymus triticoides* Alliance**
Leymus triticoides Association
Leymus triticoides – Lolium perenne Association

5a6. *Mimulus guttatus* or another wetland *Mimulus* species dominates or co-dominates in the herbaceous layer with *Eleocharis*, *Juncus*, or *Lolium perenne*. Stands are found in moist or saturated settings along streams, ephemeral cascades, ditches, fens, seeps, and springs.

***Mimulus* (*guttatus*) Alliance**
Mimulus guttatus Association

5b. Stands dominated or characterized by the non-native or ruderal taxa mentioned above: *Bidens*, *Lepidium*, *Persicaria*, and/or *Xanthium*.

Naturalized Warm-Temperate Riparian and Wetland Group

5b1. *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.

***Lepidium latifolium* Semi-Natural Alliance**
Lepidium latifolium – Distichlis spicata Semi-Natural Association

5b2. *Bidens frondosa*, *Persicaria* spp., and/or *Xanthium* spp. dominate in marshes and regularly disturbed vernally wet ponds, fields, and stream terraces.

***Persicaria lapathifolia – Xanthium strumarium* Provisional Alliance**
Bidens frondosa Provisional 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*, *Asclepias solanoana*, *Avena*, *Brachypodium*, *Brassica*, *Briza*, *Bromus*, *Calamagrostis*, *Carpobrotus*, *Centaurea*, *Cynosurus*, *Danthonia*, *Deschampsia*, *Elymus elymoides*, *E. glaucus*, *E. multisetus*, *Eriogonum cedrorum*, *E. luteolum*, *E. nudum*, *Erodium*, *Eryngium armatum*, *Eschscholzia*, *Festuca arundinacea*, *F. californica*, *F. idahoensis*, *Heterotheca*, *Holcus*, *Hordeum*, *Lasthenia californica*, *Leymus mollis*, *Lolium*, *Melica*, *Mesembryanthemum*, *Nassella*, *Phalaris*, *Plagiobothrys nothofulvus*, *Plantago erecta*, *Pteridium*, *Raphanus*, *Selaginella wallacei, Streptanthus*, and/or *Vulpia*.

6. *Allium falcifolium*, *Asclepias solanoana*, *Eriogonum cedrorum*, *E. luteolum*, *E. nudum*, *Selaginella wallacei,* and/or *Streptanthus morrisonii* characterize or dominate stands on exposed rock.

California Cliff, Scree, and Other Rock Vegetation Macrogroup

Central California Coast Ranges Cliff and Canyon Group

6a. *Selaginella wallacei* dominates or characterizes small stands on rock outcrops, cliff faces, or skeletal soils over gently to steeply sloping, impervious substrates. Moss and lichen species often intermix.

***Selaginella wallacei* Alliance**

6b. Sparsely vegetated herbaceous stands (generally less than 2% absolute cover) characterized by *Allium falcifolium*, *Asclepias solanoana*, *Eriogonum cedrorum*, *E. luteolum*, *E. nudum*, and/or *Streptanthus morrisonii,* growing on steep serpentine barrens with exposed gravel and bedrock.

***Allium falcifolium – Eriogonum* spp. – *Streptanthus* spp. Provisional Alliance**
Eriogonum luteolum – Streptanthus morrisonii Provisional Association

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

California Coastal Scrub Macrogroup

Central and South Coastal California Seral Scrub Group

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

***Eriogonum* (*elongatum*, *nudum*) Provisional Alliance**
Eriogonum nudum Provisional Association

7b. *Heterotheca oregona*, a perennial herb that acts like a short-lived shrub, dominates herbaceous stands with seasonal hydrologic disturbance. Found along sunny, rocky stream terraces, seasonally dry streambeds, sandbars in river drainages, and cobbled gravel bars in floodplains.

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

8. Native and non-native annual forb/grass vegetation AND native perennial grasslands growing within the California Mediterranean climate. Stands are generally found in relatively drier sites than those in the 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, *Avena*, *Brassica*, *Bromus*, *Centaurea*, *Cynosurus*, *Elymus glaucus*, *Eschscholzia*, *Lasthenia californica*, *Lolium*, *Nassella*, *Melica*, *Plantago erecta*, *Pteridium aquilinum*, *Vulpia microstachys*, and *Plagiobothrys nothofulvus*.

California Annual and Perennial Grassland Macrogroup

8a. Herbaceous vegetation dominated, co-dominated or characterized by native annual forbs and grasses such as *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.

California Annual Herb/Grass 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*) Provisional Alliance**
Bromus hordeaceus – Lupinus nanus – Trifolium spp. Association
Eschscholzia californica 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*, *Erigeron glaucus*, *Calycadenia multiglandulosa*, *C. truncata*, *Hemizonia congesta*, *Lomatium*, *Lotus humistratus*, *Micropus californicus*, *Plantago erecta*, and/or *Vulpia microstachys* dominate individually or in combination 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 Provisional Association
Hemizonia congesta – Lolium perenne Provisional Association
Lotus humistratus – Plantago erecta – Lomatium spp. Provisional Association
Micropus californicus Provisional Association
Vulpia microstachys – Plantago erecta – Calycadenia (*truncata*, *multiglandulosa*) Association

8b. *Bromus carinatus*, *Elymus glaucus*, *Melica californica*, *Nassella pulchra,* and/or *Pteridium aquilinum*, all native perennial grasses, are dominant or characteristic in stands, sometimes with equal or greater cover of non-native herbs.

California Perennial Grassland Group

8b1. *Bromus carinatus*, *Elymus glaucus* and/or *Pteridium aquilinum* dominate or co-dominate near meadows, in forested openings, and on elevated flats. *Anagallis arvensis*, *Bromus hordeaceus*, *Geranium dissectum*, *Rumex acetosella*, and *Vulpia bromoides* are often present.

***Elymus glaucus – Bromus carinatus* Provisional Alliance**
Bromus carinatus Provisional Association
Elymus glaucus Association
Pteridium aquilinum Provisional Association

8b2. *Melica californica* and/or *Nassella pulchra* are dominant, co-dominant or characteristic in stands. *Achnatherum lemmonii*, *Avena*, *Bromus*, *Hemizonia congesta*, *Lolium perenne*, *Plantago erecta*, and/or *P. lanceolata* intermix as dominant, co-dominant or characteristic taxa in associations of this alliance.

***Nassella* spp. – *Melica* spp. Provisional Alliance**
Melica californica Provisional Association
Nassella pulchra Association
Nassella pulchra – Achnatherum lemmonii Provisional Association
Nassella pulchra – Avena spp. – *Bromus* spp. Association
Nassella pulchra – Hemizonia congesta Provisional Association
Nassella pulchra – Lolium perenne – Plantago erecta Serpentine Provisional Association
Nassella pulchra – Melica californica – Annual Grass Association
Nassella pulchra – Plantago lanceolata Provisional Association

8c. Herbaceous vegetation strongly dominated by non-native grasses and forbs such as *Avena*, *Brachypodium*, *Brassica*, *Briza*, *Bromus*, *Centaurea*, *Cynosurus*, *Danthonia pilosa*, *Erodium*, *Lolium, Nassella manicata,* 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.

Mediterranean California Naturalized Annual and Perennial Grassland Group

8c1. *Avena*, *Brachypodium*, *Briza*, *Bromus*, and/or *Erodium* dominate individually or in combination.

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

8c2. *Brassica nigra*, *Raphanus sativus,* or another non-native mustard dominates in the herbaceous layer, often in old or active agriculture lands.

***Brassica nigra* and Other Mustards Semi-Natural Alliance**
Brassica nigra Semi-Natural Association
Raphanus sativus Semi-Natural Association

8c3. *Centaurea solstitialis* or another non-native species of *Centaurea* dominates herbaceous stands.

***Centaurea* (*solstitialis*, *melitensis*) Semi-Natural Alliance**
Centaurea solstitialis Semi-Natural Association

8c4. *Cynosurus echinatus*, *Danthonia pilosa*, 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* Semi-Natural Alliance**
Cynosurus echinatus – (*Danthonia pilosa* – *Nassella manicata*) Provisional Semi-Natural Association

8c5. *Lolium perenne* dominates or co-dominates with *Avena barbata*, *Bromus hordeaceus*, *Hordeum marinum*, *H. murinum*, *Medicago*, *Trifolium subterraneum,* and other non-natives in herbaceous stands. Often found on moist or poorly drained sites, on or off serpentine.

***Lolium perenne* Semi-Natural Alliance**
Lolium perenne 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*, *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*, *Festuca arundinacea*, *Holcus*, and/or *Phalaris* are dominant, co-dominant, or characteristic in herbaceous stands.

Western North American Temperate Grassland and Meadow Macrogroup

9a1. Non-native, slightly mesic, disturbed pasturelands dominated or co-dominated by the following perennial grasses: *Agrostis gigantea*, *A. stolonifera*, *Anthoxanthum*, *Festuca arundinacea*, *Holcus*, 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.

Vancouverian and Rocky Mountain Naturalized Perennial Grassland 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 Sonoma County.

***Agrostis* (*gigantea*, *stolonifera*) – *Festuca arundinacea* Semi-Natural Alliance**
Festuca arundinacea Provisional Semi-Natural Association

9a1b. *Holcus lanatus* and/or *Anthoxanthum odoratum* dominate individually or in combination. Other co-dominants may include *Briza maxima*, *Pteridium aquilinum*, *Rumex acetosella*, and *Vulpia bromoides*.

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

9a1c. *Phalaris aquatica* dominates in naturalized or planted stands. Other non-native herbs, such as *Carduus pycnocephalus* may be present with similar cover.

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

9b. Native grasslands dominated, co-dominated, or characterized by the following perennial grasses: *Bromus carinatus*, *Elymus elymoides*, *E. glaucus*, *E. multisetus*, *Festuca californica*, *F. idahoensis*, or *Pteridium aquilinum*. May occur near the coast or inland.

Western Dry Upland Perennial Grassland Group

9b1. *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.

***Elymus* (*elymoides*, *multisetus*) Provisional Alliance**
Elymus multisetus – (*Eschscholzia californica – Plantago erecta*) Provisional Association

9b2. *Festuca idahoensis* dominates or co-dominates with *Danthonia californica* and/or *Elymus multisetus*. *Bromus carinatus*, *Elymus glaucus*, *Plantago erecta,* and a variety of native and non-native forbs and grasses may intermix as sub-dominants. Occasionally, the larger *Festuca californica* may replace *F. idahoensis* in somewhat shadier or less exposed sites.

***Festuca idahoensis* Alliance**
Festuca californica Provisional Association
Festuca idahoensis – Bromus carinatus Association
Festuca idahoensis – Danthonia californica Provisional Association
Festuca idahoensis Ultramafic Provisional Association

9c. Native, mesic to moist, primarily coastal grasslands dominated, co-dominated, or characterized by *Calamagrostis nutkaensis*, *Deschampsia cespitosa*, *Danthonia californica*, *Eryngium armatum,* and/or *Hordeum brachyantherum*. *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.

9c1. *Deschampsia cespitosa*, *Danthonia californica*, 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.

Western Cordilleran Montane-Boreal Wet Meadow Macrogroup

Western Cordilleran Montane-Boreal Mesic Wet Meadow Group

***Deschampsia cespitosa* Alliance**
Deschampsia cespitosa – Danthonia californica Association
Deschampsia cespitosa – Eryngium armatum Provisional Association
Deschampsia cespitosa – Holcus lanatus Provisional Association

9c2. *Hordeum brachyantherum* dominates or co-dominates with *Bromus carinatus*, *Hypochaeris*, *Lolium perenne*, *Lotus corniculatus*, *Plantago erecta*, and *Trifolium subterraneum* in moist meadows, along stream terraces and coastal bluffs, and near seeps and springs.

Western Cordilleran Montane Shrubland and Grassland Macrogroup

Western Cordilleran Montane Moist Graminoid Meadow Group

***Hordeum brachyantherum* Alliance**
Hordeum brachyantherum Association

9c3. *Calamagrostis nutkaensis* dominates or co-dominates with *Baccharis pilularis* OR stands are dominated or characterized by *Danthonia californica* with *Briza maxima*, *Nassella pulchra*, and/or *Vulpia bromoides*. Stands are found along valley bottoms, lower portions of alluvial slopes, terraces, floodplains, and ridges.

Vancouverian Lowland Grassland and Shrubland Macrogroup

Vancouverian Coastal Grassland Group

9c3a. *Calamagrostis nutkaensis* dominates or co-dominates with *Baccharis pilularis*. *Heracleum maximum*, *Holcus lanatus*, *Juncus patens*, and/or *Rubus ursinus* often intermix in stands.

***Calamagrostis nutkaensis* Alliance**
Calamagrostis nutkaensis / *Baccharis pilularis* Association

9c3b. *Danthonia californica* dominates OR characterizes stands in combination with: 1) *Nassella pulchra* or 2) *Briza maxima* and/or *Vulpia bromoides*. In the latter two cases, *Danthonia* and the other species share at least 15% relative cover in the herb layer, with other non-native grasses and forbs sometimes having higher cover (e.g., *Cynosurus echinatus*, *Holcus lanatus*, and *Hypochaeris radicata*).

***Danthonia californica* Alliance**
Danthonia californica – (*Briza maxima* – *Vulpia bromoides*) Provisional Association
Danthonia californica – *Nassella pulchra* Provisional Association

10. Coastal dune, bluff, meadow, and other vegetation dominated by herbaceous species such as *Abronia*, *Ambrosia*, *Ammophila*, *Carpobrotus*, *Leymus mollis*, and *Mesembryanthemum*.

10a. Native species, including *Abronia latifolia*, *Ambrosia chamissonis*, *Artemisia pycnocephala*, and/or *Leymus mollis* dominate or co-dominate on dunes or bluffs. Plants are adapted to salt spray, wind and shifting sands and are thus capable of colonizing relatively unstable and sterile substrates.

Vancouverian Coastal Dune and Bluff Macrogroup

Vancouverian/Pacific Dune Mat Group

10a1. *Abronia latifolia*, *Ambrosia chamissonis*, and/or *Artemisia pycnocephala* dominate, sometimes with *Calystegia soldanella* or *Polygonum paronychia* occurring as associated species. *Cakile maritima*, *Ammophila arenaria*, *Camissonia cheiranthifolia* and *Eriogonum latifolium* may be present.

***Abronia latifolia – Ambrosia chamissonis* Alliance**
Ambrosia chamissonis Provisional Association
Artemisia pycnocephala – Calystegia soldanella Association
Artemisia pycnocephala – Polygonum paronychia Association

10a2. *Leymus mollis* dominates in the herbaceous layer. *Abronia*, *Artemisia pycnocephala*, *Cakile*, and other herbaceous species may be present as sub-dominants.

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

10b. Non-natives, including *Ammophila*, *Carpobrotus*, and/or *Mesembryanthemum* dominate on dunes, bluffs, or disturbed lands. Emergent shrubs such as *Baccharis pilularis* or *Lupinus arboreus* may be present.

California–Vancouverian Semi-Natural Littoral Scrub and Herb Vegetation Group

10b1. *Ammophila arenaria* is strongly dominant in the herbaceous layer.

***Ammophila arenaria* Semi-Natural Alliance**
Ammophila arenaria Semi-Natural Association

10b2. *Carpobrotus* and/or *Mesembryanthemum* dominate on bluffs, dunes, or disturbed lands, often forming impenetrable mats that prevent natives from establishing.

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

APPENDIX F

Classification Crosswalk

This table is a crosswalk showing the relationship between the NVCS-compliant alliances of the Sonoma vegetation classification and two other classification systems: the California Wildlife Habitat Relationships (CWHR) and the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg). Associations are not included in this table because they generally crosswalk to the same CWHR and Calveg types as their parent alliances. The only exceptions are the *Quercus lobata* associations, which can crosswalk to a riparian or woodland CWHR type depending upon environment.

The crosswalk is divided into three sections based on dominance by trees, shrubs, or herbs. Alliances are listed alphabetically within each section.

NVCS Name	CWHR Type	CWHR Code	Calveg Name	Calveg Code
Trees				
Abies grandis Alliance	Redwood	RDW	Grand Fir	GF
Acer macrophyllum Alliance	Montane Hardwood	MHW	Bigleaf Maple	QM
Acer negundo Alliance	Valley Foothill Riparian	VRI	Fremont Cottonwood	QF
Aesculus californica Alliance	Montane Hardwood	MHW	California Buckeye	QI
Alnus rhombifolia Alliance	Montane Riparian	MRI	White Alder	QE
Alnus rubra Alliance	Valley Foothill Riparian	VRI	Red Alder	QR
Arbutus menziesii Alliance	Coastal oak woodland	COW	Madrone	QH
Eucalyptus (globulus, camaldulensis) Semi-Natural Alliance	Eucalyptus	EUC	Eucalyptus	QZ
Fraxinus latifolia Alliance	Montane Riparian	MRI	Riparian Mixed Hardwood	NR
Hesperocyparis macnabiana Alliance	Closed-Cone Pine–Cypress	CPC	McNab Cypress	MN
Hesperocyparis macrocarpa Special Stands and Semi-Natural Alliance	Closed-Cone Pine–Cypress	CPC	Monterey Cypress	MM
Hesperocyparis sargentii Alliance	Closed-Cone Pine–Cypress	CPC	Sargent Cypress	MS
Juglans hindsii and Hybrids Special Stands and Semi-Natural Alliance	Valley Foothill Riparian	VRI	Riparian Mixed Hardwood	NR
Notholithocarpus densiflorus Alliance	Montane Hardwood	MHW	Tanoak	QT
Pinus attenuata Alliance	Closed-Cone Pine–Cypress	CPC	Knobcone Pine	KP
Pinus muricata Alliance	Closed-Cone Pine–Cypress	CPC	Bishop Pine	PM

NVCS Name	CWHR Type	CWHR Code	Calveg Name	Calveg Code
Pinus ponderosa – Pseudotsuga menziesii Alliance	Montane Hardwood–Conifer	MHC	Douglas-Fir – Ponderosa Pine	DP
Pinus radiata Alliance	Closed-Cone Pine–Cypress	CPC	Monterey pine	PR
Pinus sabiniana Alliance	Blue Oak–Foothill Pine	BOP	Gray Pine	PD
Populus fremontii Alliance	Valley Foothill Riparian	VRI	Fremont Cottonwood	QF
Pseudotsuga menziesii – Notholithocarpus densiflorus Alliance	Douglas Fir	DFR	Pacific Douglas-Fir	DF
Pseudotsuga menziesii Alliance	Douglas Fir	DFR	Pacific Douglas-Fir	DF
Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni) Alliance	Montane Hardwood	MHW	Coastal Mixed Hardwood	EX
Quercus agrifolia Alliance	Coastal Oak Woodland	COW	Coast Live Oak	QA
Quercus chrysolepis (tree) Alliance	Montane Hardwood	MHW	Canyon Live Oak	QC
Quercus douglasii Alliance	Blue Oak Woodland	BOW	Blue Oak	QD
Quercus garryana (tree) Alliance	Montane Hardwood	MHW	Oregon White Oak	QG
Quercus kelloggii Alliance	Montane Hardwood	MHW	California Black Oak	QK
Quercus lobata Alliance	Valley Oak Woodland, Valley Foothill Riparian	VOW, VRI	Valley Oak	QL
Quercus lobata – Fraxinus latifolia / (Vitis californica) Association	Valley Foothill Riparian	VRI	Valley Oak	QL
Quercus lobata – Quercus agrifolia / Grass Association	Valley Oak Woodland	VOW	Valley Oak	QL
Quercus lobata / Grass Association	Valley Oak Woodland	VOW	Valley Oak	QL
Quercus lobata / Rubus ursinus – Rosa californica Provisional Association	Valley Foothill Riparian	VRI	Valley Oak	QL
Quercus parvula var. *shrevei* Provisional Alliance	Coastal Oak Woodland	COW	Shreve Oak	AS
Quercus wislizeni (tree) Alliance	Montane Hardwood	MHW	Interior Live Oak	QW
Salix laevigata Alliance	Valley Foothill Riparian	VRI	Willow	QO
Salix lucida Alliance	Montane Riparian	MRI	Willow	QO
Sequoia sempervirens Alliance	Redwood	RDW	Redwood	RW
Umbellularia californica Alliance	Coastal Oak Woodland	COW	California Bay	QB
Shrubs				
Adenostoma fasciculatum Alliance	Mixed Chaparral	MCH	Chamise	CA

NVCS Name	CWHR Type	CWHR Code	Calveg Name	Calveg Code
Arctostaphylos (bakeri, montana) Provisional Alliance	Mixed Chaparral	MCH	Manzanita	SD
Arctostaphylos (canescens, manzanita, stanfordiana) Provisional Alliance	Mixed Chaparral	MCH	Manzanita	SD
Arctostaphylos (nummularia, sensitiva) Alliance	Mixed Chaparral	MCH	Pygmy (Fort Bragg) Manzanita	AN
Arctostaphylos glandulosa Alliance	Mixed Chaparral	MCH	Manzanita	SD
Arctostaphylos viscida Alliance	Mixed Chaparral	MCH	Whiteleaf Manzanita	CW
Baccharis pilularis Alliance	Coastal Scrub	CSC	Coyote Brush	CK
Ceanothus cuneatus Alliance	Mixed Chaparral	MCH	Wedgeleaf Ceanothus	CL
Ceanothus oliganthus Alliance	Mixed Chaparral	MCH	Ceanothus Chaparral	CC
Ceanothus thyrsiflorus Alliance	Coastal Scrub	CSC	Blueblossom	SC
Cercocarpus montanus Alliance	Mixed Chaparral	MCH	Birchleaf Mountain Mahogany	WM
Eriodictyon californicum – Lupinus albifrons Provisional Alliance	Coastal Scrub	CSC	North Coastal Scrub	NC
Eriogonum (elongatum, nudum) Provisional Alliance	Coastal Scrub	CSC	North Coastal Scrub	NC
Frangula californica – Rhododendron occidentale Provisional Alliance	Valley Foothill Riparian	VRI	Willow (Shrub)	WL
Gaultheria shallon – Rubus (ursinus) Provisional Alliance	Coastal Scrub	CSC	Salal–California Huckleberry	CB
Lupinus arboreus Alliance and Semi-Natural Alliance	Coastal Scrub	CSC	North Coastal Scrub	WA
Lupinus chamissonis – Ericameria ericoides Alliance	Coastal Scrub	CSC	North Coastal Scrub	NC
Morella californica – Rubus spectabilis Provisional Alliance	Valley Foothill Riparian	VRI	Riparian Mixed Shrub	NM
Quercus berberidifolia – Adenostoma fasciculatum Alliance	Mixed Chaparral	MCH	Scrub Oak	CS
Quercus berberidifolia Alliance	Mixed Chaparral	MCH	Scrub Oak	CS
Quercus durata Alliance	Mixed Chaparral	MCH	Scrub oak	CS
Quercus wislizeni (shrub) Alliance	Mixed Chaparral	MCH	Scrub Oak	CS
Rubus armeniacus Semi-Natural Alliance	Valley Foothill Riparian	VRI	Riparian Mixed Shrub	NM
Salix breweri Alliance	Valley Foothill Riparian	VRI	Willow (shrub)	WL
Salix exigua Alliance	Valley Foothill Riparian	VRI	Willow (shrub)	WL
Salix lasiolepis Alliance	Valley Foothill Riparian	VRI	Willow (shrub)	WL
Salix sitchensis Provisional Alliance	Valley Foothill Riparian	VRI	Willow (Shrub)	WL

NVCS Name	CWHR Type	CWHR Code	Calveg Name	Calveg Code
Sambucus nigra Alliance	Coastal Oak Woodland	COW	Coastal Mixed Hardwood	EX
Toxicodendron diversilobum Alliance	Coastal Scrub	CSC	North Coastal Scrub	NC
Herbs				
Abronia latifolia – Ambrosia chamissonis Alliance	Coastal Scrub	CSC	Dunes	DU
Agrostis (gigantea, stolonifera) – Festuca arundinacea Semi-Natural Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Allium falcifolium – Eriogonum spp. *– Streptanthus* spp. Provisional Alliance	Barren	BAR	Barren	BA
Ammophila arenaria Semi-Natural Alliance	Perennial Grassland	PGS	Dunes	DU
Argentina egedii Alliance	Fresh Emergent Wetland	FEW	Wet Meadows	HJ
Avena spp. *– Bromus* spp. Provisional Semi-Natural Alliance	Annual Grassland	AGS	Annual Grasses and Forbs	HG
Azolla (filiculoides, mexicana) Provisional Alliance	Fresh Emergent Wetland	FEW	Water	WA
Bolboschoenus maritimus Alliance	Saline Emergent Wetland	SEW	Tule-Cattail	HT
Brassica nigra and Other Mustards Semi-Natural Alliance	Annual Grassland	AGS	Annual Grasses and Forbs	HG
Calamagrostis nutkaensis Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Carex (pansa, praegracilis) Provisional Alliance	Wet Meadow	WTM	Wet Meadows	HJ
Carex barbarae Alliance	Fresh Emergent Wetland	FEW	Wet Meadows	HJ
Cynosurus echinatus Semi-Natural Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Carex nudata Alliance	Montane Riparian	MRI	Wet Meadows	HJ
Carex obnupta Alliance	Fresh Emergent Wetland	FEW	Wet Meadows	HJ
Carex serratodens Provisional Alliance	Wet Meadow	WTM	Wet Meadows	HJ
Centaurea (solstitialis, melitensis) Semi-Natural Alliance	Annual Grassland	AGS	Annual Grasses and Forbs	HG
Ceratophyllum demersum Provisional Alliance	Fresh Emergent Wetland	FEW	Water	WA
Danthonia californica Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Deschampsia cespitosa Alliance	Perennial Grassland	PGS	Wet Meadows	HJ
Distichlis spicata Alliance	Saline Emergent Wetland	SEW	Pickleweed–Cordgrass	HC
Eleocharis (acicularis, macrostachya) Provisional Alliance	Fresh Emergent Wetland	FEW	Wet Meadows	HJ
Elymus (elymoides, multisetus) Provisional Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM

NVCS Name	CWHR Type	CWHR Code	Calveg Name	Calveg Code
Elymus glaucus – Bromus carinatus Provisional Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Eschscholzia (californica) – Lupinus (nanus) Provisional Alliance	Annual Grassland	AGS	Annual Grasses and Forbs	HG
Festuca idahoensis Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Grindelia (stricta) Provisional Alliance	Saline Emergent Wetland	SEW	Pickleweed–Cordgrass	HC
Heterotheca (oregona, sessiliflora) Provisional Alliance	Coastal Scrub	CSC	North Coastal Scrub	NC
Holcus lanatus – Anthoxanthum odoratum Semi-Natural Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Hordeum brachyantherum Alliance	Wet Meadow	WTM	Wet Meadows	HJ
Juncus (effusus, patens) Provisional Alliance	Wet Meadow	WTM	Wet Meadows	HJ
Juncus arcticus (var. balticus, mexicanus) Alliance	Fresh Emergent Wetland	FEW	Perennial Grasses and Forbs	HM
Juncus lescurii Alliance	Fresh Emergent Wetland	FEW	Wet Meadows	HJ
Lasthenia californica – Plantago erecta – Vulpia microstachys Alliance	Annual Grassland	AGS	Annual Grasses and Forbs	HG
Lasthenia glaberrima Alliance	Annual Grassland	AGS	Vernal Pool	VP
Lepidium latifolium Semi-Natural Alliance	Saline Emergent Wetland	SEW	Pickleweed–Cordgrass	HC
Leymus mollis Alliance	Perennial Grassland	PGS	Dunes	DU
Leymus triticoides Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Lolium perenne Semi-Natural Alliance	Annual Grassland	AGS	Annual Grasses and Forbs	HG
Ludwigia (hexapetala, peploides) Semi-Natural Alliance	Fresh Emergent Wetland	FEW	Water	WA
Mesembryanthemum spp. – *Carpobrotus* spp. Semi-Natural Alliance	Coastal Scrub	CSC	Coastal Bluff Scrub	SH
Mimulus (guttatus) Alliance	Wet Meadow	WTM	Wet Meadows	HJ
Nassella spp. – *Melica* spp. Provisional Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Nuphar spp. – *Potamogeton* spp. – *Lemna* spp. Freshwater Aquatic Provisional Alliance	Fresh Emergent Wetland	FEW	Water	WA
Oenanthe sarmentosa Alliance	Fresh Emergent Wetland	FEW	Wet Meadows	HJ
Persicaria lapathifolia – Xanthium strumarium Provisional Alliance	Fresh Emergent Wetland	FEW	Wet Meadows	HJ
Phalaris aquatica Semi-Natural Alliance	Perennial Grassland	PGS	Perennial Grasses and Forbs	HM
Plagiobothrys nothofulvus Alliance	Annual Grassland	AGS	Annual Grasses and Forbs	HG

NVCS Name	CWHR Type	CWHR Code	Calveg Name	Calveg Code
Sarcocornia pacifica (Salicornia depressa) Alliance	Saline Emergent Wetland	SEW	Pickleweed–Cordgrass	HC
Schoenoplectus acutus Alliance	Fresh Emergent Wetland	FEW	Tule–Cattail	HT
Schoenoplectus californicus Alliance	Fresh Emergent Wetland	FEW	Tule–Cattail	HT
Scirpus microcarpus Alliance	Fresh Emergent Wetland	FEW	Tule–Cattail	HT
Selaginella wallacei Alliance	Coastal Scrub	CSC	Annual Grasses and Forbs	HG
Spartina foliosa Alliance	Saline Emergent Wetland	SEW	Pickleweed–Cordgrass	HC
Typha (angustifolia, domingensis, latifolia) Alliance	Fresh Emergent Wetland	FEW	Tule-Cattail	HT