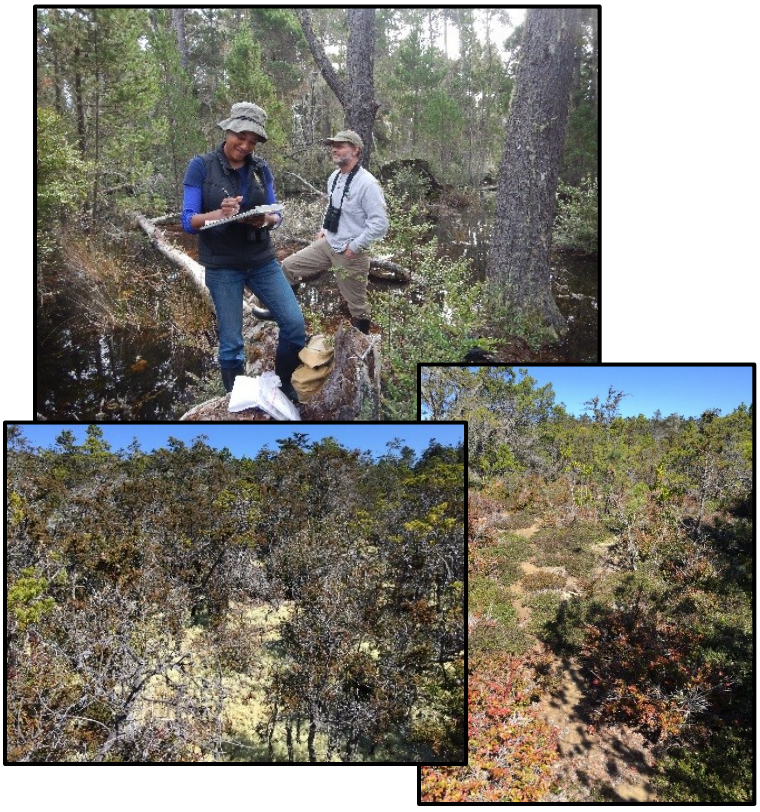
Classification and Mapping of Mendocino Cypress *(Hesperocyparis pygmaea)* Woodland and Related Vegetation on Oligotrophic Soils, Mendocino and Sonoma Counties, California



California Department of Fish and Wildlife Vegetation Classification and Mapping Program

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ABSTRACT

Analysis of field samples of woody vegetation collected on and adjacent to nutrient-poor soils of western Mendocino and northwest Sonoma counties established three new vegetation associations of the Mendocino Cypress *(Hesperocyparis pygmaea)* Woodland Alliance: *Hesperocyparis pygmaea – Pinus contorta* var*. bolanderi / Rhododendron columbianum, Hesperocyparis pygmaea – Pinus contorta* var*. bolanderi - Pinus muricata / Rhododendron macrophyllum,* and *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia.* Additionally, three other associations were also described: *Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia in the Pinus muricata - Pinus radiata Alliance; Arctostaphylos nummularia* in the *Arctostaphylos (nummularia, sensitiva) Alliance;* and *Chrysolepis chrysophylla / Vaccinium ovatum* in the *Chrysolepis chrysophylla Alliance.* Two provisional associations in the *Sequoia sempervirens* Alliance need additional sampling: *Sequoia sempervirens – Pinus muricata* and *Sequoia sempervirens – Hesperocyparis pygmaea*. Mapping the vegetation and land cover types on the extent of the oligotrophic soils in what is likely the historical extent of the Mendocino Cypress *(Hesperocyparis pygmaea)* Woodland and related vegetation reveals a loss of between 20% and 44% of these sensitive vegetation types due to agricultural and urban development.

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CONTRIBUTORS

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California Department of Fish and Wildlife (CDFW) Region 1 staff instrumental in the project included Jennifer Garrison, Linda Miller, Angela Liebenberg, Gordon Leppig, Michael van Hattem, Daniel Harrington, Clare Golec, Cheri Sanville, Rick Macedo, Danielle Castle, and Janelle Deshais. CDFW Vegetation Classification and Mapping Program (VegCAMP) staff included Rachelle Boul, Mary Jo Colletti, Catherine Curley, Diana Hickson, Todd Keeler-Wolf, Anne Klein, Aicha Ougzin, Jaime Ratchford and Rosie Yacoub. We received helpful comments on this report from Jennifer Garrison, Teresa Sholars, and Julie Evens.

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

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INTRODUCTION

The Mendocino cypress forest (also known as the Mendocino pygmy forest) is one of the best-known examples of a sensitive natural community in California. The unique soil and climatic attributes and the resulting vegetation of the Mendocino coastal terraces described by Jenny et al. (1969), Westman (1975), Westman and Whittaker (1975), Sholars (1979), Sholars (1982), Sholars (1984), and others are well known in the scientific and conservation literature. Cheatham and Haller (1975) were among the first to identify "pygmy cypress forest" as a highly localized plant community of conservation value. Since then, the California Department of Parks and Recreation, The Nature Conservancy, and other agencies and organizations have developed conservation and education projects around the notable ecological conditions giving rise to the unique "pygmy ecosystem."

Despite almost a half century of conservation awareness, there has never been an exhaustive study of the distribution and floristic composition of the pygmy vegetation. Until now, specific questions pertaining to extent, variation, and conservation-related threats to the pygmy forest ecosystem have remained unanswerable. Due to the increasing popularity of California's North Coast and the paucity of relatively flat, "unproductive" (with reference to timber production) land, the coastal terrace setting of this ecosystem has become a focal point for development. Therefore, a study specifying the extent and definition of the pygmy ecosystem has become essential to the local, regional, and statewide agencies and organizations tasked with conservation and management.

The California Department of Fish and Wildlife's Vegetation Classification and Mapping Program (VegCAMP) is responsible for the identification, mapping, and rarity ranking of all terrestrial and wetland ecosystems in California. Following several decades of refinement, VegCAMP has developed a set of standards based on the most practical methods of inventory and mapping (see: https://www.wildlife.ca.gov/Data/VegCAMP/Publications-and-Protocols).

The projects typically take a "wall-to-wall" approach of describing and depicting all vegetation of a particular area, such as a county or ecoregion. However, in some cases localized and distinctive sensitive natural communities are inventoried and mapped, disregarding surrounding vegetation or habitat. Such efforts are undertaken when a specific critical conservation need arises and when the natural community in question can be clearly differentiated from surrounding vegetation, such as with Sycamore Alluvial Woodland (Keeler-Wolf et al. 1997).

The project described in this report assumes that the unique and biologically significant elements of the pygmy forest ecosystem are definable without a complete inventory of the surrounding regional vegetation and land-use patterns. This study requires an objectively circumscribed area of interest, assembled from existing geographic information on soils, topography, land use, and ownership data. Within that area, vegetation samples representing the full array of vegetation patterns were collected and classified.

This study has two main objectives. The first is to develop a scientifically rigorous and repeatable definition of the unique suite of vegetation types (or natural communities) that are restricted to, or characteristic of, the nutrient-poor (oligotrophic) soils of the outer coast of Mendocino and adjacent Sonoma Counties. The second is to map and identify the floristically and structurally distinct vegetation patterns at a large scale useful to local planning and management.

The map records information on the vegetation type, horizontal and vertical structure, and degree of disturbance for each individual occurrence. It also categorizes anthropogenic areas within the area,

including development, roads, and other land-use patterns. These areas can show habitat loss or degradation relative to the likely original extent of the natural vegetation.

The primary focus of this study was to describe all natural vegetation falling within the oligotrophic soil boundary. Other vegetation adjacent to the oligotrophic soils of the study area was also targeted for sampling, although generally to a less intense degree; these samples were used to define the outer limit of oligotrophic vegetation. In this report, we refer to vegetation limited to oligotrophic soils as "oligotrophic vegetation" in the same way that vegetation types limited to serpentinite-derived soils are commonly referred to as "serpentine vegetation" (see sidebar).

The additional sampling done outside of the primary focus area did reveal a new rare vegetation type: a plant association defined by the presence of *Hesperocyparis pygmaea* (Mendocino cypress) in a sub-dominant role in forests classified as *Sequoia sempervirens* (Coast Redwood) Alliance. This unique mixture of redwood, Mendocino cypress, and several other tree species is, as with the Mendocino cypress itself, restricted to the coast of Mendocino County and perhaps adjacent Sonoma County. Unlike the other associations defined by the presence of Mendocino cypress, the Coast Redwood-Mendocino Cypress Association contains tall cypress trees that grow alongside mature redwoods. In fact, these rare stands contain the tallest Mendocino cypress known. Therefore, additional effort was taken to inventory (sample, describe, and map) this sensitive natural community, which occurs sporadically in the area immediately surrounding the defined oligotrophic boundary.

Mendocino cypress as a species is recognized as rare by both CNPS (California Rare Plant Rank: 1B.2) and State and National Natural Heritage rankings (State Rank - S1 Critically Imperiled; Global Rank - G1 Critically Imperiled). Vegetation characterized by the presence of such rare species is considered by CDFW to be sensitive species habitat and must be addressed under the California Environmental Quality Act (CEQA) in project planning.

Prior to this project, the first edition of the Manual of California Vegetation (Sawyer and Keeler-Wolf 1995) listed four associations of Mendocino Cypress Alliance. These were interpreted from Westman (1975) based on his 61 samples, which included lichens and vascular plants, and ranged from mesic redwood forest to very short "pygmy" forest. These were then reinterpreted in the second edition of the Manual of California (Sawyer et al. 2009) into three associations as shown in the table below. Due to the

Peinobiome

The most suitable existing term we could find for vegetation limited to nutrient-poor soils is "peinobiome," derived from the Greek peina (hunger), referring to "starved" soils that are very poor in nutrients, from Walter and Box (1976) and Mucina (2018). Westman (1975) states, "analyses of pygmy forest soils show low levels of macro- and micro-nutrients, and high levels of exchangeable aluminum." The Soil Survey for Mendocino County describes the Blacklock-Aborigine Soils (the most likely to support the shortest Mendocino cypress-dominated vegetation types) as "a combination of unfavorable soil properties, including extreme acidity, aluminum toxicity, low nutrient content within the rooting zone, and ... seasonally saturated soil conditions, [resulting] in the stunted plant growth in areas of this unit." Peinobiome may yet become the commonly accepted term for this pygmy forest ecosystem (and other cypress types, serpentine vegetation, and maritime chaparrals) in California, but we aren't making the leap here and will use "oligotrophic vegetation."

small sample size and the incomplete representation of the geographic and gradational range of types, all Westman-derived associations are being replaced by the classification used in this report and are reflected in the updated Online Manual of California.

Westman (1975)	Sawyer and Keeler-Wolf (1995)	Sawyer et al. (2009)
Short hydric pygmy cypress type	*Pygmy cypress / Cladonia bellidiflora*	*Callitropsis (=Hesperocyparis) pygmaea / Cladonia bellidiflora*
Mesophytic pygmy cypress type	*Pygmy cypress / Cladina impexa*	*Callitropsis (=Hesperocyparis) pygmaea / Cladina impexa*
Extreme pygmy cypress type	*Pygmy cypress / Usnea subfloridana*	*Callitropsis (=Hesperocyparis) pygmaea / Usnea subfloridana*
Tall hydric pygmy cypress type	*Pygmy cypress / Ramalina tharusta*	Lumped with *Callitropsis (=Hesperocyparis) pygmaea / Cladonia bellidiflora*

METHODS

Defining the Study and Mapping Area

We used several spatial data layers to circumscribe the potential universe of oligotrophic vegetation communities—the study and mapping area for this project. These included:

- Selected soil types from the SSURGO soil database (NRCS 2014) likely to support oligotrophic vegetation in coastal Mendocino and Sonoma Counties, based on previous studies and field observations (Jenny et al. 1969, Teresa Sholars, personal communication). Primary soil types include Blacklock and Aborigine, Shinglemill-Gibney Complex, and Tropaquepts; secondary types include Gibney-Gibwell complex, Gibwell loamy sand, Noyo coarse sandy loam, Seaside-Rock outcrop complex, and Tregoning-Cleone complex mapping units.
- Point locations for pygmy forest field observations made by CDFW Region 1 staff.
- *Hesperocyparis pygmaea* occurrences recorded by the California Native Plant Society as part of an initiative to map Mendocino cypress and other rare cypress species (CNPS 2007+).
- Rhiannon Korhummel's field reconnaissance observations of pygmy forest or Mendocino cypress collected for graduate work (personal communication).
- Plant species composition and cover plot data collected along a soil gradient from pygmy to non-pygmy forest, provided by Dr. William Russell (personal communication, see also Russell and Woolhouse 2012).
- Map of Mendocino cypress forest locations based on field observation and image interpretation from Tom Bendure, Mendocino Redwoods Company Inventory Forester (personal communication).
- Sonoma County and Mendocino County coastal marine terraces mapped using airborne LiDAR (Chris Bowles, personal communication, see also Bowles, C.J. and E. Cowgill 2012).
- Image interpretation by CDFW vegetation ecologists.

The polygons drawn from the combination of the above data served as the basis for the boundary of our field sampling and mapping. Interpretation of aerial imagery (National Agricultural Imagery Program

(NAIP) from 2014) was used to exclude portions of the polygons that were heavily urbanized. The study and mapping area comprises many individual "islands" surrounded by distinctively non-oligotrophic vegetation growing on non-oligotrophic soils. As the mapping progressed, new areas south of the Navarro River were added based on image interpretation. The final mapping area is shown in Figure 1.

FIGURE 1. The Mendocino Cypress Woodland study area in Mendocino and Sonoma Counties is depicted in green.

Sample Allocation Method and Field Sampling

We allocated sample sites to direct data collection across the range of vegetation types and across the geographic extent of the mapping area. CDFW staff worked with local agencies, non-profits, and private landowners to get permission to access as many areas within the oligotrophic footprint as possible. The accessible parcels were prioritized based on soil type and corroborating field observations. To ensure that samples were well spaced and situated inside parcels that we had permission to enter, we allocated specific points, rather than parcels or soil polygons, to which the field crews would navigate. They would then sample the closest vegetation stand to that point. All allocations were made within the areas shown in Figure 1. Figure 2 illustrates the assignment of allocation points based upon soil type.

In 2015, field crews used the "Combined Vegetation Rapid Assessment and Relevé Field Form" and "Protocol for Combined Vegetation Rapid Assessment and Relevé Sampling Field Form" (Appendix A) to sample 117 stands; eight additional stands were sampled in 2018 after the analysis was completed and so were not included. Survey crews recorded their full names or initials on the data forms (Appendix B provides names and initials from the forms). The survey data included the date of sampling, GPS location, and 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. Complete species lists were recorded for plot-based Relevé surveys, while the most dominant and/or characteristic species were recorded for Rapid Assessments.

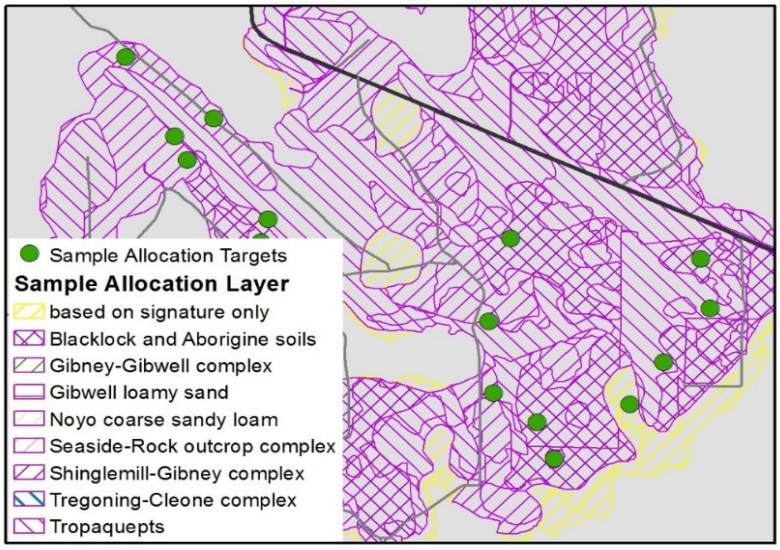

FIGURE 2. An example of a sample allocation map, showing targeted sampling sites.

Percent cover estimates to the nearest 1% were recorded for all listed species. For this study, due to the dense, low woody vegetation typical of the study area, the teams used "bounded" Rapid Assessments. Instead of laying out and measuring the perimeter of the samples using tapes and chaining pins, teams were directed to use laser rangefinders and temporary flagging to measure a set radius from the selected center of a circular plot. The radius reflected the maximum discernable area from the central point, a distance that was typically 20-30 meters (mean 22.9m radius). Crews placed temporary flagging at four measured boundary points and the center. Species composition and estimates of cover, strata height, and topography are restricted to the circular area. This method requires acceptance of variation in the sample area, but due to the relatively low species diversity of the oligotrophic stands, the variation in sample area appeared to have little effect on the total species composition.

An additional 89 samples were collected using the Reconnaissance Field Form and associated protocol (Appendix A). These short surveys include the date of sampling, GPS location, field-assessed vegetation type, descriptive comments, photos, and an abbreviated species list containing only the most dominant/diagnostic species at each site. Because the species lists are limited, these samples were not included in this classification project, but they were used during mapping to identify air photo signatures.

Figure 3 shows the distribution of field samples collected during this project. Also shown are the locations of five samples previously collected by the Dorothy King Young Chapter of CNPS in Mendocino County and six samples from Sonoma County (Klein et al. 2015) that were analyzed together with samples from the current project.

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. 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 staff, and were quality-controlled for accuracy.

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 "2JM" was applied to codes for taxa not in PLANTS but recognized by *The Jepson Manual Online* (Jepson Flora Project 2015). General vegetation types, such as moss and lichen, also have codes beginning with the number 2 (e.g., 2MOSS).

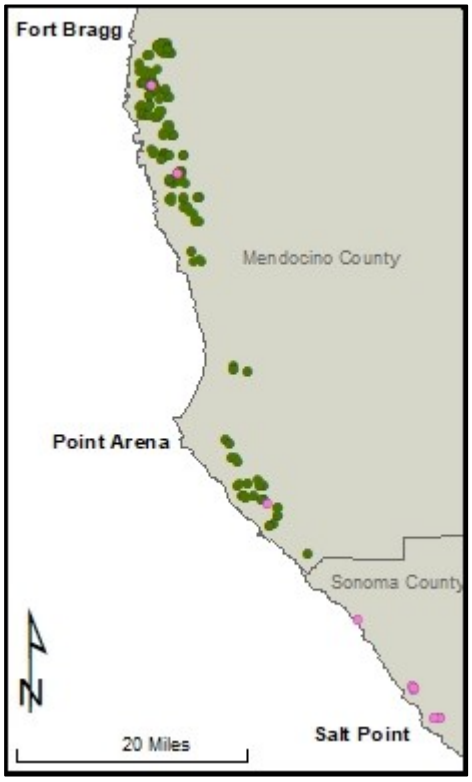

FIGURE 3. Field samples collected for the Mendocino Cypress Woodland project are shown as green points. Samples collected in other projects are shown in pink.

Each field team was given a GPS unit loaded with the sample allocation layer, property boundaries, and aerial imagery to help with navigation, to collect the location of the surveys, and to mark which targeted stands had been surveyed or were not able to be surveyed. In addition to collecting data at the allocated points, field teams were also directed to collect samples in new or under-sampled types as they were able. In areas where we did not have landowner

permission to sample, we collected surveys from public roadsides. Landowner access permission letters are on file at VegCAMP. The survey database and photographs taken at each GPS point are also on file at VegCAMP.

Data Analysis

Classification

Prior to classification, the species list from the samples was reviewed and standardized. Of note, the manzanita taxa *Arctostaphylos nummularia* ssp. *nummularia* and *A. n.* ssp. *mendocinoensis* were merged for classification purposes because they were not clearly distinguishable in the field. The 117 Rapid Assessment samples including 97 species were brought into PC-Ord™ (McCune and Medford 1997) to run indicator species and cluster analyses (Appendix C). After testing for outliers, three samples that were more than 3 standard deviations from the mean were removed (PYGM0065, SONO0663, SONO0466). Additionally, 45 species that occurred in fewer than three samples were removed, leaving 114 samples and 39 species for the cluster analysis. The cluster analysis was based on abundance (cover) values 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%. Appendix D provides the list of taxa identified in all surveys, their PLANTS code, and if they were removed prior to classification or as outliers during classification.

For the analysis, we used the Sorensen distance measure and flexible beta linkage method at -0.25 (McCune and Grace 2002). Indicator species analysis (as programed in PC-Ord 6.0) showed relatively low p-values and high numbers of significant indicator species from three different groupings representing few, moderate, and higher numbers of significant indicator species (Figure 4).

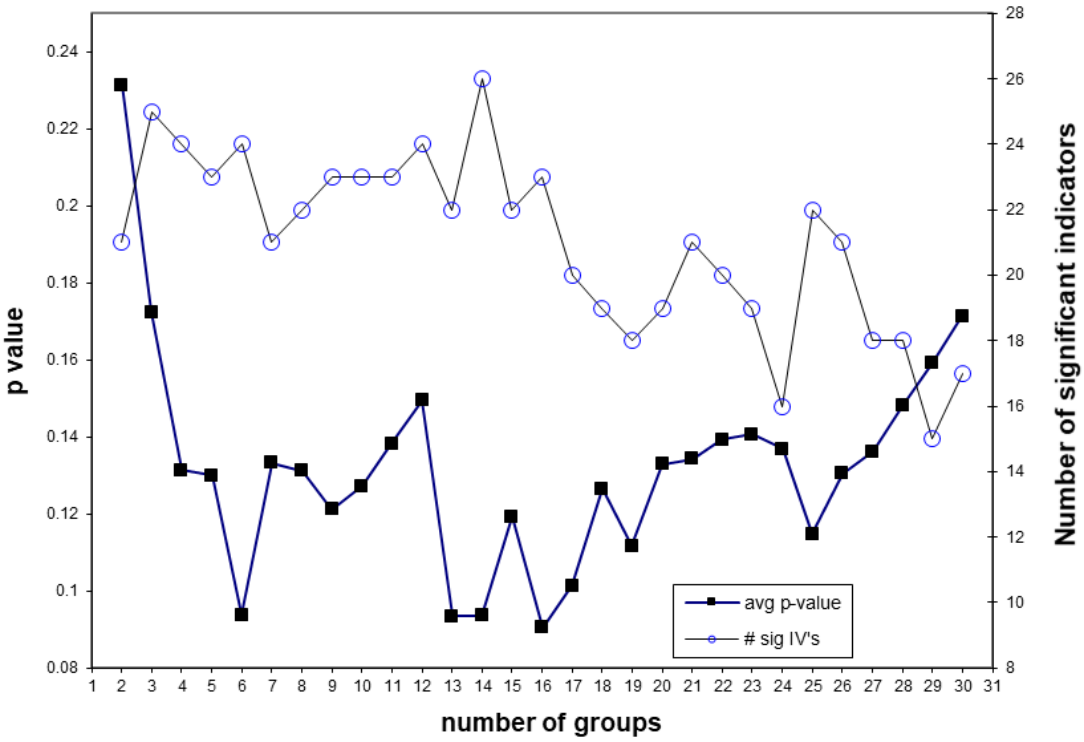

FIGURE 4. Indicator species analysis run for different numbers of groups. Cluster groupings 6, 14, and 25 show relatively low p-values and concomitantly high numbers of significant indicator species.

During the classification process, samples were partitioned into groups based on cluster membership (Appendix E). Membership rules for assigning samples to vegetation types were defined 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 misclassified in the cluster analysis are reclassified based on the membership rules.

The most distinct association is the *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association; almost all samples segregate from samples representing other associations. The next most distinct is the *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association, and while it does overlap with some samples of *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* and *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association, it is a cohesive unit. The *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* and *Arctostaphylos nummularia* Associations are related, with the *Arctostaphylos nummularia* Association nesting within the broader *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association. The *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association is the least cohesive, spreading out somewhat into all the other main types except the *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association.

The resulting floristic classification is compliant with the Manual of California Vegetation (Sawyer et al. 2009) and the U.S. National Vegetation Classification (FGDC 2008). The most specific vegetation unit, the association, is defined by a group of samples that have similar dominant and/or characteristic species in the overstory, along with other important species in the understory; 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.

Ordination

Non-metric multidimensional scaling (NMS) Ordination (PC-Ord 6.0) was used to explore relationships with significant environmental variables. An ordination of the classified samples with useful environmental variables often clarifies the underlying ecological parameters, which control the physical and compositional relationships among the different vegetation types. Ecological variables for this analysis are shown in Table 1.

TABLE 1. Ecological variables used in ordination.

Variable Name	Description
Alliance	Alliance name assigned to each plot
Association	Association name assigned to each plot
Group	Group name assigned to each plot
UTME	Universal Transverse Mercator Easting sample centroid
UTMN	Universal Transverse Mercator Northing sample centroid
Soil Prioritization	Synthetic ordinal variable based on degree of oligotrophic priority from sample allocation: Blacklock and Aborigine soils, 3; Shinglemill-Gibney complex and Tropoquepts, 2; Gibney-Gibwell complex, Gibwell loamy sand, Noyo coarse sandy loam, Seaside-Rock outcrop complex, Tregoning-Cleone complex, 1.

Variable Name	Description
Soil mapping unit	Soil mapping unit
Slope	Slope in degrees
Maximum July Temperature	Maximum July temperature derived from Prizm data
Precipitation	Precipitation (average annual from 1980-2010)
Elevation	Elevation (derived from 10 m DEM)

The ordination was first run using presence/absence data from 165 samples, including 117 rapid assessments and 48 reconnaissance samples. This set of samples covers both the oligotrophic and adjacent non-oligotrophic vegetation. It was then run again using Braun-Blanquet cover classes from only the 117 rapid assessments used in the classification. Both ordinations included all species with more than two occurrences; 45 species were included in the first analysis and 39 in the second.

Mapping

Mapping was conducted using ArcGIS to digitize vegetation stands. The base imagery was the 2014 NAIP dataset. Ancillary data sets through 2017 were used for identification of vegetation, including Google Earth Street View, soils, and topographic maps. Digitizing was done at a scale from 1:500 to 1:2000. Field samples, including reconnaissance samples, formed the basis of the interpreter's understanding of the vegetation type's photo signature. Stands were mapped to the association level when possible, with wetland types being mapped to group level in most cases. Full mapping rules are presented in Appendix F. Once the draft map was complete, each mapped polygon was reviewed by a VegCAMP staff member who did not originally delineate or attribute the polygon.

Accuracy Assessment

Sample Allocation and Field Sampling

An independent sample was selected to test the accuracy of the major mapped elements in the project. First, a prioritized selection of mapped polygons was created. Only polygons that intersected parcels that we had permission to enter or polygons that intersected publicly accessible roads were selected, and all polygons that had been previously surveyed were removed. Next, the allocation was stratified by vegetation type to try to ensure that all vegetation types would receive enough samples to be evaluated for accuracy.

Surveyors did not know the mapped vegetation type of the polygons they were surveying. Each polygon was given a priority level so that the types with the fewest polygons had higher priority. Figure 5 shows how a portion of the allocation looked during the accuracy assessment effort.

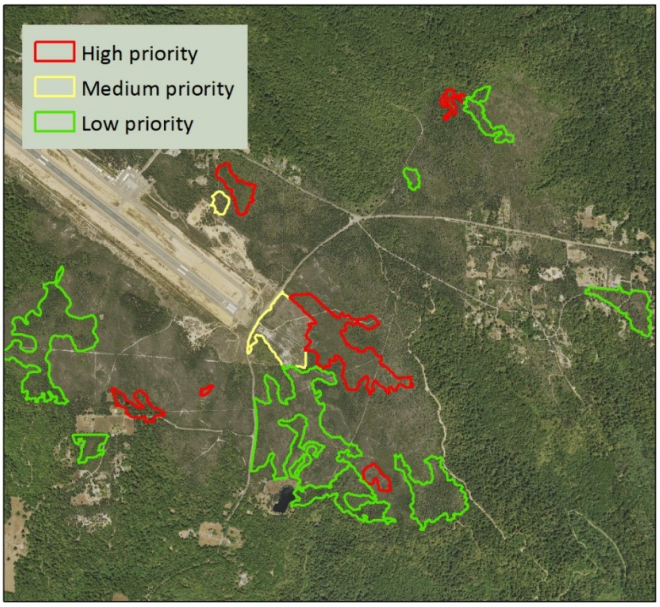

FIGURE 5. Example of the accuracy assessment allocation, showing polygons near Little River Airport. Polygons are color-coded by priority.

In 2018, 173 samples were collected to assess the accuracy of the mapped polygons using the "Accuracy Assessment Field Form" and "Accuracy Assessment Protocol - Mendocino Cypress Woodland and Related Vegetation" in Appendix A. Figure 6 shows the locations of the accuracy assessment samples collected in the field.

FIGURE 6. Locations of accuracy assessment samples collected in the Mendocino Cypress Woodland project.

Scoring

A VegCAMP member who had not previously been involved in the project reviewed map delineations and attributes and compared them to the accuracy assessment field data. She then ranked the accuracy of each polygon using fuzzy logic.

Using a traditional method of accuracy assessment, only one possible answer (considered to be the best answer by an 'expert' in the field) is compared to the map label. However, vegetation map classes do not always lend themselves to unambiguous attribution. While a map label of *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association may be considered absolutely correct for a particular site, a mapper may only be able to discern a map label of *Hesperocyparis pygmaea* Alliance, which is accurate but not as specific. An alternative method for evaluating map accuracy, and the one chosen for use in this assessment, is based on the use of fuzzy sets, first developed by Gopal and Woodcock (1994). With the fuzzy logic method of accuracy assessment, for each evaluation site, the map label is assigned a ranking score based on the degree of ecological similarity with the ground data. The numeric scoring used in this assessment is shown in Table 2.

The field and scoring data were entered into an Access database, available from VegCAMP.

TABLE 2. Accuracy assessment fuzzy logic scoring points.

Reason For Score	Score
Photointerpreter completely correct	5
Correct Group OR next level up in hierarchy	4
Threshold/transition between PI call and Final call	4
Based on close ecological similarity	3
Correct Macro Group OR next level up in hierarchy	3
Correct Division	2
Some floristic/hydrologic similarity	2
Correct only at Lifeform	1
No similarity above Formation and incorrect lifeform	0

Reason For Score	Score
Survey removed because significant change in polygon	none
Survey removed because inadequate portion of the polygon viewed	none
Survey removed because field/PI data is incomplete, inadequate or confusing	none
Supplementary point, not scored	none

RESULTS

Flora

A total of 150 taxa were recorded in all field surveys (rapid assessment, relevé, reconnaissance, and accuracy assessment surveys) and are listed in Appendix D. Of these, ten are considered rare in California. These ten taxa, their rarity ranks, and the vegetation types in which they were observed are listed in Appendix G.

Classification

The classification analysis resulted in the identification of new associations and several provisional associations specific to the oligotrophic soils of the study area. The classified types and their relationship to the U.S. National Vegetation Classification (USNVC) hierarchy are shown in Table 3. Types considered to be oligotrophic are denoted in the table.

The classification analysis also enabled us to differentiate between a number of other vegetation types not locally restricted to oligotrophic soils. These exist where soil conditions are more typical of the Northern California coastal zone.

One purpose of the vegetation classification is to assist in determining the level of rarity and imperilment of vegetation types. The new associations identified in this project's classification were ranked for their rarity using the standardized ranking criteria used by the NatureServe Element Rank Estimator (Rank Calculator). This calculator ranks types based on their degree of imperilment as measured by rarity, trends, and threats, with 5 being the least imperiled and 1 being the most imperiled. Because the *Hesperocyparis pygmaea* Alliance was assigned a rank of G1/S1, its three associations, which are more limited in extent than the alliance, could not have received a lower rank and so were not ranked separately. Some of the other, existing alliances already had assigned ranks. NatureServe ranks are shown in Table 3. Ranks of 1, 2, or 3 are considered sensitive.

Descriptions of the classified vegetation types in the form of stand tables, summaries of environmental variables, and maps of the distribution of mapped stands are presented in Appendix H.

Once the classification was finalized, a field key was developed (see Appendix I). The field key is organized by vegetation layer (tree-overstory, shrubland) 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. A table containing final classification names for each field sample is located in the final survey database, which is available from VegCAMP.

A crosswalk of vegetation types to two other classifications, the California Wildlife Habitat Relationships (CWHR) and the Classification and Assessment with Landsat of Visible Ecological Groupings (Calveg) is presented in Appendix J.

Mendocino cypress vegetation is best described with both floristic and structural attributes

For many years, there has been confusion about the best way to define the unique vegetation of the coastal terraces of Mendocino and adjacent Sonoma Counties. The striking distinction between the dwarfed "pygmy" conifer woodland on the tops of the old marine terraces and the tall redwoods and Douglas-firs on the adjacent, deeper, and more permeable soils seems so unmistakable. Yet, upon closer inspection, the dwarfed woodlands do vary in structure and floristic composition, and the same species, including Mendocino cypress, formerly known as pygmy cypress, may be dwarfed in some conditions and not in others. It has not proven possible to distinguish a single "pygmy" forest from all other taller forest, because there is a range of variation in stature of the species of plants.

In this study, the sampling and analysis of multiple vegetation stands across an array of different soils has clarified the relationships of the vegetation to environmental conditions. For example, Mendocino cypress and ledum (*Rhododendron columbianum*) survive on deep Tropoquepts **and** on highly impeded Aborigine/Blacklock soils because these soils hold water throughout much of the year. Although soil has a strong effect on plant size, the availability of water throughout the year is the determinant factor for wetland species like *Rhododendron columbianum*. Since vegetation is defined using a combination of species composition and structural features, we can describe the tall stands and the short stands as members of the same plant association because they share the same floristic composition. However, they are mapped as different stands based on height: short versus tall.

Native plant species have adapted to the suite of relatively harsh environmental conditions on the tops of the old terraces. The plants forming the vegetation on these oligotrophic soils overlap to some degree based on their ability to tolerate a combination of soil moisture, fertility, and depth. Through vegetation classification, we have identified six plant associations that are different floristically and structurally from the surrounding vegetation growing under more "forgiving" conditions. Three of these are in the Mendocino Cypress Woodland Alliance, and encompass both what was formerly termed "pygmy forest" and the non-stunted stands of the same floristic composition. The other three associations are not characterized by Mendocino cypress but are on oligotrophic soils: *Chrysolepis chrysophylla / Vaccinium ovatum* Association, *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association and *Arctostaphylos nummularia* Provisional Association. These six types occur only on the marine terrace "islands" ranging from near Salt Point in Sonoma County to just north of Fort Bragg in Mendocino Countv.

TABLE 3. Final Vegetation Classification, organized within the current USNVC hierarchy. The asterisk denotes types that are newly described from this project. NatureServe rarity ranks are given for new and mapped types in the Rank column (UR denotes that this type's entire range is not yet known, and so it is unranked; NA means it is not ranked because it is a non-native type; ? indicates our best interpretation, based on the standardized rank estimator, given we have not sampled and mapped all of California). Types considered limited to oligotrophic soils for this project are noted with an "O" in the Soil column.

Vegetation Type	Rank	Soil
Class A. Tree–Overstory (Woodland / Forest) Vegetation		
Temperate Forest Formation Subclass		
Cool Temperate Forest Formation		
Western North America Cool Temperate Forest Division		
Vancouverian Rainforest Macrogroup		
Vancouverian Hypermaritime Lowland Rainforest Group		
Sequoia sempervirens Alliance	G3/S3	
Sequoia sempervirens – Pinus muricata Provisional Association*	UR	
Sequoia sempervirens – Hesperocyparis pygmaea Provisional Association*	G1/S1	
Californian–Vancouverian Montane and Foothill Forest Macrogroup		
Vancouverian Evergreen Broadleaf and Mixed Forest Group		
Pseudotsuga menziesii – Notholithocarpus densiflorus Alliance	G3/S3	
Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum Association	G2/S2	
Chrysolepis chrysophylla Alliance	G2/S2	
Chrysolepis chrysophylla / Vaccinium ovatum Association	G2/S2	O
Warm Temperate Forest Formation		
Madrean Forest and Woodland Division		
California Forest and Woodland Macrogroup		
Californian Evergreen Coniferous Forest and Woodland Group		
Pinus muricata Alliance	G3/S3	
Pinus muricata – Notholithocarpus densiflorus Provisional Association*	G3/S3	
Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia Association*	G2/S2	O
Hesperocyparis pygmaea Alliance	G1/S1	O
Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia Association*	G1/S1	O
Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi / Rhododendron columbianum* Association*	G1/S1	O
Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association*	G1/S1	O

Vegetation Type	Rank	Soil
Class B. Shrubland Vegetation		
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*	UR	
Morella californica – Rubus spp. Provisional Association*	UR	
Western North America Warm Temperate Flooded and Swamp Forest Division		
Southwestern North American Riparian, Flooded and Swamp Forest Macrogroup		
Southwestern North American Riparian/Wash Scrub Group		
Frangula californica – Rhododendron occidentale Provisional Alliance*	UR	
Temperate Grassland, Meadow, and Shrubland Formation		
Vancouverian and Rocky Mountain Grassland and Shrubland Division		
Vancouverian Lowland Grassland and Shrubland Macrogroup		
Naturalized non-native deciduous scrub Group		
Rubus armeniacus – Sesbania punicea – Ficus carica Semi-Natural Alliance	SNA/GNA	
Rubus armeniacus Semi-Natural Association	SNA/GNA	
Mediterranean Scrub and Grassland Formation Subclass		
Mediterranean Scrub Formation		
California Scrub Division		
California Chaparral Macrogroup		
Californian Maritime Chaparral Group		
Arctostaphylos (*nummularia*, *sensitiva*) Alliance	G2/S3	O
Arctostaphylos nummularia Provisional Association*	G2/S2	O
Shrub & Herb Wetland Subclass		
Temperate to Polar Bog & Fen Formation		
North American Bog & Fen Division		
North Pacific Bog & Fen Macrogroup		
North Pacific Acidic Open Bog & Fen Group		
Rhododendron columbianum (=*Ledum glandulosum – Ledum groenlandicum)* Shrub Bog & Acidic Fen Alliance	G4/S2?	O

Ordination

The first NMS analysis, with presence/absence data from samples within and outside of the oligotrophic soil boundary, arranged the classified samples in a 2-dimensional array (Figure 7). Five of the 11 variables tested show significant positive or negative r-values. These correlations (Table 4) are arrayed along the first ordination axis.

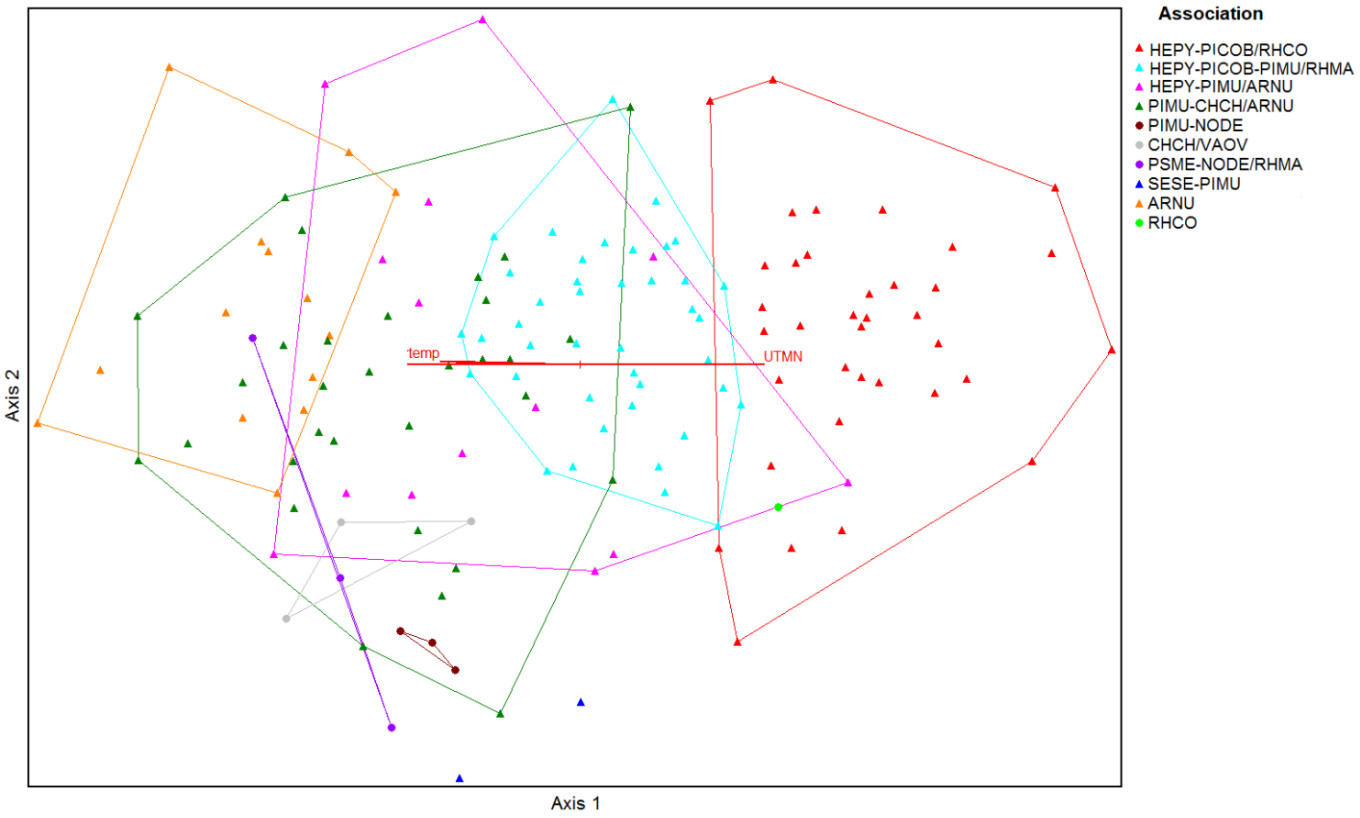

FIGURE 7. NMS ordination of 165 samples using presence/absence species data. Boxes delineate the boundaries of the 10 different plant associations shown[1] (including some sampled outside of the oligotrophic boundary). Orange vectors display the relationships of strongly associated environmental variables including the positively correlated UTMN and the negatively correlated Maximum July Temperature.

[1] Key to vegetation types in Figures 7 and 8

HEPY-PICOB/RHCO = *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association

HEPY-PICOB-PIMU/RHMA = *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association

HEPY-PIMU/ARNU = *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association

PIMU-CHCH/ARNU = *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association

PIMU-NODE = *Pinus muricata – Notholithocarpus densiflorus* Provisional Association

CHCH/VAOV = *Chrysolepis chrysophylla / Vaccinium ovatum Association*

PSME-NODE/RHMA = *Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum* Association

SESE-PIMU = *Sequoia sempervirens – Pinus muricata* Provisional Association

ARNU = *Arctostaphylos nummularia* Provisional Association

RHCO = *Rhododendron columbianum* Alliance

TABLE 4. Correlations between samples and significant environmental variables for the first ordination analysis.

Code	Environmental Variable	NMS r-value
Elev	Elevation	-0.551
UTMN	UTM Northing	0.532
PPT	Precipitation	-0.0506
Temp	Maximum July Temperature	-0.492
UTME	UTM Easting	-0.492

The next step was to limit the ordination to the samples representing the natural vegetation within the oligotrophic soil boundary using seven cover classes (Figure 8).

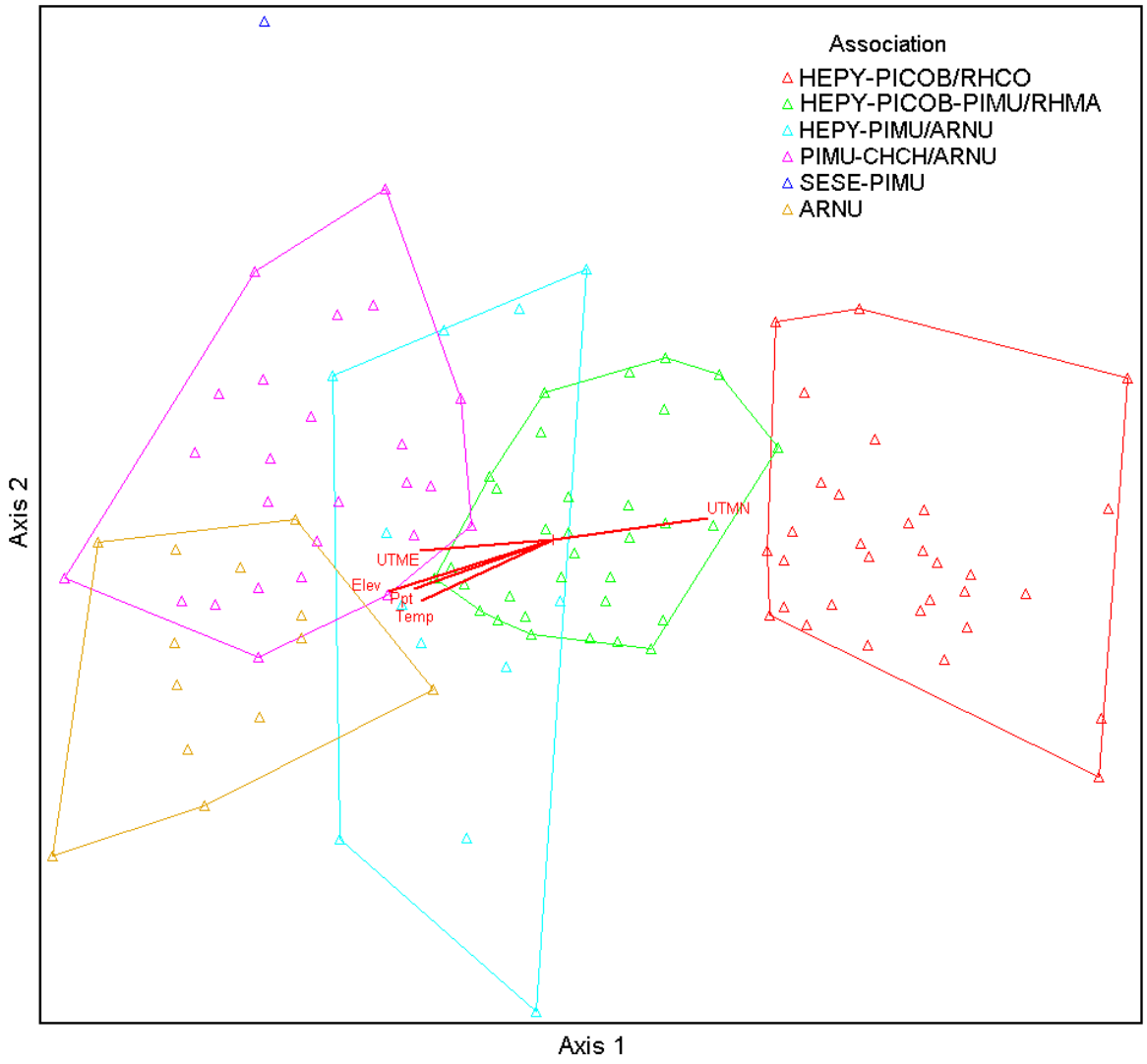

FIGURE 8. Ordination of the core plant associations[1] restricted to the oligotrophic soils of the study area. Orange vectors display the relationships of strongly associated environmental variables including the positively correlated UTMN and the negatively correlated UTME, Elevation, Precipitation, and Maximum July Temperature.

The relationships are clearer because of the more constrained analysis with higher cover/abundance resolution. In Figure 8, the *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association segregates from its closest ecological counterpart, the *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association. In contrast, the type with the greatest overlap, the *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association shows similarities to both the *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association and the *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association. The *Arctostaphylos nummularia* Association only overlaps to a small degree with the adjacent *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association.

As in the view in Figure 7, which includes samples outside the oligotrophic soil boundary, Figure 8 shows that as UTMN increases there is a shift from the mesic *Hesperocyparis pygmaea – Pinus contorta* var. *bolanderi – Pinus muricata* / *Rhododendron macrophyllum* Association to the strictly wetland *Hesperocyparis pygmaea – Pinus contorta* var. *bolanderi / Rhododendron columbianum* type. The environmental variables UTME, Elevation, Maximum July Temperature, and Precipitation line up with increasingly less mesic vegetation types including *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia*, *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia*, and *Arctostaphylos nummularia*. A single plot of *Sequoia sempervirens – Pinus muricata* lies outside of the main gradient in the upper left quadrant of Figure 8.

UTMN, a measure of latitudinal geographic distance from south to north, increases (+ r-value) to the right in Figures 7 and 8. This is associated with a shift from mesic Mendocino cypress stands of *Hesperocyparis pygmaea – Pinus contorta* var. *bolanderi – Pinus muricata* / *Rhododendron macrophyllum* Association to *Hesperocyparis pygmaea – Pinus contorta* var. *bolanderi / Rhododendron columbianum* Association, mapped as wetlands by the U.S. Fish and Wildlife Service's National Wetlands Inventory.

All samples classified as *Hesperocyparis pygmaea – Pinus contorta* var. *bolanderi / Rhododendron columbianum* have a high frequency and cover of the wetland indicator plant *Rhododendron columbianum,* and are associated with high UTM Northings, restricted to the area north of the Navarro River. The lowest UTMN values (on the left side of Figure 7) are associated with samples that lack *Pinus contorta* var. *bolanderi*. The *Arctostaphylos nummularia* Association is on the far left. The samples classified as *Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum*, *Pinus muricata – Notholithocarpus densiflorus*, and *Chrysolepis chrysophylla / Vaccinium ovatum* Associations and sampled outside the boundary of the oligotrophic soil boundary are intermediate, and encompassed by other broadly sampled types such as *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* and *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia*.

UTME is a measure of latitudinal distance from west to east. The negative correlation with the UTM Eastings along Axis 1 shown in Figure 8 can be explained by the general orientation of the Northern California coast in the study area. The eastern-most locations within the study area are in the south, while farther north the coastline angles to the northwest (e.g., lower Eastings to the north). Thus, although UTME shows a negative correlation, it co-varies with the more important variables of Elevation and Maximum July Temperature to culminate in the southern distribution of samples having hotter, more xeric conditions.

Samples plotted against Elevation are shown in Figure 9. The variables have high negative correlations (Table 4) with the vegetation samples, and co-vary along the Axis 1 gradient. In coastal California, temperature "inversions" occur where coastal mountains rise above the cool, moist summer marine layer, bringing higher overall summer temperatures to higher elevations, along with higher rates of evaporation typical of the hot summers of the California interior. The oligotrophic vegetation types between Fort Bragg

and the Navarro River all tend to be within the elevation of summer inversion (< 600 ft.) and, due to the cool summer fog and maritime air, are associated with lower maximum temperatures and lower evaporation rates. Comparatively, the oligotrophic vegetation south of the Navarro River tends to occur at higher elevations (as high as 1400 ft.) above the inversion layer and, therefore, has higher evaporation rates than the oligotrophic soil terraces north of the Navarro River.

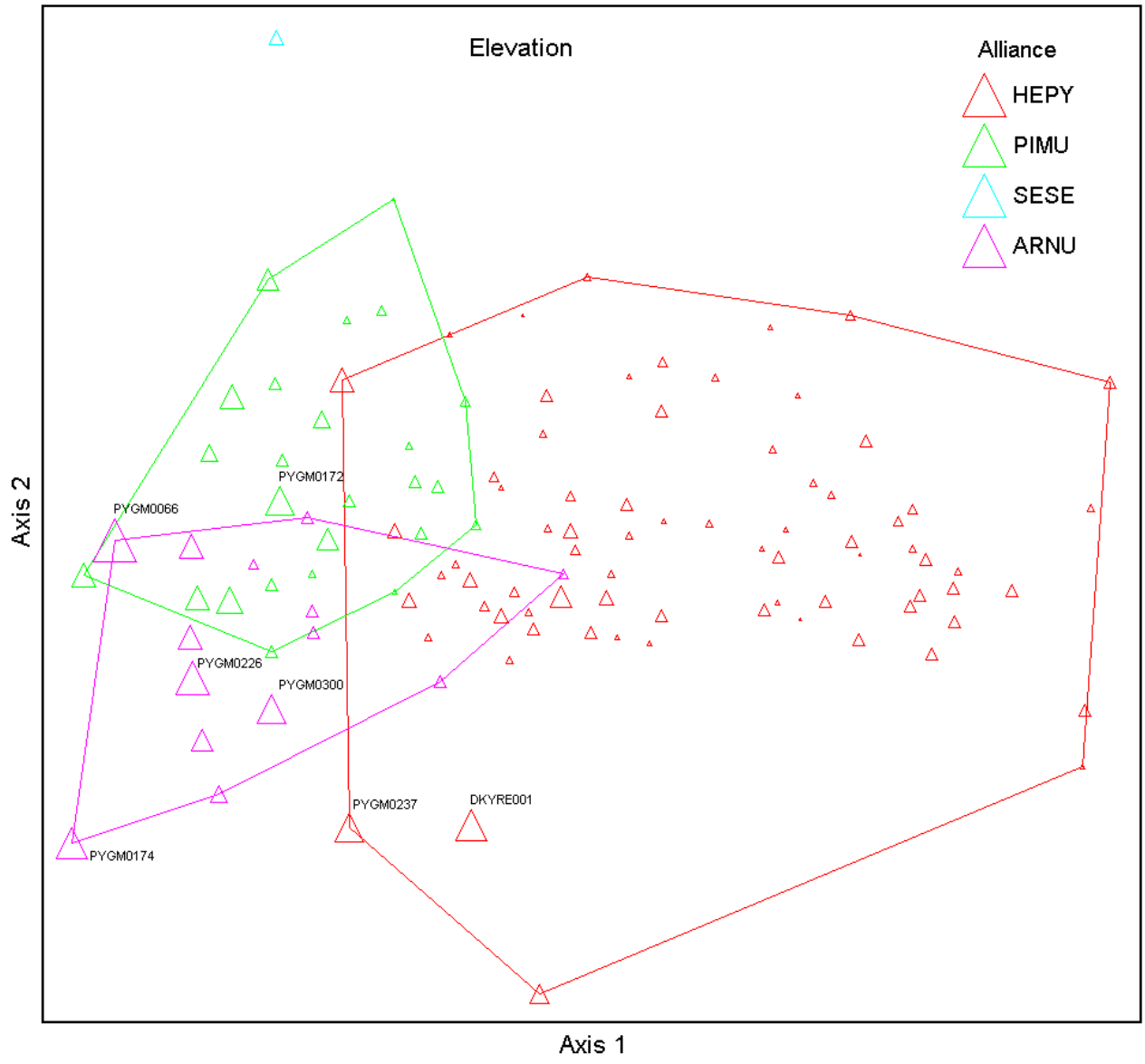

FIGURE 9. Samples plotted against Elevation. This diagram shows the relative elevation of samples assigned to the *Hesperocyparis pygmaea* (HEPY), *Pinus muricata* (PIMU), *Sequoia sempervirens* (SESE), and *Arctostaphylos (nummularia, sensitiva)* (ARNU) Alliances; relative elevation is indicated by the size of the sample triangles. Note that the seven samples with the highest elevations are associated with the lower left quadrant. Elevation is not positively associated with the distribution of mesic or wetland vegetation types.

Precipitation co-varies negatively with Elevation, Maximum July Temperature, and UTME, as shown in Figure 8. Samples plotted against Precipitation are shown in Figure 10. Interestingly, the more xeric stands of the *Pinus muricata* (PIMU) and *Arctostaphylos (nummularia, sensitiva)* (ARNU) Alliances tend to have the samples with the highest precipitation and in general, high precipitation samples tend to be associated with less hydric expressions of vegetation; thus, there is no direct correlation with precipitation.

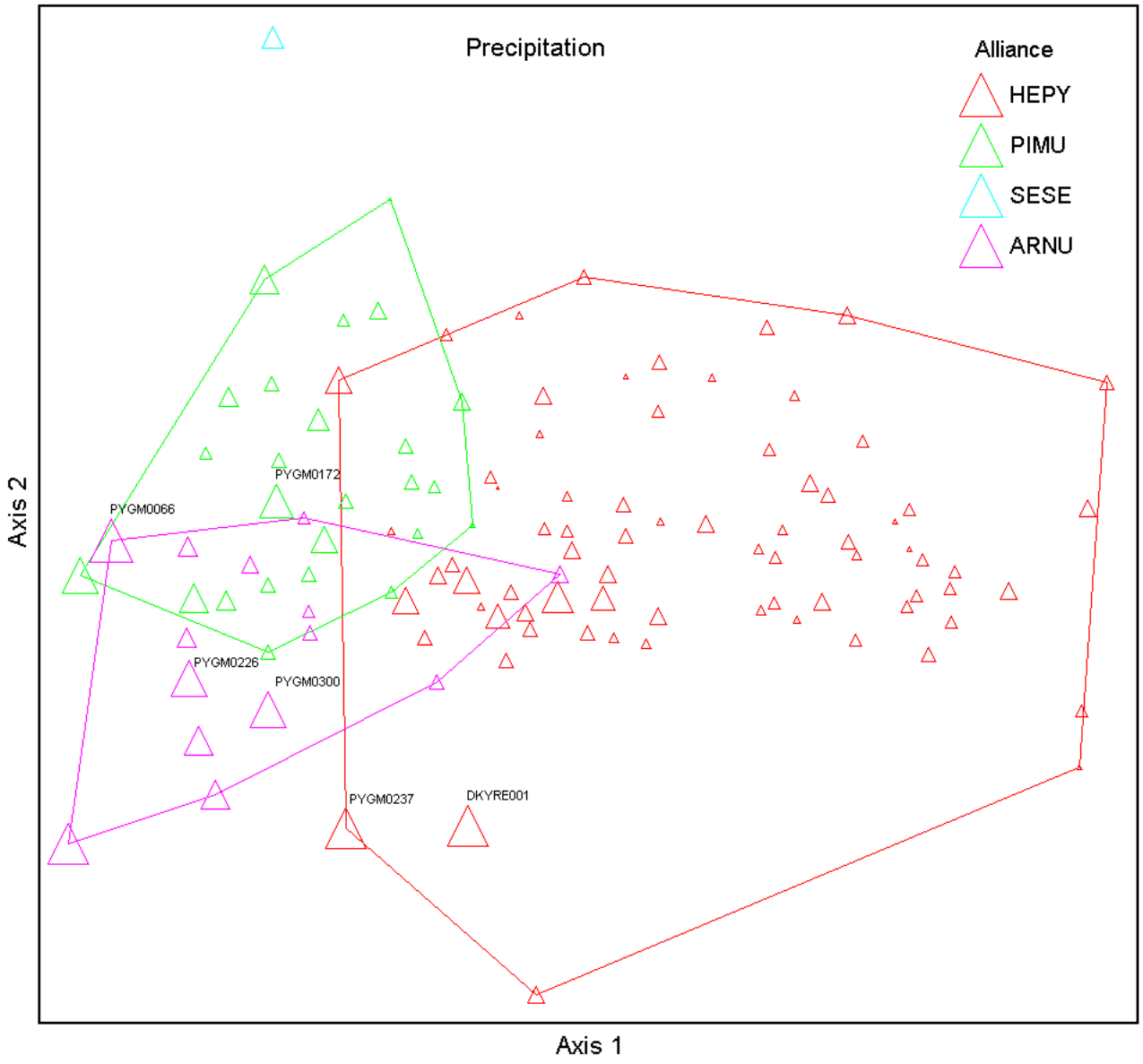

FIGURE 10. Samples plotted against Precipitation. This diagram shows the relative precipitation of samples assigned to the *Hesperocyparis pygmaea* (HEPY), *Pinus muricata* (PIMU), *Sequoia sempervirens* (SESE), and *Arctostaphylos (nummularia, sensitiva)* (ARNU) Alliances. Precipitation ranges from 1080-1386 mm/yr; relative precipitation is indicated by the size of the sample triangles (larger = higher precipitation). The six highest precipitation samples are labeled.

As shown in the ordination diagrams (Figures 7 and 8), the samples are also arrayed vertically along Axis 2 with some strong outliers showing up in the stands of *Sequoia sempervirens*, showing unexplained variation. Unfortunately, our attempt to bring in soil variables such as Soil Prioritization and Soil Mapping Unit did not reveal any clear relationships with the samples. We hypothesize that when more detailed information about soil variables becomes available (perhaps fertility, rooting depth, porosity, and texture), they will be useful in explaining the variations on the vertical axis.

Mapping

The mapped area encompassed 9,782 acres, with 24 mapping units (Table 5). Appendix K provides examples of the true color and color infrared imagery signatures of the mapping units. The final map geodatabase is downloadable from CDFW's BIOS website as dataset 2805.

TABLE 5. Mapping units for the Mendocino cypress woodland project, including number of polygons, total acreage, and average polygon size.

Map Code	Mapping Unit	# of polygons	Total acres	Average polygon acres
1110	*Hesperocyparis pygmaea* Alliance	7	61	9
1111	*Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association	70	620	9
1112	*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association	367	2290	6
1113	*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association	264	2027	8
1114	*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Fen Variant	4	9	2
1131	*Pinus muricata – Notholithocarpus densiflorus* Provisional Association	5	20	4
1132	*Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association	212	1834	9
1211	*Chrysolepis chrysophylla / Vaccinium ovatum* Association	13	55	4
1231	*Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum* Association	4	47	12
1310	*Sequoia sempervirens* Alliance	7	38	5
1311	*Sequoia sempervirens – Pinus muricata* Provisional Association	13	185	14
1312	*Sequoia sempervirens – Hesperocyparis pygmaea* Provisional Association	24	277	12
2111	*Arctostaphylos nummularia* Association	102	472	5
2115	*Arctostaphylos columbiana* Provisional Alliance	3	13	4
3211	*Rubus armeniacus* Semi-Natural Association	1	2	2
3520	*Rhododendron columbianum* Alliance	8	23	3
4100	Vancouverian Freshwater Wet Meadow and Marsh Group	1	1	1
5200	Temperate Freshwater Floating Mat Group	1	0	0
7200	Forest Plantation and Agroforestry	1	24	24
7300	Pasture and Hay Field Crop, Lawn, Garden, Recreational Vegetation	4	14	3
8200	*Cortaderia (jubata, selloana)* Semi-Natural Alliance	3	25	8
9100	Built-up and Urban Disturbance	416	1491	4
9300	Anthropogenic areas of little or no vegetation	56	242	4
9400	Water	12	12	1

Accuracy Assessment

The contingency table (Appendix L) displays the 15 vegetation map types assessed or partially assessed. Each row in the table represents a type as mapped by the photointerpreters (PIs, the producers); by reading across the row, one can see what the field surveyors (users) assessed the mapped polygon types to be on the ground. Numbers on the diagonal show when the PI and the users agreed on a specific polygon's vegetation map type. The table displays the numbers of assessed polygons by type, and does not incorporate fuzzy scores.

Due to the relatively few map types, we expect to have relatively high scores of accuracy in this project. Limited access to private lands, though, and the difficulty in physically accessing some selected vegetation polygons reduced the number of samples below the optimal accuracy assessment sample size for several of the types. However, it was most important to have adequate samples for the sensitive oligotrophic vegetation types, and this was accomplished. Of the six sensitive oligotrophic types, only one (*Chrysolepis chrysophylla / Vaccinium ovatum* Association) had fewer than 8 samples, while the average number of accuracy assessment samples for the other five ranged from 13 to 38 (average of users' and producers' samples). The most highly sampled types were indeed the rarest and most important based on their conservation significance.

Two forms of accuracy (users' and producers') can be estimated from the data (Story and Congalton 1986). Users' accuracy provides an estimate of commission error, or how well spatial mapping data actually represent what is found on the ground, i.e., if the user goes to a location mapped as a certain type, what is the probability it is in fact that type? Producers' accuracy, on the other hand, measures omission error, or the probability that vegetation type observed in the field is mapped as that type. Producers' accuracy may inform the mappers if a mapping type is even detectable (Story and Congalton 1986, Lea and Curtis 2010).

The overall accuracy of each of the five adequately sampled types was between 82% and 92% (averaging users' and producers' scores for each). These scores are above the minimally acceptable average correctness put forth by VegCAMP standards. Table 6 shows the users' and producers' accuracy scores for sampled types.

The most commonly mistaken vegetation type was *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association, and it was most frequently mistaken for the ecologically closely related *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association. The second most commonly mistaken vegetation type was *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association and it was mistaken for six different types. Part of the problem with this type is the difficulty of distinguishing the relative proportion of living to dead overstory trees of *Pinus muricata*. If there is too little living tree cover, it keys to *Arctostaphylos nummularia* Association; a bit too much *Hesperocyparis pygmaea* and *Pinus contorta* ssp. *bolanderi* and it keys to *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association, and the addition of *Hesperocyparis pygmaea* without *Pinus contorta* ssp. *bolanderi* keys to *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association.

Once the map was scored for accuracy, we corrected the attributions and delineations in the sampled polygons. Thus, the accuracy numbers shown in Table 6 are the minimum accuracy of the final map.

TABLE 6. Producers' and users' polygon count and average closeness-of-fit (fuzzy) scores per map class. Polygon counts may be found in the contingency table in Appendix L. The table is ordered alphabetically.

Vegetation Type	Producers' Count	Producers' Accuracy	Users' Count	Users' Accuracy
Arctostaphylos (nummularia, sensitiva) Alliance	1	80.0	1	80.0
Arctostaphylos nummularia Association	15	84.0	12	93.3
Chrysolepis chrysophylla / Vaccinium ovatum Association	4	80.0	4	65.0
Hesperocyparis pygmaea – Pinus contorta bolanderi / Rhododendron columbianum Association	33	90.3	27	94.1
Hesperocyparis pygmaea – Pinus contorta bolanderi / Rhododendron columbianum Fen Variant	1	100.0	3	100.0
Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association	40	85.5	35	90.3
Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia Association	13	81.5	12	83.3
Hesperocyparis pygmaea Alliance	1	20.0	5	80.0
North American Boreal & Sub-boreal Bog & Acidic Fen	0	N/A	1	0.0
Pinus attenuata Alliance	3	80.0	2	100.0
Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia Association	30	93.3	35	86.3
Pinus muricata – Notholithocarpus densiflorus Association	8	82.5	11	78.2
Pinus muricata Alliance	2	80.0	0	N/A
Sequoia sempervirens – Hesperocyparis pygmaea Provisional Association	1	80.0	0	N/A
Sequoia sempervirens – Pinus muricata Provisional Association	3	86.7	7	71.4

ANALYSIS OF THE HISTORICAL LOSS OF MENDOCINO CYPRESS AND RELATED VEGETATION

There are no maps of the historical extent of oligotrophic vegetation prior to human development, and so an accurate calculation of the loss is not possible. However, by comparing the extent of oligotrophic soils, oligotrophic vegetation, and human clearing and development in a GIS analysis, we calculated two different estimates of loss of the oligotrophic vegetation types: one we consider the most restrictive estimate and one we consider more inclusive. See Table 3 for vegetation types that we considered oligotrophic for this analysis.

Restrictive estimate

The study and mapping area described earlier in this report established the footprint of oligotrophic vegetation by using a combination of soils, field observations, and aerial signatures of vegetation. The soil/vegetation boundaries delineating the study and mapping area show up as individual "islands" surrounded by distinctly non-oligotrophic vegetation growing on non-oligotrophic soils. In addition to the mapping of vegetation, areas of human development and clearing were also mapped within these "islands." For this analysis, the map was divided into: 1) oligotrophic vegetation; 2) development, agriculture, and exotic plants; and 3) other native vegetation types that occur in pockets within the mapping boundaries, such as drainages that are dominated by coast redwood. These last types, totaling 361 acres, were excluded from our analysis because they have likely always been non-oligotrophic

vegetation. The first two types were combined to give the total acreage estimate of the historical extent (Table 7). Figures 11 and 12 are examples of the restrictive boundary drawn in this manner.

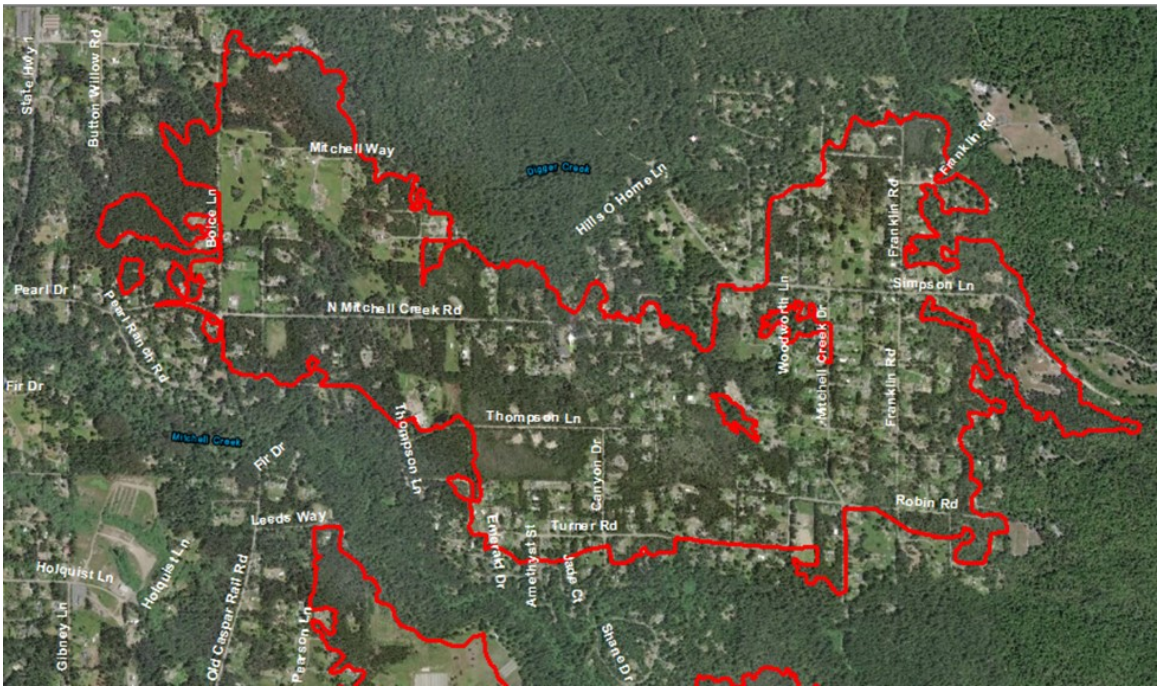

FIGURE 11. A map showing the boundary of the restrictive estimate (in red) of the oligotrophic vegetation footprint near Caspar.

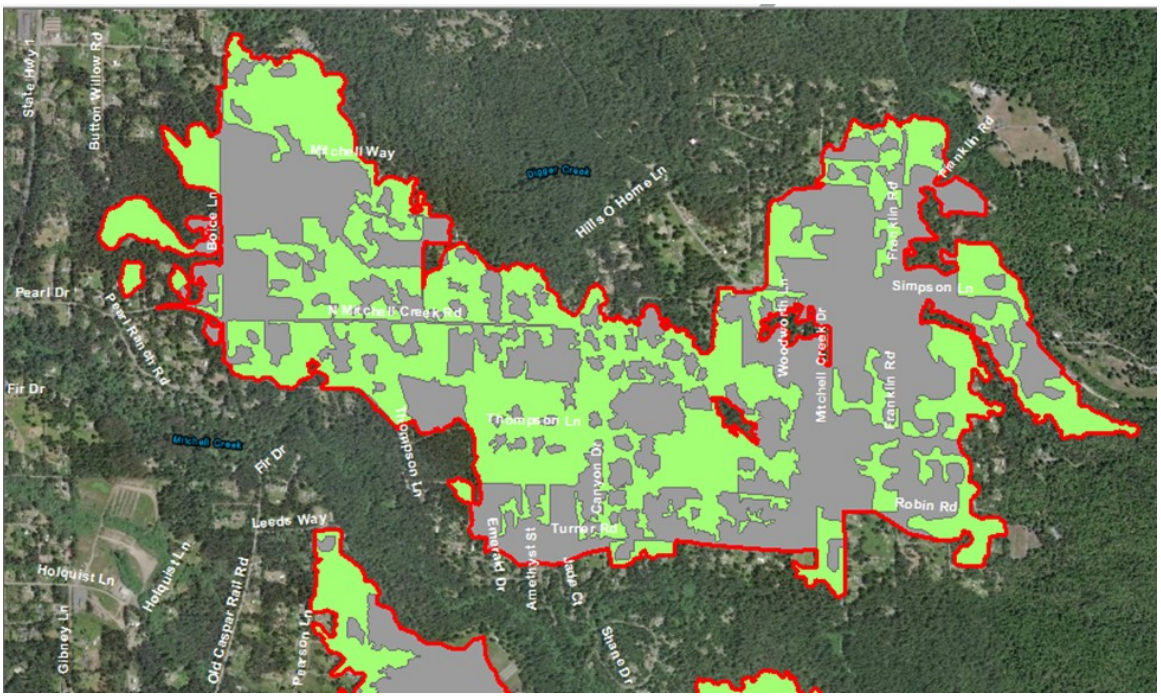

FIGURE 12. A map of the same area as Figure 11, showing the areas of development (gray) and oligotrophic vegetation (green).

TABLE 7. Total acres of existing oligotrophic vegetation and two estimates of historic range and percent loss.

	Total Acres	% Loss
Oligotrophic vegetation existing as of 2014 (base imagery for map)	7,397	n/a
Restrictive estimate of oligotrophic vegetation plus development and agriculture within mapping boundary	9,208	20
Soil-inclusive estimate using elevation-clipped soil polygons that contain oligotrophic vegetation	13,145	44

Soil-inclusive estimate

Over the past 150 years, development has replaced oligotrophic vegetation so completely in some areas that it is now undetectable. Yet soil maps suggest that these areas once supported such vegetation. For the soil-inclusive estimate, the SSURGO soil polygons of the following oligotrophic soil mapping units were used: Blacklock and Aborigine, Gibney-Gibwell complex, Gibwell loamy sand, Noyo coarse sandy loam, Seaside-rock outcrop complex, Shiglemill-Gibney complex, Tregoning-Cleone complex, and Tropoquets. Some of these oligotrophic soil polygons continue towards the shore beyond the second marine terrace, where studies have shown that the stunting of Mendocino cypress forest begins (Jenny et al. 1969). Based on an estimate of the elevation of the second marine terrace, the soil polygons were clipped to 175 feet above sea level using a dataset derived from Intermap Technologies's NextMap IfSAR elevation data with 5 m vertical accuracy. From the soil polygons that were clipped by elevation, we selected a subset consisting of those that intersected existing oligotrophic vegetation. The acreage of this subset is the soil-inclusive estimate reported in Table 7. An example of this analysis is shown in Figure 13. To see the analysis over the entire study area see this story map: http://arcg.is/01aGmf.

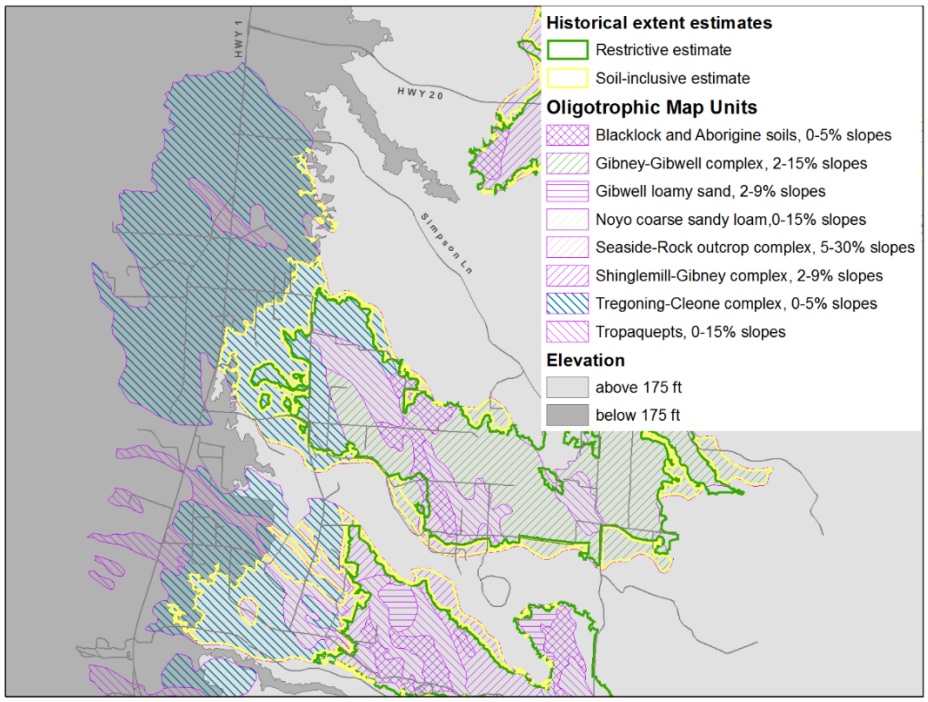

FIGURE 13. Map showing the soil-inclusive expansion of the oligotrophic soil footprint along with the soil layer and elevation layer used to produce it. This map is centered on the same area shown in Figures 11 and 12.

In addition to this 20-44% loss due to development, each of the Mendocino cypress and related vegetation types on oligotrophic soils is suffering from the negative effects of suppressed fire. Fire intervals longer than 40-60 years for *Pinus muricata* tend to allow the build-up of infestations of dwarf mistletoe (*Arceuthobium campylopodum*) and western gall rust *(Endocronartium harknessii),* which weaken and kill the trees. The lack of fire reduces the natural post fire regeneration of the conifers and over time brings about a transition from conifer overstory to Ericaceous shrub dominance of upland *Arctostaphylos nummularia, Arctostaphylos columbiana,* or *Arctostaphylos glandulosa*, or wetland dominance of *Rhododendron columbianum*. The general increase of woody shrubs in these stands on oligotrophic soils also has an indirect effect on the species diversity of plants and probably invertebrate and vertebrate animals. In particular, the relative decrease of the number and extent of the *Hesperocyparis pygmaea – Pinus contorta* ssp*. bolanderi / Rhododendron columbianum* Association Fen Variant, as observed by several long-term residents of the area, is most likely to be associated with the proliferation of dark, shady understories following decades of expansion of shade tolerant species such as *Rhododendron columbianum*. For example, T. Sholars (in email to D. Hickson, December 18, 2018) has records of collecting *Cornus canadensis* in what is known as Sholars' Bog in the mid-1980s, where today there is only *Rhododendron columbianum.* Ditching and draining of stands is common in developed areas. These and other long-term trends suggest that revisions of management and planning should be taken for the long-term sustainability of these sensitive vegetation communities.

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APPENDIX A

Field Forms and Protocols

Combined Vegetation Rapid Assessment and Relevé Field Form

(Revised February 19, 2015 for Mendocino Cypress Woodland)

Relevé or Rapid Assessment (circle one)

For Office Use:	**Final database #:**	**Final vegetation type:**	**Alliance**_____ **Association**

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

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

| Location Name:

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:**

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 19, 2015 for Mendocino Cypress Woodland)

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: _____

California Native Plant Society – California Department of Fish and Wildlife
Mendocino Cypress Woodland Protocol for
Combined Vegetation Rapid Assessment and Relevé Sampling Field Form
(January 22, 2015)

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 Mendocino Cypress Woodland 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 this project, we collect relevés in herbaceous vegetation and rapid assessments in woody vegetation.

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:

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 as 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.

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

Plot Shape:

A relevé has no fixed shape, though plot shape should reflect the character of the stand and is either square or rectangle. 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, 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 PYGMxxxx number from a series of provided numbered stickers. If the GPS point is taken in a different corner, this should be noted in the Site History section.

For Rapid Assessments, 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 PYGMxxxx sticker in this field for all relevé 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.

Location Name: The name of the property, park, or the location within large holdings (like USFS or BLM properties).

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

GPS name: The name/number assigned to the 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 of the Identifier Point 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 (i.e., the point is projected), these are the UTMs of the base point.

PDOP: Record the PDOP from the GPS unit.

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 waypoint 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.

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.

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 the radius of the visually estimated sample area for rapid assessments; the radius should be a minimum of 20m.

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*. **We are not recording this attribute for the Mendocino Cypress Woodland project.**

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. **We are not recording this attribute for the Mendocino Cypress Woodland project.**

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). **We are not recording this attribute for the Mendocino Cypress Woodland project.**

% 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, 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, 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 the 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 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 percent 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 percent (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 percent 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.*

III. INTERPRETATION OF STAND

Field-assessed vegetation Alliance name: Enter the name of alliance following the Manual of California Vegetation, 2nd Edition (Sawyer et al. 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 case 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.

IV. VEGETATION DESCRIPTION

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[2] 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[2] 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).

Regenerating Tree: The total foliar cover of seedlings and saplings, disregarding overlap[2] of individual recruits. See seedling and sapling definitions below.

Shrub: The total foliar cover (considering porosity) of all live shrub species disregarding overlap[2] of individual shrubs.

Herbaceous: The total cover (considering porosity) of all herbaceous species, disregarding overlap[2] 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).*

[2] 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.

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 a 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, cryptogamic 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 Mendocino cypress woodland. 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.

Species: 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.

% Cover: 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 (ie. 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).

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).

Final species determination: Use this column to record the final species name after it has been keyed. Do not erase the original field determination.

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.

RECON FIELD FORM – MENDOCINO CYPRESS WOODLAND (February 20, 2015)

Recorder: **Other Surveyors:** **Date:** **Return?** □

Waypoint ID:

Location Name:

GPS Name _____ **Projected? Yes / No / Base / Digitized**

If Yes, enter: **Bearing (°): _____** **Distance (m): _____** **Inclination (°): _____**

UID:

If Yes or Digitized, enter: **Base Waypoint ID**: _____

Base UTMs / **Projected** UTMs (circle one)

UTME _ _ _ _ _ _ _ _ _ _ **UTMN** _ _ _ _ _ _ _ _ _ _ **PDOP: +/-**

Stand Size: <1 1–5 >5

View Radius _____

Camera: **Photos**:

Field Alliance name:

Comments:

% Cover: Conifer_____ Hardwood_____ Total Tree_____ Regen Tree_____ Shrub_____ Herb_____ Total Veg_____ Exotics_____

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

Recorder: **Other Surveyors:** **Date:** **Return?** □

Waypoint ID:

Location Name:

GPS Name _____ **Projected? Yes / No / Base / Digitized**

If Yes, enter: **Bearing (°): _____** **Distance (m): _____** **Inclination (°): _____**

UID:

If Yes or Digitized, enter: **Base Waypoint ID**: _____

Base UTMs / **Projected** UTMs (circle one)

UTME _ _ _ _ _ _ _ _ _ _ **UTMN** _ _ _ _ _ _ _ _ _ _ **PDOP: +/-**

Stand Size: <1 1–5 >5

View Radius _____

Camera: **Photos**:

Field Alliance name:

Comments:

% Cover: Conifer_____ Hardwood_____ Total Tree_____ Regen Tree_____ Shrub_____ Herb_____ Total Veg_____ Exotics_____

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

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE PROTOCOL FOR
RECONNAISSANCE FIELD FORM
(February 2015)

This protocol describes the methodology for the reconnaissance technique as recorded in the Recon Field Form – Mendocino Cypress Woodland dated February 20, 2015. Reconnaissance surveys (recons) are complementary to relevés and rapid assessments, but contain only a small subset of the data gathered using the more detailed methods. Recons are generally used as an aid to digital vegetation mapping, to determine the boundaries of a stand, or to illustrate a particular vegetation signature. For more background on the relevé and rapid assessment sampling methods, see the relevé and rapid assessment protocol at http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18599.

DEFINITIONS OF FIELDS IN THE FORM

LOCATIONAL/ENVIRONMENTAL DESCRIPTION

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 name 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.

Date: Date of the sampling.

Return?: Check this box if team members should return to this spot at a later date to take a recon or RA/relevé. This can be used if the phenology is not conducive to identification of the major species, or if there is not enough time to take the survey.

Waypoint ID: The Waypoint ID in this format: GPS device name + date (yymmdd) + time (hhmm). For example, for a survey taken on iPad "V" on March 27 at 1:45 in the afternoon, the Waypoint ID will be "V1803271345."

UID: The ID number of a reference point or polygon which this reconnaissance describes.

Location Name: The name of the property, park, or the location within large holdings (like USFS or BLM properties).

GPS name: The name/number assigned to the GPS unit.

Projected? Yes / No / Base / Digitized: Circle the appropriate option:

> **Yes** - The point is a projected, or offset point. The surveyor used a bearing and distance to project the point to match what they are describing with the survey.
>
> **No** - The surveyors are in the vegetation they are describing and the point is where the observer was standing for photographs. This location can also be used as a base location for an offset survey.
>
> **Base** - Base point only. This is where a surveyor was standing when taking an offset survey to describe vegetation not at that point. No plant data or vegetation descriptions are associated with this location. However, cardinal photos taken at this point will be stored in a directory of this name.

Digitized – An offset point was created on the GPS unit without taking bearing and distance readings. This option should only be used when the imagery on the GPS unit is unique and unmistakable.

Bearing (°): The compass bearing from the Base point to the Projected point.

Distance (m): The distance in meters from the Base point to the Projected point, determined by use of a range finder.

Inclination (°): The vertical offset from the Base point to the Projected point.

Base Waypoint ID: For a projected or digitized point, this is the location where the surveyor was standing when the information was collected. Cardinal photographs will be taken at this point and will be stored on the computer under this ID. Photographs of the stand vegetation will be taken from this point and will be stored on the computer under the Projected point's ID.

Base / Projected UTMs: If the point is projected or digitized, circle whether the coordinates of the base point or the offset point have been recorded. These will generally be for the offset point.

GPS coordinates: Record easting (**UTME**) and northing (**UTMN)** from a GPS unit.

PDOP: The accuracy of the GPS location. Record the error reading from the GPS unit.

Stand Size: Estimate the size of the entire stand in which the sample is taken and circle the appropriate range. As a measure, one acre is similar in size to a football field.

Camera/Photos: Write the name camera, JPG numbers, and direction of photos. Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the GPS location. This symbol can be used to indicate the cardinal photos:  . If additional photos are taken in other directions, please note the JPG numbers and a description of each photo.

HABITAT AND VEGETATION DESCRIPTION

Field Alliance name: Name of alliance following the most recent Mendocino Cypress Woodland classification, using scientific nomenclature, *e.g., Hesperocyparis pygmaea*. An alliance is based on the dominant or diagnostic species of the stand, and usually reflects 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.

Please note: 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.

Comments: Briefly describe the stand age/seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors that will aid in the mapping effort.

% Cover:

Conifer: The total cover of conifer trees taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute tree cover, disregarding the overlap of individual trees.

Hardwood: The total cover of hardwood trees taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute tree cover, disregarding the overlap of individual trees.

Total Tree: The total cover of all the trees taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute tree cover, disregarding the overlap of individual trees.

Regen Tree: The total cover of regenerating trees (seedlings and saplings) taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute tree cover, disregarding the overlap of individual trees.

Shrub: The total cover of all the shrubs taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute shrub cover, disregarding the overlap of individual shrubs.

Herb: The total cover of all the herbs taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute herbaceous cover, disregarding the overlap of individual herbs.

Total Veg: The total cover of all vascular vegetation taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute vegetation cover, disregarding the overlap of the various tree, shrub, and/or herbaceous layers and species.

Exotics: Estimate the percent cover of non-native vegetation (non-native cover/total veg). Enter **L** for <33%, **M** for 33%-66%, or **H** for >66%.

Species List and Coverage

List the species that are dominant or that are characteristically consistent throughout the stand. This list is used if there is some uncertainty in the field-assessed alliance name, so the most common species should be listed. In the interests of time and efficiency, this species list should not be exhaustive.

Strata:

T = Tree. A woody perennial plant that has a single trunk.

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.

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; re-sprouts are not recorded here even if they meet the size requirements.

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.

N = Non-vascular. Includes moss, lichen, liverworts, hornworts, cryptogamic crust, and algae.

When one or more tree species are regenerating, the Tree, Seedling and/or Sapling strata may be noted on the same line, e.g.:

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

Species: Use Jepson Manual nomenclature. 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.

% cover: provide the % absolute aerial cover for each species listed. All species percent covers may total over 100% because of overlap.

Collections: If a species collection is made, it should be indicated in the blank column next to "% cover" 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, add a "T" to the "C" in that column (CT = thrown out after confirmation) or cross out the "C". If the specimen is kept but is still not confidently identified, add a "U" to the "C" (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" (CC = collected and confirmed). If the specimen is later deposited in an herbarium, add a "D" to the existing "C" (CD = collected and deposited) and note the receiving herbarium.

Accuracy Assessment – Mendocino cypress woodland (3/16/2018)

Recorder:	**Other Surveyors:**	**Date:**

Waypoint ID:

Polygon UID:

Location Name:

GPS Name _____ **Projected? Yes / No / Base / Digitized**

If Yes, enter: **Bearing (°): _____** **Distance (m): _____** **Inclination (°): _____**

If Yes or Digitized, enter: **Base Waypoint ID**: **_____**

Base UTMs / **Projected** UTMs (circle one) Record either UTMs or Decimal Degrees

UTME ____ ____ ____ ____ ____ ____ **UTMN** ____ ____ ____ ____ ____ ____ ____ **PDOP: +/-**

Decimal degrees: **LAT** __ __ . __ __ __ __ __ __ **LONG** __ __ __ . __ __ __ __ __ __

Strata	**Species**	**% cover**	**C**	**Strata**	**Species**	**% cover**	**C**

Notes:

Map Unit Name:	Secondary:

Confidence in map unit ID: L M H Explain:

Describe above:	Linework problems ☐	More than 1 vegetation type in this polygon ☐	Vegetation change since imagery taken ☐

Camera Name: Photo #s:

Conifer Cover: _____ Hardwood Cover: _____ Total Tree Cover: _____ Shrub Cover: _____

Tree Height <0.5m 0.5-1m 1-2m 2-5m 5-10m 10-15m 15-20m 20-35m 35-50m >50 m NA

Tree DBH <1” 1- 6” >6-11” >11-24” > 24”

Exotics None or not visible 1 2 3 Not Applicable

Hydro/Nutrient Modification NO YES Not Applicable

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

Is this a “multiple” point assessment? NO YES if yes: _____ of ____ points for this polygon

Accuracy Assessment Protocol
Mendocino Cypress Woodland and Related Vegetation
3/21/18

This protocol describes accuracy assessment (AA) data collection procedures. The primary purpose of the AA fieldwork is to supply data to test the accuracy of a specific vegetation map. The information collected can also contribute additional data for the classification of vegetation communities. The primary sampling units are the vegetation polygons delineated by photo-interpreters in the creation of the vegetation map.

If an entire AA polygon cannot be fully investigated due to terrain or other reasons, as much of the polygon as can be evaluated should be assessed.

Note that a delineated polygon may differ from the conventional definition of a stand of vegetation. A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some stands of vegetation are very small while some may be several square kilometers in size. 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.

A properly delineated polygon may contain more than one stand. One example is a stand that is below the minimum mapping unit (MMU); it cannot be mapped separately and will be absorbed into the surrounding vegetation type. Another example is vegetation that is difficult to identify accurately on photo imagery. Several similar-looking stands may be grouped into one polygon and assigned a vegetation type at a high level, such as Group.

Selecting a location to sample within a polygon (for subsamples only):

If assessing a large polygon, it may be difficult to summarize the species composition, cover, and structure of the entire area. We are also usually trying to capture the most information as efficiently as possible. Thus, we may be forced to select a representative portion to sample.

When taking a subsample, the main point to remember is to select an area that, in as many ways possible, is representative of that polygon. This means that you are not randomly selecting a sample location; on the contrary, you are actively using your own best judgment to find a representative example of the polygon.

Selecting an assessment site requires that you see enough of the polygon you are sampling to feel comfortable in choosing a representative sample location. If possible, take a brief walk through the

polygon and figure out where the boundary lines are drawn. Look for variations in species composition and in stand structure. In the process, decide whether the polygon includes more than one mappable vegetation type or if the stand boundaries don't seem to match up with the polygon delineation. **If more than one vegetation type is present, fill out an AA form for each type ONLY IF each type is mappable (i.e., it is large enough to meet MMU and can be delineated without creating unreasonably shaped polygons).** For the Mendocino Cypress Woodland project, the MMU is 1 acre for upland and 0.25 acre for special stands such as small wetlands, riparian areas, and serpentine barrens. The minimum width is 30 feet. Small variations in vegetation that are repeated throughout the polygon should be included in your subsample. Once you assess the variation within the polygon, attempt to find an area that captures the stand's species composition and structural condition to sample.

HOW TO ENTER FIELDS ON THE FORM:

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.

Date: The date the AA point was sampled. Use the standard U.S. format of "month-day-year" or use letters to write out the month.

Waypoint ID: The Waypoint ID in this format: GPS device name + date (yymmdd) + time (hhmm). For example, for a survey taken on iPad "V" on March 27 at 1:45 in the afternoon, the Waypoint ID will be "V1803271345."

Note that the GPS point should be taken away from the edge of the polygon, and near the center of the subsample (if one is used).

Polygon UID: The unique identifier (UID) assigned to each polygon, displayed in the GPS data and on paper maps.

Location Name: The name of the property, park, or the location within large holdings (like USFS or BLM properties).

GPS name: The name/number assigned to the GPS unit.

Projected? Yes / No/ Base/ Digitized: Circle the appropriate option

> **Yes** - The point is a projected, or offset point. The surveyors used a bearing, distance, and inclination to project the point into the polygon they are describing.
>
> **No** - The surveyor is within the boundary of the polygon being assessed and the point is where the observer was standing for photographs. This location can also be used as a base location for an offset survey.
>
> **Base** - Base point only. This is where a surveyor was standing when taking an offset survey to describe vegetation not at that point. No plant data or vegetation descriptions are associated with this location. However, cardinal photos taken at this point will be stored in a directory of this name.

Digitized – An offset point was created on the GPS unit without taking bearing and distance readings. This option should only be used when the imagery on the GPS unit is unique and unmistakable.

If Projected = Yes

Bearing (°): The compass bearing from the Base point to the Projected point.

Distance (m): The distance in meters from the Base point to the Projected point, determined by use of a range finder.

Inclination (°): The vertical offset from the Base point to the Projected point.

If Projected = Yes or Digitized

Base Waypoint ID: The location where the surveyor was standing when the information was collected. Cardinal photographs will be taken at this point and will be stored on the computer under this ID. Photographs of the stand vegetation will be taken from this point and will be stored on the computer under the Projected point's ID.

Base UTMs / Projected UTMs: If the point is projected or digitized, circle whether the UTM coordinates of the base point or the projected point have been recorded. These will generally be for the base point.

UTM coordinates: Easting (**UTME**) and Northing (**UTMN**) location coordinates using the Universal Transverse Mercator (UTM) grid. Record this information from a GPS unit.

PDOP: The accuracy of the GPS location, when taking the UTM field reading using positional dilution of precision (PDOP). It is typical for commercial GPS units to be accurate with a PDOP value of 1 to 5.The lower the error number, the more accurate the GPS reading.

Note: if your GPS device does not report accuracy in PDOP, cross this out and record the accuracy value and unit instead, e.g. "5m".

Decimal degrees: *Use this only if your GPS unit will not record UTM coordinates.* Latitude–Longitude reading in decimal degrees. Record the information from your GPS unit.

Species list and coverage

List up to twelve 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.

Strata:

T = Overstory tree. A woody perennial plant that has a single trunk.

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.

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; re-sprouts are not recorded here even if they meet the size requirements.

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.

N = Non-vascular Includes mosses, liverworts, hornworts, and algae.

Species: Use Jepson Manual nomenclature. 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.

% cover: provide the % absolute aerial cover for each species listed. All species percent covers may total over 100% because of overlap.

C: If a species collection is made, it should be indicated 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, add a "T" to the "C" in that column (CT = thrown out after confirmation) or cross out the "C". If the specimen is kept but is still not confidently identified, add a "U" to the "C" (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" (CC = collected and confirmed). If the specimen is later deposited in an herbarium, add a "D" to the existing "C" (CD = collected and deposited) and note the receiving herbarium.

Notes: Describe the stand age or seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors. Include recommendations for line-work revision, discernibility of the vegetation based on season and topography, problems with classification interpretation, homogeneity of vegetation, and unusual sightings of plants or animals.

Map Unit Name: Enter the vegetation type name here**.** Refer to the Mendocino Cypress Woodland Vegetation Key to select the type. If the vegetation in this polygon does not exactly match the descriptions in the key, enter the best-fitting vegetation type here and the second-best type in the next field. For further verification of the vegetation, refer to the Stand Tables.

Secondary (Optional): Assign a second-best-fitting name for the vegetation within the polygon. Assign a secondary code **only** if there is some ambiguity in assigning the polygon to a primary vegetation. Note the reason for assigning a secondary call within the "*Confidence in map unit ID"* field below.

Confidence in map unit ID? L M H Explain: Note the level of confidence you feel in the map unit identification by circling **L**ow, **M**oderate, or **H**igh. This is an area to describe how well the stand characteristics match the Vegetation Key. Are all diagnostic species present in proper proportions? If not, how do they differ? If a secondary type is identified, what made the stand type ambiguous? ***Note that if you choose low or moderate confidence, you should have a secondary call, as an alternative way to classify the vegetation.***

Linework problems: Check the box if the polygon boundary line does not surround a distinct vegetation type. Examples for which you would check the box include situations where there is more than one type of mappable vegetation within the polygon, when a portion of the boundary includes part of an adjacent stand, or when the stand continues beyond the polygon boundary. If checked, provide comments in the Notes section to explain.

More than 1 vegetation type in this polygon: Check if there is more than one vegetation type within the polygon. If the polygon includes more than one type, take a separate GPS point and fill out an AA form for each ***mappable*** vegetation type. If these other types are smaller than the MMU, and therefore would not be expected to be mapped, just note the additional vegetation types in the Notes section.

Vegetation change since imagery taken: Check the box if the vegetation in the polygon has changed since the aerial imagery used as the base of the vegetation map was taken. If yes, provide a description in the Notes section of how the vegetation has changed (for example: burned, developed, visible dominance change over time).

Camera name / Photo #s: Write the name or the camera, JPG numbers, and direction of photos. *Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the GPS location.* This symbol can be used to indicate the cardinal photos:  . Make sure to take additional photos of the general composition of the stand if the cardinal photos do not do an adequate job; note the JPG numbers and a description and direction of each additional photo.

Conifer Cover: The total foliar cover (considering porosity) of all live conifer trees, disregarding overlap of individual trees.

Hardwood Cover: The total foliar cover (considering porosity) of all live hardwood trees, disregarding overlap of individual trees.

Total Tree Cover: The total foliar cover (considering porosity) of all live tree species, disregarding overlap of individual trees. This value may be less than the sum of the conifer and hardwood covers due to overlap.

Shrub Cover: The total foliar cover (considering porosity) of all live shrubs, disregarding overlap.

Tree Height: Circle the height range of the modal tree height.

Tree DBH: Circle one of the tree size classes provided. 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.

Exotics: Circle the appropriate level:

None or not visible
1 = Light, less than 33% of total cover is non-native
2 = Moderate, between 33% and 66% of total cover is non-native
3 = Heavy, more than 66% of total cover is non-native
Not Applicable

Hydro/Nutrient Modification: Circle the appropriate level:

NO = Hydrologic and/or nutrient modification was not observed
YES = Hydrologic and/or nutrient modification has resulted in changes to oligotrophic vegetation
Not Applicable

Estimated area of identifiable vegetation viewed:

Enter the **radius in meters** of the area around your GPS point that you were able to assess within the polygon.

OR

Enter a rough estimate of the **percent of the polygon** that you were able to assess from your point AND any additional area that you were able to view while driving or walking around or through the polygon.

APPENDIX B

Initials used on Field Survey Forms

AE	Annie Eicher
AG	Alison Gardener
AK	Anne Klein
AL1	Adrienne Long
AL	Angela Liebenberg
AO	Aicha Ougzin
AS	Asa Spade
BH	Brett Hall
CC	Catherine Curley
CG	Clare Golec
CS	Cheri Sanville
DC	Danielle Castle
DH, DEH	Diana Hickson
DH	Daniel Harrington
GL	Gordon Leppig
HR	Haley Ross
JD	Janelle Deshais
JG	John Gurley
JIG	Jennifer Garrison
JR, JSR	Jaime Ratchford
KY	Karen Youngblood
LM1	Louisa Morris
LM	Linda Miller
LP	Linda Perkins
MA	Mario Abreu
MJ	Mary Jo Colletti
MK	Melissa Kraemer
MR	Mona Robison
MV	Mike Vasey
MvH	Michael van Hattem
NH	Nicolet Houtz
NM	Nancy Morin
PH	Pam Huntley
PR	Peter Rowland
PW	Peter Warner
RM	Rick Macedo
RP	Renee Pasquinelli
RW	Rixanne Wehren
RY, RAY	Rosie Yacoub
TF	Terra Fuller
TF1	Tina Fabula
TG	Tamara Gedik
TKW	Todd Keeler-Wolf
TS	Teresa Sholars
TS	Teresa Spade

APPENDIX C

Species Cover Class by Plot

This table records cover classes of species by code (rows) in field samples used in the classification (columns). Appendix D lists the species and their codes. The seven cover classes are 1= <1%, 2= 1-5%, 3= >5-15%, 4= >15-25%, 5= >25-50%, 6= >50-75%, 7= >75%.

Species	DKYRE001	DKYRE002	DKYRE003	DKYRE004	DKYRE005	PYGM0001	PYGM0002	PYGM0003	PYGM0004	PYGM0005	PYGM0006	PYGM0007	PYGM0008	PYGM0009	PYGM0011	PYGM0021	PYGM0022	PYGM0023	PYGM0024	PYGM0025	PYGM0026	PYGM0027	PYGM0041	PYGM0042	PYGM0043	PYGM0044	PYGM0045	PYGM0047	PYGM0054	PYGM0061	PYGM0062	PYGM0063	PYGM0064	PYGM0065	PYGM0066
2CLPOP						1	2	3		1		1				3		2								1			1	1			1		
2CRYPTO																																			
2JMRHCO18							2	4		3	3		1			3		4			4					2	2		2	4	3	1	2		
ABGR																						1													
AGROS2																																			
AICA																																			
ANOD																																			
ARCA17			1																																
ARCA3																																			1
ARCEU		1																																	
ARCO3		1	1	1	1				1			1		2	3								2	2			3	2				1			
ARGL3	1	1	1	1	1									3	3									1				1						3	1
ARME																															1				
ARNU3	5	5	4	6	5	1			1			3	4	3	5	1						3	2	1	1	2	2	1	2	1		5	2	4	5
ATFI																																			
BLSP							1				1																								
CABO																																			
CACA9	1		1			1	1	1					1			2		1			2		1		1				2	2					
CAEC							5																												
CANU							1																												
CAOB3							1																												
CEFO																																			
CEGLE																																			
CHCH7			1	2	2				3			1		2	2													2			1	1		3	2
COCOC																																			
COSE4											1																								
CYER																																			
CYSC4																																			
DEHO2																																			
DROSE							2									1																			
ERIOP2																																			
FRCA12																																			
FRPU7																																			
GASH	1	3	2	2	2	3	1	1	2	2	5	1	2	2	2	1	5	2	4	2	2	4	2	3	2	1	1	2	2	2	2	2	2		
GASTR																																			
GENIS											1																								
GOOB2																	1																		
HEPI11	4	3	4	1	3	3	3	4	2	3	4	2	3			3		3	4	3	3	3	2	2	3	2	3		3	3	3	1	3		
HESC2																																			
HOLA																																			
HOTE2																																			
HYAN2																																			
HYRA3																																			
IRDO																																			
JUAR2																																			
JUEF							1																												
JUSU3																																			
LEGL					1																														
LIMA		1																										1							
LOHI2																																			
LOHU2																																			
LUCO6	1																										1								
MIGU																																			
MIMUL																																			
MOCA6		3	2			1	2	3	1	1	2	2				2	1	2	1		2		2	2	1		1	1	1	1					
NODE3									2		1			1	1		2		1			1				1	1	1							
PEDE																										1									
PIAT																																		3	
PICOB			3			3	2	3	1	2	1	2				3		2		3	3	2	2	2	2	3	2	1	3	2	2	1	3		
PIMO5	1																																		
PIMU	3	3	2	3	3	1			4		1	2	2	3	2		3	1	3	4		4	2	3	2	2	2	2			3	3			3
PIPER2																																			
PLOV																																			
POA	1																																		
POCA5			1																																
POMU																																			
POSC4																																			
PSME														1	1							1		1				1							2
PTAQ		1	1	1	1			1				1	1	2	1		3		1					2		1	1	1		1	1	1			
QUCH2																																			
QUWI2																																			
RHAL3																																			
RHMA3		3	3	2	2	2			2	2		2	2				2		1	2		2	3	3	2	2	2	2	2	2	2	4	2		2
RHOC																																			
ROCA2																																			
RUAR9											1																								
RUPA																																			
RUUR																																			
SALA7																																			
SAPU4																																			
SASC																																			
SCMI2																																			
SESE3				1		1											1						1								1				2
SOCA5																																			
STCH																																			
TODI																																			
TRBOL																																			
TROV2																																			
TSHE		1	1																									1			1				
VAOV2	3	4	3	3	5	3	1	2	4	5	3	2	3	2	2	2	4	3	5	6	3	4	3	3	3	2	2	2	5	3	5	3	2		2
VAPA		1							1								1		2																
VEFI2																																			
VIAMA3																																			
VISE3																	1										1								
WHMO																																			
XETE	2	1	1	1	1				1			1		2												1		3							
ZIGAD																																			

Species	PYGM0081	PYGM0082	PYGM0083	PYGM0084	PYGM0085	PYGM0086	PYGM0087	PYGM0088	PYGM0090	PYGM0092	PYGM0094	PYGM0095	PYGM0096	PYGM0097	PYGM0098	PYGM0101	PYGM0102	PYGM0105	PYGM0106	PYGM0107	PYGM0108	PYGM0109	PYGM0111	PYGM0112	PYGM0113	PYGM0114	PYGM0116	PYGM0121	PYGM0122	PYGM0123	PYGM0124	PYGM0125	PYGM0126	PYGM0127	PYGM0137	PYGM0141	PYGM0142	PYGM0143	PYGM0144	PYGM0161	PYGM0162	PYGM0163
2CLPOP	1	1			2	1	2			5		2			2	2						1			2			1			1		1			2	1		2	1	2	2
2CRYPTO																3																										
2JMRHCO18	5							2		4	1	3	4		3	2					3	2	1	4	2					5	3	2	2	2		5	5	5	2		2	
ABGR											1																															
AGROS2																																										
AICA																																										
ANOD																																										
ARCA17																																										
ARCA3						1	1																																			
ARCEU																																								1		
ARCO3		1	1	2	1	2	2		2		2			3			2	2	2	2						1	1	2	1						2					1		
ARGL3				3			2												1							4	2		1													
ARME																																										
ARNU3		3	2	3	4	5	4		4		4			5				3	2	2		3	2		1	4	5	4	2						3					4		2
ATFI																																										
BLSP																					1			1												2						
CABO																																										
CACA9	1				1	1	1			2		1			1	1							1		1		1				2						1	2	1	1	1	1
CAEC																																										
CANU																																				1						
CAOB3																					1															3		1				
CEFO																																										
CEGLE																																										
CHCH7		3	2	2		2	2		2		1							1	1	1		1					1					3			2					1		
COCOC																																										
COSE4																																										
CYER																																										
CYSC4																								1																		
DEHO2																																										
DROSE																																				1						
ERIOP2																										1																
FRCA12																											1															
FRPU7																								1																		
GASH	1	1	2	2	2	2	2		2	1	3	2	2	2	2	1	2	3	5	3	1	2	3	3	2	1	1	3	1	2	2	1	1	1	2	2	2	3	3	2	2	2
GASTR																																										
GENIS																																										
GOOB2																																								1		
HEPI11	3	2			3			1	2	4	4	5	5	1	5	3	2			1	3	3	3	3	3			2	3	4	3	3	3	4	3	4	3	3	4	1	3	2
HESC2																																										
HOLA																																										
HOTE2																											1															
HYAN2																					1															1						
HYRA3																							1																			
IRDO																																										
JUAR2																																										
JUEF								2													1			1												3						
JUSU3																					1																					
LEGL																																										
LIMA																					1																					
LOHI2																																										
LOHU2																																										
LUCO6						1																					1								1							
MIGU																																										
MIMUL																																										
MOCA6	1	1		2	1	2			2	1	1				2		2				1	1	1	2	1	1		1		1	1				2	3	1		1			
NODE3			2	1		1								1				1	1				1			1	2					2		1						1		
PEDE																						1																				
PIAT																																										
PICOB	2	2			2			3	2	3	3	3	3	1	4	2			1	1	2	1	2	1	2			2	1	2	3	2	3	2	3	2	3	3	3	2	2	2
PIMO5																											1															
PIMU		3	4	3	2	3	3		2		2		2	3	1	1	3	2	4	3		2	2	2		1	2	2	3			3	1	2	2	1	1	3		2		1
PIPER2																																								1		
PLOV																																										
POA																																										
POCA5																																										
POMU																																										
POSC4																																										
PSME		1	1	1		1	2											1	1	1			2	2		1	2								1							
PTAQ		1	2	2		1	2		1							1		1	1	1			1	1		1	1	1							1		1	1		1		
QUCH2																																										
QUWI2																																										
RHAL3																																				1						
RHMA3	1	3	3	2	3	3	3		2		2		2	3	1	2	2	3		2		2	1		1	1	1	2	1	1		2		2	3		2		2	3		2
RHOC																																										
ROCA2																																										
RUAR9																																										
RUPA																																										
RUUR																																										
SALA7																											1															
SAPU4																																				1						
SASC																																										
SCMI2																																										
SESE3		1	1								1			2			2	1	1							2						1		2								
SOCA5																																										
STCH																																										
TODI																																										
TRBOL																																										
TROV2																																										
TSHE				1			1				1			1									1	1													1					
VAOV2	3	3	4	2	2	2	2	2	2	2	4	2	4	3	3	3	5	3	4	3	1	3	3	4	2	2	2	2	5	5	2	3	2	4	2		3	5	5	2	2	3
VAPA																																		1								
VEFI2																																										
VIAMA3																																										
VISE3						1	1							1												1														1		
WHMO																										1																
XETE			2	2	1	2	2		1		1			1				1				1				1	1	1							2					2		1
ZIGAD																			1							1																

Species	PYGM0164	PYGM0165	PYGM0166	PYGM0167	PYGM0168	PYGM0169	PYGM0171	PYGM0172	PYGM0173	PYGM0174	PYGM0181	PYGM0182	PYGM0183	PYGM0184	PYGM0185	PYGM0191	PYGM0192	PYGM0193	PYGM0220	PYGM0221	PYGM0222	PYGM0223	PYGM0224	PYGM0225	PYGM0226	PYGM0237	PYGM0238	PYGM0240	PYGM0300	PYGM0301	PYGM0302	PYGM0303	PYGM0880	PYGM0882	PYGM0883	SONO0163	SONO0464	SONO0465	SONO0466	SONO0663
2CLPOP	1		1								3	1	2		2		2	1				1											1							
2CRYPTO																																								
2JMRHCO18			1	1							4	3	5				3	1		1								1												
ABGR																																								
AGROS2																										1														
AICA																										1														
ANOD																																								2
ARCA17																																								
ARCA3																																								
ARCEU																																								
ARCO3		2	1	1	1	1		2		1						1			1	2		1		2	2	1	3	2			1		1	1		2	2	2		
ARGL3		1				1				3									1	2			2	2	2	3			2	1		1		2						
ARME																																								
ARNU3	1	4	3	3		2		3		3	1			3	5		2	3	3	3	3	1	3	4	5	3		2	5	3	5	2	1	3	3	5	3	5		
ATFI																																								2
BLSP									1																															
CABO																										1				1										
CACA9	1										1	1	1					1				1				1	1													
CAEC												1																												
CANU																																								3
CAOB3																																							3	2
CEFO										1																														
CEGLE										1																														
CHCH7	1	1		1	3	3	3	2						2	1	4			2	2	1		3	2	2	1	2	2		1	1		3	2	2	2	2	2		
COCOC																																								2
COSE4																																								
CYER																																							2	
CYSC4																																								
DEHO2										1																														
DROSE																																								
ERIOP2																																								
FRCA12																																							1	3
FRPU7																																								
GASH	1	2	2	1	1	2	2	3	1		2	2	2	2	2	2	2	2	2	2	2	2	2	3	1	2	3	3	2	2			2	2	3	5	2	2	2	
GASTR																																							1	
GENIS																																								
GOOB2		1																									1													
HEPI11	2		2	3		1					3	4	4	2	2	3	3	2	2	2	2	2				2						3	1	3	2	3				
HESC2																																						1		
HOLA																																								2
HOTE2																										1														
HYAN2																																								
HYRA3																																								
IRDO																										1	1			1										
JUAR2																																							1	
JUEF																																								
JUSU3																																								
LEGL																																				1				3
LIMA																												1												
LOHI2																											1												1	
LOHU2																																						1		
LUCO6																																						1		
MIGU																																							2	
MIMUL																																1								
MOCA6			2	1	1	1	1				1	2	2		2		2	1	2	1	1	1				1	2	2						2					2	6
NODE3	1	1			1	2	2		1	1						1			2	2		1		1		1	3			2	2									
PEDE																																								
PIAT																																								
PICOB	2	2	2			2					2	2	1	1	2		2	2	2	2	2	2											1		2					
PIMO5										2																1			1											
PIMU	2	2	2	2	2	2	3	4	3	2				4	2	3		2	2	2	1	2	2	2	1	2	3	3	2	3	3	1	4	3	4	3	3	2		
PIPER2																																								
PLOV																																							1	
POA																																								
POCA5																											1													
POMU									1																														2	3
POSC4									1																															
PSME		2		1		1		2		2		1		1	1					1		1	2			1	1			1	1	1				1			2	
PTAQ		1	1		1	1	1	2	1	2	1			1	1	1		1	1	1		2	2	2	1	3	2	2	2	2		1	2	1				2		2
QUCH2																										2														
QUWI2										1																														
RHAL3																																								
RHMA3	2	2	2	3	3	3	2	2	1					2	3	2	2	2	2	2	2	2	2	2			2	2	1				2	3	3					
RHOC																																					2		5	
ROCA2																																							1	
RUAR9																																								2
RUPA																																								2
RUUR										1																													2	3
SALA7																																								
SAPU4																																								
SASC																																							3	
SCMI2																																								2
SESE3		2	1						3						1	1						1	2				2	2								2				
SOCA5																										1														
STCH																																							2	
TODI										1																														2
TRBOL																												1												
TROV2									1																															
TSHE		1									1								1	1		1	1										1							
VAOV2	3	2	3	2	3	2	3	3	1	2	2	2	2	5	3	5	2	2	3	3	3	3	2	2	3	3	2	3	3	4	2	1	3	2	3	5	5	3	2	
VAPA			1													2				1		1						1						1						
VEFI2																																							2	1
VIAMA3																																							1	
VISE3		1							1																	1	1													
WHMO									1																	1														
XETE		1				3		1						1	2	1		1	2	2	1		2		1			3	2				2	2						
ZIGAD										1																														

APPENDIX D

Plant Taxa Included in the Mendocino Cypress Classification

A total of 150 plant taxa were recorded in the 171 field surveys analyzed in the classification. An additional 28 species were reported in reconnaissance and accuracy assessment surveys that were not included in the analysis. All species are listed below; 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) that are not in the USDA PLANTS database. Codes for snags or non-vascular categories, such as moss and lichen, have codes beginning with "2" (e.g., 2MOSS, 2SNAG).

Of the 150 plants analyzed in this project, 53 were removed or consolidated before analysis began; these are marked with an *. An additional 57 species were removed during the analysis because they were found in fewer than three samples or were reported in the three outlier samples. These additional removals are marked with **. The 28 species that were not included in the analysis are marked with ***. The remaining 39 taxa were analyzed to produce the classification.

Layer	Code		Taxon Name
Tree			
	ABGR	**	*Abies grandis*
	ACACI	*	*Acacia*
	ACME	***	*Acacia melanoxylon*
	ALRU2	***	*Alnus rubra*
	ARME	**	*Arbutus menziesii*
	CHCH7		*Chrysolepis chrysophylla*
	CHCHC4	*	*Chrysolepis chrysophylla* var. *chrysophylla*
	CHCHM	*	*Chrysolepis chrysophylla* var. *minor*
	EUCAL	*	*Eucalyptus*
	EUGL	***	*Eucalyptus globulus*
	HEPI11		*Hesperocyparis pygmaea*
	NODE3		*Notholithocarpus densiflorus*
	PIAT	**	*Pinus attenuata*
	PICO	*	*Pinus contorta*
	PICOB		*Pinus contorta var. bolanderi*
	PILA	***	*Pinus lambertiana*
	PIMU		*Pinus muricata*
	PSME		*Pseudotsuga menziesii*
	PSMEM	*	*Pseudotsuga menziesii* var. *menziesii*
	QUCH2	**	*Quercus chrysolepis*
	QUWI2	**	*Quercus wislizeni*
	QUWIF	***	*Quercus wislizeni* var. *frutescens*
	SALIX	*	*Salix*
	SALA5	***	*Salix lasiandra*
	SALU	*	*Salix lucida*
	SESE3		*Sequoia sempervirens*
	2SNAG	*	Standing snag
	TSHE		*Tsuga heterophylla*
	UMCA	*	*Umbellularia californica*

Layer	Code	Taxon Name
Shrub		
	2JMACPA	*** *Acmispon parviflorus*
	ARCTO3	* *Arctostaphylos*
	ARCO3	*Arctostaphylos columbiana*
	ARGL3	*Arctostaphylos glandulosa*
	ARNU3	*Arctostaphylos nummularia*
	2JMARNUM	* *Arctostaphylos nummularia* ssp. *mendocinoensis*
	2JMARNUN	* *Arctostaphylos nummularia* ssp. *nummularia*
	BAPI	*** *Baccharis pilularis*
	CEFO	** *Ceanothus foliosus*
	CEGL	*** *Ceanothus gloriosus*
	CEGLE	** *Ceanothus gloriosus* var. *exaltatus*
	CETH	*** *Ceanothus thyrsiflorus*
	COCOC	** *Corylus cornuta* var. *californica*
	COFR3	*** *Cotoneaster franchetii*
	CYSC4	** *Cytisus scoparius*
	FRCA12	*Frangula californica*
	FRPU7	** *Frangula purshiana*
	GASH	*Gaultheria shallon*
	GENIS	** *Genista*
	GEMO2	*** *Genista monspessulana*
	HEAR5	*** *Heteromeles arbutifolia*
	ILAQ80	*** *Ilex aquifolium*
	LOHI2	** *Lonicera hispidula*
	DIPU4	* *Mimulus aurantiacus var. puniceus*
	MOCA6	*Morella californica*
	PICKE	* *Pickeringia*
	PIMO5	*Pickeringia montana*
	2JMRHCO18	*Rhododendron columbianum*
	RHMA3	*Rhododendron macrophyllum*
	RHOC	** *Rhododendron occidentale*
	RUBUS	* *Rubus*
	RUAR9	** *Rubus armeniacus*
	RUPA	** *Rubus parviflorus*
	RUSP	* *Rubus spectabilis*
	RUUR	*Rubus ursinus*
	SASC	** *Salix scouleriana*
	SARA2	* *Sambucus racemosa*
	SPJU2	*** *Spartium junceum*
	SUMO	*** *Suaeda moquinii*
	TODI	** *Toxicodendron diversilobum*
	VAOV2	*Vaccinium ovatum*
	VAPA	*Vaccinium parvifolium*
Herb		
	AGROS2	** *Agrostis*
	AICA	** *Aira caryophyllea*

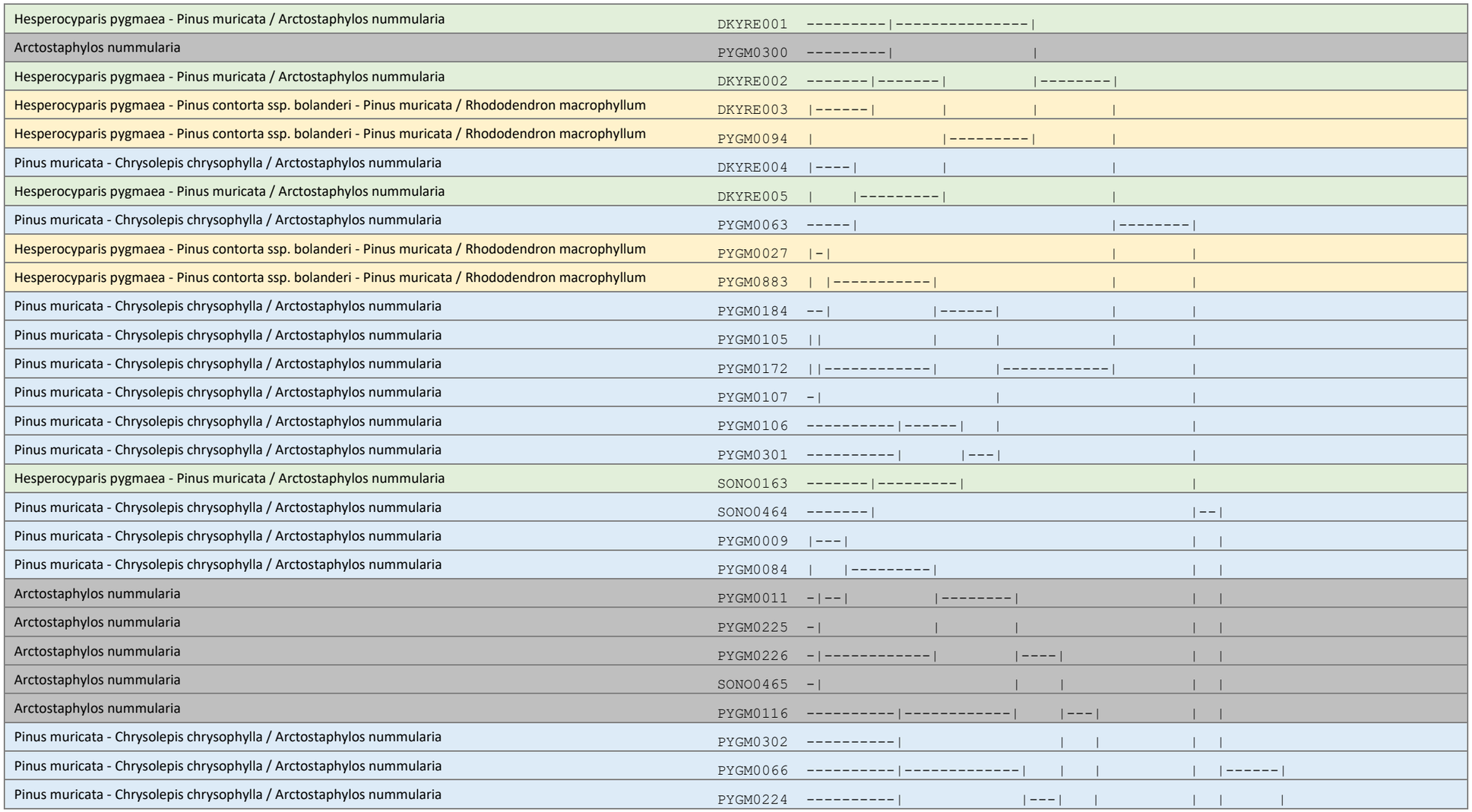
Layer	Code	Taxon Name
Herb		
	ANTHO	* *Anthoxanthum*
	ANOC5	*** *Anthoxanthum occidentale*
	ANOD	** *Anthoxanthum odoratum*
	ARCEU	** *Arceuthobium*
	ARCA17	** *Arceuthobium californicum*
	ARCA3	*Arceuthobium campylopodum*
	ATFI	** *Athyrium filix-femina*
	BLSP	*Blechnum spicant*
	BRMA	*** *Briza maxima*
	CALAM	* *Calamagrostis*
	CABO	** *Calamagrostis bolanderi*
	CANU	*Calamagrostis nutkaensis*
	CABU	*** *Calypso bulbosa*
	CAPUS	*** *Calystegia purpurata* ssp*. saxicola*
	CAREX	* *Carex*
	CACA9	*Carex californica*
	CAEC	** *Carex echinata*
	CAECP	* *Carex echinata* ssp*. phyllomanica*
	CAOB3	*Carex obnupta*
	COMA2	* *Conium maculatum*
	COJU2	* *Cortaderia jubata*
	COSE4	** *Cortaderia selloana*
	CYER	** *Cyperus eragrostis*
	DEHO2	** *Deschampsia holciformis*
	DROSE	*Drosera*
	DRRO	* *Drosera rotundifolia*
	EPILO	* *Epilobium*
	EPCI	* *Epilobium ciliatum*
	ERMI8	* *Erechtites minimus*
	ERIOP2	** *Eriophyllum*
	ERLA6	* *Eriophyllum lanatum*
	2FORB	* Forb (herbaceous, not grass nor grasslike)
	GALIU	* *Galium*
	GAPU3	* *Gamochaeta purpurea*
	GASTR	** *Gastridium*
	GNPU2	*** *Gnaphalium purpureum*
	GOOB2	*Goodyera oblongifolia*
	2GRAM	* Graminoid (grass or grasslike)
	HESC2	** *Helianthemum scoparium*
	HOLA	** *Holcus lanatus*
	HOTE2	** *Horkelia tenuiloba*
	HYAN2	** *Hypericum anagalloides*
	HYGL2	*** *Hypochaeris glabra*
	HYRA3	** *Hypochaeris radicata*
	IRDO	*Iris douglasiana*

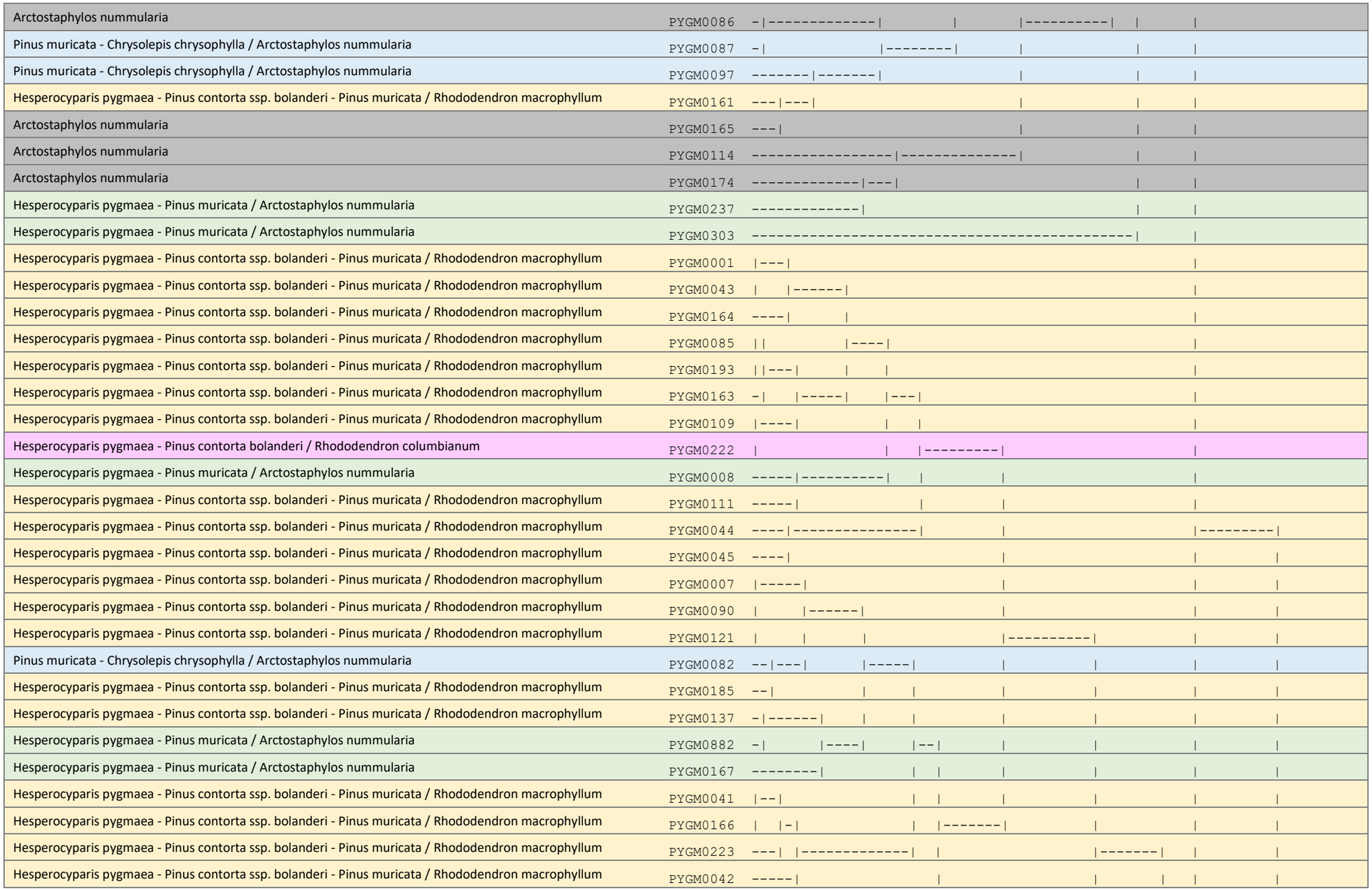
Layer	Code	Taxon Name
Herb		
	JUNCU	* *Juncus*
	JUAR2	** *Juncus arcticus*
	JUEF	*Juncus effusus*
	JUEFB	* *Juncus effusus* var. *brunneus*
	JUPA2	*** *Juncus patens*
	JUSU3	** *Juncus supiniformis*
	LIMA	*Lilium maritimum*
	LOHU2	** *Lotus humistratus*
	LOMI	* *Lotus micranthus*
	LUZUL	* *Luzula*
	LUCO6	*Luzula comosa*
	MIMUL	** *Mimulus*
	MIAU	*** *Mimulus aurantiacus*
	MIGU	** *Mimulus guttatus*
	OXOR	* *Oxalis oregana*
	PEDE	** *Pedicularis densiflora*
	PIPER2	** *Piperia*
	PLOV	** *Plantago ovata*
	POA	** *Poa*
	POCA5	** *Polygala californica*
	POSC4	** *Polypodium scouleri*
	POLYS	* *Polystichum*
	POMU	*Polystichum munitum*
	POGR9	*** *Potentilla gracilis*
	PTAQ	*Pteridium aquilinum*
	PTAQP2	* *Pteridium aquilinum* var. *pubescens*
	RASA2	* *Raphanus sativus*
	RHAL3	** *Rhynchospora alba*
	RUOB	* *Rumex obtusifolius*
	SALVI	* *Salvia*
	SALA7	** *Sanicula laciniata*
	SAPU4	** *Sarracenia purpurea*
	SCMI2	** *Scirpus microcarpus*
	SEMI4	*** *Senecio minimus*
	SOCA5	** *Solidago californica*
	SOAS	* *Sonchus asper*
	STCH	** *Stachys chamissonis*
	2JMTOFR	*** *Toxicoscordion fremontii*
	TRBOL	** *Trientalis borealis* ssp. *latifolia*
	TROV2	** *Trillium ovatum*
	2BRASSI	* unknown Brassicaceae
	2FABACE	* unknown Fabaceae
	2LILIAC	* unknown Liliaceae
	POACEA	* unknown Poaceae
	VEFI2	** *Veratrum fimbriatum*

Layer	Code	Taxon Name
Herb		
	VIAMA3	** *Vicia americana* ssp. *americana*
	VISE3	*Viola sempervirens*
	WHMO	*Whipplea modesta*
	XEROP	* *Xerophyllum*
	XETE	*Xerophyllum tenax*
	ZIGAD	*Zigadenus*
	ZIFR	* *Zigadenus fremontii*
Non-vascular		
	2CLPOP	*Cladonia portentosa* ssp. *pacifica*
	2CRYPTO	** Cryptogammic crust
	2FUNGI	* Fungus
	2LICHN	* Lichen
	2MOSS	* Moss
	SPHAG2	*** *Sphagnum*

APPENDIX E
Cluster Analysis Dendrogram

Example diagram showing the arrangement of samples from the cluster analysis. Surveys that group to the left (with more information remaining) have more overlap than those that group to the right.




Arctostaphylos nummularia
PYGM0086
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0087
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0097
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0161
Arctostaphylos nummularia
PYGM0165
Arctostaphylos nummularia
PYGM0114
Arctostaphylos nummularia
PYGM0174
Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia
PYGM0237
Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia
PYGM0303
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0001
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0043
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0164
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0085
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0193
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
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Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
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Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0222
Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia
PYGM0008
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
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Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0044
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0045
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0007
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0090
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0121
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0082
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0185
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0137
Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia
PYGM0882
Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia
PYGM0167
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0041
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0166
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
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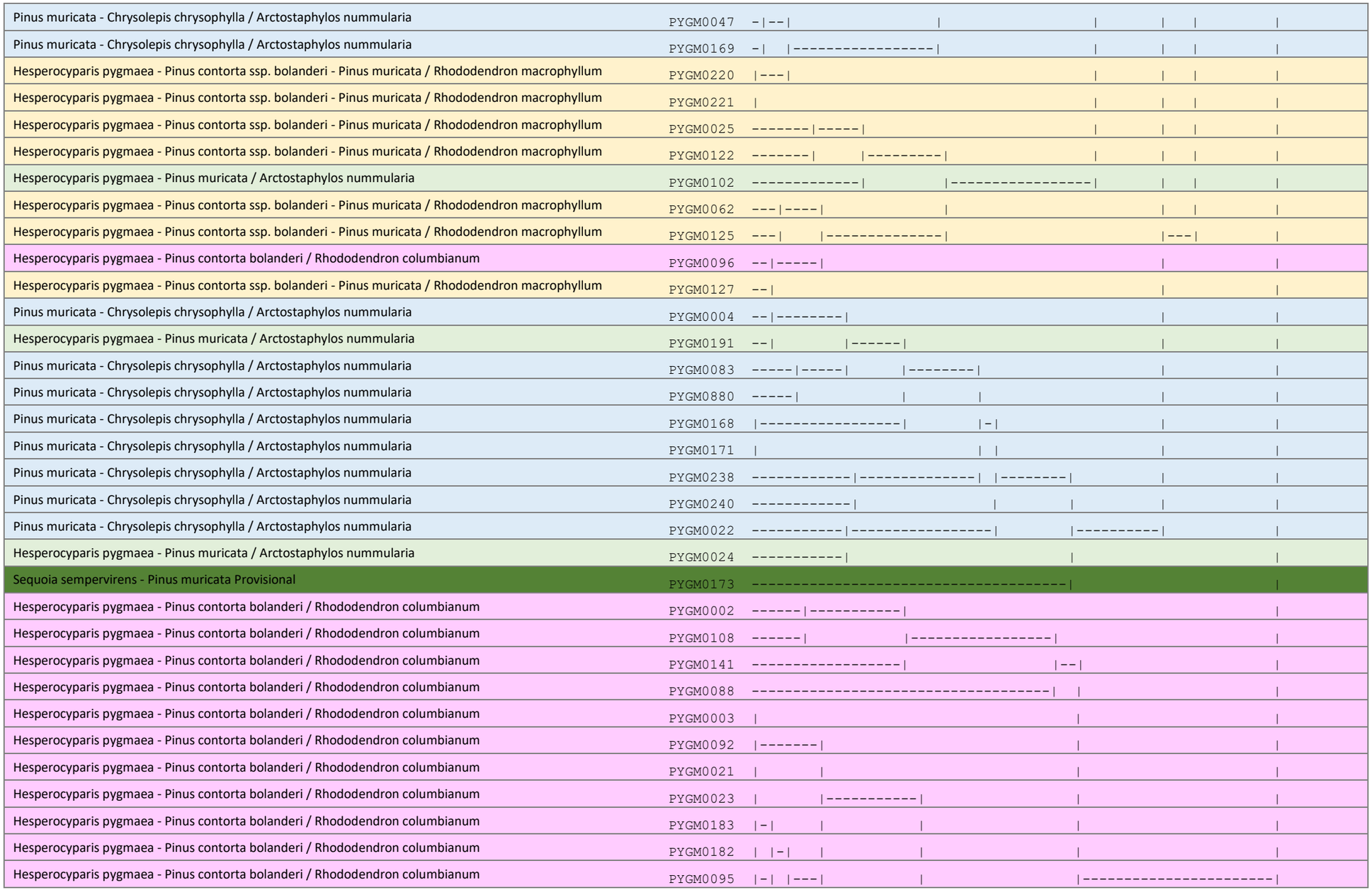
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0042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Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0169
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0220
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0221
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0025
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0122
Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia
PYGM0102
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0062
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0125
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0096
Hesperocyparis pygmaea - Pinus contorta ssp. bolanderi - Pinus muricata / Rhododendron macrophyllum
PYGM0127
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0004
Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia
PYGM0191
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0083
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0880
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0168
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0171
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0238
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0240
Pinus muricata - Chrysolepis chrysophylla / Arctostaphylos nummularia
PYGM0022
Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia
PYGM0024
Sequoia sempervirens - Pinus muricata Provisional
PYGM0173
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0002
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0108
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0141
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0088
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0003
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0092
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0021
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0023
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0183
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0182
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum
PYGM0095

Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0098	| | | |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0026	|---| |----------| |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0124	| | | |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0064	|--------| | | |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0192	| |--| | | |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0113	|| | | | | |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0162	||-------| |-------| | |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0181	-| | | |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0101	---|--------| |-----|
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0126	---| |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0005	|--| |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0123	| |-----| |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0054	|--| | |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0144	| |------| |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0061	| | | |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0142	|--------| |---------| |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0081	| | |------|
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0143	----------| |
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0006	------|----------|
Hesperocyparis pygmaea - Pinus contorta bolanderi / Rhododendron columbianum	PYGM0112	------|

APPENDIX F
Mapping Rules

Mapping extent

The mapping boundary as described in the "Defining the Study and Mapping Area" portion of the Methods section of this report is used is a guide. This layer is available from VegCAMP. Oligotrophic vegetation units are mapped to their actual extent. Urban and other non-vegetation mapping units are mapped within and to the edge of the oligotrophic boundary.

Vegetation types

The following vegetation types are considered oligotrophic and mapped to association level whenever possible:

Hesperocyparis pygmaea Alliance
Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia Association
Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association
Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi / Rhododendron columbianum* Association
Hesperocyparis pygmaea – Pinus contorta ssp*. bolanderi / Rhododendron columbianum* FEN VARIANT (note: fens are not consistently photo-interpretable and so this type is mapped when there was field-based evidence)
Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia Association
Chrysolepis chrysophylla / Vaccinium ovatum Association
Arctostaphylos nummularia Association
Rhododendron columbianum Alliance

The *Sequoia sempervirens – Hesperocyparis pygmaea* Provisional Association is also mapped, although it is not considered oligotrophic.

The following non-oligotrophic types are mapped when oligotrophic vegetation types surround them completely or when the type cuts across an area of oligotrophic vegetation:

Arctostaphylos columbiana Provisional Alliance
Cortaderia (jubata, selloana) Semi-Natural Alliance
Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum Association
Sequoia sempervirens Alliance
Sequoia sempervirens – Pinus muricata Provisional Association
Pinus muricata – Notholithocarpus densiflorus Association
Rubus armeniacus Semi-Natural Association

Three vegetated ponded areas are mapped because they were surrounded by oligotrophic types, although they could be mapped to group level only:

Temperate Freshwater Floating Mat Group (likely *Lemna minor* Alliance)
Temperate Pacific Freshwater Aquatic Bed Group (likely *Nuphar lutea* Provisional Alliance)
Vancouverian Freshwater Wet Meadow and Marsh Group (likely *Carex obnupta* Alliance)

Non-Vegetation types

Anthropogenic areas of little or no vegetation: These are areas with little vegetation cover resulting from human-related clearing. Vegetation is <10% cover, and, if present, is not evenly or naturally distributed across the polygon. A small area of herbaceous vegetation that is adjacent to a larger cleared area may be included in a polygon mapped as this type.

Built-up and Urban Disturbance: Urban and suburban areas of homes and other structures, driveways, parking areas, hardscaping, landscaping, and turf sports fields or parks. Roads at least 30 feet wide are also in this category. Areas of Pasture and Hay Field Crop are included in this category if they are continuous with Built-up areas. Areas in which the understory of trees has been purposely and completely cleared of native vegetation are considered Built-up and Urban Disturbance.

Forest Plantation and Agroforestry: Agricultural crops dominated by intensive (often short-rotation) forest plantations and various agroforestry woody crops. Long-rotation plantings in the early stages of development, especially if planted in rows and if the understory is strongly manipulated, are included.

Pasture and Hay Field Crop: Agricultural vegetation, including pastures and hayfields, often regularly mowed, fertilized, intensively grazed, and/or manipulated to maintain a particular desirable structure and composition. These are mapped separately only if they meet the 0.25-acre minimum mapping unit and are not adjacent to Built-up and Urban Disturbance.

Water: Areas of open water. If man-made, the attribute value for Anthropogenic Alteration is 3 (see below). If water has >10% cover of hydrophytes in the imagery, the pond is mapped as that vegetation type.

Map Attributes

Map Unit

Code	Map Unit
1110	*Hesperocyparis pygmaea* Alliance
1111	*Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association
1112	*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association
1113	*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association
1114	*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* FEN VARIANT
1131	*Pinus muricata – Notholithocarpus densiflorus* Association
1132	*Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association
1211	*Chrysolepis chrysophylla / Vaccinium ovatum* Association
1231	*Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum* Association
1310	*Sequoia sempervirens* Alliance

Code	Map Unit
1311	*Sequoia sempervirens – Pinus muricata* Provisional Association
1312	*Sequoia sempervirens – Hesperocyparis pygmaea* Provisional Association
2111	*Arctostaphylos nummularia* Association
2115	*Arctostaphylos columbiana* Provisional Alliance
3211	*Rubus armeniacus* Semi-Natural Association
3520	*Rhododendron columbianum* Alliance
4100	Vancouverian Freshwater Wet Meadow and Marsh Group
5100	Temperate Pacific Freshwater Aquatic Bed Group
5200	Temperate Freshwater Floating Mat Group
7200	Forest Plantation and Agroforestry
7300	Pasture and Hay Field Crop, Lawn, Garden, Recreational Vegetation
8200	*Cortaderia (jubata, selloana)* Semi-Natural Alliance
9100	Built-up and Urban Disturbance
9300	Anthropogenic areas of little or no vegetation
9400	Water

Conifer, Hardwood, and Total Tree Cover

Estimated cover by cover class as "bird's-eye cover," which considers plant porosity. Regenerating trees as well as trees >6" dbh are included in the Conifer and Hardwood covers. Any overlap of Conifer and Hardwood is not included in the Total Tree Cover. Coded values and cover classes are as follows:

0 none
1 0-1%
2 >1-5%
3 >5-15%
4 >15-25%
5 >25-50%
6 >50-75%
7 >75-100%
9 not applicable

Shrub Cover

Shrub cover is the estimated shrub cover under trees. However, if tree cover is greater than or equal to 50%, then shrub cover is not estimated (= not applicable) because it is not possible to accurately see the shrubs beneath the trees. Cover classes are the same as for trees.

Notes on Cover Estimates

The tree or shrub cover is averaged over the entire polygon, that is, if a polygon is roaded or has sub-MMU clearings within it, the cover is averaged including the openings.

Herbaceous cover is estimated only if the stand is an herbaceous type, and then the cover class estimate is put in the notes field using the following cover classes: 2-9% (used only for naturally sparse herbaceous types such as aquatic vegetation, otherwise polygon is not considered vegetated), 10-39%, 40-59%, 60-100%.

Tree Height

Coded values and height classes are as follows:

2	<1 m
4	1-5 m
5	5-10 m
6	10-15 m
11	>15 m
99	not applicable

The height class is for the dominant layer. For Mendocino Cypress vegetation types, the tree height may be 1-5 m, even though the trees have been characterized as regenerating trees in the field sample. If there are some taller trees over a pygmy layer, the modal height is recorded, that is, the pygmy tree height. Emergent tree heights are not considered.

For shrub types, if there is an emergent tree layer, the height of this layer is recorded in the "Tree Height" field.

Tree DBH

When marking the main size class, the mean diameter of all trees is estimated over the entire stand, and the mean weighted toward the larger tree dbh's. Code values and classes are as follows:

T1	<1" dbh
T2	1" to 6"
T3	>6" to 11"
T4	>11" to 24"
T5	> 24"
99	not applicable

Roadedness

Roadedness is estimated as the percent of the stand that does not have roads or one- or two-track vehicle trails, i.e., the largest unroaded area (intact portion) of the stand divided by the area of the entire stand. Note that we observed roads in areas of higher tree cover in the field that were not visible on the imagery, so roadedness is likely underestimated in areas of high tree cover.

0	None or none visible.
1	Low: there is an intact portion of the stand that makes up at least 67% of the entire stand. If the stand is bounded by a road for at least a portion of the perimeter, this code is used. Also, if a stand is bounded by a road for more than 10 meters of its

perimeter, whether or not the road is pulled out as a separate polygon (i.e., it is >10 m wide and paved), the polygon received a 1 for roadedness.

2 Moderate: between 33% and 66% of the vegetation polygon is intersected by roads.

3 High: less than 33% of the vegetation polygon lacks roads.

9 Not applicable.

Development

The percent of the polygon affected by sub-MMU occurrences of structures, cement pads, trash piles, etc., estimated using the following categories:

0 None or none visible.

1 Low: <2% of polygon is affected. Structures, cement pads, trash piles, etc. are widely spaced at very low density.

2 Moderate: 2-5% - Multiple examples of structures, cement pads, trash piles, etc. are visible throughout the polygon. There may be a dense concentration of development within a single or few parts of the vegetation polygon.

3 High: >5% - Multiple structures, etc., are evenly distributed in a vegetated polygon to cover at least 5% of the polygon, but remain individually isolated and surrounded by the predominant vegetation for which the polygon is labeled. If such an area is 0.25 acre or larger, it is mapped separately as Built-up and Urban Disturbance.

9 Not applicable.

Anthropogenic alteration (AnthroAlt)

This attribute is used for vegetation removal of overstory, understory, or both, for vegetation polygons.

0 none or none visible

1 <2% of polygon is affected; clearing is at low density.

2 2-5% of the polygon is affected, and there may be a dense concentration of clearing within a single or few parts of the vegetation polygon.

3 >5% of the polygon has clearings, with multiple examples evenly distributed. Fully cleared areas over 0.25 acre are mapped separately as Anthropogenic areas of little or no vegetation.

9 Not applicable

Hydro/Nutrient Modification (HydroNutrientMod)

This attribute captures, when interpretable on the imagery, situations in which hydrologic and/or nutrient modification has resulted in changes to oligotrophic vegetation. These situations occur when oligotrophic soils are being unnaturally drained by roads and ditches, or when nutrients from adjacent land use increase the stature or cover of otherwise “pygmy” vegetation.

0 No hydrology/nutrient modification

1 Appears altered by hydrology or nutrient changes

9 Not applicable

Exotics

This attribute is used when invasive plant species are visible in the imagery or were noted in the field for a particular polygon.

0 No exotics visible
1 <2% of the polygon is affected; exotic plants are at low density or patchy.
2 2-5% of the polygon is affected.
3 >5% of the polygon is affected by exotics, or stand may be characterized by exotics.
9 Not applicable.

Method of ID (MethodID)

How the map unit and attributes were determined:

1 Rapid assessment (current project)
2 Relevé
3 Field verification or accuracy assessment field form
4 Photo interpretation
5 Adjacent stand information or photo
6 Reconnaissance (current project)
7 Other information (can include using street view in Google Earth)
8 Other plot information
9 Older reconnaissance data

Survey ID

The sample identification number if a field form was used to attribute the polygon.

Notes

Any comments that may be helpful to the map users.

Minimum mapping unit (MMU)

The minimum mapping unit varies based on type, with natural vegetation generally having a 1-acre MMU. Wetland MMU is generally 0.25 or 0.5 acre per state standards. With this project, however, much of the mapping included wetland types. The MMU was selected based on the scale of the base imagery and on the focus of the project on capturing the woody vegetation dominating the study area. The most important wetlands within the study are the ones that are also part of the target ecosystem (*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association, for instance). The smaller wetlands are generally not restricted to the oligotrophic setting (sag ponds, human made ponds, ditches, etc.).

Vegetation polygons of the same type are broken into smaller polygons, with a 1-acre minimum mapping unit, based on a cover class change in the dominant layer per the following Braun-Blanquet cover classes: 1=<1%, 2=1-5%, 3=>5-15%, 4=>15-25%, 5=>25-50%, 6=>50-75%, 7=>75%.

Tree-dominated vegetation polygons of the same type are broken into smaller polygons, with a 1-acre minimum mapping unit, based on changes in tree height class.

Polygons are not broken based on changes in Exotics, Hydrologic/Nutrient modification, Roadedness values, or Anthropogenic Alteration (unless the MMU for Anthropogenic Alteration, 0.25 acre, is reached).

			Required Attributes										
Mapping Units	**Non-veg map code**	**Minimum mapping unit**	**Hydrologic/Nutrient Modification**	**Conifer Cover**	**Hardwood Cover**	**Total Tree Cover**	**Tree Height**	**Tree DBH**	**Shrub Cover**	**Roadedness**	**Development**	**Anthropogenic Alteration**	**Exotics**
Vegetation limited to oligotrophic soils		1 acre and >30 ft. wide	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aquatic vegetation types		0.25 acre	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Forest Plantation and Agroforestry	7200	0.25 acre	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A
Pasture and Hay Field Crop, Lawn, Garden, Recreational Vegetation	7300	0.25 acre	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A
Built-up and Urban Disturbance	9100	0.25 acre	N/A	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
Anthropogenic areas of little or no vegetation	9300	0.25 acre	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water	9400	0.25 acre	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3 *	N/A

Table F-1. Map codes, minimum mapping units, and attribute requirements for mapping unit type.

* Anthropogenic Alteration is "3" for a Water type if the feature is man-made.

Note: Polygons with the attributes "Development" and "Anthropogenic Alteration," when of sufficient size and intensity, are given the mapping units "Built-up and Urban Disturbance" and "Anthropogenic areas of little or no vegetation." When these are used as an attribute, they define a condition of a given polygon better named as something else (e.g., a MapUnit of *Hesperocyparis pygmaea - Pinus muricata / Arctostaphylos nummularia* Association which has a portion affected by anthropogenic alteration). See individual descriptions of attributes for rules of coding polygons for these.

OTHER INFORMATION

Imagery base

NAIP 2014 is the basis for development. Ancillary data sets were used for identification of vegetation through 2017.

Mapping scale

Digitizing was done at a scale from 1:500 to 1:2000.

APPENDIX G
Noteworthy Taxa

Ten of the taxa encountered in the field surveys 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 **Vegetation type(s) in which it was observed**	**CA Rare Plant Rank**	**NatureServe Global/State Rank**
Arctostaphylos nummularia ssp. *mendocinoensis* *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association	1B.2	G3?T1/S1
Calamagrostis bolanderi *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association	4.2	G4/S4
Carex californica *Arctostaphylos nummularia* Association *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association	2B.3	G5/S2
Ceanothus gloriosus var. *exaltatus* *Arctostaphylos nummularia* Association	4.3	G4T4/S4
Hesperocyparis pygmaea *Chrysolepis chrysophylla / Vaccinium ovatum* Association *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association *Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum* Association *Rhododendron columbianum* Alliance	1B.2	G1/S1

Taxon Name Vegetation type(s) in which it was observed	CA Rare Plant Rank	NatureServe Global/State Rank
Horkelia tenuiloba *Arctostaphylos nummularia* Association *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association	1B.2	G2/S2
Juncus supiniformis *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association	2B.2	G5/S1
Lilium maritimum *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association	1B.1	G2/S2
Rhynchospora alba *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association	2B.2	G5/S2
Veratrum fimbriatum *Frangula californica – Rhododendron occidentale* Provisional Alliance * *Morella californica – Rubus spectabilis* Provisional Alliance *	4.3	G3/S3

* These vegetation types were sampled but were not mapped since they were not on oligotrophic soils.

APPENDIX H

Mendocino Cypress Vegetation Type Descriptions

This Appendix provides descriptions of the vegetation alliances and associations that were sampled in this study. It summarizes distributional, structural, environmental, and plant species data for each type.

The vegetation type descriptions in this volume are divided into two sections based on dominance by trees or shrubs; they are organized alphabetically by alliance within each section, with association-level descriptions located under the alliance they fall within hierarchically. Alliance descriptions begin with a statewide and local narrative, followed by a local summary of sample size, global and state ranking, and list of related associations from this project. Association descriptions include a summary of the type, an overview map of the mapped stands of the association for this project, notes about distribution and photos of example stands of the type. Additional data include vegetation cover and height by layer, elevation, slope, and surface cover composition. Soil types on which the association is found are listed. Stand tables summarizing species composition by type show constancy and cover estimate values (average, minimum and maximum) for all taxa occurring in at least 20% of stands.

Definitions of terms used in vegetation descriptions

Bare ground – percent (exposed) cover of fine sediment or soil particles with a diameter less than 2 mm; i.e., ground that is not covered by litter, small rock, or large rock.

Con / Avg / Min / Max – the percent constancy of the species within all stands of the alliance or association (that is, percent of the stands in which the species occurs); average, minimum, and maximum estimated percent cover of the species across all sampled stands.

Large rock – percent cover of rocks on the ground with a diameter greater than 25 cm. Includes rocks that were recorded in the field as bedrock, boulder (>60 cm in diameter) and stone (>25 cm – 60 cm in diameter).

Litter – percent cover of litter, duff, and/or unattached wood on the ground.

Regenerating tree – seedlings and saplings defined as follows:

Seedlings - trees clearly of a young age that have less than 1” diameter at breast height (dbh) or have not reached breast height. Applies only to trees propagating from seed; resprouts are not recorded here even if they meet the size requirements.

Saplings – trees with 1" – 6" dbh and young in age, OR small trees that are less than 1” dbh, are clearly of appreciable age, and are kept short by repeated browsing, burning, or other disturbance. Includes trees that are re-sprouting from roots or stumps following fire, logging or other disturbance. These re-sprouts may exhibit a shrubby form, with multiple small trunks, but are species that are generally considered trees. If a majority of the trunks are greater than 6” dbh, then the re-sprouts would be recorded under the “Tree” stratum.

Global/State Rank – We use the NatureServe’s Heritage Program methodology defined for natural community conservation ranks as defined below (and see http://www.natureserve.org). “G” indicates the alliance’s rarity and threat globally, and “S” indicates the alliance’s rarity and threat in California.

G1/S1: Fewer than 6 viable occurrences worldwide/statewide, and/or up to 518 hectares
G2/S2: 6–20 viable occurrences worldwide/statewide, and/or more than 518–2,590 hectares
G3/S3: 21–100 viable occurrences worldwide/statewide, and/or more than 2,590–12,950 hectares
G4/S4: Greater than 100 viable occurrences worldwide/statewide, and/or more than 12,950 hectares
G5/S5: Demonstrably secure because of its worldwide/statewide abundance

Small rock – percent cover of rocks on the ground with a diameter ranging from 2 mm to 25 cm. Includes rocks that were recorded in the field as gravel (2 mm – 7.5 cm in diameter) and cobble (>7.5 cm – 25 cm in diameter).

Hesperocyparis pygmaea Alliance

Mendocino cypress woodland

Summary

Hesperocyparis pygmaea is dominant or co-dominant throughout the stand. *Pinus contorta* ssp. *bolanderi* and/or *Pinus muricata* may co-dominate. All of these trees may be dwarfed or not depending upon the restrictive properties of the substrate. In this study area, three associations of the *Hesperocyparis pygmaea* Alliance were classified.

Distribution

The range of stands of this alliance extends from near Fort Bragg south to the southern portion of Salt Point State Park in Sonoma County; this is the entire global distribution of this type. Two of the three associations defined are limited to the area north of the Navarro River.

Local Alliance Summary (n = 102)

Alliance Rarity Rank: G1/S1[3]

Associations within this Alliance:

Hesperocyparis pygmaea – Pinus contorta ssp*. bolanderi / Rhododendron columbianum* Association

Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association

Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia Association

Stand Table

***Hesperocyparis pygmaea* Alliance**

n=102

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Hesperocyparis pygmaea	100	11.8	0.2	40
	Pinus contorta ssp*. bolanderi*	86	5.4	0.2	23.2
	Pinus muricata	71	5.1	0.2	21
	Chrysolepis chrysophylla	25	1.9	0.2	10
Shrub					
	Vaccinium ovatum	99	13.6	0.2	70
	Gaultheria shallon	96	3.4	0.2	45
	Rhododendron macrophyllum	70	3.5	0.2	19
	Morella californica	62	1.2	0.2	7
	Rhododendron columbianum	62	12.6	0.1	60
	Arctostaphylos nummularia	50	9.6	0.2	35
	Arctostaphylos columbiana	28	1.5	0.2	12

[3] Global and state ranks are determined from data collected to date; they are subject to change based on increased knowledge of the distribution of the types across the state. However, for types dominated by plants with well-known distributions (such as this alliance), the ranking will likely not change to a less rare level.

Hesperocyparis pygmaea Alliance, continued

Stand Table, continued

Lifeform	Botanical Name	Con	Avg	Min	Max
Herb					
	Carex californica	42	0.6	0.2	3
	Pteridium aquilinum	28	0.6	0.2	6
	Xerophyllum tenax	24	1	0.2	5
Non-vascular					
	Lichen	38	2.2	0.2	33
	Moss	25	7.5	0.2	90

Hesperocyparis pygmaea – Pinus contorta ssp*. bolanderi / Rhododendron columbianum* Association

Summary

Pinus contorta ssp. *bolanderi* is present with *Hesperocyparis pygmaea*, while *Pinus muricata* is usually absent or insignificant. *Rhododendron columbianum* is usually present, often exceeding *Pinus contorta* ssp. *bolanderi* in cover. This association currently includes both the "tall pygmy" usually occurring on Tropaquept soils, where mature trees are upwards of 15 meters tall and 20 inches in diameter, as well as "short pygmy" where mature trees do not exceed 2 meters tall and 2 inches in diameter, typically on Blacklock-Aborigine soils. This is a wetland type, defined in the National Wetlands Inventory (NWI) maps as PSS4/FO4B (Palustrine Scrub-shrub, Needle-Leaved Evergreen, Forested and Seasonally Saturated).

Stands are only known north of the Navarro River. Both the "tall" and the "short" versions of this plant association occasionally have stands where the understory is less strongly dominated by *R. columbianum.* This version has a more continuous herbaceous and non-vascular understory characteristic of fens with species usually considered diagnostic of the USNVC Macrogroup 073: North Pacific Bog & Fen, including *Sphagnum* spp., *Drosera* spp., *Rhynchospora alba,* and *Carex echinata* ssp. *phyllomanica*. Classification analysis of vascular plant composition and cover does not support a formal division of this association into either "short pygmy," "tall pygmy," or "pygmy-fen" variants.

Research in Washington by Department of Natural Resources ecologists (J. Roccio, personal communication, October 2018) shows a correlation in the reduction of fen and bog species with a concomitant increase in *Rhododendron columbianum* cover. That increase is associated with a reduction of fire in fens and bogs since the decline of Native American burning practices. It is likely that many of the stands of this association that currently have an understory strongly dominated by *R. columbianum* had higher covers of herbaceous and non-vascular fen species in past decades. Recent review by long-term residents of the area confirm a negative relationship between cover of fen herbs and mosses and cover of *R. columbianum* and other wetland shrubs such as *Morella californica*.

Because of the unique species composition, we attempted to separately map stands of this association with a distinctive fen understory. However, due to the difficulty of identifying a distinctive imagery signature, only the few ground-verified examples were mapped as the "fen variant" of this association. Also of note is that some of these fen understories have had non-native bog and fen ornamentals introduced into them, including *Sarracenia purpurea, Drosera anglica, Drosera peltata*, and *Dionaea muscipula.* Some have been impacted by draining.

Hesperocyparis pygmaea – Pinus contorta ssp*. bolanderi / Rhododendron columbianum* Association, continued

Distribution

The entire global distribution of this type is limited to the area north of the Navarro River between Pudding Creek (NE of Fort Bragg) to approximately 4 km ESE of Albion, as shown on the map.

Association Rarity Rank: G1/S1

Examples

Figure H-1: Example of "tall pygmy" growing on Tropaquept soils, a version of the *Hesperocyparis pygmaea – Pinus contorta* ssp*. bolanderi / Rhododendron columbianum* Association with tall (>20m) straight stems of dominant *H. pygmaea* with diameters between 18-24 inches. The understory is dominated by *R. columbianum*.

Figure H-2: Example of a "short pygmy" forest underlain by Blacklock-Aborigine soils in Jackson State Forest. Winter scene with seasonally perched water over shallow duripan soils. Trees are <3m tall and the understory is dominated by *R. columbianum*.

Figure H-3: Example of "Fen Variant" *Hesperocyparis pygmaea – Pinus contorta* ssp*. bolanderi / Rhododendron columbianum* Association. with a short tree canopy <5m. The understory shrub layer is dominated by sparse *R. columbianum*. The herb/moss layer is continuous with *Sphagnum* spp., *Drosera rotundifolia*, and *Carex echinata* ssp. *phyllomanica* (summer view).

Figure H-4: An example of a fen variant of the *Hesperocyparis pygmaea – Pinus contorta* ssp*. bolanderi / Rhododendron columbianum* Association with a relatively tall tree layer (>10m) dominated by *H. pygmaea*. The understory of this stand is co-dominated by *Carex echinata* ssp. *phyllomanica* and *Sphagnum* spp.

Hesperocyparis pygmaea – Pinus contorta ssp*. bolanderi / Rhododendron columbianum* Association, continued

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	41	12	85
Conifer	8	0	50
Hardwood	0	0	1
Regenerating Tree	13	0	0
Shrub	29	4	70
Herb	2	0	38

Vegetation Height[4]	<.5m	.5-1m	1-2m	2-5m	5-10m	10-15m	15-20m	20-35m	35-50m
				(percentage of plots)					
Conifer				13%	24%	13%	9%	7%	
Hardwood					2%				
Regenerating Tree			20%	39%	9%	2%	2%		
Shrub		24%	37%	9%	2%				
Herb	50%	11%							

Environment Data

	Mean	Range
Elevation	441	226 – 573
Slope	2	0 – 6
Large Rock	0	0 – 0
Small Rock	0	0 – 0
Bare ground	9	0 – 70
Litter	84	14 – 98

Soil Types
Blacklock and Aborigine soils, 0 to 5 percent slopes (n=21)
Shinglemill-Gibney complex, 2 to 9 percent slopes (n=3)
Ferncreek sandy loam, 2 to 9 percent slopes (n=2)
Tropaquepts, 0 to 15 percent slopes (n=7)

Stand Table

***Hesperocyparis pygmaea – Pinus contorta* ssp*. bolanderi / Rhododendron columbianum* Association**
n=46

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus contorta ssp*. bolanderi*	100	5.7	0.2	23.2
	Hesperocyparis pygmaea	100	14.1	0.2	40
	Pinus muricata	35	1.8	0.2	7

[4] This table illustrates the distribution of vegetation among the various height categories. For instance, in the *Hesperocyparis pygmaea – Pinus contorta* ssp*. bolanderi / Rhododendron columbianum* Association shown here, 13% of plots have conifers that are 2-5m tall, 24% have conifers that are 5-10m tall, 13% have conifers that are 10-15m tall, 9% have conifers that are 15-20m tall, and 7% have conifers that are 20-35m tall.

Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi / Rhododendron columbianum* Association, continued

Stand Table, continued

Lifeform	Botanical Name	Con	Avg	Min	Max
Shrub					
	Vaccinium ovatum	98	12.3	0.2	49
	Gaultheria shallon	96	2.5	0.2	26
	Rhododendron columbianum	96	16.9	1	60
	Morella californica	67	1.5	0.2	7
	Rhododendron macrophyllum	43	1.8	0.2	8
Herb					
	Carex californica	54	0.8	0.2	3
Non-vascular					
	Lichen	57	3.2	0.2	33
	Moss	24	15.9	0.2	90

Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association

Summary

Both *Pinus contorta* ssp. *bolanderi* and *Pinus muricata* intermix with *Hesperocyparis pygmaea,* while *Rhododendron macrophyllum* grows in the understory. This is not typically a wetland as defined in NWI. Understory species include *R. macrophyllum*, *Arctostaphylos* spp., and *Xerophyllum tenax*. The understory does not have high, uniform cover of *R. columbianum* or other wetland species, though such species may be patchily distributed. Distinguishing this association from the *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* association is best done by viewing large portions of individual stands of each type, paying particular attention to the overall distribution of indicators of wet versus relatively drier (though still moist) settings. The relatively higher cover and wide distribution of species such as *Rhododendron macrophyllum, Xerophyllum tenax,* and species of *Arctostaphylos* in this association is distinctive.

Distribution

The entire global distribution of this type is limited to the area north of the Navarro River between Pudding Creek (NE of Fort Bragg) to ca. 4 km ESE of Albion, as shown on the map.

Association Rarity Rank: G1/S1

Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association, continued

Examples

Figure H-5: An open stand of *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association with widely-spaced trees of three species >5m tall, over a shrub and herb layer with *R. macrophyllum, Vaccinium ovatum, Arctostaphylos nummularia*, and *Xerophyllum tenax*.

Figure H-6: A stand of *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association dominated by *H. pygmaea* averaging about 3m tall and 2.5cm diameter. Van Damme State Park pygmy forest boardwalk.

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	35	0	75
Conifer	9	0	42
Hardwood	0	0	10
Regenerating Tree	11	0	0
Shrub	25	3	70
Herb	1	0	5

Vegetation Height	<.5m	.5-1m	1-2m	2-5m	5-10m	10-15m	15-20m	20-35m	35-50m
	(percentage of plots)								
Conifer				2%	27%	17%	17%	7%	
Hardwood			2%	2%	10%				
Regenerating Tree			2%	41%	24%	5%			
Shrub		7%	44%	22%					
Herb	44%	12%	2%						

Environment Data

	Mean	Range
Elevation	466	288 – 637
Slope	2	0 – 4
Large Rock	0	0 – 0
Small Rock	0	0 – 2
Bare ground	6	0 – 60
Litter	89	4 – 99

Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association, continued

Environment Data, continued

Soil Types
Blacklock and Aborigine soils, 0 to 5 percent slopes (n=11)
Ferncreek sandy loam, 2 to 9 percent slopes (n=1)
Gibwell loamy sand, 2 to 9 percent slopes (n=1)
Shinglemill-Gibney complex, 2 to 9 percent slopes (n=16)
Tropaquepts, 0 to 15 percent slopes (n=2)

Stand Table

***Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association**

n = 41

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus contorta ssp. *bolanderi*	100	5.2	0.2	20
	Pinus muricata	100	5.3	0.2	21
	Hesperocyparis pygmaea	100	9.4	0.6	30
	Chrysolepis chrysophylla	41	2.0	0.2	10
	Notholithocarpus densiflorus	29	0.6	0.2	2
	Sequoia sempervirens	22	0.4	0.1	1
Shrub					
	Rhododendron macrophyllum	100	3.7	0.2	13
	Vaccinium ovatum	100	12.7	0.2	70
	Gaultheria shallon	98	3.2	0.2	20
	Arctostaphylos nummularia	80	8.7	0.2	25
	Morella californica	56	0.6	0.2	2
	Arctostaphylos columbiana	46	1.0	0.2	7
	Rhododendron columbianum	39	2.3	0.1	15
Herb					
	Xerophyllum tenax	39	0.8	0.2	5
	Carex californica	37	0.3	0.2	1
	Pteridium aquilinum	32	0.4	0.2	2
Non-vascular					
	Lichen	32	0.4	0.2	1

Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia Association

Summary

Together, *Hesperocyparis pygmaea* and *Pinus muricata* dominate the tree layer, while *Pinus contorta* ssp. *bolanderi* is absent. This is the most widely distributed association of the *H. pygmaea* Alliance and is the only one found south of the Navarro River. Compared to the other two associations of the *H. pygmaea* Alliance, it has the widest distribution with the broadest range of average annual precipitation. In addition to being the most widespread of the three *H. pygmaea* associations, this association also has the highest diversity of soil mapping units (6).

This *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association averages higher shrub cover than the other two. The seral relationship between this association, the *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association (*Pinus muricata – Pinus radiata* Alliance), and the *Arctostaphylos nummularia* Association (*Arctostaphylos (nummularia, sensitiva)* Alliance*)* is reflected in the similar shrub species composition and in the tendency of most stands to have relatively low cover of *Pinus muricata,* with many senescent or standing dead individuals. The overall health and cover of living *P. muricata* has declined in each of these associations due to reduced fire frequency over the past several decades and the increase of pine pitch canker and dwarf mistletoe disease.

Note: this association was originally described from Sonoma County (Klein et al. 2015) as *Pinus muricata – Hesperocyparis pygmaea* Provisional Association within the *Pinus muricata* Alliance.

Distribution

The entire global distribution of this type occurs both north and south of the Navarro River, ranging from near Fort Bragg south to Salt Point State Park, Sonoma County, as shown on the map. Although this has the broadest distribution of the three *H. pygmaea* associations, it has a patchier distribution, fewer occurrences, and covers less area than each of the other two associations.

Association Rarity Rank: G1/S1

Examples

Figure H-7: A stand of *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association over massive sandstone of the Seaside-Rock outcrop complex. Due to the large rocks, shrubs of *A. nummularia* and *A. columbiana*, are widely scattered. Fish Rock Road south of the Navarro River.

Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia Association, continued

Examples, continued

Figure H-8: A stand of *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association at the "pygmy forest" location in Salt Point State Park, Sonoma County. This is the southern-most occurrence of this association and near the southern-most outpost of *H. pygmaea*. Trees are <5m in height. The low shrub understory is dominated by *A. nummularia, Vaccinium ovatum*, and *Gaultheria shallon*.

Figure H-9: A stand of *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association with higher cover of *Pinus muricata* than *H. pygmaea*, over dense cover of low-growing *A. nummularia*. The road cuts through a 3-9% slope of Shinglemill-Gibney soil, Van Damme State Park.

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	49	10	95
Conifer	12	1	26
Hardwood	1	0	4
Regenerating Tree	6	0	0
Shrub	36	2	95
Herb	1	0	7

Vegetation Height	<.5m	.5-1m	1-2m	2-5m	5-10m	10-15m	15-20m	20-35m	35-50m
				(percentage of plots)					
Conifer				7%	20%	7%	27%	7%	
Hardwood				13%	13%				
Regenerating Tree			7%	40%	7%	7%			
Shrub			47%	20%					
Herb	33%	20%							

Environment Data

	Mean	Range
Elevation	679	248 – 1243
Slope	2	0 – 6
Large Rock	0	0 – 5.2
Small Rock	1	0 – 5.2
Bare ground	16	0 – 75
Litter	74	20 – 98

Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia Association, continued

Environment Data, continued

Soil Types
- Blacklock and Aborigine soils, 0 to 5 percent slopes (n=1)
- Havensneck-Seaside complex, 5 to 30 percent slopes (n=1)
- Mendocino sandy clay loam, 30 to 50 percent slopes (n=1)
- Noyo coarse sandy loam, 0 to 15 percent slopes (n=1)
- Seaside-Rock outcrop complex, 5 to 30 percent slopes (n=3)
- Shinglemill-Gibney complex, 2 to 9 percent slopes (n=6)

Stand Table

***Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association**

n = 15

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus muricata	100	8.1	0.4	15
	Hesperocyparis pygmaea	100	11.1	4.2	21
	Chrysolepis chrysophylla	47	1.8	0.2	6
	Pseudotsuga menziesii	40	0.5	0.2	1.4
	Standing snag	33	0.5	0.2	1
	Notholithocarpus densiflorus	33	1.0	0.2	4
	Sequoia sempervirens	27	0.9	0.2	2
Shrub					
	Vaccinium ovatum	100	19.8	0.2	45
	Gaultheria shallon	93	6.8	0.2	45
	Rhododendron macrophyllum	67	5.7	0.2	19
	Arctostaphylos nummularia	67	18.5	2	35
	Arctostaphylos columbiana	67	2.4	0.2	12
	Morella californica	60	1.7	0.2	6.2
	Arctostaphylos glandulosa	40	1.4	0.2	6
	Vaccinium parvifolium	27	0.6	0.2	1
	Rhododendron columbianum	20	3.1	0.2	9
Herb					
	Pteridium aquilinum	47	1.4	0.2	6
	Xerophyllum tenax	33	2.0	0.2	5
	Carex californica	20	0.2	0.2	0.2
Non-vascular					
	Moss	47	1.1	0.2	3
	Lichen	20	18.0	1	52

Pinus muricata – Pinus radiata Alliance

Summary

Pinus muricata and/or *Pinus radiata* are dominant or co-dominant with *Notholithocarpus densiflorus* in the overstory or regenerating tree layers.[5] *Hesperocyparis pygmaea is* not significant in cover. In this study area, two associations of the *Pinus muricata - Pinus radiata Alliance* were classified and are described below.

Distribution

The range of stands meeting the description of this alliance extends from coastal Humboldt County south to the northern Channel Islands. The map at right shows stands that were mapped as part of this project, that is, when they were surrounded by oligotrophic vegetation.

Local Alliance Summary (n = 38)

Alliance Rarity Rank: G3/S3

Associations within this Alliance:

Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia Association

Pinus muricata – Notholithocarpus densiflorus Provisional Association

Stand Table

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

n=38

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus muricata	97	11.5	2	38
	Chrysolepis chrysophylla	82	3.9	0.2	15.2
	Pseudotsuga menziesii	61	1.3	0.2	8
	Notholithocarpus densiflorus	50	4.4	0.2	29
	Sequoia sempervirens	42	1.2	0.2	4.4
	Pinus contorta ssp. *bolanderi*	34	0.9	0.2	4.2
	Hesperocyparis pygmaea	29	0.9	0.2	2.2
	Standing snag	24	0.2	0.2	0.4
Shrub					
	Vaccinium ovatum	95	11.7	1	35
	Gaultheria shallon	87	5.9	0.2	28

[5] This alliance has been recently reviewed by NatureServe and the ESA Vegetation Peer review panel and is now considered to be a merge of the former separate *Pinus muricata* and *Pinus radiata* alliances. The two pines do not need to co-occur to be this alliance.

***Pinus muricata* – *Pinus radiata* Alliance, continued**

Stand Table, continued

Lifeform	Botanical Name	Con	Avg	Min	Max
Shrub					
	Arctostaphylos nummularia	79	12.3	0.2	51.2
	Rhododendron macrophyllum	79	5.7	1	16
	Arctostaphylos columbiana	68	1.8	0.2	7
	Morella californica	37	0.9	0.2	5
	Arctostaphylos glandulosa	32	2.1	0.2	8
Herb					
	Pteridium aquilinum	61	2.1	0.2	15
	Xerophyllum tenax	45	2.4	0.2	12

Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia Association

Summary

Pinus muricata is dominant or co-dominant with *Chrysolepis chrysophylla,* and *Arctostaphylos nummularia* is characteristic in the understory. *Chrysolepis chrysophylla* may vary in stature from a tall shrub to a sapling to a mature tree. Stands occur on oligotrophic soils throughout the area, but are particularly common south of the Navarro River.

Distribution

This association occurs both north and south of the Navarro River, ranging from the vicinity of Fort Bragg south to Salt Point State Park, Sonoma County. It may range somewhat farther south on other oligotrophic soils outside of the Pygmy Ecosystem to Marin County. For example, a few of the *P. muricata* stands known on Bolinas Ridge have similar species composition to this plant association, but have not been sampled (Todd Keeler-Wolf, personal observation). The map at right shows the distribution within the current project area.

Association Rarity Rank: G2/S2

Example

Figure H-10: A stand of *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association near the junction of Iverson and 10-Mile Roads in southern Mendocino County. Shrubby trees of *C. chrysophylla* are scattered beneath the taller layer of *P. muricata,* with a dense 1.5m shrub layer primarily composed of *A. nummularia.*

Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia Association, continued

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	40	20	90
Conifer	9	0	28
Hardwood	2	0	15
Regenerating Tree	5	0	0
Shrub	28	10	50
Herb	3	0	15

Vegetation Height	<.5m	.5-1m	1-2m	2-5m	5-10m	10-15m	15-20m	20-35m	35-50m
				(percentage of plots)					
Conifer				3%	9%	14%	40%	11%	
Hardwood			3%	9%	17%	3%	3%		
Regenerating Tree	3%	3%	3%	43%	17%	3%			
Shrub			34%	40%	3%				
Herb	31%	23%	11%						

Environment Data

	Mean	Range
Elevation	724	237 – 1851
Slope	3	0 – 8
Large Rock	0	0 – 0.2
Small Rock	0	0 – 1
Bare ground	4	0 – 50
Litter	93	47 – 99

Soil Types

Ferncreek sandy loam, 2 to 9 percent slopes (n=1)
Fishrock-Iversen complex, 2 to 15 percent slopes (n=1)
Fishrock-Iversen complex, 15 to 30 percent slopes (n=1)
Gibney-Gibwell complex, 2 to 15 percent slopes (n=2)
Gibwell loamy sand, 2 to 9 percent slopes (n=2)
Gibwell loamy sand, 9 to 15 percent slopes (n=1)
Havensneck sandy loam, 2 to 15 percent slopes (n=2)
Havensneck-Seaside complex, 5 to 30 percent slopes (n=1)
Iversen sandy loam, 2 to 15 percent slopes (n=2)
Noyo coarse sandy loam, 0 to 15 percent slopes (n=2)
Shinglemill-Gibney complex, 2 to 9 percent slopes (n=13)

Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia Association, continued

Stand Table

***Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association**
n=35

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus muricata	97	11.4	2	38
	Chrysolepis chrysophylla	86	4.0	0.2	15.2
	Pseudotsuga menziesii	57	0.8	0.2	4.2
	Notholithocarpus densiflorus	46	1.4	0.2	9.2
	Sequoia sempervirens	40	0.8	0.2	2
	Pinus contorta ssp. *bolanderi*	37	0.9	0.2	4.2
	Hesperocyparis pygmaea	31	0.9	0.2	2.2
	Standing snag	26	0.2	0.2	0.4
Shrub					
	Vaccinium ovatum	94	11.4	1	35
	Gaultheria shallon	86	5.3	0.2	28
	Arctostaphylos nummularia	86	12.3	0.2	51.2
	Rhododendron macrophyllum	77	6.3	1	16
	Arctostaphylos columbiana	74	1.8	0.2	7
	Arctostaphylos glandulosa	34	2.1	0.2	8
	Morella californica	34	1.0	0.2	5
Herb					
	Pteridium aquilinum	60	1.8	0.2	15
	Xerophyllum tenax	49	2.4	0.2	12

Pinus muricata – Notholithocarpus densiflorus Provisional Association

Summary
Notholithocarpus densiflorus and *Pinus muricata* are characteristic*. Pseudotsuga menziesii* may share similar cover with *Pinus muricata* and *Notholithocarpus.* This is a non-oligotrophic vegetation type often adjacent to oligotrophic surfaces.

Distribution
This association ranges from near Eureka, Humboldt County, to Inverness Ridge in Marin County. The map at right shows stands that were mapped as part of this project, that is, when they were surrounded by oligotrophic vegetation.

Association Rarity Rank: G3/S3

Example

Figure H-11: A tall stand of *Pinus muricata – Notholithocarpus densiflorus* Association on non-oligotrophic soils, upper slopes of Salt Point State Park.

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	46	33	60
Conifer	17	12	25
Hardwood	10	2	16
Regenerating Tree	11	4	4
Shrub	25	20	30
Herb	3	0	9

Vegetation Height and Environment Data not available.

Pinus muricata – Notholithocarpus densiflorus **Provisional Association, continued**

Stand Table

Pinus muricata - Notholithocarpus densiflorus **Provisional Association**

n = 3

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus muricata	100	12.5	7	20
	Pseudotsuga menziesii	100	4.7	2.2	8
	Notholithocarpus densiflorus	100	20.0	15	29
	Sequoia sempervirens	67	4.3	4.2	4.4
	Chrysolepis chrysophylla	33	1.2	1.2	1.2
Shrub					
	Vaccinium ovatum	100	15.0	12	20
	Gaultheria shallon	100	11.7	5	20
	Rhododendron macrophyllum	100	1.0	1	1
	Morella californica	67	0.2	0.2	0.2
	Vaccinium parvifolium	33	0.2	0.2	0.2
	Arctostaphylos	33	2.0	2	2
Herb					
	Pteridium aquilinum	67	4.5	1	8
	Viola sempervirens	33	1.0	1	1
	Iris douglasiana	33	0.2	0.2	0.2

Pseudotsuga menziesii – Notholithocarpus densiflorus Alliance

Douglas fir – tanoak forest

Summary

This alliance is characterized by *Pseudotsuga menziesii* and *Notholithocarpus densiflorus* in the canopy. *Pseudotsuga* is typically dominant to co-dominant with *Notholithocarpus*, but may be slightly sub-dominant. This vegetation is not found on oligotrophic soils, but may occur immediately adjacent to them in the study area.

In this study area, one association of the *Pseudotsuga menziesii - Notholithocarpus densiflorus* Alliance was classified and is described below. Three of the four surveys were classified to the association and one was classified to alliance only. For this reason, the stand tables for both the alliance and association follow.

Distribution

This alliance occurs along the Monterey County coast into Oregon in the Coast Range, in the Klamath Mountains, Cascades, and in the northern Sierra Nevada range.

Local Alliance Summary (n = 4)

Alliance Rarity Rank: G3/S3

Associations within this Alliance:

Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum Association

Stand Table

n = 4

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Notholithocarpus densiflorus	100	15.2	1	45
	Pseudotsuga menziesii	100	8.5	3	14
	Sequoia sempervirens	75	3.7	3	5
	Pinus muricata	75	3.3	1	8
	Chrysolepis chrysophylla	50	0.2	0.2	0.2
	Hesperocyparis pygmaea	25	1	1	1
Shrub					
	Vaccinium ovatum	100	9	4	12
	Arctostaphylos columbiana	75	12.7	3	20
	Rhododendron macrophyllum	75	7.4	0.2	12
	Gaultheria shallon	50	3	2	4
	Vaccinium parvifolium	25	2	2	2
	Morella californica	25	0.2	0.2	0.2
Herb					
	Pteridium aquilinum	25	0.2	0.2	0.2
	Xerophyllum tenax	25	0.2	0.2	0.2
	Trillium ovatum	25	0.2	0.2	0.2

Pseudotsuga menziesii – Notholithocarpus densiflorus Alliance, continued

Stand Table, continued

Lifeform	Botanical Name	Con	Avg	Min	Max
Herb					
	Polystichum munitum	25	0.2	0.2	0.2
	Anthoxanthum occidentale	25	0.2	0.2	0.2
	Viola sempervirens	25	0.2	0.2	0.2

Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum Association

Summary

This association is characterized by *Pseudotsuga menziesii* and *Notholithocarpus densiflorus* in the overstory and *Rhododendron macrophyllum* and *Vaccinium ovatum* in the shrub understory. This vegetation is not found on oligotrophic soils, but may occur immediately adjacent to them in the study area.

Distribution

This association has been described from the Klamath and Six Rivers National Forest (Jimerson et al. 1996). The map at right shows stands that were mapped as part of this project, that is, when they were surrounded by oligotrophic vegetation. Some unmapped stands not immediately adjacent to oligotrophic soils range as far south as Salt Point State Park (see Figure H-12).

Association Rarity Rank: G2/S2

Example

Figure H-12: A tall stand of *Pseudotsuga menziesii – Notholithocarpus densiflorus/ Rhododendron macrophyllum* off oligotrophic soils about 500m from pygmy forest site, Salt Point State Park (photo taken December 2010).

Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum Association, continued

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	60	60	60
Conifer	25	25	25
Hardwood	45	45	45
Regenerating Tree	0	0	0
Shrub	15	15	15
Herb	0	0	0

Vegetation Height	<.5m	.5-1m	1-2m	2-5m	5-10m	10-15m	15-20m	20-35m	35-50m
	(percentage of plots)								
Conifer							33%		
Hardwood					33%				
Regenerating Tree									
Shrub				33%					
Herb	33%								

Environment Data

	Mean	Range
Elevation		
Slope	15	15 – 15
Large Rock	0	0 – 0
Small Rock	0	0 – 0
Bare ground	8	8 – 8
Litter	90	90 – 90
Soil Types	Quinliven Fern Creek complex, 2 to 15 percent slopes (n=1)	

Stand Table

***Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum* Association**
n = 3 (this project)

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Notholithocarpus densiflorus	100	20.0	5	45
	Pseudotsuga menziesii	100	6.7	3	12
	Pinus muricata	100	3.3	1	8
	Chrysolepis chrysophylla	67	0.2	0.2	0.2
	Sequoia sempervirens	67	4.0	3	5
	Hesperocyparis pygmaea	33	1.0	1	1
Shrub					
	Rhododendron macrophyllum	100	7.4	0.2	12
	Vaccinium ovatum	100	8.7	4	12

Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum Association, continued

Stand Table, continued

Lifeform	Botanical Name	Con	Avg	Min	Max
Shrub					
	Arctostaphylos columbiana	67	11.5	3	20
	Gaultheria shallon	33	4.0	4	4
	Vaccinium parvifolium	33	2.0	2	2
Herb					
	Trillium ovatum	33	0.2	0.2	0.2
	Anthoxanthum occidentale	33	0.2	0.2	0.2
	Viola sempervirens	33	0.2	0.2	0.2
	Xerophyllum tenax	33	0.2	0.2	0.2
	Polystichum munitum	33	0.2	0.2	0.2

Sequoia sempervirens Alliance

Summary

Sequoia sempervirens is characteristic (rarely with as little as 5% cover). In this study area, two associations of the *Sequoia sempervirens* Alliance were classified and are described below. Other associations of this alliance occur nearby outside the study area.

Distribution

Stands of this alliance occur from coastal Monterey County to coastal southern Oregon. The map at right shows stands that were mapped as part of this project, that is, when they were surrounded by oligotrophic vegetation.

Local Alliance Summary (n = 9)

Alliance Rarity Rank: G3/S3.2

Associations within this Alliance:

Sequoia sempervirens – Hesperocyparis pygmaea Provisional Association
Sequoia sempervirens – Pinus muricata Provisional Association

Stand Table

n = 9

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus muricata	100	9.6	3	16.2
	Sequoia sempervirens	100	7.2	3	13
	Notholithocarpus densiflorus	89	6.7	0.2	15
	Hesperocyparis pygmaea	67	7	3	14
	Pseudotsuga menziesii	56	5.5	0.2	11.2
	Tsuga heterophylla	56	1	0.2	2
	Chrysolepis chrysophylla	44	3.7	0.2	13.2
Shrub					
	Rhododendron macrophyllum	100	2.4	0.2	6
	Vaccinium ovatum	100	18.6	0.2	45
	Gaultheria shallon	89	2.7	0.2	5
	Morella californica	56	0.5	0.2	1
	Arctostaphylos columbiana	44	4.5	1	7
	Vaccinium parvifolium	33	0.8	0.2	2
	Lonicera hispidula	22	0.2	0.2	0.2
Herb					
	Viola sempervirens	56	0.2	0.2	0.2
	Pteridium aquilinum	44	0.4	0.2	1

Sequoia sempervirens Alliance, continued

Stand Table, continued

Lifeform	Botanical Name	Con	Avg	Min	Max
Herb					
	Polystichum munitum	33	0.5	0.2	1
	Cortaderia jubata	33	0.2	0.2	0.2
	Trillium ovatum	33	0.2	0.2	0.2
	Blechnum spicant	22	0.2	0.2	0.2
	Whipplea modesta	22	0.2	0.2	0.2

Sequoia sempervirens - Hesperocyparis pygmaea Provisional Association

Summary

Sequoia sempervirens is characteristic of the stand. If present, *Hesperocyparis pygmaea* is usually sub- to co-dominant and may exceed *S. sempervirens* in cover. *Notholithocarpus densiflorus* and *Pseudotsuga menziesii* may also co-dominate. The shrub layer is dominated by *Vaccinium ovatum*. These forests exist off of oligotrophic soils, although they may be gradational at the edges and sometime intrude (due to local erosion into oligotrophic surfaces).

Stands were sampled on the edges of stunted pygmy forest in areas mapped as Shinglemill-Gibney complex soils and on the somewhat poorly drained terraces of Quinliven Fern Creek complex soils. The distribution of this provisional association is limited. It grows adjacent to, but not strictly on, strongly oligotrophic soils. Some of the stands have been logged and show regrowth of *Sequoia sempervirens*, but stumps are at low densities, suggesting that *Hesperocyparis pygmaea* has long been a co-dominant in these areas and that this type is persistent rather than successional. Based on the dimensions of the original logged stumps of *S. sempervirens*, these stands appear to produce relatively small individuals of *S. sempervirens*, yet some exceptionally large *H. pygmaea* (see Figure H-13). Further sampling and research into the structural and nutritional components of the soils supporting stands of this provisional association may help clarify this unique coexistence of tall *H. pygmaea* and relatively small *S. sempervirens*.

Due to the proximity of *Sequoia sempervirens* Alliance stands to the stands with *H. pygmaea,* we might expect to see more of an area of overlap between the two tree species. However, *S. sempervirens* does not grow well on the oligotrophic soils of the pygmy ecosystem, and *H. pygmaea* is usually a poor competitor off oligotrophic soils. Thus, the situations where *H. pygmaea* can grow in stands with *S. sempervirens* and reach near-equal proportions is quite unique. More recently, human alteration of the lands where such conditions occur have become a limiting factor. Most of the known stands occur near the northern end of the distribution of *H. pygmaea* where it appears to grow the tallest. Historically these were considered non-commercial timberlands because redwood did not grow well there. Hence, much of these non-commercial lands were developed for housing. Over decades, the fragmentation of stands by the expansion of housing has likely reduced the extent of this association.

Distribution

Stands were mapped from the terrace that is just north of Pudding Creek south to a small site east of the Little River Airport (see map at right.)

Provisional Association Rarity Rank: G1/S1

Sequoia sempervirens – Hesperocyparis pygmaea Provisional Association, continued

Example

Figure H-13: A stand of the *Sequoia sempervirens – Hesperocyparis pygmaea* Association in the Newman Gulch Drainage SE of Ft Bragg. The tall tree in the center is *H. pygmaea,* over 35m tall and 130cm dbh. The other tall trees to the left are *S. sempervirens.*

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	50	41	65
Conifer	19	10	24
Hardwood	7	1	15
Regenerating Tree	7	0	0
Shrub	26	10	47
Herb	1	0	3

Vegetation Height	<.5m	.5-1m	1-2m	2-5m	5-10m	10-15m	15-20m	20-35m	35-50m
	(percentage of plots)								
Conifer					17%	17%	17%	17%	
Hardwood				17%	33%				
Regenerating Tree					33%				
Shrub				67%					
Herb	50%	17%							

Sequoia sempervirens – Hesperocyparis pygmaea Provisional Association, continued

Vegetation Summary, continued

Environment Data

	Mean	Range
Elevation		
Slope	6	2 – 13
Large Rock	0	0 – 0
Small Rock	0	0 – 0
Bare ground	6	0 – 18
Litter	92	80 – 98
Soil Types	Gibwell loamy sand, 2 to 9 percent slopes (n=1)	
	Quinliven Fern Creek complex, 2 to 15 percent slopes (n=3)	
	Shinglemill-Gibney complex, 2 to 9 percent slopes (n=2)	

Stand Table

***Sequoia sempervirens – Hesperocyparis pygmaea* Provisional Association**

n = 6

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus muricata	100	7.9	3	16.2
	Notholithocarpus densiflorus	100	7.7	0.2	15
	Hesperocyparis pygmaea	100	7.0	3	14
	Sequoia sempervirens	100	6.7	3	10
	Pseudotsuga menziesii	83	5.5	0.2	11.2
	Tsuga heterophylla	67	1.2	0.3	2
	Chrysolepis chrysophylla	50	0.5	0.2	1
Shrub					
	Vaccinium ovatum	100	18.0	7	45
	Rhododendron macrophyllum	100	2.7	0.2	6
	Gaultheria shallon	83	3.6	1	5
	Arctostaphylos columbiana	67	4.5	1	7
	Morella californica	67	0.4	0.2	1
	Vaccinium parvifolium	50	0.8	0.2	2
	Lonicera hispidula	33	0.2	0.2	0.2
Herb					
	Viola sempervirens	67	0.2	0.2	0.2
	Cortaderia jubata	50	0.2	0.2	0.2
	Polystichum munitum	33	0.6	0.2	1
	Trillium ovatum	33	0.2	0.2	0.2
	Pteridium aquilinum	33	0.2	0.2	0.2

Sequoia sempervirens - Pinus muricata Provisional Association

Summary

Sequoia sempervirens is characteristic of the stand. If present, *Pinus muricata* is usually sub- to co-dominant and may exceed *S. sempervirens* in cover. These forests exist off of oligotrophic soils, although they may be gradational at the edges of them and sometime intrude (due to local erosion into oligotrophic surfaces).

Distribution

Stands of this provisional association were mapped in the project area only if they were surrounded by oligotrophic vegetation types, but unmapped stands were observed off the oligotrophic soils on terraces throughout the project area. The association extends from Southern Sonoma County in the vicinity of Fort Ross north to Trinidad Head, Humboldt County (MCV 2 online).

Example

Figure H-14: A stand of *Sequoia sempervirens – Pinus muricata* Association close to the oligotrophic boundary at Salt Point Pygmy Forest, exhibiting straight boles typical of forest vegetation off oligotrophic soils, but notably shorter and more stout than typical *S. sempervirens* stands.

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	35	18	44
Conifer	17	16	18
Hardwood	6	0	19
Regenerating Tree	1	0	0
Shrub	21	0	40
Herb	0	0	1

Vegetation Height	<.5m	.5-1m	1-2m	2-5m	5-10m	10-15m	15-20m	20-35m	35-50m
	(percentage of plots)								
Conifer								33%	33.0
Hardwood						33%	33%		
Regenerating Tree				33%		33%			
Shrub		33%		33%					
Herb	67%								

Sequoia sempervirens – Pinus muricata Provisional Association, continued

Vegetation Summary, continued

Environment Data

	Mean	Range
Elevation	646	646 – 646
Slope	3	3 – 3
Large Rock	0	0 – 0
Small Rock	0	0 – 0
Bare ground	1	0 – 1
Litter	98	97 – 99
Soil Types	Iversen sandy loam, 2 to 15 percent slopes (n=1)	
	Quinliven Fern Creek complex, 2 to 15 percent slopes (n=1)	

Stand Table

***Sequoia sempervirens – Pinus muricata* Provisional Association**

n = 3

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus muricata	100	13.1	12	15
	Sequoia sempervirens	100	8.3	5	13
	Notholithocarpus densiflorus	67	3.8	0.6	7
	Chrysolepis chrysophylla	33	13.2	13.2	13.2
	Tsuga heterophylla	33	0.2	0.2	0.2
Shrub					
	Gaultheria shallon	100	1.1	0.2	3
	Vaccinium ovatum	100	19.7	0.2	40
	Rhododendron macrophyllum	100	1.8	0.2	5
	Morella californica	33	1.0	1	1
Herb					
	Pteridium aquilinum	67	0.6	0.2	1
	Blechnum spicant	33	0.2	0.2	0.2
	Polypodium scouleri	33	0.2	0.2	0.2
	Polystichum munitum	33	0.2	0.2	0.2
	Trillium ovatum	33	0.2	0.2	0.2
	Viola sempervirens	33	0.2	0.2	0.2
	Whipplea modesta	33	0.2	0.2	0.2

Arctostaphylos (nummularia, sensitiva) Alliance

Summary

Arctostaphylos nummularia ssp. *nummularia, A. n.* ssp. *mendocinoensis* and *A. sensitiva* dominate or co-dominate with *Arctostaphylos glandulosa, Gaultheria shallon, Rhododendron macrophyllum,* and/or *Vaccinium ovatum*. *Arctostaphylos columbiana*, *Chrysolepis chrysophylla* var. *minor*, *Notholithocarpus densiflorus* and *Pinus muricata* are often emergent, while *Pteridium aquilinum* and *Xerophyllum tenax* often intermix with the dominant species. This alliance includes all three taxa. However, two of them (*A. nummularia* ssp. *nummularia* and *A. nummularia* ssp. *mendocinensis*) overlap in our study area and are ecological equivalents, so they are treated together in the *Arctostaphylos nummularia* Association.

In this study area, only one association of the *Arctostaphylos (nummularia, sensitiva)* Alliance was classified and is described below. Since the stand table is the same for alliance and association, it is presented only in the association section.

Distribution

The closely related taxa *A. nummularia* ssp. *nummularia*, *A. nummularia* ssp. *mendocinensis*, and *A. sensitiva* all occupy oligotrophic soils characteristic of maritime chaparral from Santa Cruz to Fort Bragg.

Local Alliance Summary (n = 14)

Alliance Rarity Rank: G2/S2

Associations within this Alliance:

Arctostaphylos nummularia Association

Arctostaphylos nummularia Association

Summary

Arctostaphylos nummularia ssp. *nummularia* and/or *Arctostaphylos nummularia* ssp. *mendocinensis* dominates or co-dominates with *Arctostaphylos glandulosa, Gaultheria shallon, Rhododendron macrophyllum,* and/or *Vaccinium ovatum*. *Arctostaphylos columbiana*, *Chrysolepis chrysophylla* var. *minor*, *Notholithocarpus densiflorus* and *Pinus muricata* are often emergent, while *Pteridium aquilinum* and *Xerophyllum tenax* often intermix with the dominant species.

Distribution

This association extends from the vicinity of Fort Bragg south through Sonoma County to the slopes of Mount Tamalpais, Marin County. The map at right shows where it was mapped within the project area.

Association Rarity Rank: G2/S2

Example

Figure H-15: An old-growth stand of *Arctostaphylos nummularia* Association with *A. nummularia, A. columbiana,* and *A. glandulosa,* along with scattered shrubby trees of *Chrysolepis chrysophylla.* Northern inland portion of Salt Point State Park. February 2015.

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	42	13	60
Conifer	2	0	6
Hardwood	0	0	2
Regenerating Tree	3	0	0
Shrub	39	12	60
Herb	2	0	8

Vegetation Height	<.5m	.5-1m	1-2m	2-5m	5-10m	10-15m	15-20m	20-35m	35-50m
	(percentage of plots)								
Conifer					21%	29%	14%	7%	
Hardwood					14%	7%			
Regenerating Tree	7%			29%	21%	7%			
Shrub		7%	43%	21%					
Herb	57%	14%							

Arctostaphylos nummularia Association, continued

Vegetation Summary, continued

Environment Data

	Mean	Range
Elevation	899	489 – 1294
Slope	6	1 – 23
Large Rock	0	0 – 0.4
Small Rock	0	0 – 2.2
Bare ground	6	0 – 23
Litter	93	75 – 99

Soil Types
Blacklock and Aborigine soils, 0 to 5 percent slopes (n=1)
Fishrock-Iversen complex, 15 to 30 percent slopes (n=1)
Fishrock-Iversen complex, 2 to 15 percent slopes (n=1)
Havensneck-Seaside complex, 5 to 30 percent slopes (n=1)
Noyo coarse sandy loam, 0 to 15 percent slopes (n=2)
Seaside-Rock outcrop complex, 5 to 30 percent slopes (n=2)
Shinglemill-Gibney complex, 2 to 9 percent slopes (n=1)
Tropaquepts, 0 to 15 percent slopes (n=1)

Stand Table

***Arctostaphylos nummularia* Association**

n = 14

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Pinus muricata	100	2.9	0.2	8.2
	Chrysolepis chrysophylla	71	2.0	0.2	5
	Notholithocarpus densiflorus	57	0.5	0.2	2.2
	Pseudotsuga menziesii	57	1.4	0.2	3.2
Shrub					
	Arctostaphylos nummularia	100	26.9	10	50
	Vaccinium ovatum	100	4.0	0.2	15
	Gaultheria shallon	79	2.0	0.2	7
	Arctostaphylos glandulosa	79	6.4	0.2	19
	Arctostaphylos columbiana	64	2.2	0.2	10
	Rhododendron macrophyllum	57	2.0	0.2	7
Herb					
	Pteridium aquilinum	79	0.8	0.2	5
	Xerophyllum tenax	57	1.4	0.2	5
	Viola sempervirens	21	0.2	0.2	0.2
Non-vascular					
	Moss	29	9.6	0.2	30
	Lichen	21	4.1	0.2	10

Arctostaphylos columbiana Provisional Alliance

Summary

Arctostaphylos columbiana dominates, while *Vaccinium ovatum* and *Gaultheria shallon* form a shorter shrub layer. While this species occurs in low cover in other types, is does not form stands on oligotrophic soils. The few stands observed are associated with timber harvest and other disturbance within larger stands of *Pseudotsuga menziesii – Notholithocarpus densiflorus* Alliance. The related *Pinus contorta* var. *contorta / Arctostaphylos columbiana* Woodland is known from the coastal dunes of Oregon and perhaps Humboldt County, California (USNVC 2017).

Distribution

The map at right shows stands that were mapped as part of this project, that is, when they were surrounded by oligotrophic vegetation.

Local Alliance Summary (n = 1)

Example

Figure H-16: A tall stand of *Arctostaphylos columbiana* in the Newman Gulch Drainage, Mendocino Co. Shrubs are approximately 8 m tall. The stand formed from seedlings, recolonizing a clearing along a powerline right of way. (Gordon Leppig and Jenn Garrison provide scale). March 2018.

Arctostaphylos columbiana Provisional Alliance, continued

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation			
Conifer	3	3	3
Hardwood	2	2	2
Regenerating Tree			
Shrub	51	51	51
Herb			

Vegetation Height Data not available.

Environment Data

	Mean	Range
Elevation		
Slope		
Large Rock	0	0 – 0
Small Rock	0	0 – 0
Bare ground	10	10 – 10
Litter	90	90 – 90
Soil Type	Quinliven Fern Creek complex, 2 to 15 percent slopes (n=1)	

Stand Table

***Arctostaphylos columbiana* Provisional Alliance**

n = 1

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Sequoia sempervirens	100	1	1	1
	Notholithocarpus densiflorus	100	2	2	2
	Pinus muricata	100	3	3	3
Shrub					
	Vaccinium ovatum	100	5	5	5
	Gaultheria shallon	100	2	2	2
	Arctostaphylos columbiana	100	45	45	45
Herb					
	Cortaderia jubata	100	0.2	0.2	0.2
	Pteridium aquilinum	100	0.2	0.2	0.2
	Viola sempervirens	100	0.2	0.2	0.2
	Whipplea modesta	100	0.2	0.2	0.2

Chrysolepis chrysophylla Alliance

Summary

Chrysolepis chrysophylla dominates as a tree, sapling, or tall shrub while conifers intermix as sub-dominants. If *Pinus muricata* is present as a co-dominant, key to the *Pinus muricata* Alliance above. This vegetation type occurs in relatively dry and well-drained oligotrophic soils.

In this study area, only one association of the *Chrysolepis chrysophylla* Alliance was classified and is described below. Since the stand table is the same for alliance and association, it is presented only in the association section.

Distribution

This alliance extends from near Fort Bragg south to the Santa Lucia Mountains in Monterey County.

Local Alliance Summary (n = 3)

Alliance Rarity Rank: G2/S2

Associations within this Alliance:

Chrysolepis chrysophylla / Vaccinium ovatum Association

Chrysolepis chrysophylla / Vaccinium ovatum Association

Summary

Chrysolepis chrysophylla dominates as a tree, sapling, or tall shrub while conifers intermix as sub-dominants. *Vaccinium ovatum* and *Gaultheria shallon* dominate the shrub understory. This type occurs on oligotrophic soils.

Distribution

This association was described from Bolinas Ridge in Marin County (Keeler-Wolf et al. 2003), and ranges southward to the Santa Lucia Mountains (Monterey County) and at least as far northward as Mendocino County near Fort Bragg. The map at right shows the stands mapped within the study area.

Association Rarity Rank: G2/S2

Example

Figure H-17: A stand of *Chrysolepis chrysophylla / Vaccinium ovatum* Association, dominated by small trees of *C. chrysophylla* with lesser cover of *Pinus muricata.* Mendocino Redwood Company land, off Iverson Rd., Southern Mendocino County, June 2018.

Vegetation Summary

Vegetation % Cover	Mean	Min	Max
Total Vegetation	50	50	50
Conifer	10	10	10
Hardwood	20	20	20
Regenerating Tree	2	2	2
Shrub	22	22	22
Herb	1	1	1

Vegetation Height and Environment Data not available.

Chrysolepis chrysophylla / Vaccinium ovatum Association, continued

Stand Table

***Chrysolepis chrysophylla / Vaccinium ovatum* Association**

n = 3 (this project)

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Chrysolepis chrysophylla	100	20.7	20	22
	Pseudotsuga menziesii	100	3.5	0.6	5
	Pinus muricata	100	2.7	0.2	5
	Notholithocarpus densiflorus	67	7.5	3	12
	Sequoia sempervirens	67	1.1	0.2	2
	Abies grandis	33	0.2	0.2	0.2
	Hesperocyparis pygmaea	33	2.0	2	2
Shrub					
	Vaccinium ovatum	100	6.3	3	10
	Gaultheria shallon	100	3.7	2	7
	Rhododendron macrophyllum	67	2.6	0.2	5
	Arctostaphylos columbiana	67	1.6	0.2	3
	Morella californica	33	2.0	2	2
	Arctostaphylos nummularia	33	1.0	1	1
	Vaccinium parvifolium	33	0.2	0.2	0.2
	Pteridium aquilinum	33	0.2	0.2	0.2

Rhododendron columbianum Alliance

Summary

Rhododendron columbianum dominates in small stands where overstory trees have been trimmed or removed by disturbance. Stands are small and usually below minimum map unit size. We have insufficient data to differentiate associations.

General Distribution

Small isolated stands of *R. columbianum* occur in seeps and coastal fens from Humboldt County south to the Point Reyes Peninsula in Marin County. The map at right shows stands within the project area.

Local Alliance Summary (n = 1)

Alliance Rarity Rank: G4/S2?

Example

Figure H-18: A narrow, treeless stand of *Rhododendron columbianum* in a wet swale adjacent to the Salt Point pygmy forest area Sonoma County, November 2010

Vegetation Summary

Vegetation and Environment Data not available.

***Rhododendron columbianum* Alliance, continued**

Stand Table

n = 1

Lifeform	Botanical Name	Con	Avg	Min	Max
Tree					
	Hesperocyparis pygmaea	100	0.4	0.4	0.4
	Pinus muricata	100	0.2	0.2	0.2
Shrub					
	Rubus	100	0.2	0.2	0.2
	Rhododendron columbianum	100	80	80	80
	Vaccinium ovatum	100	5	5	5
	Gaultheria shallon	100	4	4	4
	Morella californica	100	4	4	4
Herb					
	Pteridium aquilinum	100	0.2	0.2	0.2

APPENDIX I

Hierarchical Field Key to the Vegetation Types of the Mendocino Cypress *(Hesperocyparis pygmaea)* Woodland and Related Vegetation on Oligotrophic Soils, Mendocino and Sonoma Counties, California

This key is for the Mendocino Cypress woodland and related vegetation of oligotrophic soils of Mendocino and Sonoma Counties, 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 both within and adjacent to the oligotrophic study area. It is meant to assist interpretation of vegetation and non-vegetated land cover within and immediately adjacent to the project area. The natural vegetation key is not dichotomous; instead it follows the hierarchy of the United States National Vegetation Classification (USNVC) with updates based on the *Manual of California Vegetation Online* and California vegetation classification projects reflected in the January 2018 Natural Communities List: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=153398&inline).

The USNVC hierarchy is promoted by the State of California, the Federal Geographic Data Committee (FGDC) and the Ecological Society of America's Vegetation Panel (FGDC 2008, Faber-Langendoen et al. 2014). This key identifies vegetation types at the Alliance and Association levels within two categories: Tree (Woodland/Forest) and Shrubland.

Herbaceous vegetation was not sampled or classified in this project, although several herbaceous types were mapped: *Cortaderia (jubata, selloana)* Semi-Natural Alliance, which occurs in mappable stands only in disturbed locations, and two types of aquatic vegetation that we could see in ponds, which were mapped to Group level only. Only the *Cortaderia* was identifiable to Alliance level through photointerpretation.

Follow the instructions in each 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. Note that this vegetation key includes types that are not accurately detectable in remotely-sensed imagery or occur in stands that are below the minimum mapping unit.

Terms and concepts used throughout the key are defined at the end of the key.

Key to Natural and Anthropogenic Land Cover:

1. Landscape unit consists of water bodies with no vegetative cover discernable on aerial imagery (NAIP 2014).

Water (9400)

2. Landscape is sparsely to very well-vegetated with naturally growing (not planted and heavily tended) vegetation.

Go to: Key to vegetation types of the Mendocino cypress woodland and related vegetation on oligotrophic soils, Sonoma and Mendocino Counties

3. Landscape consists of individual human-created units of at least ¼ acre in size that are either vegetated entirely by humans or characterized by human dwellings, roads, or other types of human development.

3a. Landscape units defined as forest plantations, with plantings of trees used as wood products.

Forest Plantation and Agroforestry (7200)

3b. Landscape unit includes food-based agriculture, pasture, lawn, gardens, or recreational areas (such as sports fields).

Pasture and Hay Field Crop, Lawn, Garden, Recreational Vegetation (7300)

3c. Landscape unit is associated with homes, out buildings, industrial buildings, roads, or driveways, and may include small gardens and remnant patches of natural or semi-natural vegetation associated with the buildings or development. These landscape units are often in a matrix of buildings and vegetation and are defined by the lack of stands of natural vegetation ≥ ¼ acre.

Built-up and Urban Disturbance (9100)

4. Landscape units of at least ¼ acre in size lack human dwellings, roads, or other types of development, but are cleared and unvegetated (generally < 2% plant cover).

Anthropogenic areas of little or no vegetation (9300)

Key to vegetation types of the Mendocino cypress woodland and related vegetation on oligotrophic soils, Sonoma and Mendocino Counties

Class A. Trees are evenly distributed with at least 10% cover unless noted in the key. Understory shrubs and/or herbs may have higher cover than trees = Tree (Woodland / Forest) Vegetation

Class B. Shrubs usually have at least 10% cover and are evenly dispersed. Herbaceous species may have higher cover than shrubs = Shrubland Vegetation

Class A. Tree (Woodland / Forest) Vegetation

1. *Sequoia sempervirens* characteristic (rarely with as little as 5% cover).

***Sequoia sempervirens* Alliance (1310)**

1a. *Pinus muricata* is sub- to co-dominant with *Sequoia sempervirens.*

***Sequoia sempervirens – Pinus muricata* Provisional Association (1311)**

1b. *Hesperocyparis pygmaea* is sub- to co-dominant with *Sequoia sempervirens.*

***Sequoia sempervirens – Hesperocyparis pygmaea* Provisional Association (1312)**

2. *Hesperocyparis pygmaea*, *Notholithocarpus densiflorus, Pinus attenuata*, *Pinus contorta* ssp. *bolanderi,* and/or *Pinus muricata* characteristic.

2a. *Pinus muricata* (or *Pinus attenuata,* see 2a2) dominant, or co-dominant with *Notholithocarpus densiflorus,* in the overstory or regenerating tree layers; *Hesperocyparis pygmaea* not significant in cover.

***Pinus muricata* Alliance (1130)**

2a1. *Notholithocarpus densiflorus* and *Pinus muricata* characteristic. If *Pseudotsuga menziesii* shares similar cover with *Pinus muricata* and *Notholithocarpus,* key out here.

***Pinus muricata – Notholithocarpus densiflorus* Provisional Association (1131)**

2a2. *Pinus muricata* dominant or co-dominant with *Chrysolepis chrysophylla,* and *Arctostaphylos nummularia* characteristic in the understory. *Chrysolepis chrysophylla* may vary in stature from a

tall shrub to a sapling to a mature tree. Note: In a single location on Alta Mesa, *Pinus attenuata* was present instead of *P. muricata* as the dominant species, although other species strongly suggested the same plant association.

Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia **Association (1132)**

2b. *Hesperocyparis pygmaea* dominant or co-dominant throughout stand. *Pinus contorta* ssp. *bolanderi* and/or *Pinus muricata* may co-dominate.

Hesperocyparis pygmaea **Alliance (1110)**

2b1. Together *Hesperocyparis pygmaea* and *Pinus muricata* dominate the tree layer, while *Pinus contorta* ssp. *bolanderi* is absent.

Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia **Association (1111)**

2b2. *Pinus contorta* ssp. *bolanderi* is present with *Hesperocyparis pygmaea,* while *Pinus muricata* is absent or insignificant. *Rhododendron columbianum* is usually present, often exceeding *Pinus contorta* ssp. *bolanderi* in cover.

Hesperocyparis pygmaea – Pinus contorta **ssp. *bolanderi / Rhododendron columbianum*** **Association (1113)**

An informal variant of this association was mapped where the understory composition suggests a fen (e.g., presence of *Sphagnum* spp., *Carex echinata* ssp. *phyllomanica*, *Drosera* spp.).

Hesperocyparis pygmaea – Pinus contorta **ssp. *bolanderi / Rhododendron columbianum*** **Provisional Association Fen Variant (1114)**

2b3. Both *Pinus contorta* ssp. *bolanderi* and *Pinus muricata* intermix with *Hesperocyparis pygmaea,* while *Rhododendron macrophyllum* grows in the understory.

Hesperocyparis pygmaea – Pinus contorta **ssp*. bolanderi – Pinus muricata / Rhododendron macrophyllum*** **Association (1112)**

3. Vegetation characterized by *Pseudotsuga menziesii* and *Notholithocarpus densiflorus* in the canopy. *Pseudotsuga* is typically dominant to co-dominant with *Notholithocarpus*, but may be sub-dominant, especially in timberlands.

Pseudotsuga menziesii – Notholithocarpus densiflorus **Alliance (1230)**

Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum **Association (1231)**

4. *Chrysolepis chrysophylla* dominates as a tree, sapling, or tall shrub while conifers intermix as sub-dominants. If *Pinus muricata* is present as a co-dominant, key to the *Pinus muricata* Alliance above.

Chrysolepis chrysophylla **Alliance (1210)**

Chrysolepis chrysophylla / Vaccinium ovatum **Association (1211)**

5. Vegetation dominated by *Eucalyptus* species (primarily *E. globulus*), originating from plantings, but persisting without human management.

Eucalyptus **spp. –** ***Ailanthus altissima – Robinia pseudoacacia*** **Semi-Natural Stands (1410)**

6. *Morella californica*, *Rubus parviflorus*, and/or *Rubus spectabilis* dominant or co-dominant. This type was sampled but not mapped because stands were below minimum mapping unit.

Morella californica – Rubus spectabilis **Provisional Alliance (1510)**

Morella californica – Rubus **spp. Provisional Association (1511)**

7. *Frangula californica* and *Rhododendron occidentale* dominant, individually or together, often intermixing with *Rubus* spp. This type was sampled but not mapped because stands were below minimum mapping unit.

Frangula californica – Rhododendron occidentale **Provisional Alliance (1610)**

8. *Arctostaphylos nummularia* ssp. *nummularia* dominates or co-dominates with *Arctostaphylos glandulosa, Gaultheria shallon, Rhododendron macrophyllum,* and/or *Vaccinium ovatum*. *Arctostaphylos columbiana*, *Chrysolepis chrysophylla* var. *minor*, *Notholithocarpus densiflorus* and *Pinus muricata* are often emergent, while *Pteridium aquilinum* and *Xerophyllum tenax* often intermix with the dominant species.

***Arctostaphylos* (*nummularia*, *sensitiva*) Alliance (2110)**

Arctostaphylos nummularia **Association (2111)**

9. *Arctostaphylos columbiana* is strongly dominant as tall shrubs (up to 8 m), associated with clearings in *Pseudotsuga menziesii – Notholithocarpus densiflorus* or *Pinus muricata* Alliance stands.

Arctostaphylos columbiana **Provisional Alliance (2115)**

10. *Rhododendron columbianum* dominates in (usually) small wetland stands where overstory trees cannot survive due to persistent flooding or saturation, or where trees have been trimmed or removed by disturbance.

Rhododendron columbianum **Alliance (3520)**

Rhododendron columbianum **Provisional Association (3521)**

11. The non-native *Rubus armeniacus* dominates, often in disturbed areas, and often in stands below minimum mapping unit.

Rubus armeniacus **Semi-Natural Association (3211)**

in the ***Rubus armeniacus – Sesbania punicea – Ficus carica*** **Semi-Natural Alliance (3210)**

12. Vegetation dominated by the invasive non-native pampas grass, in human clearings and waste places.

Cortaderia (jubata, selloana) **Semi-Natural Alliance (8200)**

Terms and Concepts

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 2008 by the FGDC.

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.

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.

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.

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.

Co-dominance: 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.

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. We use the accepted lifeforms in the USNVC or the PLANTS Database (USDA NRCS 2015).

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

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 *Pinus muricata* trees may comprise an emergent tree layer of 2% cover over dense *Arctostaphylos nummularia* in the shrub understory; the stand would be considered within the *Arctostaphylos nummularia* Association 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). 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 chose based on best available definitions.

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% 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.

Botanical nomenclature: We use the PLANTS database (USDA NRCS 2015) as our standard for botanical names. 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. For this project, we used the PLANTS code (HEPI11) but used the Jepson spelling, *Hesperocyparis pygmaea*. General vegetation types, such as moss and lichen, have codes beginning with the number 2 (e.g., 2MOSS).

APPENDIX J

Classification Crosswalk

This table is a crosswalk showing the relationship between the USNVC-compliant alliances of the Mendocino cypress and related 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.

USNVC Name	CWHR Type	CWHR Code	Calveg Name	Calveg Code
Trees				
Hesperocyparis pygmaea Alliance	Closed-Cone Pine–Cypress	CPC	Pygmy Cypress	MY
Pinus muricata Alliance	Closed-Cone Pine–Cypress	CPC	Bishop Pine	PM
Pseudotsuga menziesii – Notholithocarpus densiflorus Alliance	Douglas Fir	DFR	Pacific Douglas-Fir	DF
Quercus chrysolepis (tree) Alliance	Montane Hardwood	MHW	Canyon Live Oak	QC
Sequoia sempervirens Alliance	Redwood	RDW	Redwood	RW
Shrubs				
Arctostaphylos (nummularia, sensitiva) Alliance	Mixed Chaparral	MCH	Pygmy (Fort Bragg) Manzanita	AN
Frangula californica – Rhododendron occidentale Provisional Alliance	Valley Foothill Riparian	VRI	Willow (Shrub)	WL
Morella californica – Rubus spectabilis Provisional Alliance	Valley Foothill Riparian	VRI	Riparian Mixed Shrub	NM
Rubus armeniacus Semi-Natural Alliance	Valley Foothill Riparian	VRI	Riparian Mixed Shrub	NM
Rhododendron columbianum Alliance	Coastal Scrub	CSC	North Coastal Mixed Shrub	NC

APPENDIX K

Mapping Signatures

Below are examples of mapped vegetation types as shown on 2014 color infrared (CIR) and 2016 true color National Agricultural Imagery Program (NAIP), with notes on identification.

1111 *Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association

In the CIR above, *Hesperocyparis* is the deep burgundy mixed in with the dark gray/blackish *Pinus muricata*. The shorter, deep red between the trees is *Arctostaphylos nummularia*. The tree canopy is much more closed in the northwestern portion of this stand, north of the east-west road.

1112 *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association

The deep burgundy trees are *Hesperocyparis*, the lighter burgundy with smaller crowns are *Pinus contorta* ssp. *bolanderi*, and the larger gray crowns are *Pinus muricata*. The shrub layer varies in color and texture, indicating a more diverse understory than one that is very wet and dominated by *Rhododendron columbianum*.

1113 *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association

The example above is "classic" short Mendocino cypress forest, with very few tall trees, and with short, gray, fine-texture in the CIR. White soil patches are visible.

1114 *Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* FEN VARIANT

The FEN VARIANT is often not visible in the imagery due to the presence of tall trees. Mapped polygons of this type have been visited in the field; there may be more examples of this variant in the study area than have been mapped.

1131 *Pinus muricata – Notholithocarpus densiflorus* Provisional Association

In the above image the bright pink crowns are *Notholithocarpus* trees while the darker reddish gray crowns are *Pinus muricata*. In the adjacent true color image of the same polygon *Notholithocarpus* shows brighter green than the gray-green of the *Pinus muricata* crowns. In both images, note that the relative proportion indicates co-dominance of the two diagnostic tree species.

1132 *Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association

In this pair of CIR and true color images note the darker crowns of *Pinus muricata* punctuated by brighter vibrant crowns of low, shrubby trees of *Chrysolepis chrysophylla*.

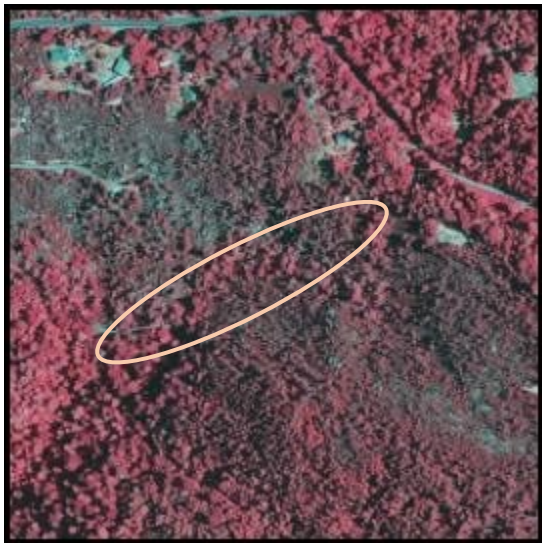
1211 *Chrysolepis chrysophylla / Vaccinium ovatum* Association

Both CIR and true color imagery show the bright variably-sized crowns of *Chrysolepis chrysophylla* in a shorter matrix of other shrubs. Scattered dead (gray) or senescent *Pinus muricata* are visible in the northern and central portion of the stand.

1231 *Pseudotsuga menziesii – Notholithocarpus densiflorus / Rhododendron macrophyllum* Association

The dark green crowns of *Pseudotsuga menziesii* contrast with the bright pale green crowns of *Notholithocarpus densiflorus* trees.

1310 *Sequoia sempervirens* Alliance

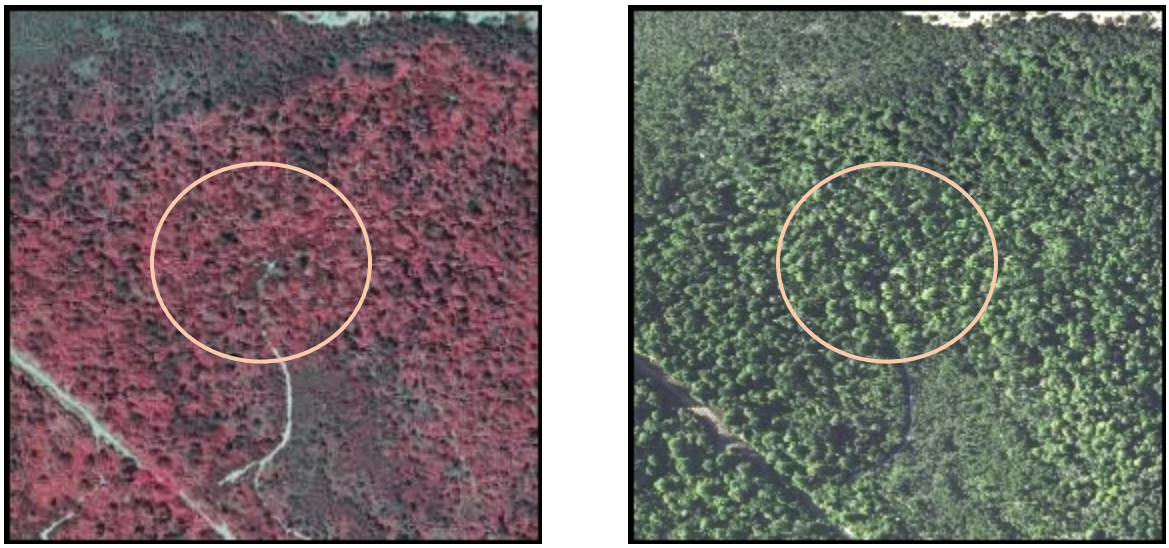


Sequoia individuals show up as bright green in the true color and lighter red in CIR. In the example above, you can see the sinuous stand of Sequoia in a drainage.

1311 *Sequoia sempervirens* – *Pinus muricata* Provisional Association

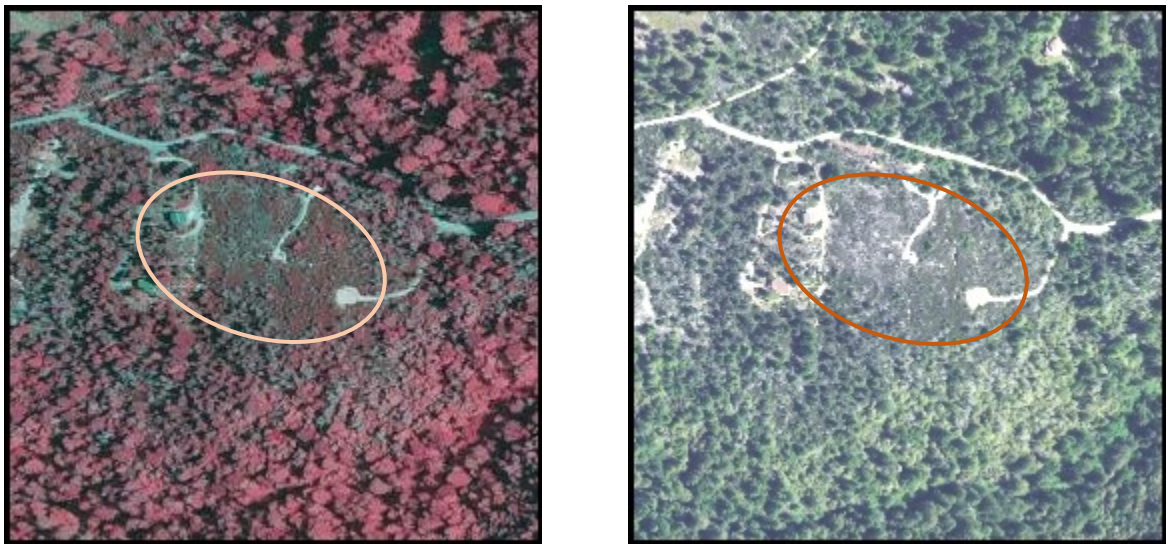
Sequoia crowns show as tall conical bright green compared to the shorter gray-green rounded crowns of *Pinus muricata.*

1312 *Sequoia sempervirens* – *Hesperocyparis pygmaea* Provisional Association



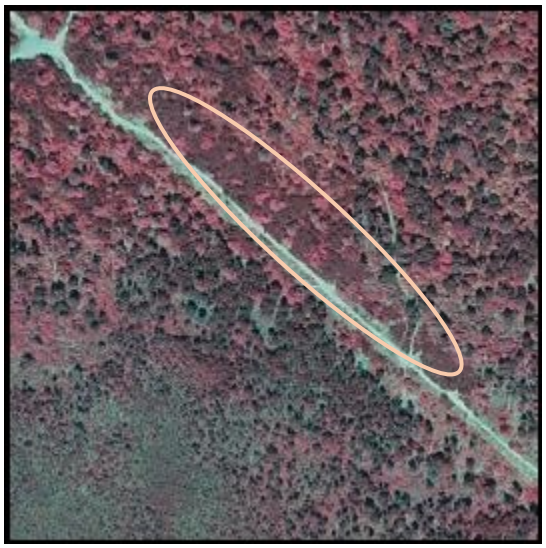
In the CIR image on the left, the rich dark crowns of *Hesperocyparis pygmaea* are scattered throughout the stand (especially concentrated in the lower-center). *Sequoia sempervirens* crowns are taller with distinctive shadows and are paler pink than the adjacent short *Notholithocarpus*.

2111 *Arctostaphylos nummularia* Association



Arctostaphylos nummularia (and other *Arctostaphylos* species) shows as a short, uniform, dark red (CIR) or dark gray-green (true color) matrix punctuated by other taller shrubs and unhealthy or dead small *Pinus muricata* (light gray). The scattered taller woody plants just to the right of the dirt road passing into the center of the polygon from the north are *Chrysolepis chrysophylla*.

2115 *Arctostaphylos columbiana* Provisional Alliance



Arctostaphylos columbiana shows up as dark red in the CIR. It is taller than other *Arctostaphylos* species present locally. The taller emergent trees are *Notholithocarpus densiflorus* (pink), with some dying *Pinus muricata* (gray). The disturbed roadside setting is typical for this type.

3211 *Rubus armeniacus* Semi-Natural Association

Rubus shows as very bright red, low, and smooth in the CIR, and almost lime green in true color.

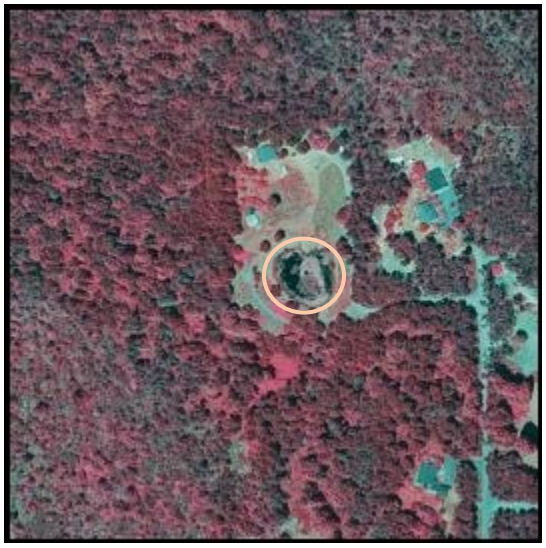
3520 *Rhododendron columbianum* Alliance

Rhododendron columbianum shows its strong dominance in this polygon. Its bright foliage underscores the wetland nature of this vegetation. This is along a powerline corridor where trees have been cleared.

4100 Vancouverian Freshwater Wet Meadow and Marsh Group

Small depressions are either inundated (and mapped as water) or mapped to this group if they are vegetated.

5200 Temperate Freshwater Floating Mat Group

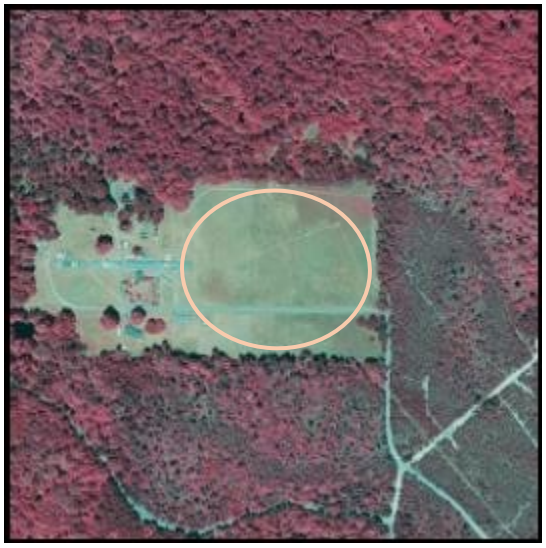


Manmade ponds with floating aquatic vegetation over much of the surface were mapped to this group.

7200 Forest Plantation and Agroforestry

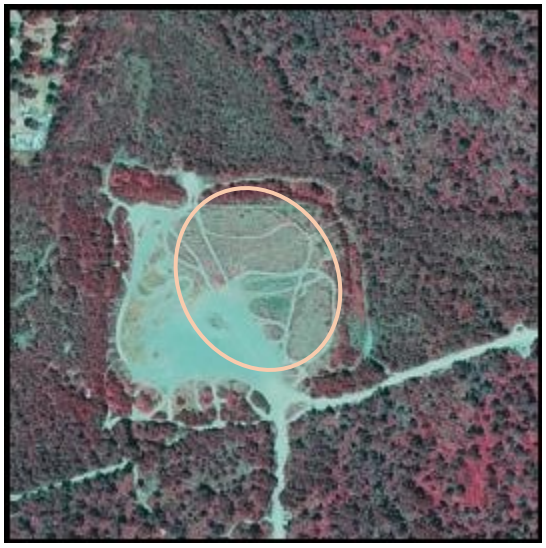
This area shows linear rows of planted trees, most obvious in the true color imagery.

7300 Pasture and Hay Field Crop, Lawn, Garden, Recreational Vegetation



Pasture and hayfields were delineated together with lawns and gardens and are evidenced by almost completely smooth texture.

8200 *Cortaderia (jubata, selloana)* Semi-Natural Alliance

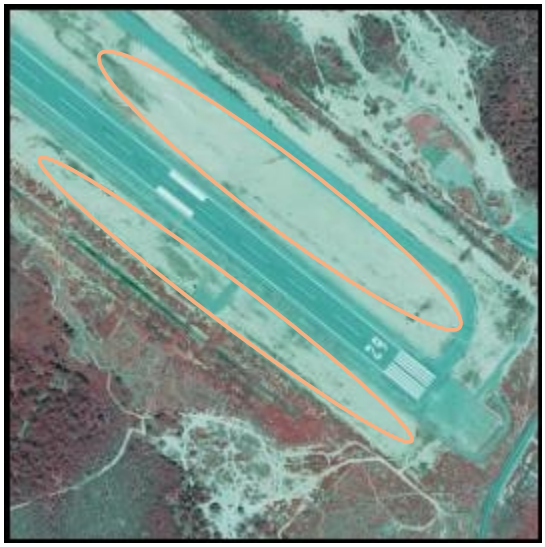


Large stands of pampas grass were evident in a few locations based on the very light green color and papillosa texture, and are the result of past disturbance.

9100 Built-up and Urban Disturbance

This mapping unit encompasses roads, parking lots, and structures, and often includes sub-minimum mapping units of natural vegetation. These small fragments often have a cleared understory or have been either planted with or invaded by non-native species.

9300 Anthropogenic areas of little or no vegetation



These are areas that have been cleared, scraped, or repeatedly mown such that there is very little native vegetation remaining.

9400 Water

Areas of open water appear black on the CIR and either black or reflective on the true color imagery.

APPENDIX L
Contingency Table

Type Mapped		Observed Type in Field															
		Arctostaphylos (nummularia, sensitiva) Alliance	*Arctostaphylos nummularia* Association	*Chrysolepis chrysophylla / Vaccinium ovatum* Association	*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* Association	*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi / Rhododendron columbianum* FEN VARIANT	*Hesperocyparis pygmaea – Pinus contorta* ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association	*Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia* Association	*Hesperocyparis pygmaea* Alliance	North American Boreal & Sub-boreal Bog & Acidic Fen	*Pinus attenuata* Alliance	*Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia* Association	*Pinus muricata – Notholithocarpus densiflorus* Association	*Pinus muricata* Alliance	*Sequoia sempervirens – Hesperocyparis pygmaea* Provisional Association	*Sequoia sempervirens – Pinus muricata* Provisional Association	**Grand Total**
	Arctostaphylos (nummularia, sensitiva) Alliance		1														**1**
	Arctostaphylos nummularia Association		9									2	1				**12**
	Chrysolepis chrysophylla / Vaccinium ovatum Association		1	2							1						**4**
	Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi / Rhododendron columbianum* Association				19		8										**27**
	Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi / Rhododendron columbianum* FEN VARIANT				2	1											**3**
	Hesperocyparis pygmaea – Pinus contorta ssp. *bolanderi – Pinus muricata / Rhododendron macrophyllum* Association				10		19	5				1					**35**
	Hesperocyparis pygmaea – Pinus muricata / Arctostaphylos nummularia Association		1				4	4				1	2				**12**
	Hesperocyparis pygmaea Alliance				1		2	1						1			**5**
	North American Boreal & Sub-boreal Bog & Acidic Fen				1												**1**
	Pinus attenuata Alliance										2						**2**
	Pinus muricata – Chrysolepis chrysophylla / Arctostaphylos nummularia Association	1	3	1			3	3				21	2			1	**35**
	Pinus muricata – Notholithocarpus densiflorus Association			1			2					4	3	1			**11**
	Pinus muricata Alliance																**0**
	Sequoia sempervirens – Hesperocyparis pygmaea Provisional Association																**0**
	Sequoia sempervirens – Pinus muricata Provisional Association						2		1			1			1	2	**7**
	Grand Total	**1**	**15**	**4**	**33**	**1**	**40**	**13**	**1**	**0**	**3**	**30**	**8**	**2**	**1**	**3**	**155**