

Marin County Open Space District Vegetation Mapping Report

Photo Interpretation and Mapping Classification Report

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Prepared for Marin County Open Space District

**by Aerial Information Systems, Inc.
with contribution from Jeff Kennedy**



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INTRODUCTION

Aerial Information Systems, Inc. (AIS) has prepared this report for Marin County Open Space District (MCOSD). The following information is contained in this report:

- A description of the mapping conventions and methodologies used to delineate and assign attributes to polygons for the vegetation map for the 36 properties (35 Marin County Open Space Preserves and 1 County Park) and surrounding land on MCOSD property (the 36 properties that were mapped can be found in Appendix C).
- The descriptions for the MCOSD mapping types, which was initially based on the Marin Municipal Water District (MMWD) Vegetation Classification, jointly created by MMWD and California Native Plant Society (CNPS), then further refined for the MCOSD study area by field reconnaissance and plot data collection by MCOSD.
- An area report of the study area, complete with the vegetation code, polygon count, acres, hectares and average polygon size (in acres).
- A list of the fields used for attributing polygons in the final map.

MARIN COUNTY OPEN SPACE DISTRICT VEGETATION MAPPING METHODOLOGY

In order to efficiently produce the MCOSD Vegetation Map, the project occurred in several stages within two phases, which are listed below. Due to time constraints for the field reconnaissance, the order of actual mapping process slightly differs from the steps listed in the MCOSD Proposal (submitted by AIS in May 2007).

PHASE I

- Stage 1 Field Reconnaissance
- Stage 2 Data Inventory, Organization of Project Materials and Uploading of Digital Files
- Stage 3 Aerial Photo Signature Identification
- Stage 4 Photo Interpretation
- Stage 5 Quality Control
- Stage 6 Preliminary Field Check and Field Revisions
- Stage 7 Data Processing

PHASE II

- Stage 8A AIS Review of the AA Plot Analysis
- Stage 8B Revisions Based On Accuracy Assessment Plot Data
- Stage 9 Final Quality Control
- Stage 10 Final Data Processing and Presentation Map Production
- Stage 11 Documentation

PHASE I

STAGE 1: Field Reconnaissance

The field reconnaissance trip occurred in June 2007. MCOSD employees David Herlocker (Interpretive Naturalist), Mischon Martin (Resource Ecologist) and Matt Sagues (Project Manager) accompanied the AIS Photo Interpreters, John Menke and Anne Hepburn, on a 2-day field reconnaissance trip throughout representative regions within the study area. The main purpose of the field reconnaissance trip was to identify vegetation on the ground and correlate the digital photo signatures with the signature of the vegetation found on the ground.

The photo interpreters from AIS often review the imagery prior to the field reconnaissance trip, but for this project, the reconnaissance trip occurred prior to AIS receiving the data, including the imagery, for the project. Because June was a good time to get out in the field to observe the vegetation, the trip happened before the photo interpreters reviewed the imagery for any questionable signatures. AIS took many waypoints with a global positioning system (GPS), a rangefinder and a compass in

order to get as many signature correlations as possible after the imagery was received. The waypoints were located in the stand as well as remotely. Remote waypoints required the use of a rangefinder and a compass in addition to the GPS. These waypoints were used to guide the photo interpreters on signature differences when the mapping began.

MCOSD Vegetation Mapping Classification

Because of the proximity of it to the MCOSD study area, the Preliminary MCOSD Mapping Classification was initially based on the existing Marin Municipal Water District Mapping Classification along with field reconnaissance data collected by AIS prior to mapping. As the mapping process evolved, MCOSD and California Native Plant Society (CNPS) jointly gathered plot data to be used in analysis in creating a floristic classification. Field plots and plot analysis support the floristically derived classification for MCOSD. The MCOSD Vegetation Classification (Floristic Vegetation) will be consistent with the standards set by the National Vegetation Classification System of floristically derived alliances and associations.

Further analysis of plot data collected by MCOSD will help to eventually finalize the Mapping Classification for MCOSD. With guidance from the ecologists at MCOSD and CNPS, AIS made some modifications to the MCOSD Mapping Classification, in order to suit the MCOSD study area. The mapping units created for this classification were defined by woody-vegetation species dominance and what could be seen on the imagery and modeled using environmental characteristics known to exist for each mapping type.

Subsequent efforts in mapping on the MCOSD should first address cross walking to the floristic classification which will be complete in the near future. This may entail assigning polygons new codes; especially ones labeled with the general categories 1101-1104 and also updating any discrepancies between the mapping and floristic classifications. This effort will probably not involve a great deal of linework modification, but will entail a thorough review of polygons to the updated mapping classes which will crosswalk to the floristic classification.

STAGE 2: Data Inventory, Organization of Project Materials and Uploading of Digital Files

MCOSD sent AIS a computer hard drive containing the data necessary for the mapping. A decision to change the base imagery (Vargis digital imagery) format from SID to TIFF was made during the field reconnaissance trip. The TIFF format allows the imagery to be manipulated easier than the SID format; therefore the TIFF format was more useful for mapping purposes. Due to the time necessary to convert the images from SID to TIFF format, AIS received the hard drive with all the data (including the imagery in both SID and TIFF formats) about a week after returning from the field recon trip.

A detailed inventory of the project materials was performed to verify that all the materials were received. The data on the hard drive was then uploaded to AIS' computer network, which took a few days due to the size of the imagery. The website marinmap.gov was used to get data that AIS thought useful but was not on the MCOSD hard drive.

Any additional manipulation of the data to make it ready for the interactive photo interpretation process also occurred at this time.

STAGE 3: Photograph Signature Identification

After the data had been uploaded from MCOSD's hard drive and implemented into an ArcMap project, the photo interpreters began a review of the digital imagery. The waypoint locations that AIS took on the field recon trip were used to correlate photo signatures on the imagery with the type of vegetation that AIS observed and recorded in the field. Any outstanding questions about photo signature, such as the areas that were not observed on the field recon trip and had no waypoint data associated, were flagged by the photo interpreters for the MCOSD field crew to answer.

The AIS photo interpreters broke the study area into different areas and sent 3 shipments to MCOSD so the field crew could address the questions that the photo interpreters had created. AIS also asked the field crew to try to do an informal quality control check of the areas they visited so the photo interpreters could better identify correct and incorrect mapping trends that were occurring in the study area.

STAGE 4: Photo Interpretation

Viewing the digital imagery on screen and using the Preliminary MCOSD Mapping Classification, the photo interpreter began the mapping process. There were 3 sets of digital imagery used for the mapping. The base imagery (natural color imagery created by Vargis Inc.) covered the entire study area and was flown in September 2004 (per Matt Sagues email 6-14-07). The resolution for the imagery varies within the study area. The urban areas are a 4-inch resolution natural color orthophotography at 1"=100' map scale and the rural areas are a 1-foot resolution natural color orthophotography at 1"=700' map scale.

The natural color imagery from the National Agriculture Imagery Program (NAIP) was used as ancillary data, and has a 1-meter resolution. This imagery was very useful in determining the presence of California bay since it appears bright green on this imagery, and is not discernible on the Vargis imagery.

The IKONOS CIR TIFF images which were flown in June 2001 with a resolution of 4 meters were also used, but not to the extent that NAIP imagery was used. Although this imagery was useful for making some coding decisions, it was not as helpful as the NAIP imagery for ancillary purposes. This imagery is at a very coarse resolution, therefore it does not yield quite as much detail as the base imagery or NAIP.

Ancillary Data

Prior to making any delineations or decisions regarding the vegetation type, all ancillary data was reviewed. A table containing the data, description and where it came from is located in APPENDIX D. The ancillary data used for the mapping project included the following:

- NAIP imagery
- Contours (5ft, 10ft and 50ft intervals)
- AIS Waypoints
- Jeff Kennedy Waypoints
- David Herlocker Waypoints
- Geology
- Marin Roads
- Marin Streams
- Marin Trails
- MCOSD Preserves
- Precipitation
- SOD buffer
- SOD Confirm
- SOD Suspect
- Tiburon Serpentine
- Water body
- Watershed
- Wetland
- Weeds Map

Photo Interpretation

The study area was broken into several smaller pieces to allow more than one photo interpreter to work on the mapping at once. By starting at one edge of the study area and working methodically, the photo interpretation was conducted for the entire study area using heads-up digitizing techniques. The heads-up mapping procedure incorporated custom ArcMap tools that AIS had developed specifically for vegetation mapping projects. The minimum mapping unit (MMU) used for delineating polygons was 0.5 hectares. However, there were a few exceptions such as: areas of critical habitats, critical water sources and wetlands that were mapped smaller than the MMU.

The photo interpreters assigned 9 attributes to each polygon label. These attributes consist of the following fields:

- PI
- DenCon
- DenHard
- DenShr
- BroomModifier
- DeadVegetation Modifier (due to SOD)
- FieldCheck
- InitFCCom

The explanations for each attribute are described below:

Photo Interpretation

The photo interpreter assigned a 4-digit numeric code to the polygon that represented either the best alliance, mapping unit or association from the Preliminary MCOSD Mapping Classification. When assigning a vegetation code to a polygon (veg), the photo interpreter would first review all data available that could help with the decision- making process.

Density

The densities for the conifer, hardwood and shrub components were assigned to the polygon. Cover class densities for the conifer, hardwood and shrub components were assigned the following values:

- 0 = Not Applicable
- 1 = Greater than 60%
- 2 = 40-60%
- 3 = 25-40%
- 4 = 10-25%
- 5 = 2-10%

Neither the non-vegetated surfaces nor the herbaceous component were assigned a density value. Absolute density cover was used instead of relative density cover in order to accurately depict total plant coverage from the aerial images. Absolute density refers to the sum total of the visible plant and non-vegetative cover within a given mapping unit. The total density cover for all visible over-, mid- and understory vegetated and non-vegetated surfaces must equal 100% present. Vegetation not visible on the aerial imagery was not considered as part of the total plant density.

Broom Disturbance Modifier

After the densities were assigned for the conifer, hardwood and shrub layers, the modifier for the broom disturbance was given. Within the study area, a presence of broom species, including French broom, Scotch broom and Spanish broom, were noted. Several species, especially French broom, are considered aggressively invasive exotics. As an aggressive exotic plant, it creates safety issues including reduced visibility along roadsides, increasing the fuel load and reducing biological diversity in natural areas. Due to these concerns, MCOSD considered it a priority to map the presence of broom. The disturbance modifier for the presence of broom in a polygon was assigned the following values:

- 0 = Minimal or no disturbance visible
- 1 = Low: 1-5% of the polygon had broom visible
- 2 = Moderate: 5-10% of the polygon had broom visible
- 3 = Severe: Over 10% of the polygon had broom visible

It is important to note that the broom modifier should be considered temporal since the imagery may differ from what was actually found on the ground. The broom modifier was only used when seen on the digital imagery and was not a line former for polygons. In other words, the line work for a polygon was not based on the presence of broom.

Dead Vegetation Modifier (due to SOD)

Within the study area, Sudden Oak Death (SOD) is a disease that infects oaks or close relatives to oaks (e.g. tanoak). The SOD pathogen had contributed to the death of trees, particularly coast live oak (*Quercus agrifolia*) on MCOSD lands, and also tanoak (*Lithocarpus densiflorus*) on MMWD land adjacent to and occurring less often on MCOSD property. When the trees died due to SOD, the dead trees not only created increased fuel for fire, but also would occasionally fall. The new openings in the forest would change the fire dynamics, sometimes allowing broom and Douglas-fir to grow where there was once a sheltered herbaceous layer. Since the dead trees can create a dangerous fire hazard, their presence was given a modifier. The trees most commonly affected by SOD in this study area are primarily coast live oak, and tanoak. The disturbance modifier for the presence of dead vegetation was assigned the following values:

- 0 = Minimal or no mortality – (standing trees)
- 1 = Low: 1-5% of the polygon had canopy mortality
- 2 = Moderate: 5-10% of the polygon had canopy mortality
- 3 = Severe: Over 10% of the polygon had canopy mortality

The dead vegetation disturbance modifier is temporal so the imagery may differ from what was noted in the field effort. The dead vegetation disturbance modifier was not a line former for polygons, so the line work of a polygon was not based on the presence of the dead trees; however, the densities were affected by the amount of dead trees present.

FieldCheck Attribute

The fieldcheck attribute was used to notify the field crew that the photo interpreters had a question about the vegetation. The following values were assigned to this field:

- 0 = No Field Questions
- 1 = PI Field Questions
- 2 = Answered by Field Crew
- 6 = Not Accessible (per Field Crew)

A value of 1 was assigned to a polygon when the photo interpreter had a question about a polygon that needed to be checked by a field crew person. Once the question was answered, the PI code was assigned based on the field crew's findings, and a value of 2 was given to the field attribute in the polygon. A value of 6 was given to polygons that the field crew deemed inaccessible due to the terrain.

InitFCCom Attribute

This field was originally called Comment. It would contain any information regarding the field questions from AIS in order to better guide the field crew person to what the specific field question was for the initial field questions (Jeff Kennedy). It now contains the field crew's answers or observations for a polygon or the remaining field question if it wasn't answered. The field question remains here in case there is a subsequent effort after this project is complete. Otherwise, it will be blank.

STAGE 5: Quality Control

Once the Photo Interpretation stage was completed, a comprehensive quality control was performed by the senior photo interpreter (also known as the reviewer) in conjunction with checking the map for any internal AIS questions or field questions. Any remaining field questions were then sent to MCOSD for the field crew to answer.

In order to ensure the completeness of the interpretations, custom programs were used that indicated which polygons have been reviewed. Once a polygon was reviewed, updated, or flagged for further field, the on-screen codes for that polygon changed color. This way, the reviewer could keep track of what had been previously reviewed and/or updated. This eliminated any duplication of effort resulting from revisiting previously reviewed areas and ensured that every polygon delineated on the digital image was reviewed. In addition to the visual QC effort, automated QC programs were run on the data that checked for coding errors.

Since everything had gone through an extensive QC process, this attribute was removed from the polygon for the final product.

STAGE 6: Preliminary Field Check and Field Revisions

In order to answer any of the photo interpreter's questions about the vegetation and to make cursory verifications for the photo interpreters, the MCOSD field crew ground-truthed both specific polygons and general signatures on the imagery for which initial interpretation was complete. To facilitate this, AIS made several interim deliveries of the digital database, including the line work and codes, as shapefiles to MCOSD.

Hard copy plots containing the vegetation delineations, vegetation codes and project imagery were then generated with all problematic polygons flagged for the field review. Both the MCOSD Preliminary Mapping Classification and photo interpretation efforts were assessed for changes necessary to accurately finish the vegetation map. Any information that was given to the photo interpreters during this process was incorporated into the final preliminary map.

The Interpretive Naturalist from MCOSD (David Herlocker) and the field crew consultant (Jeff Kennedy) answered field questions for AIS photo interpreters. Jeff Kennedy's findings were written on the field plots that were created for the field effort, and the plots were sent to AIS. The comments and changes from the hard copy plots that he suggested were reviewed then input into the geodatabase. AIS also kept a separate spreadsheet noting the field crew comments, AIS' original question and the codes each had assigned. This gave a good overview of what AIS was over mapping and under mapping in each area. Generalizations were made based on the results of the field crew findings, and extrapolations were made across the study area. Shouldn't

STAGE 7: Data Processing

The modules that were split in order for 2 people to work on it were merged together into one geodatabase, and edge matching occurred. A series of automated QC checks were run on the final preliminary geodatabase to identify any GIS-related errors as well as any line or coding errors. Once all the errors were corrected, the QC checks were run again until the geodatabase was error free.

PHASE II

STAGE 8A: AIS Review of the AA Plot Analysis

Upon completion of the Interim Phase of the project by the MCOSD field crews, AIS revised the preliminary vegetation map to incorporate the field data that was gathered.

AIS reviewed approximately 250 plots were collected due to the field crew call being different from the PI (vegetation code) given by AIS prior to the AA. Each plot was compared to the polygon it was taken in, then either changed to the code the field crew wanted, or something else based on the plot data or not changed because AIS did not agree with the field crew assessment. Sometimes there were location issues, and the plot actually described an adjacent polygon instead. When this happened, it was noted in the labels of both polygons.

A few new fields were added to the polygon label by the field crew and when AIS reviewed the AA plot data. The new fields are described below and separated by fields created by the MCOSD field crew and fields created by AIS.

New fields created by MCOSD Field Crew:

Count_ - Assigned by field crew; left in the geodatabase in case it is needed later.

FIELDPI- PI code that the field crew assigned the polygon based on the plot data. Only the polygons that didn't match the PI code were reviewed during the AA review.

New fields created by AIS:

AIS_OID- This is the original unique polygon number that the field crew used, and so it is also the plot number that was assigned to the polygon. This is sometimes the number used when referring to a *polygon #* in the AISComment_AA field.

PostAAScoresAIS- This is where the polygon was scored after being reviewed by AIS. The following scores were used:

- 2 = AIS disagreed with field crew call
- 3 = AIS agreed with field crew call; changed PI to match FIELDPI code
- 4 = AIS disagreed with field crew call code, but changed the PI code to something else based on the plot data
- 8 = Not a plot, but mentioned in another plot or extrapolated from another plot or on hard copy plot, but not in geodatabase
- 9 = post imagery change from plot data information (should also have information in PostImageryChanges and PostImageryChangesComment fields)
- 10=Plots deleted by MCOSD

AISComments_AA- Contains any pertinent information regarding the plot data findings and the PostAAScoresAIS field

PostImageryChanges- 0 if there are no changes on the ground after the imagery was taken; 1 if there have been changes

PostImageryChangesComment – If there has been a change on the ground since the imagery was taken, then it is noted in the PostImageryChanges field and the details are documented in this field

STAGE 8B: Revisions Based On Accuracy Assessment Plot Data

After reviewing the plots that the field crew coded differently than the PI code, some changes were made to the map. The plots helped reveal vegetation that is hard to see on the imagery, under mapping, and over mapping of certain vegetation types. Some polygon changes were made on a case by case basis, but there were some global changes that were made as well. The most common modifications that were made to the map are listed below.

Vegetation Types Hard to Discern On the Imagery

California buckeye is not usually discernable on the imagery and not a very common dominant in the study area. It has been noted by the field crew as a component to some vegetation stands, but it is not easily identified on the imagery, so most of it is mapped based on plot data and field recon notes. It is not a global change that we can make.

Canyon live oak is tough to discern on imagery and is primarily mapped based on plot data and field recon notes except in high elevations on steep north trending coves.

Young stands of Coast Redwood (especially small stands) can be difficult to discern from other vegetation types including chinquapin or bay.

Older growth Douglas-fir and Coast Redwood are difficult to distinguish in some settings.

In some instances, Mt. Tamalpais manzanita is hard to see under a dense cover of Sargent cypress, so it was mapped as pure Sargent cypress (PI code=1242) instead of Sargent cypress/ Mt. Tamalpais manzanita (PI code=1241).

When Eastwood manzanita and chamise mix together, we use PI code 3190, regardless of which species dominates. When these two species mix, it is very difficult to determine the dominant species on the imagery.

Purple needle grass can be a component of serpentine grasses (usually PI code=4610), so if it is on serpentine we generally call it PI code=4610. We can't ID the native grass species on the imagery, so when purple needle grass is mapped off serpentine (PI code=4520), it is based on plot data or field recon notes. Purple needle grass (PI code=4520) can't be extrapolated across the study area.

When blue oak hybridizes with any type of white oak (valley oak and Oregon oak were both noted in the study area), PI code 2241 is used. The imagery doesn't yield what species of white oak it is, so this code is used for white oaks hybridizing with blue oak.

Serpentine balds are sometimes hard to ID on the imagery, but once we reviewed the plot data, we looked at Google imagery and they were easier to see. Changes were made to areas that were noted in the plots, but no global changes were made across the study area.

Common and sensitive manzanita can't be discerned on the imagery. We can detect that it is manzanita. In this study area, if it is off serpentine, then we called it Eastwood manzanita. We made changes to the polygons that were noted in the plot data, but this is not a global change that can be made.

Monkeyflower is not discernable on the imagery and its presence is modeled based on environmental setting. It is usually noted as a component to other types and not mapped alone.

Giant chinquapin is hard to ID on the imagery. We attempted to map several larger stands, but the signature is easily confused with other things, especially young coast redwood. It is primarily mapped based on plot data.

Bracken fern can be difficult to discern on the imagery, especially when it is sparse.

Poison oak is sometimes tough to discern when it occurs with coyote brush.

Temporal Changes Noted

If a plot indicates that there has been a temporal change since the imagery was flown, it is noted by a "1" in the PostImageryChanges field, and any pertinent description is noted in the PostImageryChangesComment field.

Broom dominated polygons may be a temporal change – more may have grown since 2004 (when the imagery was taken).

Bracken fern presence or absence can be a temporal change between FC sampling in 2007-2008 and PI interpretation in imagery from 2004.

Coyote brush may be a temporal change issue. There is a 3 to 4 year time lapse between when the imagery was flown (2004) and when the field crew sampled (2008). Coyote brush can often be an ecological successional type so sometimes there was more coyote brush present on the ground from when it was mapped, which could be attributed to several instances of under mapping of this type.

A few plots noted recent disturbance such as fire or fuel reduction which were not mapped on the imagery because it happened after it was flown. This did not change the polygon, and was noted in the PostImageryChangesComment.

Mapping Grass on Serpentine

The grasslands on serpentine (PI codes 4610, 4611) were mapped using a combination of ancillary geologic data and image signature. We generally cannot determine species composition of these grassland types but we can determine usually when they are on serpentine derived soils.

Rather than merge the serpentine grasslands with the native purple needle grass, maybe we can rename the type 4610 to: Native grasslands on serpentine derived soils. We believe the serpentine soils are an important variable to map even if it contains similar species in some cases to off-serpentine native grasslands. Also, we can rename the type 4611 to the same thing as 4610, only with rock outcroppings: Native grasslands on serpentine derived soils containing rock. We also feel this is a valuable distinction from type 4610.

There are many serpentine grasslands (PI code 4610 and 4611) that we request a verification of serpentine soils. This usually happens when the plot doesn't indicate if it is serpentine, but the geology map has serpentine in the polygon and it looks like it is serpentine derived.

We mapped non-serpentine grasses as 4312 in areas of poor soils yielding sparse grasses. Several field points differed on our interpretations of sparse vs. dense grasses – and we reviewed each plot in relation to the entire mapped polygon. It was changed to 4311 if it didn't look like sparse soils, but remained the same if it did look sparse.

Mapping Manzanita on Serpentine

The manzanita on serpentine (Mt. Tamalpais manzanita) was mapped using a combination of ancillary geologic data and image signature. Based on our prior experience with the adjacent MMWD area and the field reconnaissance, if manzanita occurred off serpentine then we coded it as Eastwood manzanita and if it occurred on serpentine, then we coded it as Mt. Tamalpais manzanita. Some changes were made based on plot data, but a few plots did not specify the manzanita species, so we have requested that and left the polygon coded as it was with no change. We can't make a

determination of the mapping type to use unless we know that. Basically it is a question of whether it is a serpentine type or a non-serpentine type.

PI code 3121 vs. 3120- Code 3121 is used when Mt. Tamalpais manzanita dominates or co dominates the shrub layer, with chamise an important co-dominant or subordinate. Jepson Ceanothus, garraya, leather oak are often minor components to the shrub layer. 3120 is used when we see a strong component of Mt. Tam manzanita with a sparse component of other shrubs (~5%).

Common Confusions with the Mapping Units

This is a brief description of common mistakes or confusions that occur when using the mapping classification.

When California bay mixes with other species that are present in a low cover, it can be called pure California bay (1111) instead of California bay alliance (1110).

Type 1223 (Douglas-fir-California bay mapping unit) vs. 1221 (Douglas-fir-Mixed Hardwoods) – Type 1223 can contain some Coast Live Oak in it (in a low cover). When California bay occurs with Douglas-fir, even if QUAG is present, we will code it as 1223. We code to type 1221 when California bay is not present and Douglas-fir is in a xeric setting.

Type 1115 (California Bay-Coast Live Oak)- This type is mapped when bay and coast live oak mix and either may dominate. We can't always determine which tree is dominant and often it changes within a stand of vegetation, so it would be difficult for us to create a new mapping unit: (2114 was proposed). Per the mapping descriptions, either species can dominate in this type.

Type 2232 (Valley Oak – Coast Live Oak) - If bay, coast live oak and valley oak mix, we generally map to the valley oak – coast live oak type, even when valley oak is relatively low in cover. We tried to capture valley oak presence whenever possible. 1115 (California bay – Coast Live Oak): Several stands had a presence of valley oak not detectable by the PI's and therefore we had to call them out as 1115.

Coast Redwood types: 1214 (Redwood /Ca Bay) vs. 1217 (Redwood –Riparian): 1217 generally occurs along larger perennial stream and includes a component of riparian vegetation such as big leaf maple, or alder. 1214 has a California bay component with no riparian vegetation.

Types 2231 (Valley Oak Riparian) vs. 2232 (Valley Oak-Coast Live Oak)- 2231 is used when there are riparian species present, but UMCA can be present. Examples of the riparian species that must be present are alder and maple.

Type 3223 (Coyote Brush-Mixed Shrub/Grass) can have MIAU and ARCA as minor components to it. Type 3221 (Coyote Brush-Ca Sagebrush-Sticky Monkeyflower) has more ARCA and MIAU present in it.

Global Changes

In Rush Creek Open Space Preserve, change all polygons coded as 2232 to 2241 based on plot data.

In Lucas Valley area, most polygons coded as type 3311 were switched to either chamise types or coyote brush types, depending on surrounding area and plot data. Some polygons were left as 3311 per plot data.

Tanoak was under mapped along the MMWD boundary, so it was reworked to include tanoak as a component to the mapping units. Dead tanoak was also noted in these stands.

Madrone was over mapped in Roy's Redwoods, so the polygons were remapped.

STAGE 9: Final Quality Control

A series of automated QC checks were run on the final coverage to identify label errors and were resolved on-screen and the coverage went through another series of QC checks. The automated QC review was repeated until the coverage was error free.

STAGE 10: Final Data Processing and Presentation Map Production

Once the data was error free, presentation quality maps were produced for the study area. The final database and the plot file in digital format and one hardcopy 1:24,000 scaled presentation map were provided to MCOSD.

STAGE 11: Documentation

AIS provided MCOSD with a final project report. The report contains the methodology used to delineate and attribute polygons, a link between each mapped vegetation type and the National Vegetation Classification System (NVCS), and detailed descriptions of each mapping class in the project area.

OPEN SPACE PRESERVE DESCRIPTIONS

Marin County, California



Gary Giacomini Open Space Preserve



Location: Gary Giacomini Open Space Preserve shares a boundary with the MMWD property. The southern boundary that is located next to MMWD land runs along San Geronimo Ridge Road, which is located along a ridge. The east boundary is shared with the White Hill MCOSD Open Space Preserve. Gary Giacomini OSP is located north of Kent Lake, and also south of Sir Francis Drake Blvd and French Ranch, Maurice Thorner and Roy's Redwoods OSP.

Elevation Range: ~230' - 1410'

Vegetation: Mostly north and northeast facing, the vegetation is predominantly conifer-hardwood mixes. Coast redwood, Douglas-fir, California bay, coast live oak, interior live oak, madrone, Sargent cypress, valley oak, chamise (on and off serpentine), Mt. Tamalpais manzanita, Eastwood manzanita, coyote brush, grasslands (on and off serpentine) and broom are all found here.

Hydrology: Creeks in the Open Space Preserve include San Geronimo Creek, Montezuma Creek, Candelerio Creek, Creamery Creek, Deer Camp Creek, Bates Canyon Creek, Woodacre Creek and Pine Mountain Creeks.

French Ranch, Maurice Thorner and Roy's Redwoods Open Space Preserves



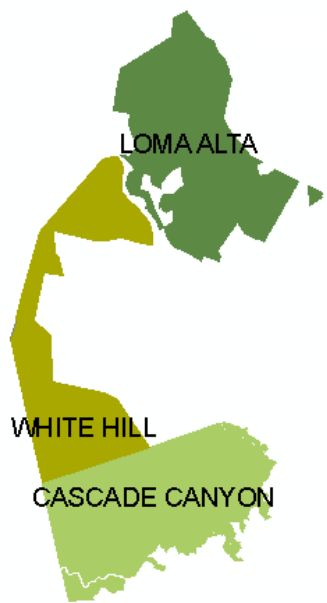
Location: French Ranch, Maurice Thorner and Roy's Redwoods Open Space Preserves are located north of the towns of Forest Knolls, San Geronimo and Woodacre; Gary Giacomini Open Space Preserve is located south across Sir Francis Drake Blvd.

Elevation Range: French Ranch 300' - 1150'
Roy's redwoods 350'- 1300'
Maurice Thorner 350' – 500'

Vegetation: Madrone, California bay, Douglas-fir, coast live oak, coast redwood, tanoak (tanoak mapped based on field crew comments), willow spp., valley oak, chamise, Mt. Tamalpais Manzanita, coyote brush, sedge, rush, wet graminoids and grasslands (serpentine and non-serpentine) are found in these Open Space Preserves.

Hydrology: Clear Creek runs through French Ranch Open Space Preserve. Larsen Creek and Spirit Rock Creek are located in Roy's Redwoods Open Space Preserve. There are no creeks in Maurice Thorner Open Space Preserve.

Loma Alta, White Hill and Cascade Canyon Open Space Preserves



Location: Both White Hill and Cascade Canyon are located east of Gary Giacomini Open Space Preserve, directly west of the city of Fairfax and north of Bon Tempe and Alpine Lakes. They are also adjacent to MMWD property and share a boundary with the MMWD land.

Loma Alta Open Space Preserve is located northwest of Fairfax and is NW of White Hill and its boundaries are primarily formed by 4 ridgelines.

Elevation Range: Cascade Canyon 200' - 1000'
White Hill 300' - 1400'
Loma Alta 300' – 1550'

Vegetation: White Hill, Cascade Canyon and Loma Alta Open Space Preserve contain madrone, coast live oak, California bay, interior live oak, coast redwood, Douglas-fir, chamise (serpentine and non-serpentine), Mt. Tamalpais manzanita, California sagebrush, interior live oak, Eastwood manzanita, broom, coyote brush, sedge, rush, wet graminoids, cliffs, rock outcrops and grasslands (serpentine and non-serpentine). There are a few exceptions in Loma Alta Open Space Preserve. Since it has very little serpentine geology, Mt. Tamalpais manzanita, serpentine chamise and serpentine grasslands are not mapped in Loma Alta OSP.

Hydrology: Cascade Falls, Pine Mountain Creek, Cascade Falls Creek, Carey Camp Creek and Rush Creeks are located in Cascade Canyon Open Space Preserve. Pine Mountain Creek and Cascade Falls Creeks are located on White Hill Open Space Preserve. Fairfax Creek is found in Loma Alta Open Space Preserve.

Bald Hill Open Space Preserve



Location: Bald Hill Open Space Preserve is found on the western edge of the town of San Anselmo and north of Bald Hill. It also shares a boundary with MMWD land.

Elevation Range: 300' - 650'

Vegetation: Predominantly east facing, coast live oak, California bay, coast live oak, broom, coyote brush, non-serpentine grasses and valley oak (rarely occurs) occur in this Open Space Preserve.

Hydrology: There are no creeks running through Bald Hill Open Space Preserve.

Terra Linda/ Sleepy Hollow Divide Open Space Preserve



Location: The town of Sleepy Hollow is located to the west and Santa Margarita Valley occurs south and east of Terra Linda/Sleepy Hollow Divide Open Space Preserve. Lucas Valley Open Space Preserve is located north of this Open Space Preserve. There are several ridges with fire roads in this Open Space Preserve.

Elevation Range: 100' – 1000'

Vegetation: coast live oak, madrone, California bay in and out of riparian), valley oak, broom, coyote brush, grasslands (on and off serpentine) and native grasses occur in these Preserves.

Hydrology: Miller Creek is the only major creek in this Open Space Preserve and it occurs in the NE section.

San Pedro Mountain Open Space Preserve



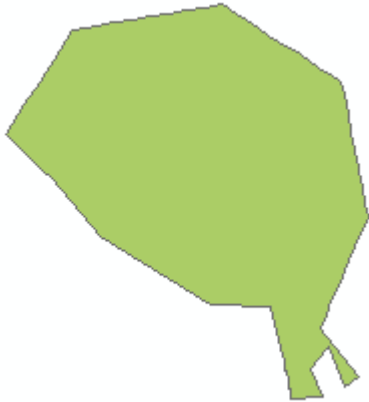
Location: Found east of Highway 101 and Terra Linda / Sleepy Hollow Divide Open Space Preserve, north of the city of San Rafael and south of Santa Margarita Island Open Space Preserve.

Elevation Range: 100' - 1000'

Vegetation: coast live oak, madrone, California bay, common manzanita, coyote brush, and grasslands (off serpentine) occur in this Preserve.

Hydrology: There is only one unnamed creek running through this Open Space Preserve.

Santa Margarita Island Open Space Preserve



Location: Located west of San Pablo Bay, north of San Pedro Mountain Open Space Preserve and surrounded by the South Fork of the Gallinas Creek.

Elevation Range: 5' - 50'

Vegetation: Coast live oak, valley oak and off serpentine grasslands occur on this Preserve.

Hydrology: The South Fork of the Gallinas Creek is the only creek that occurs in this Open Space Preserve.

Lucas Valley Open Space Preserve



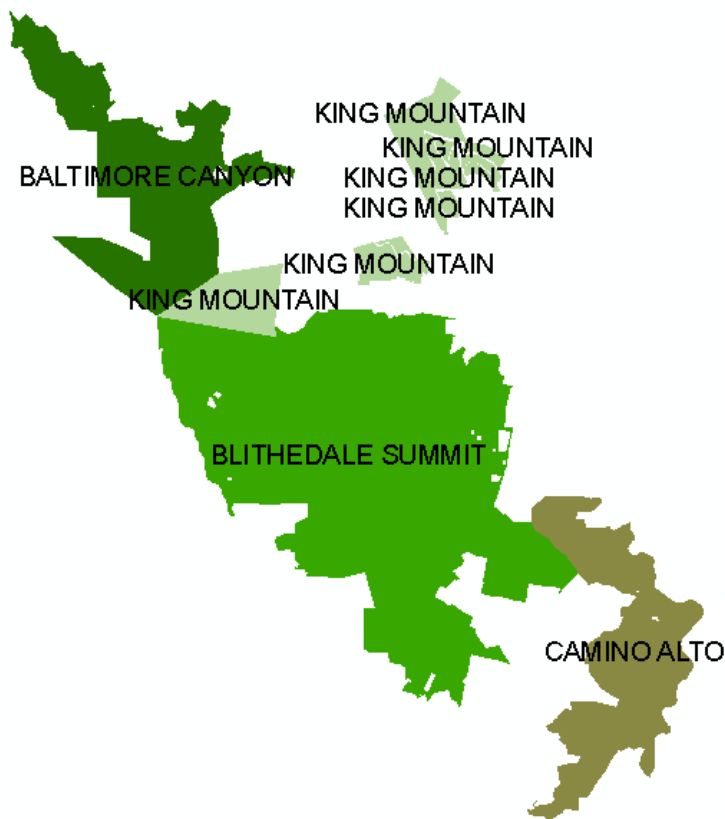
Location: Found north of Terra Linda/Sleepy Hollow Divide Open Space Preserve, SW of Indian Valley Open Space Preserve, and west of Ignacio Valley Open Space Preserve, which shares a boundary with Lucas Valley Open Space Preserve, Pacheco Valle and Loma Verde and also east of Roy's Redwoods. Located between Big Rock Ridge in the northeast and Lucas Valley Road in the southwest.

Elevation Range: 200' - 1800'

Vegetation: Coast live oak, madrone, California bay, willow, valley oak, mesic chaparral, chamise, Eastwood manzanita, coyote brush, California sagebrush, grasslands (on and off serpentine) ,and bracken fern are found in this Preserve.

Hydrology: Miller Creek and 4 of its tributaries run through this Open Space Preserve.

Baltimore Canyon, King Mountain, Blithedale Summit and Camino Alto Open Space Preserves



Location: Baltimore Canyon Open Space Preserve is located southwest of the town of Kentfield. Windy Ridge and Blithedale Ridge form some of the western boundary, and Knob Hill is located just outside the Open Space Preserve.

Blithedale Summit Open Space Preserve is located northeast of Mill Valley and west of the towns of Corte Madera and Larkspur and south of Baltimore Canyon and King Mountain Open Space Preserves. It contains Blithedale Ridge in the west and Corte Madera Ridge in the eastern part of the Preserve.

Camino Alto Open Space Preserve shares part of its western boundary with Blithedale Summit Ridge Open Space Preserve. It is located southwest of the town of Corte Madera and northeast of Mill Valley and Corte Madera Ridge runs through the Preserve.

King Mountain Open Space Preserve is broken into several small pieces. The largest piece is located south of Baltimore Canyon and north of Blithedale Summit Open Space Preserves, and shares boundaries with each. The other smaller pieces are located north of Larkspur and south and east of King Mountain. These smaller pieces of King Mountain Open Space Preserve are not adjacent to any other Open Space Preserves in the study area.

Elevation Range: Baltimore Canyon 200' – 1200'
King Mountain 150' – 700'
Blithedale Summit 100' – 1000'
Camino Alto 150' – 700'

Vegetation: Coast live oak, madrone, California bay, canyon live oak, interior live oak, coast redwood, Douglas-fir, chamise, Eastwood manzanita, broom, coyote brush and off serpentine grasses occur in these Preserves.

Hydrology: Arroyo Corte Madera del Presidio Creek is located on Blithedale Summit's west boundary and runs through King Mountain Open Space Preserve and ends in Baltimore Canyon. Larkspur Creek is located on Blithedale Summit's northern boundary and also runs through King Mountain and Baltimore Canyon Open Space Preserves. Warner Creek is located in Blithedale Summit Open Space Preserve. There are no major creeks in Camino Alto Open Space Preserve.

Deer Island Open Space Preserve



Location: Deer Island is located southeast Novato and east of Highway 101. Rush Creek Open Space Preserve is located north of Deer Island Open Space Preserve.

Elevation Range: sea level (0') – 200'

Vegetation: California bay, valley oak, coyote brush, sedge, rush, wet graminoids, off serpentine grasses and estuarine marsh are found on this Preserve.

Hydrology: Novato Creek is located just outside the Preserve boundary on the west. Deer Island Channel Creek runs along the western edge of the Open Space Preserve.

Indian Valley, Ignacio Valley, Loma Verde and Pacheco Valle Open Space Preserves



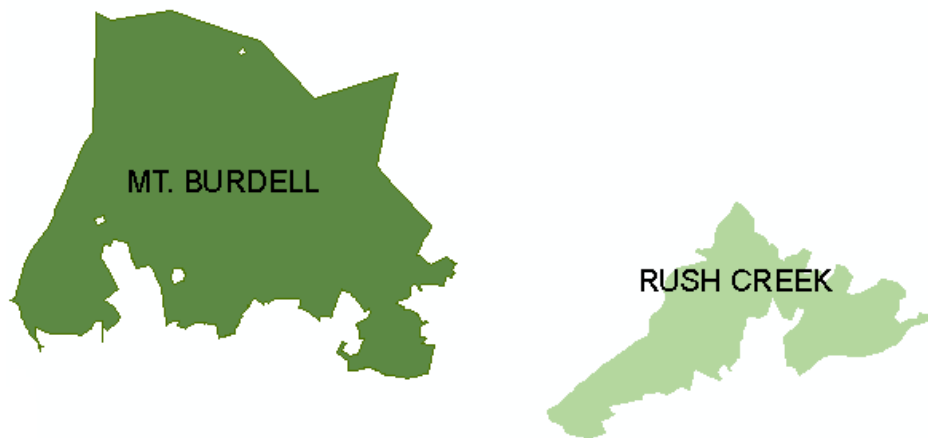
Location: Lucas Valley Open Space Preserve is located SW of this group of Open Space Preserves and shares a small boundary with Ignacio Valley Open Space Preserve. These Preserves are south of Novato Valley and north of Gallinas Valley. Big Rock Ridge is located to the west and Highway 101 is located on the east of these Open Space Preserves.

Elevation Range: Indian Valley 100' – 1100'
Ignacio Valley 150' – 1375'
Pacheco Valle 100' – 1300'
Loma Verde 150' – 650'

Vegetation: Coast live oak, California bay, madrone, valley oak, chamise, Eastwood manzanita, coyote brush, grasslands (off serpentine) and bracken fern are found on these Preserves.

Hydrology: Pacheco Creek runs through the Pacheco Valle Open Space Preserve. Arroyo de San Jose Creek and two unnamed creeks run through the Ignacio Valley Open Space Preserve. Arroyo Avichi South Fork and one unnamed creek run through Indian Valley Open Space Preserve and Arroyo Avichi Creek runs along the northern boundary of Indian Valley. There are no major creeks in Loma Verde Open Space Preserve.

Mt. Burdell and Rush Creek Open Space Preserves



Location: Mt. Burdell Open Space Preserve is located north of Novato Valley and west of Highway 101. Burdell Mountain is in the northeast corner of the Preserve. Rush Creek

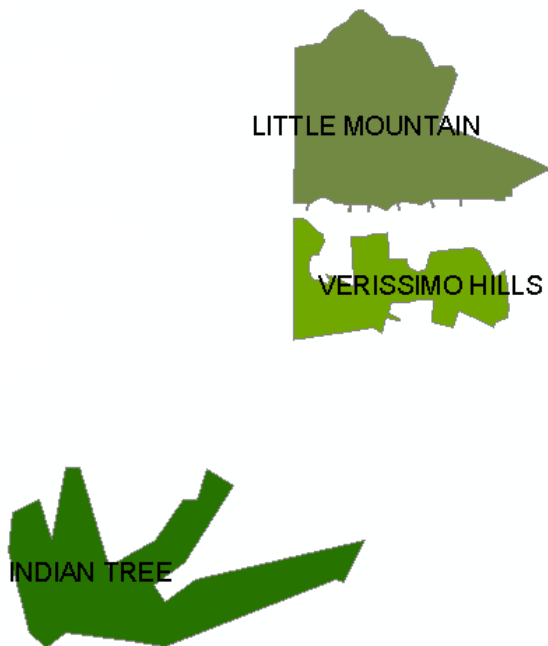
Rush Creek is across Highway 101, southeast of Mt. Burdell Open Space Preserve and southwest of where the Petaluma River enters San Pablo Bay.

Elevation Range: Mt. Burdell 125' – 1500'
Rush Creek 100' – 300'

Vegetation: Coast live oak, California bay, willow, valley oak, blue oak-white oak hybrids, coyote brush, sedge, wet graminoid, rush, grasslands (on and off serpentine) and estuarine marsh are found in this Preserve.

Hydrology: Rush Creek runs along a small portion of the northern boundary of Rush Creek Open Space Preserve and continues just north of the boundary. Mt. Burdell contains 2 small unnamed creeks and several that occur just outside of the Open Space Preserve boundary.

Little Mountain, Verissimo Hills and Indian Tree Open Space Preserves



Location: Indian Tree Open Space Preserve is located southeast of Stafford Lake County Park, and is southwest of Little Mountain and Verissimo Hills Open Space Preserves.

Little Mountain and Verissimo Hills Open Space Preserves are located east of Stafford Lake County Park and west of Novato Valley.

Elevation: Indian Tree 500' – 1400'
Verissimo Hills 250' – 525'
Little Mountain 175' – 800'

Vegetation: California bay, madrone, coast live oak, coast redwood, Douglas-fir, valley oak, non-serpentine chamise, Eastwood manzanita, coyote brush, non-serpentine grasslands and bracken fern occur in the Indian Tree Open Space Preserve.

California bay, coast live oak, valley oak and coyote brush occur in Verissimo Hills Open Space Preserve.

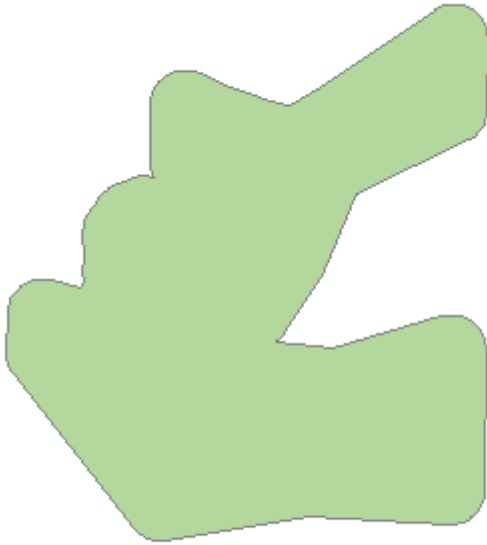
California bay, coast live oak, mixed willow, valley oak and coyote brush, *scirpus spp.*, sedge-rush-graminoids, non-serpentine grasslands, bracken fern and eucalyptus occur in Little Mountain Open Space Preserve.

Hydrology: Vineyard Creek and one unnamed creek are located in of Indian Tree Open Space Preserve.

Novato Creek runs along the northern boundary of Little Mountain Open Space Preserve.

There are no major creeks in Verissimo Hills Open Space Preserve.

Stafford Lake County Park



Location: Located south of Novato Blvd and west of Stafford Lake in Novato. Little Mountain and Verissimo Hills Open Space Preserve are east and Indian Tree Open Space Preserve is southeast of this Park.

Elevation Range: 200' – 600'

Vegetation: California bay, coast live oak, willow, coyote brush, cattail, bulrush and other *scirpus* spp., meadow and non-serpentine grasslands occur in the Park.

Hydrology: Novato Creek runs through Stafford Lake County Park and Stafford Lake is next to the Park.

Alto Bowl and Horse Hill Open Space Preserves



Location: Alto Bowl and Horse Hill Open Space Preserves are located south of the town of Corte Madera and east of Camino Alto and west of Tiburon Ridge Open Space Preserves.

Elevation Range: 50' – 425'

Vegetation: Coast live oak, California bay, madrone, broom, coyote brush and grasses (off serpentine) occur in these open Space Preserves.

Hydrology: Alto Bowl has Sutton Manor Creek running through it.

Tiburon Ridge and Ring Mountain Open Space Preserves



Location: Tiburon Ridge Open Space Preserve is east of Horse Hill and Alto Bowl Open Space Preserves and Highway 101. Ring Mountain Open Space Preserve is located east of Tiburon Ridge Open Space Preserve, and south of Paradise Drive. Both preserves are part of the Tiburon Peninsula.

Elevation Range: Tiburon Ridge 200' – 350'
Ring Mountain 50' –600'

Vegetation: Coast live oak, California bay, valley oak, broom, coyote brush, native grass and grasses (on and off serpentine) are found in these Preserves. Ring Mountain contains most of the serpentine grasses.

Hydrology: Tiburon Ridge Open Space Preserve had no major creeks; Ring Mountain Open Space Preserve has East Creek, West Creek and 3 other unnamed creeks.

Old St. Hilary's Open Space Preserve



Location: Old St. Hilary's Open Space Preserve is located on the Tiburon Peninsula east of Tiburon Blvd. in Belvedere on a strip of land between San Francisco Bay in the east and Richardson Bay in the west.

Elevation Range: 50' – 600'

Vegetation: Vegetation here is predominantly grasslands. There is serpentine on this Open Space Preserve so there are serpentine and non-serpentine grasslands. Coast live oak, California bay, willow, broom and coyote brush are also found on this Open Space Preserve.

Hydrology: Two unnamed creeks are present in Old St. Hilary's Open Space Preserve.

DESCRIPTIONS OF THE MARIN COUNTY OPEN SPACE VEGETATION MAPPING TYPES

1101 –Lower elevation Mixed Broadleaf Woodland Trending Xeric – Coast Live Oak, Madrone, Black or Oregon Oak dominate. (At least two species co-dominate)

NVCS Alliance:

Coast Live Oak, Madrone, Black Oak, Oregon Oak

Distribution:

Common throughout the drier portions of the mapping area, polygons vary in size considerably. Most common in the Indian Tree, Indian Valley, Ignacio Valley, Pacheco Valle, Loma Verde, Cascade Canyon and to a lesser extend Blithedale Summit and King Valley Preserves. Also noted frequently on the San Pedro Mountain Preserve.

Environmental Characteristics:

Trending in xeric settings in areas of deep soil; primarily mapped on mid and upper trending southeast or westerly slopes

Description:

A mapping unit combining several alliances within the California and Vancouverian mixed evergreen broadleaf forests and woodlands groups: Finer levels at this time cannot be separated out by photo interpreters but may be described later with subsequent field data and analysis. Stands are quite extensive in size. At least two hardwood species are present as a dominant or co-dominant in the stand. Coast live oak and madrone are the most frequently occurring examples of co-dominance in the mapping area. Black oak and madrone occasionally have been noted to co-dominate over small areas but not frequently. Small patches of Oregon oak have been observed in the field but are extremely difficult to map occasionally occur within this mapping unit.

Photo Interpretation Signature:

Coast live oak tends to yield a dark green signature with madrone giving off a light gray to green signature (highly variable) but with a very distinctive texture. Black oak and Oregon oak are indistinguishable on the imagery.

1102 – Tanoak – California Bay – (Canyon Oak) Higher elevation Mixed Forest

NVCS Alliance:

Tanoak, California Bay

Distribution:

Rare in the mapping area; several polygons along the edges of the study in the Baltimore Canyon Preserve

Environmental Characteristics:

Mapped in higher elevations generally in sub mesic to mesic settings

Description:

A mapping unit combining possibly two alliances within the California and Vancouverian mixed evergreen broadleaf forests and woodlands groups: Finer levels at this time cannot be separated out by photo interpreters but may be described later with subsequent field data and analysis. Tanoak or California bay dominate or co-dominate the stand generally in a forest setting. Canyon oak may be a subordinate or rarely co-dominate at higher elevations in drier settings.

Photo Interpretation Signature:

Varying degrees of tanoak death provide openings to the crown yielding a dark shadowy signature with variable gray shades mixing with the lighter green of the bay.

1103 – California Bay – Alder – Bigleaf Maple – Mixed Willow Riparian Forest

NVCS Alliance:

California Bay, White Alder, Bigleaf Maple

Distribution:

Uncommon in the mapping area – approximately twenty polygons mapped in Cascade Canyon, Terra Linda / Sleepy Hollow Divide, and the Lucas and Ignacio Valley Preserves

Environmental Characteristics:

Found in perennial watersheds very close to the water's edge.

Description:

A mapping unit combining possibly several alliances within the California mixed evergreen broadleaf forests and woodlands group and the Vancouverian riparian deciduous forest group: Finer levels at this time cannot be separated out by photo interpreters but may be described later with subsequent field data and analysis. California bay is nearly always present as a dominant, co-dominate or subordinate to any of the riparian trees noted above including big leaf maple, white alder and willow species.

Photo Interpretation Signature:

Bigleaf maple gives off a green to blue-green signature and is distinct as a narrow band adjacent to upland hardwoods. Alders tend to have a regularly occurring stipple-like crown texture when noted over larger areas.

1104 – Madrone – California Bay – (Tanoak) Forest

***Note: - AIS proposes adding a type to the mapping area defined as follows:**

Madrone – California Bay – (Coast Live Oak) Forest and renumbering the code to 1105 after final mapping is complete. (See field data collected by Jeff Kennedy also to possibly substantiate this) – AIS proposes that this effort be undertaken after the floristic classification and keys are complete.

NVCS Alliance:

Madrone, California Bay

Distribution:

Very common in the mapping area, especially in the San Pedro Mountain Preserve and to lesser extents King Mountain, Blithedale Summit, French Ranch, Roy's Redwoods, Cascade Canyon, and in open space areas south of the Lucas Valley Preserve.

Environmental Characteristics:

Often adjacent to type 1101 (usually down slope) on somewhat more mesic settings usually trending north or east. Found in most preserves in the central part of the study and Baltimore Canyon and Blithedale Summit.

Description:

A mapping unit combining possibly two alliances within the California and Vancouverian mixed evergreen broadleaf forests and woodlands groups: Finer levels at this time cannot be separated out by photo interpreters but may be described later with subsequent field data and analysis. On the MCOSD, madrone generally dominates in forest-like settings with California bay an important subordinate and at times a co-dominant species. Coast live oak is often a minor component to the forest canopy. Tanoak was not noted in this type. This type primarily differs from type 1101 because of the presence of California bay.

Photo Interpretation Signature:

Madrone gives of a generally light gray to light green signature with a distinctive repeating crown texture when strongly dominant in the canopy. In this type, California bay appears light green with a variable crown. Bay yields a very distinct green color on the NAIP imagery adjacent to other hardwoods.

1110 – California Bay Alliance

NVCS Alliance:

California Bay

California bay is generally mapped below alliance level which may later be defined to finer units by subsequent field data. This type is only used when the bay mixes with another type of vegetation that can't be placed in an existing mapping unit.

1111 – California Bay Pure Stands

NVCS Alliance:
California Bay

Distribution:
Common throughout the study area, especially in the western portions of the Lucas Valley Preserve and the open space lands to the south; also frequent in Indian Valley Preserve and west of it on adjoining open space lands

Environmental Characteristics:
Found in concave or riparian settings

Description:
A sub alliance mapping unit denoting pure and near pure stands of California bay where bay consists of at least 90% relative cover in a dense canopy. Subsequent field data may define this mapping unit to finer levels in the classification.

Photo Interpretation Signature:
Generally narrow crowns close together, light to medium green

1112 – California Bay – Buckeye

NVCS Alliance:
California Bay

This type is very rare in the MCOSD study area and mapped based on plot data.

1113 – California Bay – Interior Oak

NVCS Alliance:
California Bay, Interior Live Oak

Distribution:
Uncommon; localized strongly in the open space lands south of the Indian Tree Preserve

Environmental Characteristics:
Transitions between the mixed hardwood and chaparral stands – often noted in narrow bands adjacent to both

Description:
May be defined within the more general Californian evergreen broadleaf forest and woodland group or as a mapping unit within either the California bay or interior oak alliance. Both species are either co-dominant or an important subordinate to the other; California bay is a slight emergent to the shrubby interior oak. Mapped where both species contains at least 10% cover. Most stands are quite dense with little herbaceous understory.

Photo Interpretation Signature:
Light gray-green to green. Mottled texture depending on the composition and arrangement of both species (California bay and interior oak)

1114 – California Bay – Canyon Oak

NVCS Alliance:

California Bay, Canyon Live Oak

Distribution:

Rare – localized along the highest coves in the open space north of the Lucas Valley Preserve along the western edges of the mapping area.

Environmental Characteristics:

Steeper protected upper slopes trending neutral to concave

Description:

A mapping unit within either the California bay or canyon oak alliances: Both hardwoods co-dominate or are an important subordinate species, generally in dense woodland or forest settings.

Photo Interpretation Signature:

Rounded crowns of the canyon oak contrast to the narrow crowns of the California bay in this setting, canyon oak tends to be less bright green than coast live oak.

1115 – California Bay – Coast Live Oak

NVCS Alliance:

California Bay, Coast Live Oak

Distribution:

One of the most common types throughout the mapping area, noted on all properties and adjacent open space lands; more common in the west. Polygons are generally small to medium in size.

Environmental Characteristics:

Low elevations in minor watersheds and concavities

Description:

A mapping unit within either the California bay or coast live oak alliances: Both species co-dominate or are an important subordinate species in moderately dense to dense settings generally with an understory of annual grasses and forbs. This may contain a low amount of valley oak, but not enough to code as 232 (coast live oak – valley oak).

Photo Interpretation Signature:

Narrow crowns of the California bay and broad crowns of the coast live oak contrast well; generally coast live oak giving off a darker green signature.

1116 – California Bay – Tanoak

NVCS Alliance:
California Bay, Tanoak

Distribution:
Very rare in study area, but found in Gary Giacomini on the boundary with MMWD

Environmental Characteristics:
Located on steep slopes generally trending northeast often adjacent to redwood forest. Tanoak death is severe especially on the Bolinas ridge on MMWD property.

Description:
Both species co-dominate or are important subordinate species often with a sparse redwood emergent canopy of less than 10%. Stand densities can be spares because of tanoak death from SOD.

Photo Interpretation Signature:
Both species have narrow crowns with tanoak generally the lighter green. Open canopy from tanoak deaths are noted in these stands.

1140 – Tanoak Alliance

NVCS Alliance:
Tanoak

This is very rare and is only mapped based on plot data. The only polygon mapped is in Gary Giacomini Preserve.

1160 – Pacific Madrone Alliance

NVCS Alliance:
Pacific Madrone

Distribution:
Common but concentrated on the slopes in the Ignacio Valley Preserve; scattered elsewhere.

Environmental Characteristics:
Found on spurs, upper slopes and ridgelines almost exclusively.

Description:
Madrone usually makes up the sole dominant in the canopy, generally over 90% relative cover in dense stands. Subsequent field data and analysis may refine these stands to finer levels within the madrone alliance.

Photo Interpretation Signature:
Light gray to green color of the madrone stands out when the trees are in the visible canopy layer, often with a very distinctive texture; photo interpreters generally have difficulty in pulling out madrone when the canopy component falls below 10%. Dense pure stands are easiest to recognize.

1170 – Canyon Oak Alliance

NVCS Alliance:
Canyon Live Oak

Canyon live oak is rare in mapping area, with small polygons mapped in western portions of the study either as dominant stands or with California bay. Large rounded crown of the canyon oak is typical in more open settings and is not as dark green as coast live oak.

Sometimes there is confusion with multiple crowning or younger trees with chinquapin stands in similar settings (MMWD property). Canyon oak is extremely difficult to distinguish in mixed hardwood stands where it is not a dominant. This type is primarily mapped based on plot data and field recon notes.

1180 – Giant Chinquapin Alliance

NVCS Alliance:
Giant Chinquapin

Giant chinquapin is rare in the study area. It takes on a number of different growth forms which often yield a variety of signatures on the imagery. In chaparral settings it is extremely difficult to distinguish from adjacent manzanita; in tree settings, crowns are extremely narrow forming tight clones which can be confused as the crown of one larger tree. Several plots were taken in giant chinquapin, but the signature could not be extrapolated across the study area.

1201 – Planted Stands of Pine

NVCS Alliance:
Not Applicable (NA)

This type is very rare in the study area. One polygon (Bishop pine) mapped based on field data.

1210 – Redwood Alliance

NVCS Alliance:
Coast Redwood

Rarely mapped; used as a back off code for coast redwood.

1211 – Redwood / Tanoak

NVCS Alliance:

Coast Redwood – Tanoak Alliance

Distribution:

Rare; mapped in the western portions of Gary Giacomini Preserve, much more common on MMWD property.

Environmental Characteristics:

Protected slopes generally trending north and east

Description:

May be defined below the alliance level (under the coast redwood alliance) or as a mapping unit containing both the coast redwood and tanoak alliances. Coast redwood and tanoak generally co-dominate, with redwood often a tall emergent to tanoak; crown canopy may be open due to tanoak death.

Photo Interpretation Signature:

Tanoaks often yield a yellow to yellow-green signature; crowns are often narrow in pure stands. Coast redwood has a larger crown and appears emergent to the adjacent tanoak.

1212 – Redwood – Douglas-fir(/ Mixed Hardwoods)

NVCS Alliance:

Coast Redwood, Douglas-fir

Distribution:

Common in the western portions of Gary Giacomini Preserve

Environmental Characteristics:

Mapped in settings slightly more xeric than pure stands of redwood; generally upslope and out of immediate drainages from pure redwood.

Description:

Possibly defined as a dual-species alliance or mapped as a multiple alliance mapping unit containing the coast redwood and Douglas-fir alliances. Both conifer species co-dominate or either is an important subordinate to the other with at least 20-30% relative cover. Hardwoods such as California bay, madrone or tanoak are generally present with up to 30-40% relative cover to conifers.

Photo Interpretation Signature:

Dark blue-green signature of the Douglas-fir contrasts with lighter greens of the coast redwood; older stands are more difficult to separate out the two species. Canopies of younger trees are distinct, with Douglas-fir generally spreading branches out at an earlier age.

1213 – Redwood / Chinquapin

NVCS Alliance:

Coast Redwood

Only mapped based on field crew findings. Chinquapin is difficult to ID on imagery.

1214 – Redwood /California Bay

NVCS Alliance:
Coast Redwood

Distribution:
Fairly common in the open space west of the Indian Valley Preserve and in the Blithedale and Baltimore Canyon Preserves. Also noted in small stands on the San Pedro Mountain Preserve

Environmental Characteristics:
Upper riparian settings and small coves

Description:
A sub alliance mapping unit within the coast redwood alliance – coast redwood is an emergent to an understory of California bay with at least 10% conifer cover. In most cases, redwood occurs in a dense canopy with bay an understory component.

Photo Interpretation Signature:
In this type, redwoods are often younger and have a narrower crown. Associated California bay is also narrow crowned but with a brighter green signature.

1215 – Redwood – Pure Stands

NVCS Alliance:
Coast Redwood

Distribution:
Rare in the mapping area, noted most frequently in the Baltimore Canyon Preserve

Environmental Characteristics:
Generally in riparian settings; occasionally in upper coves above drainages in protected settings

Description:
Redwood strong dominant generally over 90% relative cover in dense very young stands, often adjacent to California bay and interior oak. Subsequent field work and analysis may define these stands into finer levels in the classification.

Photo Interpretation Signature:
Young narrow crowns that are often very close together with very definitive clonal edges characterize this type.

1216 – Redwood – Upland Mixed Hardwoods

NVCS Alliance:

Coast Redwood

Distribution:

Uncommon in the mapping area, most stands were mapped on the Baltimore Canyon Preserve.

Environmental Characteristics:

Generally found on north trending slopes either on foggy ridgelines or protected lower slopes adjacent to riparian communities.

Description:

A mapping unit within the coast redwood alliance: Highly variable with coast redwood at least 10% emergent cover to mixed hardwoods; coast redwood is often a dominant overstory with hardwoods making a second understory tree layer. Mapped where hardwood component is not distinguishable to finer species level or where at least two hardwoods co-dominate in the understory. Subsequent field data and analysis may define several types to finer levels within national vegetation classification (NVCS).

Photo Interpretation Signature:

Redwoods often obscure the understory hardwood cover; however when hardwoods are visible they are often broader crowned. Openings in the canopy are often the result of tanoak death.

1217 – Redwood – Riparian

NVCS Alliance:

Coast Redwood

Distribution:

Rare in the mapping area; stands primarily mapped in Baltimore Canyon, Gary Giacomini and adjacent to the Indian Tree Preserve.

Environmental Characteristics:

Generally mapped in major perennial watersheds adjacent to redwood mixed hardwood stands

Description:

A mapping unit within the coast redwood alliance: Redwoods are emergent to understory riparian hardwoods, often with a California bay component to the hardwood layer. Generally bigleaf maple or white alder are the most common riparian components. Subsequent field data and analysis may define several riparian types into finer levels within the NVCS.

Photo Interpretation Signature:

Riparian element inferred in redwood settings along major drainages, however, maple is often visible with a dark blue-green crown.

1218 – Redwood - Madrone

NVCS Alliance:
Coast Redwood

Rarely mapped based on field crew findings. Difficult to map based on difficulty to ID young coast redwood.

1220 – Douglas-fir Alliance

NVCS Alliance:
Douglas-fir

Rarely mapped; reserved for Douglas-fir mixing with species that don't fit into any existing mapping unit.

1221 – Douglas-fir – Mixed Hardwoods in Drier Woodland Settings

NVCS Alliance:
Douglas-fir

Distribution:
Mapped almost exclusively in the Gary Giacomini, French and Cascade Canyon Preserves

Environmental Characteristics:
The lowest elevation and most xeric conifer-mixed hardwoods type; generally located adjacent to oak woodlands and savannas in slightly more mesic settings.

Description:
A mapping unit described within the Douglas-fir alliance: Douglas-fir is a sparse (at least 10% cover) to moderate emergent over a xeric evergreen broadleaf woodland generally composed of coast live oak with some bay, madrone and black oak. This type differs from 1223 in that there is not as much bay present and there is also madrone and black oak in this type. Subsequent field data and analysis may define several finer types within the NVCS.

Photo Interpretation Signature:
Douglas-fir easily separable from adjacent hardwoods even as a sparse emergent with its dark blue conical crown. Dry annual grasses often visible towards the edges or immediately adjacent to the stand.

1222 – Douglas-fir – Mixed Hardwoods in Upland Forest Settings

NVCS Alliance:
Douglas-fir

Distribution:
Much less common than type 1221 and mapped exclusively in French Ranch and the western most portions of the Gary Giacomini Preserve.

Environmental Characteristics:
This type is best suited to slopes trending north over extensive areas such as the Rocky and Bolinas ridge.

Description:
A mapping unit described within the Douglas-fir alliance: Douglas-fir is a sparse (at least 10% cover) to dense emergent conifer over a mixed hardwood component typical of higher or more mesic settings. Hardwoods that make up the understory include canyon oak and/or tanoak with California bay and madrone often an important component. Distinguished from type 1221 by the absence of coast live oak and presence of tanoak or canyon oak. Subsequent field data and analysis may define several finer types within the NVCS.

Photo Interpretation Signature:
Difficult to distinguish from type 1221; photo interpreters infer this type by the absence of coast live oak, elevation and adjacent vegetation. Presence of tanoak or canopy openings where tanoak has died back help in classifying to this type

1223 – Douglas-fir – California Bay

NVCS Alliance:
Douglas-fir

Distribution:
Found almost exclusively on the French Ranch and Gary Giacomini Preserves

Environmental Characteristics:
Mapped in slightly more mesic settings than type 1222; generally in concavities and near riparian areas.

Description:
Currently defined as a mapping unit within the Douglas-fir Alliance: Emergent Douglas-fir (at least 10% cover) of varying densities over a generally dense canopy of hardwoods, strongly dominated by California bay. Several stands may have a minor component of coast live oak.

Photo Interpretation Signature:
Similar to type 1222 – however narrow crowns of the bay may aid in separating out this finer level type. Generally in smaller stands than type 1222.

1224 – Douglas-fir – Tanoak

NVCS Alliance:
Douglas-fir

Distribution:
Few stands mapped in the Gary Giacomini Preserve; more frequent on MMWD property.

Environmental Characteristics:
Not established on MCOSD properties.

Description:
May be defined to a multiple species alliance (Douglas-fir-tanoak) or to finer levels in the NVCS – plot data and field analysis on the MMWD property should aid in defining this type. Mapped where Douglas-fir is a co-dominant with tanoak or where either species dominates.

Photo Interpretation Signature:
Dark blue-green signature of the Douglas-fir with hardwoods that have some die off from SOD.

1226 – Douglas-fir Pure Stands

NVCS Alliance:
Douglas-fir

Distribution:
Rare- only small stands mapped in Roy's Redwoods French Canyon and Gary Giacomini Preserves

Environmental Characteristics:
Not established on MCOSD properties

Description:
A mapping unit defined within the Douglas-fir alliance: On MCOSD properties, noted in dense even-age stands.

Photo Interpretation Signature:
Dark blue-green signature with minimal variability in texture across the stand

1227 – Douglas-fir – California Bay / Interior Oak

NVCS Alliance:
Douglas-fir

Distribution:
Rare in the mapping area, mapped adjacent to MMWD property where it occurs more frequently

Environmental Characteristics:
Located in rather xeric settings between Douglas-fir – mixed hardwood communities and stands of chaparral

Description:
A mapping unit described within the Douglas-fir alliance. Douglas-fir is generally a sparse emergent (at least 5-10%) to a mix of California bay and dense interior oak chaparral. Stands may contain little bay but usually have a lot of shrubby interior oak. Subsequent field data and analysis (Including plot data from adjacent MMWD lands) may help in refining this mapping unit to a finer level in the NVCS.

Photo Interpretation Signature:
Three main life form components (tall emergent conifer, hardwoods and chaparral) make this type unique as a composite of several signatures within the stand.

1231 – Bishop Pine / Eastwood Manzanita

NVCS Alliance:
Bishop Pine

One small polygon mapped adjacent to MMWD lands

1240 – Sargent Cypress Alliance

NVCS Alliance:
Sargent Cypress

Not very common in the study area. Mapped where Sargent Cypress dominates.

1241 – Sargent Cypress / Mt. Tamalpais Manzanita

NVCS Alliance:

Sargent Cypress

Distribution:

Rare in the mapping area; found exclusively on the southern portions of Gary Giacomini Preserve adjacent to MMWD property.

Environmental Characteristics:

On serpentine derived ultramafic soils possibly on less xeric settings than pure serpentine chaparral

Description:

A mapping unit defined within the Sargent cypress alliance: Sargent Cypress is usually a sparse (at least 5-10% cover) conifer overstory over a sparse layer of serpentine chaparral composed primarily of Mt. Tamalpais manzanita.

Photo Interpretation Signature:

Sargent cypress gives off a very light gray-green signature; crowns are highly variable and irregularly shaped; understory manzanita yields a dark gray signature. Very little greenness is noted in the signature overall.

1242 – Sargent Cypress Pure Stands

NVCS Alliance:

Sargent Cypress

Distribution:

Even less common than type 1241; found in the same region. More common on adjacent MMWD property

Environmental Characteristics:

On serpentine derived ultramafic soils in relatively mesic settings for serpentine types.

Description:

A mapping unit defined within the Sargent cypress alliance: Sargent cypress is the dominant conifer found in sparse to fairly dense woodland settings containing at least 5-10% cover; California bay may be a minor hardwood component; understory shrub and herb layer is generally sparse.

Photo Interpretation Signature:

Similar to type 1241 without the understory manzanita signature

1310 – Mixed Willow

NVCS Alliance:

Several willow types possible

Distribution:

Uncommon, scattered throughout most properties in the mapping area, polygons are generally very small and narrow.

Environmental Characteristics:

Found in seasonal to permanently flooded areas along streams or on perimeters of small farm ponds or reservoirs.

Description:

A mapping unit describing possibly several alliances where any number of willow species can dominate. Arroyo willow is usually the dominant species in the stand; other tree or shrub willow species may be a component. Emergent wetland species such as cattail or bulrush can occur in small patches within the stand. Subsequent field data and analysis defining the specific willow species may refine this mapping unit to a finer level in the NVCS.

Photo Interpretation Signature:

Generally light green; edges of stand are often distinct and abruptly change to an upland type.

1410 – Black Oak Alliance

NVCS Alliance:

Black Oak

Distribution:

Rare as mappable stands in the study area. Several small areas mapped on the Rush Creek Preserve in the northeastern portion of the mapping area and Indian Valley Preserve.

Environmental Characteristics:

Upper slopes and spurs in areas of well developed soil.

Description:

Black oak dominates the stand often with a minor component of coast live oak California bay or Pacific madrone. Understory is generally composed of annual grasses.

Photo Interpretation Signature:

Black oak has a lighter green signature than coast live oak. Within the mapping area, stands are often too small to distinguish. Black oak is also indistinguishable from Oregon oak.

2000 - Woodlands

NVCS Alliance:

NA

Only one polygon mapped as a back off.

2100 – Xeric Sclerophyll Evergreen Forests & Woodlands

NVCS Alliance:
NA

Only one polygon mapped as a back off.

2110 – Coast Live Oak Alliance

NVCS Alliance:
Coast Live Oak

Distribution:
Abundant in all areas except Gary Giacomini and Rush Creek Preserves, polygon configuration and size varies considerably.

Environmental Characteristics:
Coast live oak can be found in the lower elevations on gentle or moderate slopes in drier environments, often in an open woodland or grassy setting. Also noted occasionally on steeper upper slopes in slightly more mesic settings.

Description:
Coast live oak is usually the dominant species in large, dense stands. Other hardwood species can be a minor component to the canopy; usually Pacific madrone.

Photo Interpretation Signature:
Coast live oak trees appear to be a dark green color, with broad crowns with a lumpy texture in woodland settings of varying cover.

2111 – Coast Live Oak / (Grass-Poison Oak)

NVCS Alliance:
Coast Live Oak

Distribution:
Common throughout the drier regions of the mapping area; but most extensive in the northeastern third of the mapping area

Environmental Characteristics:
Found on gently rolling topography on a variety of slopes.

Description:
A mapping unit described under the coast live oak alliance: Coast live oak is strongly dominates the canopy in a sparse to moderately dense setting with at least 10% cover; annual grasses and forbs dominate the understory; denser stands often have poison oak adjacent to small rocky outcroppings.

Photo Interpretation Signature:
Coast live oak trees appear to be a dark green color, with broad crowns in a uniform canopy over open areas of tan or brown colored shrubs and/or grass.

2112 – Coast Live Oak – Riparian

NVCS Alliance:
Coast Live Oak

Rarely mapped, only found in Lucas Valley.

2113 – Coast Live Oak – Douglas-fir

NVCS Alliance:
Coast Live Oak

Distribution:
Uncommon and localized mainly to Gary Giacomini Preserve

Environmental Characteristics:
Lower elevations in somewhat protected settings

Description:
A mapping unit defined under the coast live oak alliance. Douglas-fir is generally a sparse emergent (usually below 15% but not less than 5-10%) to dense stands of coast live oak. Subsequent field data and analysis may aid in further refining this mapping unit to a finer level in the NVCS.

Photo Interpretation Signature:
Emergent Douglas-fir shows with a conical to star-shaped crown to the dark green rounded crowns of the coast live oak.

2210 – Oregon Oak Alliance

NVCS Alliance:
Oregon Oak

Distribution:
Rare as mapped stands; primarily mapped in Cascade Canyon

Environmental Characteristics:
Probably most likely found on gentle mid and upper slopes adjacent to more common mixed hardwood types.

Description:
Oregon oak dominates the stand with important associates including coast live oak and black oak, generally in a dense woodland setting. Mapped based on plot data only. See notes below.

Photo Interpretation Signature:
On the MCOSD properties, this species cannot at the time be reliably mapped except through field data. No unique photo signature has been identified for this species.

2220 – California Buckeye Alliance

NVCS Alliance:
California Buckeye

Distribution:
Rare as mappable stands in the study area. Most stands were mapped in Mt. Burdell preserve.

Environmental Characteristics:
Steep rocky side-slopes or grassy edges to oak woodland stands.

Description
California buckeye dominates the stand in sparse settings of at least 10% cover often with a sparse understory of shrubs and grasses.

Photo Interpretation Signature:
Buckeye appears light green on the imagery – too early in the season for signs of drought stress.

2230 – Valley Oak Alliance

NVCS Alliance:
Valley Oak

Rarely mapped, but used as a back off code.

2231 – Valley Oak Riparian

NVCS Alliance:
Valley Oak

Distribution:
Uncommon, best developed stands have been mapped along the northern boundary of Gary Giacomini Preserve.

Environmental Characteristics:
Riparian settings along major perennial stream courses; often on drier fringes of the floodplain

Description:
A mapping unit within the valley oak alliance: Valley oak usually dominates or shares dominance with a number of other riparian hardwood species including white alder, big leaf maple, California bay and buckeye in a dense woodland to forest setting. Subsequent field efforts and analysis may refine this mapping unit to a finer level in the NVCS.

Photo Interpretation Signature:
Mapped stands have a highly variable signature due to the presence of a number of species within a small area; usually quite narrow.

2232 – Valley Oak – Coast Live Oak

NVCS Alliance:
Valley Oak

Distribution:
Very common in the eastern portions of the study area including the Terra Linda and Sleepy Hollow Preserves and areas north to Mt. Burdell.

Environmental Characteristics:
Found on lower slopes and adjacent flatter portions of the mapping area along the fringes of denser coast live oak woodlands.

Description:
A dual-alliance level mapping unit (valley and coast live oak alliances): Valley oak or coast live oak dominates a sparse to moderately dense woodland setting of at least 10% cover generally over annual grasses and forbs. Subsequent field efforts and analysis may refine this mapping unit to a finer level in the NVCS. Plot data indicates that a California bay component may occur.

Photo Interpretation Signature:
Valley oaks generally give off a somewhat lighter green signature than adjacent coast live oak. Individual crown appear at times to be a bit more open.

2233 – Valley Oak / Grass

NVCS Alliance:
Valley Oak

Distribution:
Uncommon; found along the eastern most portions of the Terra Linda – Sleepy Hollow Preserves in addition to the Mt. Burdell and Rush Creek Preserves.

Environmental Characteristics:
Found in similar settings to type 2232; often on the fringes of coast live oak woodland.

Description:
A sub alliance level mapping unit described within the valley oak alliance: Valley oak dominates the canopy in an open setting with at least 10% cover. Understory annual grasses and forbs dominate.

Photo Interpretation Signature:
Large relatively open crowns with a lighter green color distinguish this from the closely associated coast live oak.

2240 – Blue Oak Alliance

NVCS Alliance:
Blue Oak

Only one polygon mapped to the blue oak alliance and it is based on field crew notes.

2241 – Blue Oak – White Oak (Valley Oak or Oregon Oak) Hybrids

NVCS Alliance:
Blue Oak

Distribution:
Mapped exclusively on the Rush Creek Preserve

Environmental Characteristics:
Mapped on moderate to steep southerly trending mid and upper slopes

Description:
A mapping unit defined currently under the blue oak alliance: Mapped based on past field work and reconnaissance. Blue oak hybridizes with either Oregon oak or valley oak in this mapping type. *NOTE: This type needs to be sampled and described which will later place it into a level under the NVCS.* Based on discussions with field ecologists, valley and blue oak were hybridizing in the area.

Photo Interpretation Signature:
This type is virtually undetectable from the air, so most stands are based on plot data. The only clue that these are hybridized oaks is that in these stands they have a similar signature to valley oaks in other portions of the mapping region but generally have a smaller crown.

3101 – Northern Mixed Mesic Chaparral

NVCS Alliance:
Birch Leaf Mountain Mahogany, Toyon, Interior Live Oak

Distribution:
Rare in the mapping area; several polygons mapped on the Gary Giacomini, Lucas Valley and Ignacio Preserves

Environmental Characteristics:
Mapped on mid slopes (generally downslope from chamise) on north trending moderately steep to steep slopes

Description:
Currently not described or observed on the ground on MCOSD property. Mapped based on photo signature only at this time. Possible species may include birchleaf mountain mahogany, chamise, ceanothus spp., and toyon. Field work and analysis will be necessary to describe this mapping unit within the NVCS

Photo Interpretation Signature
Signature is highly variable, but generally darker brown than adjacent stands of chamise with a higher texture within the stand.

3110 – Chamise Alliance

NVCS Alliance:
Chamise

Rare-mapped at the alliance when veg would not fit into any existing chamise mapping units.

3112 - Chamise - Serpentine Chaparral

NVCS Alliance:
Chamise

Distribution:
Mapped exclusively on the White Hill, Cascade Canyon and Gary Giacomini Preserves

Environmental Characteristics:
Occurs in drier serpentine settings.

Description:
A sub alliance mapping unit described under the chamise alliance: Chamise strongly dominates the stand in sparse to moderately dense settings with at least 10% cover; other serpentine species are minor subordinates.

Photo Interpretation Signature:
Chamise on serpentine soils looks like short, small, round brown shrubs, usually over rocky and gravelly soils.

3114 – Chamise – mixed chaparral

NVCS Alliance:
Chamise

Distribution:
Common throughout much of the western two thirds of the mapping area; best developed on the Ignacio and Lucas Valley Preserves

Environmental Characteristics:
Found on moderate to steep mid and upper slopes, often adjacent to annual grasslands.

Description:
Mapped as a sub alliance mapping unit within the chamise alliance: Chamise dominates the shrub layer with at least 10% cover in an open to moderately dense setting with a mix of other shrubs, usually sticky monkey flower, wedgeleaf ceanothus, California sagebrush or coyote brush. Annual grasses and forbs are usually visible in the understory. Subsequent field data and analysis may aid in further refining this mapping unit to a finer level in the NVCS.

Photo Interpretation Signature:
Chamise generally yields a brown to brown-gray color; other shrubs in the stand generally are somewhat greener. Understory grasses and forbs yield a variety of colors with a fairly smooth texture.

3115 – Chamise (pure)

NVCS Alliance:
Chamise

Distribution:
Much less common than type 3114; scattered widely throughout the western half of the study.

Environmental Characteristics:
Found on ridges, spurs or on steep upper slopes.

Description:
A sub alliance mapping unit described under the chamise alliance: Dense stands of pure chamise (with at least 90% relative cover of chamise to other shrubs) mapped on non-serpentine soils.

Photo Interpretation Signature:
Signatures are consistent throughout the stand and across the mapping area as a dark brown color with a fairly smooth texture.

3120 – Mt. Tamalpais Manzanita Alliance

NVCS Alliance:
Mt. Tamalpais Manzanita

Distribution:
Mapped exclusively on the serpentine areas of Gary Giacomini Preserve.

Environmental Characteristics:
Mapped exclusively on serpentine soils on gentle to moderate slopes

Description:
Mapped where photo interpreters see manzanita as a strong dominant to the shrub layer in sparse cover from as little as 5-10%. Other shrub species are present, but in small amounts.

3121 - Mt. Tamalpais Manzanita - Chamise - (Garrya - Leather Oak – Jepson ceanothus) – Serpentine Chaparral)

NVCS Alliance:

Mt. Tamalpais Manzanita

Distribution:

Mapped in similar areas to type 3120 but over a somewhat more extensive area.

Environmental Characteristics:

Similar to type 3120

Description:

A mapping unit above the alliance level possibly consisting of a number of alliances within the California Serpentine Chaparral Group: Generally small, dense stands of Mt. Tamalpais manzanita mixed with serpentine obligate or serpentine facultative shrubs, sometimes with serpentine outcrops. Mt. Tamalpais manzanita dominates the shrub layer, with chamise an important co-dominant or subordinate. Jepson Ceanothus, garrya, leather oak are often minor components to the shrub layer. Emergent California bay is often seen in small draws. Shrub canopy is generally sparse with at least 5-10% cover.

Photo Interpretation Signature:

Signature varies considerably within the stand depending on the species; manzanita gives a dark green signature with a very definitive crown edge, chamise is browner with a more diffuse crown edge. Less frequent shrub species (including leather oak) is extremely difficult to identify on the imagery.

3122 – Mt. Tamalpais Manzanita - / sparse emergent Douglas-fir

NVCS Alliance:

Mt. Tamalpais Manzanita

Distribution:

Rare in the mapping area; primarily occurs in Gary Giacomini Preserve.

Environmental Characteristics:

Located on variable slopes in more somewhat more mesic less severe serpentine settings. Often on serpentine contact point fringes.

Description:

A mapping unit described under the Mt. Tamalpais manzanita alliance: Sparse emergent conifer layer of Douglas-fir, generally less than 5 meters tall with at least 5% cover occurs over a moderately dense stands of Mt. Tamalpais Manzanita.

Photo Interpretation Signature:

Douglas-fir individuals are small and widely scattered but contrast highly adjacent to the darker green-browns of the manzanita.

3130 – Sensitive Manzanita Alliance

NVCS Alliance:

Sensitive Manzanita

Mapped based on plot data.

3150 – *Eastwood Manzanita Alliance*

NVCS Alliance:
Eastwood Manzanita

Distribution:
Uncommon; most mapped stands occur on the open space lands northwest of the Lucas Valley Preserve; several scattered locations are also mapped on Gary Giacomini Preserve.

Environmental Characteristics:
Occurs on gentle to moderate upper slopes, spurs and ridges.

Description:
Generally found in dense stands dominated by Eastwood manzanita, with occasional sparse emergent Douglas-fir. Note: Field crews may want to evaluate species in the Blithedale Summit Preserve for presence of King Mountain Manzanita.

Photo Interpretation Signature:
Eastwood manzanita appears as a smooth, dense cover of green or dark brown shrubs, texture is consistent throughout the stand.

3155 – *Common Manzanita*

NVCS Alliance:
Common Manzanita

Common Manzanita is not discernible on the imagery, so it was mapped based on field crew feedback.

3160 – *Interior Live Oak Alliance*

NVCS Alliance:
Interior Live Oak

Uncommon in study area, and was mapped based on plot data. This was mapped as a shrub, not hardwood.

3161 – Interior Live Oak- Eastwood Manzanita

NVCS Alliance:
Interior Live Oak

Distribution:
Fairly common but highly localized to three locations on the Blithedale Summit, Cascade Canyon and open space lands adjacent to the Indian Valley Preserve.

Environmental Characteristics:
Xeric trending, generally found on convex slopes adjacent to chamise-Eastwood manzanita vegetation or California bay-interior live oak vegetation.

Description:
A multiple alliance level mapping unit containing scrubby interior live oak and Eastwood manzanita alliances: Either species can dominate but both species generally have at least 10-20% relative cover in a dense shrub setting. Subsequent field data and analysis may aid in further refining this mapping unit to a finer level in the NVCS. The interior live oak was mapped as a shrub, not a hardwood, so the densities will reflect that.

Photo Interpretation Signature:
Eastwood manzanita contrasts significantly with the scrubby interior live oak; the former having a definitive crown edge and darker green color. Taller interior live oak appears lighter green adjacent to the manzanita.

3180 – Leather Oak – Chamise – Mt. Tamalpais Manzanita Serpentine Chaparral

NVCS Alliance:
Leather Oak

Only mapped based on field crew feedback. Sparse to dense mixture of leather oak, chamise and Mt. Tamalpais manzanita. Mapped based on field plot data (#3318).

3190 – Chamise – Eastwood Manzanita

NVCS Alliance:
Chamise, Eastwood Manzanita

Distribution:
Common on the Lucas Valley Preserve and to a lesser extent on the Gary Giacomini and Baltimore Canyon Preserves

Environmental Characteristics:
Mapped in xeric settings usually upslope from pure stands of chamise on somewhat gentler spurs and ridgelines.

Description:
A mapping unit or dual-species alliance: Mapped where either species dominates the shrub layer in generally dense settings. Both species must have at least 10-20% relative cover.

Photo Interpretation Signature:
Similar to type 3150 (pure Eastwood manzanita), but signature varies considerably more within the stand depending on the relative density of each species.

3210 – (French) Broom Alliance

NVCS Alliance:
Mixed Broom

Distribution:
Abundant on the Blithedale Summit, Camino Alto and Alto Bowl Preserves; scattered but common elsewhere on the southern half of the mapping area including the serpentine fringes of Ring Mountain and St. Hilary's Preserves.

Environmental Characteristics:
Frequently found in areas of post disturbance, especially along road cuts.

Description:
A mapping unit consisting generally of French broom: Occasionally other species of broom may dominate. French broom occurs in moderate to dense cover in a grassy setting or as an invasive species within chaparral, especially Eastwood manzanita or chamise.

Photo Interpretation Signature:
Broom has a yellow (in flower) or light green stippled appearance in the imagery. Young stands are extremely difficult to distinguish from taller forbs and grasses and may at times be incorrectly mapped by the photo interpreters. Note: Mapping corresponds to the 2005 NAIP imagery; subsequent removal is not addressed in this mapping effort.

3220 – Coyote Brush Alliance

NVCS Alliance:
Coyote Brush

Not common in study area, and mapped as a back off code.

3221 – Coyote Brush – California Sagebrush – Sticky Monkey Flower

NVCS Alliance:
Coyote Brush, California Sagebrush

Distribution:
Uncommon but widely scattered; generally in the central portions of the mapping area

Environmental Characteristics:
Generally on moderate to steep, xeric slopes

Description:
A mapping unit defined within the coyote brush alliance. Coyote brush generally dominates the shrub layer although California sagebrush can locally dominate over portions of the stand. Sticky Monkey Flower is usually a minor component to the shrub layer. Overall density ranges from sparse (at least 10% cover) to moderately dense.

Photo Interpretation Signature:
Signatures vary considerably for both coyote brush and California sagebrush depending on their cover and setting. California sagebrush is generally somewhat greener than coyotebrush. Coyotebrush at times can be confused with open stands of chamise in grassy settings.

3222 – Coyote Brush / Annual or Perennial Grasslands (open stands)

NVCS Alliance:

Coyote Brush

Distribution:

Very common throughout the entire study area generally adjacent to and within the grasslands and sparse woodland communities

Environmental Characteristics:

Found on gentle slopes, usually around disturbed areas.

Description:

A sub alliance mapping unit described within the coyote brush alliance: Coyote brush is usually found in sparse small clumps or in open stands of at least 10% cover over annual or perennial grasslands and forbs. Subsequent field efforts and analysis may aid in further refining this type in the NVCS.

Photo Interpretation Signature:

Signatures for coyotebrush vary considerably from gray to light green depending on conditions of the plants within the stand.

3223 – Coyote Brush – Mixed Shrub / Grass

NVCS Alliance:

Coyote Brush

Distribution:

Less common than type 3222 but widely distributed throughout the mapping area

Environmental Characteristics:

Found on gentle to moderately steep slopes in a variety of settings.

Description:

A mapping unit described within the coyote brush alliance: Coyote brush dominates the shrub layer in moderately dense to dense settings. One or more species including California sagebrush, sticky monkey flower, poison oak and California blackberry compose a significant component to the shrub layer, generally over a sparse or dense annual grass or forb understory.

Photo Interpretation Signature:

Signature varies considerably depending on presence of other shrub species; overall, the signature is highly variable within the stand. Sticky monkey flower can give off a dark brown signature when patches are large enough to discern on the imagery. Other shrub species are usually too sparse to identify on the imagery and their presence is often inferred in the stand.

3310 – California Sagebrush Alliance

NVCS Alliance:
California Sagebrush

Distribution:
Uncommon; several small polygons identified along the eastern fringes of the study area in open space west of Indian Valley and on the Loma Alta Preserve.

Environmental Characteristics:
Mapped on steep slopes adjacent to grasslands

Description:
California sagebrush dominates the stand in moderately dense to dense cover with an understory of annual grasses and forbs.

Photo Interpretation Signature:
California sagebrush is difficult for photo interpreters to identify in the mapping area due to its occurrence in relatively small stands; overall it yields a greenish signature. The signature can sometimes be confused with coyote brush.

3311 – California Sagebrush – Sticky Monkey Flower

NVCS Alliance:
California Sagebrush

Distribution:
Slightly more common than type 3310 occurring in similar regions of the mapping area

Environmental Characteristics:
Mapped on steep slopes, usually closer to chaparral communities

Description:
A mapping unit described within the California sagebrush alliance: California sagebrush generally dominates in sparse to dense cover with sticky monkey flower a minor to significant component.

Photo Interpretation Signature:
Photo signature is difficult for sticky monkey flower and may have to be aggregated to an alliance level. The California sagebrush signature can sometimes be confused with coyote brush.

3400 - Temperate Broadleaf Cold Season Deciduous Shrubland

NVCS Alliance:
NA

Rare in study area-only used as a back off code.

3410 – *Poison Oak Alliance*

NVCS Alliance:
Poison Oak

Distribution:
Rarely mapped in study area

Environmental Characteristics:
Not defined within the MCOSD properties

Description:
Poison oak strongly dominates the shrub layer

Photo Interpretation Signature:
Can't correlate a signature due to low amount mapped.

3420 – *Riparian Deciduous Shrubland*

NVCS Alliance:
Not Applicable

Only one polygon mapped in Little Mountain.

3430 – *Upland Deciduous Shrubs (Vancouverian Coastal Deciduous Shrubs Group?)*

NVCS Alliance:
Poison Oak, Dogwood, Hazel

Distribution:
Rare in the mapping area – best examples are located on the Gary Giacomini Preserve

Environmental Characteristics:
Noted generally within canopy openings in mixed conifer and hardwood forest.

Description:
Currently not described or observed on the ground on MCOSD property. Mapped based on photo signature only at this time. Field work and sampling with subsequent analysis will be necessary to further describe this mapping unit and place it within the NVCS. Possible species may include hazel, dogwood, poison oak, blackberry and thimbleberry.

Photo Interpretation Signature:
Noted within forest openings; most of the signature is shaded by adjacent conifers but overall trending dark and highly textured varying considerably within even the small mapped polygons.

4101 – Undifferentiated Marsh (cattail, bulrush, other scirpus spp.)

NVCS Alliance:

Broad Leaf Cattail, Narrow Leaf Cattail, Common Bullrush, California Bullrush

Distribution:

Uncommon; scattered throughout the mapping area in very small stands

Environmental Characteristics:

Found in seasonally to permanently flooded settings, generally surrounding lakes, ponds and reservoirs.

Description:

A habitat-type mapping unit described under the North American Arid West Freshwater Marsh Macrogroup: Cattails or any number of species of bulrush may dominate the marsh, generally in dense settings.

Photo Interpretation Signature:

Highly variable, but ranges from nearly black to a smooth dark green to lighter green and tan. Alliance level calls are too fine for photo interpreters to discern in the mapping area.

4110 – Cattail Alliance

NVCS Alliance:

Broad leaf Cattail, Narrow leaf Cattail

Distribution:

Only several polygons mapped within the study area

Environmental Characteristics:

Found in seasonally to permanently flooded settings, generally surrounding lakes and reservoirs.

Description:

Cattails generally dominate.

Photo Interpretation Signature:

Signature is usually smooth or uniform and light brown or tan stipple texture.

4200 – Seasonally or Temporarily Flooded Graminoids

NVCS Alliance:

NA

This is mapped based no field crew feedback only.

4210 – Sedge – Rush – Wet Graminoids Meadow

NVCS Alliance:

Several wetland herbaceous alliances possible most often within the *Carex* or *Juncus* genera.

Distribution:

Uncommon, concentrated primarily on the Mt. Burdell Preserve.

Environmental Characteristics:

Found in temporarily to seasonally flooded settings at times drying up fairly early in the growing season

Description:

A habitat-type mapping unit possibly contained within several macro groups. Mapped in areas often containing a mixture of sedge, rush and wet graminoids which may include *juncus*, *carex*, *hordeum brachyantherum* and meadow barley. Subsequent field efforts and analysis should further refine this mapping unit to a finer level in the NVCS.

Photo Interpretation Signature:

Variable, but is usually a mosaic of smooth dark green and brown or gray signature.

4211- Temporarily flooded or saturated Meadow Edge

NVCS Alliance:

Juncus or *Carex* or other graminoid related species possible

Distribution:

Very rare in the study area

Environmental Characteristics:

Found in intermittent or temporarily flooded settings generally drying soon after storms.

Description:

Mixture of sedge, rush, wet graminoids, and upland annual grasses

Photo Interpretation Signature:

Variable, depending on the component of wetland grasses and upland annuals.

4300 – Tall Temperate Annual Graminoids

NVCS Alliance:

A number of possibilities within the California annual grasslands

Very rare in the study area and only used as a back off code, especially when it can't be determined what species are present.

4310 – California Annual Grasslands Alliance (Native Component Variable)

NVCS Alliance:

A number of possibilities within the California annual grasslands

Very rare in the study area and only used as a back off code.

4311 – Grasslands on well-developed soils

NVCS Alliance:

California Annual Grasslands or any number of possibilities within the following genera: *Avena*, *Hordeum*, *Bromus*, *Lolium*

Distribution:

Abundant and widely distributed throughout the mapping area. Polygons vary considerably in size.

Environmental Characteristics:

Primarily occurs on non-serpentine slopes with well developed soils.

Description:

The most common type mapped in the study that occurs all over the study area. This is a multi-alliance mapping unit described within Mediterranean California Naturalized Annual and Perennial Grassland Group: Annual grasslands dominate (*Hordeum*, *Bromus*, *Lolium*, *Avena*) with varying amounts of forbs in the herbaceous layer.

Photo Interpretation Signature:

Texture is smooth but mottling appearance can occur especially with extensive presence of taller invasive forbs. Colors vary considerably depending on location and species composition.

4312 – Grasslands on poorly developed soils

NVCS Alliance:

California Annual Grasslands or any number of possibilities within the following genera: *Avena*, *Hordeum*, *Bromus*, *Lolium* and possibly Purple Needle Grass

Distribution:

Much less common than type 4311 and restricted to the eastern margins of the mapping except along non serpentine areas at St. Hilary's, the eastern edge of Lucas Valley, throughout Cascade Canyon and sporadically throughout the remainder of the study area.

Environmental Characteristics:

Primarily occurs on non-serpentine slopes with rockiness and poorly developed soils.

Description:

A multi-alliance mapping unit described within Mediterranean California Naturalized Annual and Perennial Grassland Group: Generally open annual grasses dominate – bromes probably dominate over avena or lolium grasses – native component can be relatively high (primarily nasilla grasses). This is primarily mapped based on the sparseness or rockiness on non-serpentine soils.

Photo Interpretation Signature:

Texture is similar to type 4311 but color is generally more uniform brown. Bare ground is visible in the stand.

4313 – Grasslands with a fern or sub-shrub (golden banner) component

NVCS Alliance:
Bracken Fern

Distribution:
Uncommon and widely scattered throughout the northern two thirds of the mapping area

Environmental Characteristics:
Potentially related to grazing or fire. Noted frequently along the margins of forests and woodland types.

Description:
A multi-alliance mapping unit described within Mediterranean California Naturalized Annual and Perennial Grassland Group: Generally dense annual grasses with a sparse to moderately dense layer of bracken fern or golden banner. Temporal in nature and may not reflect the current conditions of the imagery.

Photo Interpretation Signature:
Bracken fern appears green to brownish on the imagery over a typical signature of annual grasses.

4400 – Tall Temperate Perennial Grasslands

NVCS Alliance:
A number of possibilities

This was mapped based on field crew feedback.

4410 – Harding Grass Alliance

NVCS Alliance:
Harding Grass

Separating out herbaceous communities is generally beyond the resolution of the imagery; in these examples, photo interpreters relied heavily on existing weed maps to aid in their interpretation. Most of the polygons were checked by the field crew for accuracy.

4420 – Teasal Alliance

NVCS Alliance:
Teasal

Separating out herbaceous communities is generally beyond the resolution of the imagery; in these examples, photo interpreters relied heavily on existing weed maps to aid in their interpretation.

4430 - Pampas Grass

NVCS Alliance:
Pampas Grass

Separating out herbaceous communities is generally beyond the resolution of the imagery; in these examples, photo interpreters relied heavily field recon data to map this type.

4500 – Native Temperate Perennial Grasslands

NVCS Alliance:

Several possibilities

This is based primarily on field crew feedback.

4520 – Purple Needle grass

NVCS Alliance:

Purple Needle Grass

This is difficult to see on imagery, so it was based on field crew feedback.

4600 – Serpentine Grassland

NVCS Alliance: Not Applicable

Mapped based on field crew suggestions.

4610 – Upland Serpentine Grassland

NVCS Alliance: Not Applicable

Distribution:

Localized on serpentine soils; best examples are on the St. Hilary's and Ring Mountain Preserves. Scattered polygons mapped on the Terra Linda and Sleepy Hollow Preserves and along the study area edge to MMWD lands on the Gary Giacomini Preserve.

Environmental Characteristics:

Upland slopes on serpentine or near areas that receive drainage from serpentine settings.

Description:

A mapping unit describing several possible herbaceous alliances: Rather sparse to dense grasslands that are on poorly developed serpentine soil including species such as purple needlegrass, Torrey's melic, dwarf plantain, small fescue, and sticky western rosinweed. Weedy exotics can be a component to weaker serpentine soils.

Photo Interpretation Signature:

Variable, but generally has a smooth gray or green signature. Nearly impossible to distinguish from other grasslands, so photo interpreters primarily used the USGS geology map to help determine where this type was mapped based on the location of serpentine areas.

4611 – Upland Serpentine Grasslands in Rocky Settings

NVCS Alliance:
Not Applicable

Distribution:
Similar to type 4610, but less common

Environmental Characteristics:
Similar to type 4610 but in areas where rock outcroppings are visible on the imagery.
Found throughout the study area.

Description:
Serpentine geology is often difficult to determine, so the USGS geology map was used to aid in serpentine locations. Similar to 4610 but small rock outcroppings are visible throughout the grassland. Often the community forms a mosaic or complex of alternating small grassland patches and rocks throughout the stand. Best examples were noted on the Ring Mountain Preserve. Weedy exotics can be a component to weaker serpentine soils.

Photo Interpretation Signature:
Similar to type 4611 but with visible rock outcroppings in the stand

4620 – Wetland Serpentine Grassland

NVCS Alliance:
Not Applicable

Distribution:
Four small polygons mapped; all need verification by field ecologists

Environmental Characteristics:
Found in wet seeps on serpentine.

Description:
May include perennial and annual species at varying cover such as meadow barley, rosinweed, goldfields.

Photo Interpretation Signature:
Variable, but generally smooth green or gray signature. Nearly impossible to distinguish from other grasslands, so photo interpreters primarily used the geology coverage to help determine where this type was mapped based on the location of serpentine areas.

4700 – Tidally Flooded Grasslands & Forbs

NVCS Alliance:
Not Applicable

Only 2 polygons mapped just outside of Rush Creek

4701 – Estuarine Marsh Habitats (*Pickleweed, Saltgrass, Alkalie Heath, Jaumea*)

NVCS Alliance:
A number of possibilities including: *Pickleweed, Saltgrass, Alkalie Heath, Jaumea*

Uncommon here, but mapped in a salt marsh. Found in Rush Creek, Deer Island and Santa Margarita Island.

9000 – LAND USE / UNVEGETATED
9100 – Urban Developed – Built Up
9200 – Agriculture
9210 – Rangeland – Pastureland
9240 – Plantation Pines
9250 – Eucalyptus
9260 – Other Introduced Ornamentals including Mayten, Acacia, etc.
9302 – Quarry
9400 – Sparsely Vegetated or Unvegetated Areas
9401 Serpentine Balds (Including rare species such as Tamalpais Jewelflower)
 Note: Weedy exotics can be a component to weaker serpentine soils.
9420 – Cliffs – Rock Outcrops
9430 – Streambed
9500 – Vegetation Restoration Sites
9800 – WATER
9810 – Reservoirs
9820 – Small Ephemeral Ponds
9999 – Field questions that were not answered due to limited accessibility and can still not be coded.

APPENDICES

APPENDIX A

Marin County Open Space District Vegetation Map Area Report

Coordinate System

NAD_1983_StatePlane_California_III_FIPS_0403_Feet

Projection: Lambert_Conformal_Conic

False_Easting: 6561666.666667

False_Northing: 1640416.666667

Central_Meridian: -120.500000

Standard_Parallel_1: 37.066667

Standard_Parallel_2: 38.433333

Latitude_Of_Origin: 36.500000

Linear Unit: Foot_US

GCS_North_American_1983

Datum: D_North_American_1983

Zone 10S

File Specifications

Shapefile

Attribute Fields

Field Name	Alias	Type	Length	Precision	Scale	Number Format
OBJECTID	OBJECTID	Object ID	4	0	0	
Shape	SHAPE	Polygon				
PI	PI	Short	2	0	0	Numeric
DenCon	DenCon	Short	2	0	0	Numeric
DenHard	DenHard	Short	2	0	0	Numeric
DenShr	DenShr	Short	2	0	0	Numeric
BroomModif	BroomModif	Short	2	0	0	Numeric
DeadVeg	DeadVeg	Short	2	0	0	Numeric
InitFCCom	InitFCCom	Text	250	0	0	
FieldCheck	FieldCheck	Short	2	0	0	Numeric
VegTypeName	VegTypeName	Text	250	0	0	
Num_Name	Num_Name	Text	250	0	0	
COUNT_	COUNT_	Short	2	0	0	Numeric
AIS_OID	AIS_OID	Short	2	0	0	Numeric
PostAAScoreAIS	PostAAScoreAIS	Short	2	0	0	Numeric
AISComments_AA	AISComments_AA	Text	2147483	0	0	
PostImageryChanges	PostImageryChanges	Short	2	0	0	Numeric
PostImageryChangesComment	PostImageryChangesComment	Text	250	0	0	
SHAPE_Length	SHAPE_Length	Double	8	0	0	Numeric
SHAPE_Area	SHAPE_Area	Double	8	0	0	Numeric

Data Dictionary for User Defined Fields

PI: the 4 digit numeric code from the Preliminary MCOSD Mapping Classification

DenCon: Defines density of conifer component of the mapped alliance/mapping unit within polygon, denoted with a number (0-5) that represents a density range

DenHard: Defines density of hardwood component of the mapped alliance/mapping unit within polygon, denoted with a number (0-5) that represents a density range

DenShr: Defines density of shrub component of the mapped alliance/mapping unit within polygon, denoted with a number (0-5) that represents a density range

BroomModif: broom modifier in the polygon (representational values range from 0-3)

DeadVeg: dead vegetation (usually tanoak) disturbance modifier in the polygon (representational values range from 0-3)

InitFCCom: Any pertinent information about polygon, but it usually related to field crew comments. Photo numbers refer to ground shots taken by Jeff Kennedy in 2007. Sometimes (very rarely) this contains something from the MCOSD field crew that performed AA.

FieldCheck: indicates if the polygon was not a question or observed by the field crew (0), a question for the field crew (1), answered by the field crew (2), or not accessible by the field crew (6)

VegTypeName: Mapping Classification Mapping Type-name of the Alliance, Association or Mapping Unit

Num_Name: PI code – VegType Name in one field

COUNT_: MCOSD Field Crew assigned this field and value

AIS_OID: Number originally used for polygon numbers; now used to correspond with AA plots; can also be referenced as poly# in AISComments_AA field

PostAAScoreAIS: Number used to identify if AIS agreed or disagreed with the field crew call on an AA plot

AISComments_AA: Any pertinent comments from AIS regarding the AA plot

PostImageryChanges: If a change has happened after the imagery was taken and field crew noted it, this is flagged with a 1

PostImageryChangesComment: Contains the notes about post imagery changes from field crew

Polygon Frequency and Acreage

PI	FREQUENCY	Area: Square feet	Area: Acres	Area: Hectares	Average Polygon Size (Acres)
1101	280	98585253.88	2263.12	915.85	8.08
1102	2	43186.72	0.99	0.40	0.50
1103	21	5434751.95	124.76	50.49	5.94
1104	137	54756111.69	1256.98	508.68	9.18
1110	79	14100917.62	323.70	131.00	4.10
1111	225	35064948.55	804.95	325.75	3.58
1112	2	242582.44	5.57	2.25	2.78
1113	64	7074678.51	162.41	65.72	2.54
1114	11	3060840.20	70.26	28.44	6.39
1115	695	179182101.42	4113.30	1664.60	5.92
1116	6	1242642.62	28.53	11.54	4.75
1140	1	30604.64	0.70	0.28	0.70
1160	97	14169685.41	325.28	131.64	3.35
1170	2	124666.92	2.86	1.16	1.43
1180	5	434655.70	9.98	4.04	2.00
1201	1	19585.96	0.45	0.18	0.45
1210	6	2382099.51	54.68	22.13	9.11
1211	4	3801347.39	87.26	35.31	21.82
1212	26	31530410.67	723.81	292.92	27.84
1213	2	50831.44	1.17	0.47	0.58
1214	92	20736186.78	476.02	192.64	5.17
1215	19	893389.39	20.51	8.30	1.08
1216	21	10505402.83	241.16	97.59	11.48
1217	6	4261664.45	97.83	39.59	16.31
1218	6	735301.06	16.88	6.83	2.81
1220	25	935821.97	21.48	8.69	0.86
1221	54	15988871.72	367.04	148.54	6.80
1222	14	4841711.52	111.15	44.98	7.94
1223	77	21852556.29	501.65	203.01	6.51
1224	3	1675953.56	38.47	15.57	12.82
1226	4	54325.65	1.25	0.50	0.31
1227	4	810187.88	18.60	7.53	4.65
1231	1	1316.39	0.03	0.01	0.03
1240	1	2758.91	0.06	0.03	0.06
1241	28	3346246.09	76.82	31.09	2.74
1242	4	590456.72	13.55	5.49	3.39
1310	42	2233774.28	51.28	20.75	1.22
1410	4	177433.42	4.07	1.65	1.02
2000	1	35424.07	0.81	0.33	0.81

PI	FREQUENCY	Area: Square feet	Area: Acres	Area: Hectares	Average Polygon Size (Acres)
2100	1	25743.71	0.59	0.24	0.59
2110	576	64547059.38	1481.74	599.64	2.57
2111	257	29241423.18	671.27	271.65	2.61
2112	2	617799.70	14.18	5.74	7.09
2113	12	2320499.55	53.27	21.56	4.44
2210	5	472777.65	10.85	4.39	2.17
2220	5	1105173.70	25.37	10.27	5.07
2230	5	194740.42	4.47	1.81	0.89
2231	16	2530680.80	58.09	23.51	3.63
2232	276	30864447.73	708.52	286.73	2.57
2233	46	4007421.23	91.99	37.23	2.00
2240	1	313084.67	7.19	2.91	7.19
2241	24	5406629.06	124.11	50.23	5.17
3101	11	438394.65	10.06	4.07	0.91
3110	3	46517.06	1.07	0.43	0.36
3112	19	1223011.22	28.08	11.36	1.48
3114	308	18794751.27	431.45	174.60	1.40
3115	34	2701175.15	62.01	25.09	1.82
3120	27	1402012.51	32.18	13.02	1.19
3121	57	4701971.72	107.94	43.68	1.89
3122	19	1086669.44	24.95	10.10	1.31
3130	1	18761.00	0.43	0.17	0.43
3150	50	2788045.42	64.00	25.90	1.28
3155	7	271985.32	6.24	2.53	0.89
3160	6	259443.37	5.96	2.41	0.99
3161	124	8382506.97	192.43	77.87	1.55
3180	1	304178.27	6.98	2.83	6.98
3190	224	22526861.53	517.13	209.27	2.31
3210	200	6740985.98	154.75	62.62	0.77
3220	10	290252.76	6.66	2.70	0.67
3221	77	3322963.82	76.28	30.87	0.99
3222	413	17040684.26	391.19	158.31	0.95
3223	263	13331810.21	306.05	123.85	1.16
3310	13	975362.63	22.39	9.06	1.72
3311	25	1332238.64	30.58	12.38	1.22
3400	2	15183.10	0.35	0.14	0.17
3410	4	36322.12	0.83	0.34	0.21
3420	1	14571.68	0.33	0.14	0.33
3430	6	243218.22	5.58	2.26	0.93
4101	16	162895.92	3.74	1.51	0.23
4110	5	36521.16	0.84	0.34	0.17

PI	FREQUENCY	Area: Square feet	Area: Acres	Area: Hectares	Average Polygon Size (Acres)
4200	2	12835.63	0.29	0.12	0.15
4210	24	460823.93	10.58	4.28	0.44
4211	21	747167.52	17.15	6.94	0.82
4300	13	2065779.24	47.42	19.19	3.65
4310	3	99752.78	2.29	0.93	0.76
4311	900	253252844.75	5813.67	2352.71	6.46
4312	201	7691353.47	176.56	71.45	0.88
4313	57	2125110.25	48.78	19.74	0.86
4400	2	80042.94	1.84	0.74	0.92
4410	18	679782.11	15.61	6.32	0.87
4420	2	19444.63	0.45	0.18	0.22
4440	15	158757.59	3.64	1.47	0.24
4500	8	291202.05	6.68	2.71	0.84
4520	7	325536.71	7.47	3.02	1.07
4600	2	1155999.19	26.54	10.74	13.27
4610	109	8240752.46	189.17	76.56	1.74
4611	182	3160807.77	72.56	29.36	0.40
4620	4	12629.98	0.29	0.12	0.07
4700	2	25244.08	0.58	0.23	0.29
4701	38	1016054.45	23.32	9.44	0.61
8800	1	142020.82	3.26	1.32	3.26
9100	197	32470014.48	745.38	301.65	3.78
9200	4	1355448.56	31.12	12.59	7.78
9210	2	852820.14	19.58	7.92	9.79
9240	1	55421.14	1.27	0.51	1.27
9250	23	3321853.79	76.26	30.86	3.32
9260	7	425854.12	9.78	3.96	1.40
9302	3	257905.09	5.92	2.40	1.97
9400	12	696200.53	15.98	6.47	1.33
9401	26	182607.57	4.19	1.70	0.16
9420	18	193230.05	4.44	1.80	0.25
9430	7	259154.82	5.95	2.41	0.85
9500	1	512005.21	11.75	4.76	11.75
9800	8	3178560.24	72.97	29.53	9.12
9810	3	52818.54	1.21	0.49	0.40
9820	7	151651.33	3.48	1.41	0.50
9999	4	409325.92	9.40	3.80	2.35
Total Area		1117286276.27	25648.42	10379.55	
		Square Feet	Acres	Hectares	

APPENDIX B

Marin Co Open Space District Vegetation Mapping Classification

Revised July 7, 2008

CLASS

Formation

Alliances (Series)

Mapping units or Potential Associations yet to be defined

1000 – 2000 – FORESTS & WOODLANDS

1100 – Temperate Broadleaf Sclerophyll Evergreen Forests & Woodlands (Mixed Hardwoods)

- 1101 – *Lower Elevation Mixed Broadleaf Mapping Unit (Trending Xeric) – Coast Live Oak, Madrone or Black Oak or Oregon Oak dominant (At least two species co-dominate, may include Madrone – Coast Live Oak, Black Oak or Oregon Oak – Coast Live Oak, or Black Oak or Oregon Oak – Madrone)*
- 1102 – *Tanoak – California Bay – Canyon Oak Mixed Forest (Either Tanoak or California Bay dominate but the other either co-dominates or is present. Canyon Oak may or may not be present but generally does not co-dominate.)*
- 1103 – *California Bay – Alder – Big Leaf Maple – Willow spp. Riparian Forest (California Bay is always present in association with any or all three riparian species.)*
- 1104 – *Madrone – California Bay – (Tanoak) Forest (Madrone co-dominates with either Tanoak or California Bay including Madrone – Tanoak, Madrone – California Bay, and California Bay – Black Oak – Madrone.)*

1110 – California Bay Alliance

- 1111 – *California Bay (pure)*
- 1112 – *California Bay – Buckeye*
- 1113 – *California Bay – Interior Live Oak*
- 1114 – *California Bay – Canyon Oak*
- 1115 – *California Bay – Coast Live Oak*
- 1116 – *California Bay – Tanoak*

1140 – Tanoak Alliance

1160 – Madrone Alliance

1170 – Canyon Oak Alliance

- 1171 – *Canyon Oak – Interior Live Oak*

1180 – Giant Chinquapin Alliance *(Includes a possibility of 3 associations that include Eastwood Manzanita, and stands are sometimes shrub-like in nature.)*

1200 – Temperate Needleleaf Evergreen Forests & Woodlands

- 1201 – *Planted Stands of Pine (Monterey Pine – Bishop Pine – Monterey Cypress and other spp)*

1210 – Redwood Alliance

- 1211 – *Redwood / Tanoak (Includes a possibility of at least 2 associations.)*
- 1212 – *Redwood – Douglas-fir – (Mixed Hardwoods)*
- 1213 – *Redwood / Chinquapin*
- 1214 – *Redwood / California Bay*
- 1215 – *Redwood (pure) (often young dense stands)*
- 1216 – *Redwood - Upland Mixed Hardwoods (Generally California bay, Tanoak, occur as co-dominant or subordinate species in upland settings.)*
- 1217 – *Redwood – Riparian (Redwoods in riparian settings with maple, California bay, Tanoak, and/or White alder in the secondary canopy.)*
- 1218 – *Redwood – Madrone (Surveys suggest this type with Vaccinium ovatum in the understory)*

1220 – Douglas-fir Alliance

- 1221 – *Douglas-fir - Mixed Hardwoods in upland drier settings (Coast Live Oak, Madrone)*
(Generally in smaller stands often adjacent to grassland or shrublands.)
- 1222 – *Douglas-fir Mixed Hardwoods in upland forest settings (California Bay, Canyon Oak, Tanoak – Madrone)* (Canyon Oak often occurring in larger stands adjacent to other conifer forests.)
- 1223 – *Douglas-fir – California Bay Mapping Unit* (May include Coast Live Oak as an associate.)
- 1224 – *Douglas-fir – Tanoak*
- 1225 – *Douglas-fir – Riparian* (Douglas-fir in riparian settings with White Alder, Blackberry, etc, in understory.)
- 1226 – *Douglas-fir (pure)* (Little understory development other than Douglas-fir regenerating)
- 1227 – *Douglas-fir – California Bay / Interior Live Oak*
- 1230 – *Bishop Pine Alliance*
 - 1231 – *Bishop Pine / Eastwood Manzanita*
 - 1232 – *Bishop Pine (pure)*
- 1240 – *Sargent Cypress Alliance*
 - 1241 – *Sargent Cypress / Mt. Tamalpais Manzanita*
 - 1242 – *Sargent Cypress (pure)*
 - 1243 – *Sargent Cypress – Riparian*
- 1300 – *Temporarily Flooded Cold Season Deciduous Forests & Woodlands*
 - 1310 – *Mixed Willow Mapping Unit (Arroyo Willow, Red Willow, and Yellow Willow Alliances)*
 - 1320 – *White Alder Alliance*
 - 1321 – *White Alder – California Bay*
 - 1330 – *Red Alder Alliance*
- 1400 – *Cold Season Deciduous Forests*
 - 1410 – *Black Oak Alliance*
- 2000 – **WOODLANDS**
 - 2100 – *Xeric Sclerophyll Evergreen Forests & Woodlands*
 - 2110 – *Coast Live Oak Alliance*
 - 2111 – *Coast Live Oak / (Grass-Poison Oak)*
 - 2112 – *Coast Live Oak – Riparian*
 - 2113 – *Coast Live Oak – Douglas-fir* (A small component of conifer cover (< or = 5%), as compared to 1221)
 - 2200 – *Cold Season Deciduous Woodlands*
 - 2210 – *Oregon Oak Alliance (small stands)* (Includes Oregon Oak mixed with lower to equal Coast Live Oak or California bay cover)
 - 2220 – *California Buckeye Alliance* (Includes California Buckeye mixed with lower Coast Live Oak)
[mapped based on plot data and some local extrapolation]
 - 2230 – *Valley Oak Alliance*
 - 2231 – *Valley Oak Riparian Mapping Unit* (California Bay and/or Big Leaf Maple- Alder are a co-dominant in a riparian setting)
 - 2232 – *Valley Oak – Coast Live Oak Mapping Unit*
 - 2233 – *Valley Oak/ grass*
 - 2240 – *Blue Oak Alliance*
 - 2241 – *Blue Oak – White Oak (Valley or Oregon Oak) hybrids Mapping Unit*
 - 2300 – *Temporarily Flooded Cold Season Deciduous Woodlands*
 - 2320 – *Big-leaf Maple Alliance*

2321 – *Big-Leaf Maple* – *California Bay Mapping Unit* (May be co-dominant or one slightly higher in cover than the other.)

3000 – SHRUBLANDS

3100 – Temperate Broadleaf Sclerophyll Evergreen Shrublands

3101 – Mesic Trending Chaparral (includes Birchleaf Mtn Mahogany, Chamise, Ceanothus spp., Toyon)

3110 – Chamise Alliance

3112 - Chamise - *Serpentine Chaparral* (Relatively pure chamise on ultramafic soils)

3114 – Chamise (Stands with a co-dominance of chamise with other shrub species such as Sticky Monkey-flower or Wedgeleaf Ceanothus)

3115 – Chamise (pure)

3120 – *Mt. Tamalpais Manzanita Alliance* (Includes possibly 3 associations with Eastwood Manzanita, Chamise, or Jepson's Ceanothus as associates.)

3121 - *Mt. Tamalpais Manzanita - Chamise* - (Garraya - Leather Oak – Jepson ceanothus) – *Serpentine Chaparral*)

3122 – *Mt. Tamalpais Manzanita* - \ with Sparse Douglas-fir emergent (5 - 25%)

3130 – *Sensitive Manzanita Alliance* (Small stands that may include Eastwood Manzanita or Huckleberry.)

3132 – Jepson's Ceanothus (stand noted at Nicasio Reservoir)

3140 – *Silver Leaf Manzanita Alliance* (Small stands that may include Eastwood Manzanita and Chamise.)

3150 – *Eastwood Manzanita Alliance* (May have up to 10-15% Douglas-fir emergent)

3155 – *Common Manzanita*

3160 – *Interior Live Oak Alliance*

3161 – *Interior Live Oak- Eastwood Manzanita* (QUWI and ARGL co-dominate)

3170 – *Blue Blossom Alliance* (Small stands, and may include at least 2 associations with Coyote Brush – Poison Oak and with Shrub Interior Live Oak.)

3180 – *Leather Oak – Chamise – Mt. Tamalpais Manzanita Serpentine Chaparral*

3190 – *Chamise – Eastwood Manzanita*

3200– Temperate Microphyllous Evergreen Shrubland

3210 – *(French) Broom Alliance* (May include low cover of Coyote Brush.)

3220 – *Coyote Brush Alliance*

3221 – *Coyote Brush – California Sagebrush – Sticky Monkey Flower*

3222 – *Coyote Brush / Annual or Perennial Grasslands* (open stands)

3223 – *Coyote Brush – Mixed Shrub / Grass* (May include Poison Oak or California Blackberry with mixture of grass species.)

3300 – Temperate Xeric Mixed Drought-Deciduous Evergreen Shrubland

3310 - *California Sagebrush Alliance*

3311 – *California Sagebrush – Sticky Monkey Flower*

3400 – Temperate Broadleaf Cold Season Deciduous Shrubland

3410 – *Poison Oak Alliance* (Small stands found in Coyote Brush patches)

3420 – *Riparian Deciduous Shrubland* (Includes Western Azalea.)

3430 – *Upland Deciduous Shrubs* (Includes dogwood, hazelnut, etc)

4000 – HERBACEOUS

4100 – Saturated Temperate Perennial Graminoids

4101 – *Undifferentiated Marsh (cattail, bulrush, other scirpus spp.)*
4110 – *Cattail Alliance*
4120 – *Bulrush Alliance*

4200 – Seasonally or Temporarily Flooded Graminoids

4210 – *Sedge – Rush – Wet Graminoids Meadow (Including Juncus, Carex, and Hordeum brachyantherum – Meadow barley)*
4211 – *Temporarily flooded or saturated Meadow Edge*

4300 – Tall Temperate Annual Graminoids

4310 – *California Annual Grasslands Alliance (Native Component Variable)*
4311 – *Grasslands on well-developed soils (generally dense bio-mass)*
4312 – *Grasslands on poorly developed soils (generally sparse bio-mass)*
4313 – *Grasslands with a fern or sub-shrub component (either Thermopsis or fern)*

4400 – Tall Temperate Perennial Herbaceous

4410 – *Harding Grass Alliance*
4420 – *Teasal Alliance (Dipsacus sativa)*
4430 – *Reed Canary Grass Alliance (Festuca arundinacea)*
4440 – *Pampas Grass*

4500 – Native Temperate Perennial Grasslands

4510 – *California or Idaho Fescue Grasses (Small patches in grassland settings.)*
4520 – *Purple Needle grass (Small patches with annual grasses and sometimes other native grasses such as California Melic)*

4600 – Serpentine Grassland

4610 – *Upland Serpentine Grassland (May include perennial and annual species at varying cover seasonally and annually, such as Purple Needlegrass, Torrey's Melic, Dwarf Plantain, Small Fescue, Sticky Western Rosinweed)*
4611 – *Rocky Serpentine grasses (primarily on Ring Mtn)*
4620 – *Wetland Serpentine Grassland (May include perennial and annual species at varying cover seasonally and annually, such as Meadow barley, Rosinweed, Goldfields, etc.)*

4700 - Tidally Flooded Grasslands & Forbs

4701 – *Estuarine Marsh Habitats (Pickleweed, Saltgrass, Alkali Heath, Jaumea)*

9000 – LAND USE / UNVEGETATED

9100 – Urban Developed – Built Up
9200 – Agriculture
9201 – Abandoned Orchards
9202 – Orchard
9210 – Rangeland – Pastureland
9220 – Olive Groves
9230 – Christmas Tree Farm
9240 – Plantation Pines
9250 – Eucalyptus
9260 – Other Introduced Ornamentals including Mayten, Acacia, etc.
9302 – Quarry
9400 – Sparsely Vegetated or Unvegetated Areas
9401 – *Serpentine Balds (Including rare species such as Tamalpais Jewelflower)*
9410 – Landslides
9420 – Cliffs – Rock Outcrops
9430 – Streambed
9500 – Vegetation Restoration Sites

9800 – WATER
9810 – Reservoirs
9820 – Small Ephemeral Ponds

9999 – Field questions

Density

(3 fields – conifer, hardwoods & shrubs)

1 = Greater than 60%
2 = 40-60%
3 = 25-40%
4 = 10-25%
5 = 2-10%
0 = >2 %

Field Check Codes

1 = Field questions for field crew
2 = Answered by field crew
4 = Observed on field recon trip
6 = Polygon not accessible by field crew

Broom Modifier

0 = Minimal or no disturbance visible
1 = Low: 1-5% of the polygon has broom visible
2 = Moderate: 5-10% of the polygon has broom visible
3 = Severe Over: 10% of the polygon has broom visible

Dead Vegetation Modifier (due to SOD)

0 = Minimal or no mortality – (standing trees)
1 = Low: 1-5% of the polygon had canopy mortality
2 = Moderate: 5-10% of the polygon had canopy mortality
3 = Severe: Over 10% of the polygon had canopy mortality

APPENDIX C

Marin County Open Space Properties

Alto Bowl
Bald Hill
Baltimore Canyon
Blithedale Summit
Camino Alto
Cascade Canyon
Deer Island
French Ranch
Gary Giacomini
Horse Hill
Ignacio Valley
Indian Tree
Indian Valley
King Mountain
Little Mountain
Loma Alta
Loma Verde
Lucas Valley
Maurice Thorner
Mt. Burdell
Old St. Hilary's
Pacheco Valle
Ring Mountain
Roy's Redwoods
Rush Creek
San Pedro Mountain
Santa Margarita Island
Stafford Lake County Park (Not A Preserve)
Terra Linda/Sleepy Hollow Divide
Tiburon Ridge
Verissimo Hills
White Hill

APPENDIX D

Ancillary Data Descriptions and Sources

Data Name	Description	Source
C200idx	Contour index for 4" resolution imagery (200); 50' interval	MCOSD
C200int	Contour index for 4" resolution imagery (200); 5' interval	MCOSD
C400idx	Contour index for 1' resolution imagery (400); 50' interval	MCOSD
C400int	Contour index for 1' resolution imagery (400); 10' interval	MCOSD
Final study area	MCOSD final study area	MCOSD
Geology_east	Geology for study area	marinmap.org
Image Catalog	Image catalog from Vargis imagery	MCOSD
Landslides	Landslide data from Northern CA Landslide Working Group	marinmap.org
Marin_roads	Roads	MCOSD
Marin_streams	Streams	MCOSD
Marin_trails	Trails	MCOSD
mcosd_preserves	Preserves/parks on MCOSD land	MCOSD
precipitation	Precipitation accumulations from "Isohyetal Map of the San Francisco Bay Region, California, Showing Mean Annual Precipitation"	marinmap.org
SOD_buffer	1/4 mile buffer around all SOD confirmations.	marinmap.org
SOD_confirm	Confirmed isolations of SOD.	marinmap.org
SOD_suspect	Areas of concentrated confirmed SOD.	marinmap.org
soil_expansive	Expansive soils from NRSC Soils	marinmap.org
soils	Soils data from NRSC Soils	marinmap.org
Tiburon_serpentine	Tiburon serpentine geology	MCOSD
waterbody	Water bodies	marinmap.org
watershed_major	Marin watersheds	marinmap.org
Waypoints-AIS	Waypoints collected by AIS on field recon trip	AIS
Waypoints- Jeff Kennedy	Waypoints collected by Jeff Kennedy during fieldwork.	Jeff Kennedy
Waypoints-David Herlocker	Comments by David Herlocker collected in polygon labels.	MCOSD
wetland	Marin wetlands from NWI.	marinmap.org
Weeds Map	Coverage of weeds in MCOSD	MCOSD
Imagery		
Vargis Imagery	200 and 400 SID and TIFF images	MCOSD
NAIP Imagery	imagery	CASIL