

# Orange County Vegetation Mapping Update Phase II

FINAL VEGETATION MAPPING REPORT

April 2015



Aerial Information Systems, Inc.

Redlands, California



## **Acknowledgements**

Mapping vegetation in Orange County, California was one of the most challenging efforts in our long history at Aerial Information Systems. The project would not have been possible without the funding and project management provided by the Nature Reserve of Orange County (NROC). We are grateful for the opportunity to work with Milan Mitrovich, NROC project manager, who provided all the logistic planning and field coordination, in addition to his time in the field. We are also indebted to Todd Keeler-Wolf and Anne Klein, of the California Department of Fish & Wildlife who provided us their expertise and many invaluable hours in the field. We would also like to thank Jennifer Buck-Diaz, Julie Evens, Sara Taylor, Daniel Hastings and Jamie Ratchford of the California Native Plant Society, who provided the accuracy assessment of our vegetation database and mapping product, we appreciate all of their efforts.

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# I. Introduction

Aerial Information Systems, Inc. (AIS) was contracted by the Nature Reserve of Orange County (NROC) to create an updated fine-scale regional vegetation map consistent with the California Department of Fish & Wildlife (CDFW) classification methodology and mapping standards. The mapping area covers approximately 86,000 acres of open space and adjacent urban and agricultural lands including habitat located in both the Central and Coastal Subregions of Orange County. The map was prepared over a baseline digital image created in 2012 by the US Department of Agriculture – Farm Service Agency’s National Agricultural Imagery Program (NAIP). Vegetation units were mapped using the National Vegetation Classification System (NVCS) to the Alliance level as depicted in the second edition of the Manual of California Vegetation (MCV2).

One of the most important data layers used to guide the conservation planning process for the 1996 Orange County Central & Coastal Subregion Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP) was the regional vegetation map created in the early 1990s by Dave Bramlett & Jones & Stokes Associates, Inc. (Jones & Stokes Associates, Inc. 1993). Up until now, this same map continues to be used to direct monitoring and management efforts in the NCCP/HCP Habitat Reserve.

An updated map is necessary in order to address changes in vegetation makeup due to widespread and multiple burns in the mapping area, urban expansion, and broadly occurring vegetation succession that has occurred over the past 20 years since the original map was created. This update is further necessary in order to conform to the current NVCS, which is supported by the extensive acquisition of ground based field data and subsequent analysis that has ensued in those same 20 years over the region and adjacent similar habitats in the coastal and mountain foothills of Southern California.

Vegetative and cartographic comparisons between the newly created 2012 image-based map and the original 1990s era vegetation map are documented in a separate report produced by the California Native Plant Society at the end of 2014.

## A. Study Area – Sub-regional & Focus Area Descriptions



The Orange County mapping effort contains 85,705 acres and consists of two separate subregions, one located in the northern portion of the Santa Ana Mountains and adjacent inland portions of the coastal plain, the other to the south, which is located in the San Joaquin and Laguna Hills from Newport Beach south towards the town of Dana Point. The study is bisected by two ecological provinces as defined by the U.S. Department of Agriculture Ecological Sections of California. The Coastal Subregion falls entirely within 261B (Southern California Coastal Province) and the

Central Subregion falls partially within the abovementioned Province while the higher elevation portions of this subregion just make it into M262B (Southern California Mountains and Valleys).

### The Coastal Subregion



The Coastal Subregion contains slightly over 37,000 acres of coastal scrub vegetation, riparian thickets, woodlands and forests, maritime chaparral and coastal saltmarsh vegetation types. Of this total, over 14,000 acres of mainly coastal scrub and maritime chaparral burned in the Laguna Fire of 1993. The San Joaquin Hills dominate the landscape consisting of numerous small coastal canyons from Buck Gully on the north to Niguel Hill to the south. Outlier areas to the south include land that straddles San Juan Canyon, and to the north,

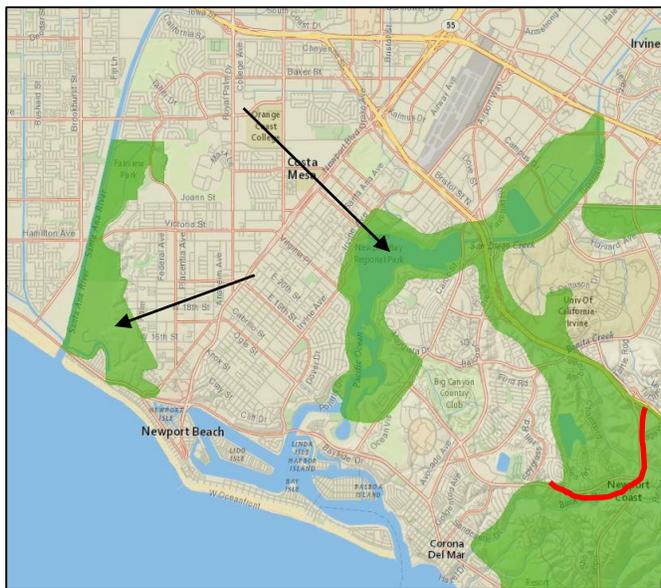
Upper Newport Bay and the Santa Ana River wetlands, which form a disjunct area in the westernmost portion of the subregion. Nearly 1/3 of the vegetation mapped (~11,900 acres)

within this subregion falls within the Central & Southern Coastal Californian Coastal Sage Scrub Group, as defined by the NVCS and include all of the major drought deciduous alliances found in the mapping area. The Coastal Subregion includes about 2500 acres of maritime chaparral communities, dominated by, but not limited to, the *Rhus integrifolia* Alliance. Not including the *Malosma laurina* alliance, which occurs inland to even the western most portions of Riverside County, the maritime chaparral stands are exclusive to this subregion. Included in this maritime chaparral are stands dominated by the coastal *Ceanothus megacarpus* and patches of the relatively uncommon *Quercus durata*.

### Focus Areas of the Coastal Subregion

Focus areas are portions of geomorphically related areas of landscape that photo interpreters divided as a way to map ecologically similar stands of vegetation without having to interpret too many types in one sitting. Boundaries are not definitive and are not geospatially separated out in a GIS layer.

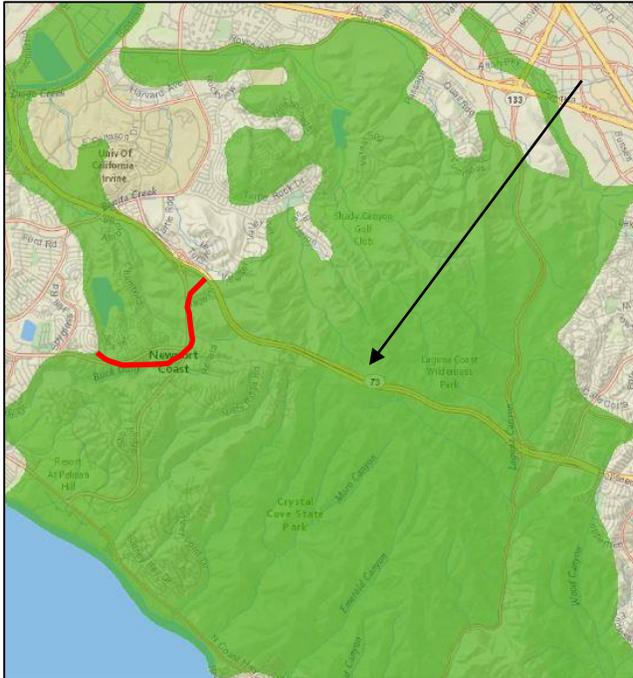
### Upper Newport Bay & the Santa Ana River Focus Area



This focus area includes the tidal salt marshes of the Upper Newport Bay from the Back Bay Science Center just inland from the Pacific Coast Highway north to where the San Diego Creek Channel empties into the bay. It continues northward along the creek and expands to include the San Joaquin Marsh Reserve where it terminates along the southern edge of the San Diego Freeway. The eastern margin of the focus area includes the Coyote Canyon Landfill vegetation restoration area and to the western edge, there is a saltmarsh restoration site east of the Santa Ana River channel.

Unique to this focus region are the approximately 450 acres of saltmarsh habitats that are defined by a number of alliances including *Sarcocornia pacifica*, *Spartina foliosa*, *Bolboschoenus maritimus*, and *Distichlis spicata*. The focus area also includes 80% (~146 acres) of all the freshwater marsh alliances in the mapping area including stands defined by the *Typha*, *Schoenoplectus californica* and *S. acutus* Alliances. The town of Costa Mesa is actually defined in part by the bluffs along the western edge of the Santa Ana River salt marsh restoration area and the bluffs east of upper Newport Bay.

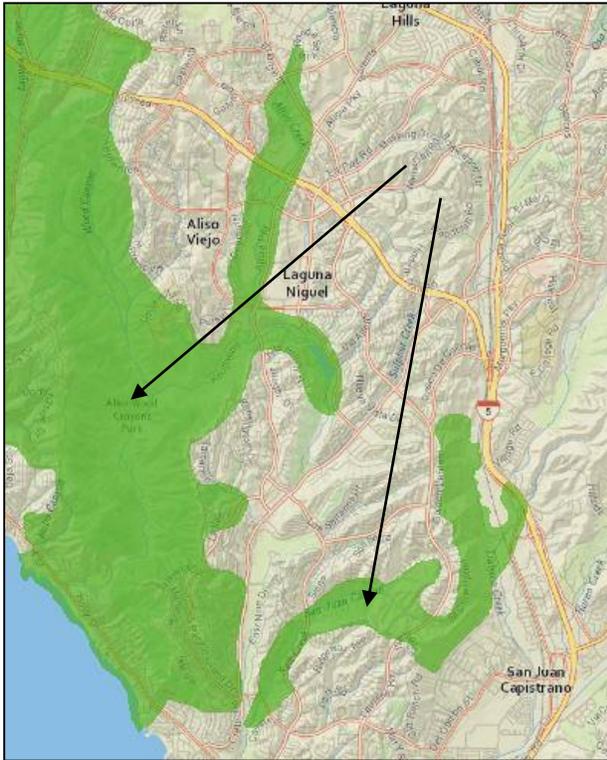
## The San Joaquin Hills & Coastal Canyons Focus Area



To the southeast of the focus area described above is a much larger one encompassing approximately 20,000 acres defined by numerous small northeasterly trending ravines including Los Trancos, Muddy, Moro, and Emerald canyons. The eastern edge of this focus area is bounded by Laguna Canyon where Laguna Creek forms some of the most extensive riparian habitat in the Coastal Subregion. The San Joaquin hills make up a majority of the focus area with Signal Peak, the highest portion reaching over 1100' above sea level. The eastern portion of the focus area is heavily built up with over 3500 acres of urban land adjacent to the natural vegetation.

The region is defined by extensive stands (nearly 8300 acres – approximately 40% of the entire focus area) of vegetation within the California Coastal Sage Scrub Group. These include vegetation types defined to the *Artemisia californica*, *Encelia californica*, *Eriogonum fasciculatum*, and *Salvia mellifera* Alliance in addition several mixed alliances that combine plants from the above types. The region also contains nearly 700 acres of maritime chaparral defined to the *Rhus integrifolia* Alliance, which accounts for well over half the entire mapping areas total. Other uncommon maritime chaparral communities defined to the *Ceanothus megacarpus* Alliance are found in this focus area in small patches totaling nearly 40 acres on slopes above Los Trancos Canyon. North of California State Route 73, with the exception of the drier *Malosma laurina* Alliance, maritime chaparral decreases considerably and shrub cover drops across much of the mapped polygons. This could be a result in part from a minor rain shadow effect from the San Joaquin Hills. Stands defined to the Coastal Maritime Succulent Scrub Group (coastal bluff scrub) occur on the focus areas southern boundary in areas where small patches of diverse vegetation occupy steep bluffs just below the coastal terrace on the shore side of the Pacific Coast Highway. *Lycium californicum*, a plant noted on both field reconnaissance and the rapid assessment effort, is one of several species that are too small to map as individual stands. Small patches of this Alliance occurs infrequently along some of the steepest portions of the bluffs, especially in Crystal Cove State Park.

## The Laguna Hills – Aliso Canyon Focus Area



This focus area is defined to the west by Laguna Canyon and to the south and east by San Juan Canyon and Salt Creek. The focus area covers steep canyon sideslopes and temporarily flooded ravines with numerous small hills. The generally north to slightly northwesterly trend of this section of the peninsula ranges typifies the patterning noted in the above described focus areas. This trend creates east-west facing aspects above the canyon bottoms. These east-west facing aspects (neutral aspects between hot and cool) are one of the reasons that vegetation is more continuously defined as just single types along large portions of the upper slope. Vegetation is more defined by the minor spur lines that originate off the main ridge which create small north and south trending aspects.

Noteworthy vegetation types include alliances from the maritime chaparral group with the exception of the drier maritime type (*Malosma laurina*) being nearly absent in the area. Approximately 500 acres of *Rhus integrifolia* occur in this small focus region in addition to nearly 250 acres mapped to a maritime variety of *Ceanothus megacarpus*. By far the most commonly occurring alliances (nearly 3300 acres in all), fall within the California Coastal Sage Scrub Group of which the *Artemisia californica* and *A. californica* – *Eriogonum fasciculatum* Alliances are best represented throughout.

## The Central Subregion



The Central Subregion contains slightly over 48,670 acres and includes extensive stands of chaparral and coastal scrub vegetation, riparian forests and woodlands, and higher elevation stands of fire recovering cypress. Nearly 40% of the Central Subregion burned in 2007 and an additional 20% burned the previous year in the north in 2006.

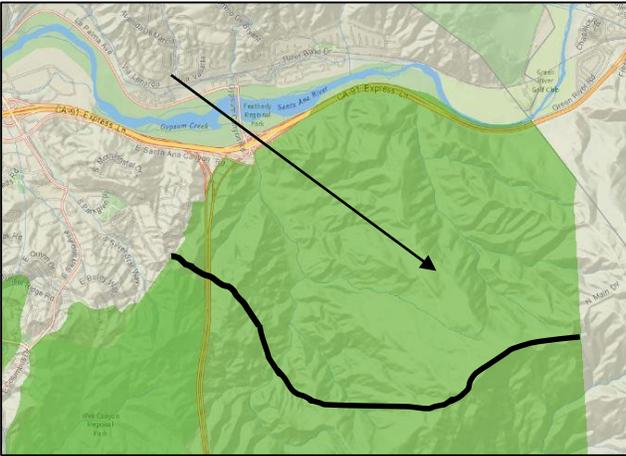
The study area is characterized by the Santa Ana Mountains, which is the major representative mountain chain of the coastal portions of the Peninsula Ranges in California. Elevations within this subregion range from just over 300' in the southwestern corner to over 2700' along the eastern perimeter of the study above Black Star Canyon. Santiago Creek bisects the Subregion and parallels a portion of the southeastern boundary

where it enters the mapping area near the town of Modjeska. The river flows northwesterly, empties into the Santiago Reservoir, and finally exits the study area just west of Rattlesnake Peak. Fremont Canyon, which is a major watershed of Santiago Creek, flows southwest and joins Santiago Creek just below the Santiago Reservoir. In the northernmost reaches of the Central Subregion, Gypsum and Coal Canyon flow nearly due north and exit the study area just south of the Santa Ana River.

Virtually all of the vegetation within the California Xeric Chaparral Group (~8100 acres) falls within this subregion and includes all four of the major alliances; *Adenostoma fasciculatum*, *Ceanothus crassifolius*, *C. megacarpus*, and the mixed *A. fasciculatum* – *Salvia mellifera* Alliance. Small stands of the higher elevation pre-montane chaparral are also found along the eastern margins of the subregion. Oak woodlands are broadly represented in both riparian and more xeric canyon side slopes with over 2900 acres mapped in all. Perhaps the most unique vegetation in the mapping area occurs in the higher elevations of the northeastern portion of the subregion; that being the recovering stands of Tecate cypress, which burned in the 2006 Sierra Peak Fire.

## Focus Areas of the Central Subregion

### The Gypsum & Coal Canyon Focus Area



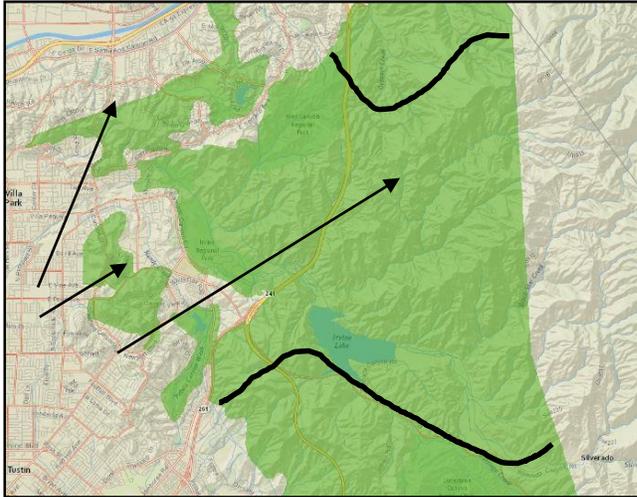
This focus area is characterized by the two major watersheds (Gypsum Canyon & Coal Canyon) that originate along a major east-west trending ridgeline and flow due north into the Santa Ana River. The southern boundary follows that ridgeline dividing the Fremont Canyon and abovementioned watersheds to the north. The eastern boundary of the focus area (as well as the entire mapping areas eastern boundary) buffers approximately 700 meters into the Cleveland National Forest where it abuts the Riverside County Line just south of California

State Route 60, which represents the mapping areas northern boundary. This focus area encompasses the northernmost portions of the Santa Ana Mountains creating some of the most extensive northerly trending slopes in the study area where elevations range from just under 400' to slightly over 2400' along the Main Divide Road. This gradient occurs over a distance of just under 1 ¾ miles.

Nearly all of the acreage within this focus area burned in 2006 from the Sierra Peak Fire, which in part, overlapped a previous burn in 2002.

It is on the uppermost portions of these slopes, on gently undulating terrain, that all of the stands of Tecate cypress are located. Most of the mapped acreage assigned to this alliance burned in 2002 as well as 2006. Nearby, in a similar upslope and ridgeline setting, vegetation assigned to the higher elevation Californian pre-montane Chaparral Group was identified and mapped, and is represented by the *Arctostaphylos glandulosa* Alliance totaling approximately 180 acres in this focus area. Stands of *Ceanothus megacarpus* totaling nearly 950 acres are also found exclusively in this focus area (with the exception of several small maritime stands near the coast). Some of these lower-elevation stands share dominance with *Rhus ovata*, a species found throughout the western portions of Riverside County in a unique group of chaparral known as the Mogollion Rim. Two very small remnant patches of *Pseudotsuga macrocarpa* were also mapped in this focus area on steep, shady north trending canyons at elevations below 1800'.

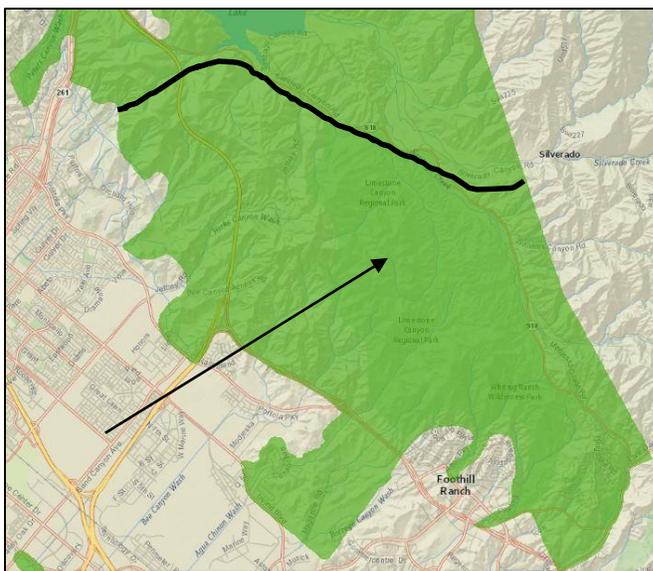
## The Fremont & Lower Santiago Canyons Focus Area



This focus area is defined by the lowermost portions of the Santiago watershed where it is joined by Williams Canyon. The northern portion of this focus area encompasses much of the Fremont Canyon watershed and the lower reaches of Black Star Canyon to the east. Included in this focus area are two disjunct areas to the west, the El Modena Open Space and adjacent natural areas and the Peralta Hills to the north. The highest point in the mapping area occurs in this focus area dividing Fremont & Black Star Canyon. On the steep northerly slopes on the Fremont

Canyon side of the divide, fairly extensive stands of *Fraxinus dipetala* and *Heteromeles arbutifolia* co-dominating with other mesic species of chaparral including *Quercus berberidifolia* and *Ceanothus tomentosus* can be found. The focus area includes all of the mapped stands of *Salvia leucophylla* (approximately 400 acres in all) where it is found on steep generally north trending slopes above Black Star Canyon. This focus area also contains a very high diversity of riparian alliances, including a few stands of *Alnus rhombifolia* in addition to *Salix gooddingii*, *S. lasiolepis*, and *Baccharis salicifolia*, all of which occur along Santiago Creek as well as *Platanus racemosa*, *Quercus agrifolia* and *Baccharis salicifolia*, which are frequently found on the adjacent tributaries. Several small patches of *Juglans californica* were mapped in the Peralta Hills north of Villa Park as well.

## The Loma Ridge – Limestone Canyon Focus Area



This region below Santiago & Silverado Canyons south to the El Toro FAA property defines this Focus Area in the southern portion of the Central Subregion. Limestone Canyon Regional Park and Whiting Ranch Wilderness Park make up a majority of this focus region of over 18,500 acres. The focus area is bisected by the Santiago canyon south of the town of Modjeska where it divides the higher elevation Santa Ana Mountains to the east from the Loma Ridge. East of this divide, the Santa Ana Mountains rise precipitously from 1200' to over 5600' (at Santiago Peak outside of the mapping

area) across a distance of just 5 ½ miles. This divide also corresponds to a group-level floristic

change, where alliances from the Coastal Sage Scrub Group dominate to the west and California xeric chaparral being the predominant vegetation to the east. Perhaps due to this quick change in elevation over a short distance, stands of *Ceanothus crassifolius* are mapped to within 15 miles of the coast where one could possibly expect the occurrence of the more maritime *C. megacarpus* to occur.

## **II. Orange County Vegetation Mapping Methodology**

### **A. Overview**

The initial steps of the mapping effort included the photo interpreters reviewing the study area for terrain, environmental features, and probable vegetation types present. Questionable photo signatures were noted so that they could potentially be visited while on the field reconnaissance trip, which took place shortly thereafter. After field reconnaissance, the GPS waypoints, associated ground photos, and image-based photo signatures were correlated. A preliminary vegetation mapping classification based on the NVCS was created from information gathered on the reconnaissance trip and discussions with NROC and CDFW ecologists. The preliminary floristic classification uses the approximately 200 ground based rapid assessment field plots collected in 2013 by AECOM Technology Corporation (AECOM 2013) and subsequently analyzed and classified by CDFW. Photo interpreters used the raw data collected from the rapid assessment plot gathering effort in addition to the preliminary keys and descriptions created by CDFW. The initial data-gathering phase of the mapping effort took approximately 2 months.

Production level delineations and labeling commenced following the correlation of the field reconnaissance data to the imagery and the subsequent development of photo interpretation & biogeographical descriptions of the types. Existing datasets depicting topography, climate and past vegetation gathering efforts aided photo interpreters in their delineations and floristic assignments during the production effort. The production level delineations and labeling effort took approximately 6 months.

During the mapping production effort, two ground based verification trips were undertaken which were designated to validate the general trends and models established by the photo interpreters in the course of the signature and model development phase of the project. Any erroneous assumptions were corrected during this effort and previous mapping was subsequently adjusted accordingly. The validation efforts and map corrections took approximately 3 weeks, of which, 3 days were spent in the field.

The draft map product was subsequently delivered to CNPS for the final Accuracy Assessment (AA). Results from the AA effort were analyzed by photo interpreters and any ensuing questions were addressed by CDFW ecologists. A final AA database was delivered to AIS that was used to update the vegetation map. The incorrect calls to the mapped polygons were corrected to the

ground based AA point. Additional corrections and refinements were made to other polygons that followed incorrect trends established from the AA database points.

## B. Project Materials

### Imagery used for the Photo interpretation

Several sets of imagery were used in the creation of the vegetation map. Since the project commenced approximately 1 year after the release of the 2012 NAIP imagery, it was determined that the baseline imagery was to come from this source. NAIP imagery is a widely distributed and low cost product to the public and although photo interpreters had access to higher resolution imagery, it was considered important to reference the data to a source imagery available to all agencies both local and statewide. All vegetation delineations and floristic assignments are referenced spatially and temporally to the 2012 NAIP Imagery. The 2012 NAIP imagery captures conditions in the mapping area shortly after the onset of the dry season in the month of June. The imagery depicts conditions after a lower than normal rainfall season. Image resolution (Image Pixel Size) is 1 meter and the imagery used is natural color.

Although the NAIP 2012 imagery serves as the baseline dataset, other image datasets aided photo interpreters in defining floristic types and delineating vegetation stands.

### Online Imagery

At times, additional online imagery was needed to help finalize vegetation-coding decisions. On these occasions, online imagery from Google Earth (GE) was used. In addition, the World Imagery layer available through ArcGIS Online was also used when needed. The dates of the online imagery from Environmental Systems Research Institute (Esri) were unknown and variable but the dates of the imagery used in conjunction with GE were acknowledged. Polygon delineations could be overlain directly onto the online imagery acquired through Esri. GE imagery was used with a follow-along tool and viewed on an adjacent screen.

The table below shows all image datasets used in the mapping effort. Those denoted with an asterisk are accessed through on-line technology.

Image Name	Year Created	Resolution	Color
NAIP	2012	1-meter	Natural Color
NAIP	2012	1-meter	CIR
Eagle Aerial	2012	3-inch	Natural Color
Orange County	2006	1-foot	Natural Color
*Google Earth	Variable	Variable	Natural Color
*Esri – World Imagery	Variable	Variable	Natural Color

## Ancillary data

The following is a list of other datasets used by the photo interpreter in the mapping process.

Ancillary Data
Orange County Management units
2008 AIS vegetation map of the Irvine Ranch Property
IRC grasslands map & 2003 Harmsworth Study
OC fire history map
1992 Jones & Stokes baseline vegetation map
Merkel & Associates Upper Newport Bay habitat map
OCFA fire history map
CNPS alluvial scrub data points
OC cactus scrub habitat map (2006, 2008 & 2011)
CNDDDB rare plants database
OC DRG topo map layer
Esri online Topo Maps
Esri online USA Topographic Maps

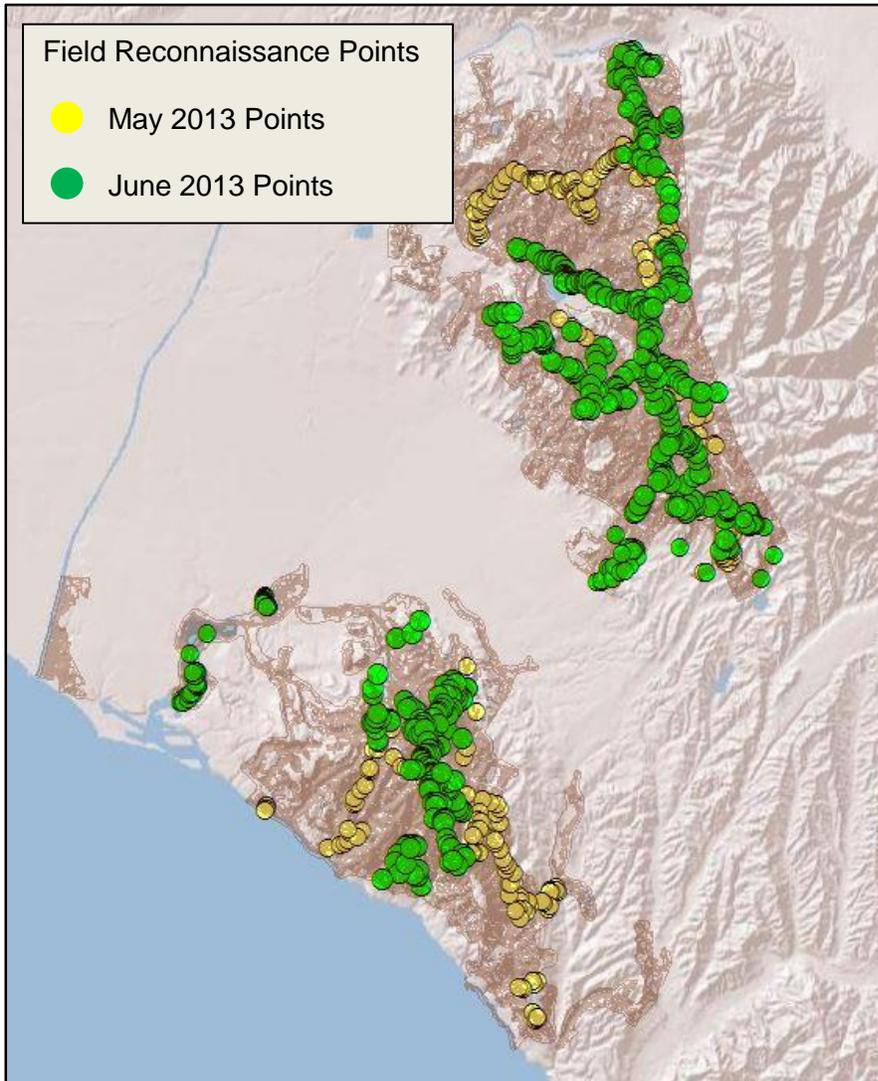
The use of contour data derived from digital elevation models and supplementary information from the ancillary datasets such as the ones in the table above are an important source of data for the photo interpreter. Vegetation communities have a wide range of image signature characteristics and overlapping signatures between differing vegetation communities can be extensive. It is therefore necessary for the photo interpreter to have a thorough understanding of the topographical setting (slope steepness, direction of the slope, shape of the slope, position of the vegetation stand on the slope) in addition to modal elevation in which the vegetation communities occur. These biogeographic variables along with substrate characteristics, flooding frequency and severity are but just a few of the features that help in defining where a stand of vegetation occurs in the landscape.

## Mapping Classification

After the initial field reconnaissance trips with CDFW & Orange County ecologists, a preliminary mapping classification was created based on the Manual of California Vegetation Second Edition. (Sawyer, Keeler-Wolf, and Evens, 2009). Mapped types in the county were characterized generally to the Alliance level in the NVCS hierarchy where possible and to more generalized categories (e.g., Group or Macrogroup) for most herbaceous vegetation and when the photo interpreters were unable to assign shrub and tree types to a specific alliance. The mapping classification has been updated throughout the production and final phase of the project and reflects what the photo interpreter can identify and map off existing imagery. The final classification has been updated based on the scoring from the accuracy assessment phase of the effort. Types, which scored too low, were aggregated into higher levels of the classification.

The final mapping classification mirrors the floristic key, but the descriptions are tailored to the more specifically defined Orange County map study area.

### C. Field Reconnaissance



Field reconnaissance visits serve two major functions. First, they enable photo interpreters to relate the vegetation ground conditions at each observation site to the signatures on the aerial imagery. Second, with guidance from ecologists in the field, the photo interpreters become familiar with the flora, vegetation assemblages, and local ecology of the study area. At the same time, ecologists gain understanding from the photo interpreters' perspective about assessing vegetation through the framework of map creation.

Prior to two reconnaissance trips in May & June of 2013, AIS photo interpreters reviewed imagery on-screen to identify and select potential reconnaissance sites in close proximity to roads and trails. Sites were selected to represent different vegetation types and percent cover, as well as

variations in geography, landform, and abiotic factors such as percent slope, aspect, shape of the slope, and elevation. AIS staff noted these sites within the study area to visit for observation. Hard copy maps were created for each of the sites; the potential site data were downloaded onto Google Earth KMZ files, and put onto a smartphone to assist in field navigation.

The field crew consisted of three photo interpreters from AIS, the state ecologist from CDFW, the Science Coordinator from NROC, in addition to ecologists and other field personnel from The Nature Conservancy, Irvine Ranch Conservancy, Orange County Parks and US Fish & Wildlife Service. Data was collected from representative sites at all focus areas throughout the study.

During reconnaissance, the crew traversed the area in two vehicles, stopping at sites that crewmembers deemed significant to study. Areas encountered in transit as well as areas of floristic or biogeographical significance were visited in the field as observation points. In addition, observation points were frequently taken to mark the transition between vegetation types, with the intent of helping photo interpreters to determine the edges of stands. A single observation point may have contained information about more than one stand. It was also possible for a given stand to be assessed in multiple places. Some stands of vegetation were remotely observed at a distance with the aid of binoculars. The location of these remote stands was determined using a compass and laser rangefinder. The field crewmembers from AIS recorded each location visited in a GPS unit and logged pertinent information on field sheets.

At many observation points, the crew took digital color ground photos. The photo number, direction the photographer was facing, and other information about the photo was recorded on a field sheet and later input into computer files for easy reference. For the mapping effort, the field data (GPS waypoints and site descriptions) and linked ground photos were essential for correlating conditions seen on the aerial imagery to conditions on the ground.

### **III. Photo Interpretation and Mapping Procedures**

#### **A. Photo Interpretation Process**

Photo interpretation is the process of identifying map units based on their photo signature. All land cover features have a range of photo signatures. These signatures are defined by the color, texture, tone, size, and pattern exhibited on the aerial imagery. By observing the context and extent of the photo signatures associated with specific land cover types, the photo interpreter is able to identify and delineate the boundaries between plant communities or signature units on a digital image or map.

It should be noted that vegetation stature as well as the scale and resolution of the aerial imagery determine the visibility of individual plants. Trees and shrubs are usually visible as individuals on high-resolution digital imagery. However, grasses (other than bunch grass clumps) are rarely seen as individual plants.

Environmental factors such as elevation, slope, and aspect also play an important part in the photo interpretation decision-making process. Knowledge of these factors, and how plant communities respond to them, guides a photo interpreter in choosing from among other plant types with similar photo signatures. Ultimately, such knowledge enables vegetation mappers to create biogeographical models of expected vegetation communities where the vegetation types are indistinct on the imagery. This ecological approach produces a more accurate product than would be created by relying solely on extracting information from the imagery, which is subject to variations in color, clarity and ground conditions.

The detailed descriptions of each vegetation type mapped in the study area, found in Appendix D, include examples of the types of information the photo interpreters incorporate into their understanding of the models. Some examples of these models include how one alliance may favor broad floodplains, while another is found in the immediate fringe of narrow well-defined channels. Some alliances may flourish on disturbed sites, while others cannot tolerate multiple frequencies of high intensity disturbance events such as fire. Moreover, some alliances are ubiquitous and found in a variety of settings.

These descriptions also discuss the importance of various plant species in the alliance. Frequently, complicated relationships exist between the relative covers of plants, such as in alliances named for indicator species having lower percent cover than other species present. Thus, both environmental setting and rules regarding relative cover factor into the intelligent delineation of vegetation polygons.

## **B. Field Questions**

During the photo interpretation process, it is common for photo interpreters to encounter areas that have questionable or confusing photo signatures. These polygons were flagged for ground observation (referred to as field checks) for the fall 2013 verification effort. Listed below are the consistently occurring difficulties photo interpreters encountered during the production mapping process:

1. Difficulty separating out the *Artemisia californica* – *Eriogonum fasciculatum* Alliance from the *Artemisia californica* – *Salvia mellifera* Alliance
2. Challenges in defining mesic chaparral communities other than scrub oak
3. Verifying the presence of unusual stands of maritime chaparral, particularly *Ceanothus megacarpus* stands within ½ mile of the coast.
4. Reliability in delineating stands strongly dominated with *Diplacus aurantiacus*
5. Problems in modeling the two tree willow alliances (*Salix laevigata* & *S. gooddingii*)

## **Conclusions Based on Field Findings**

- Topographical refinements helped in separating out variability in issue 1 above. *A. californica* – *S. mellifera* tend to be on somewhat less steep settings.

- Challenges remain in separating out mesic chaparral alliances; it was determined that *Fraxinus dipetala* stands were to be mapped to the *Heteromeles arbutifolia* Alliance (stands noted in the field shared dominance). There is currently no alliance defining the former.
- Verification of mapped stands of maritime *C. megacarpus* proved fairly accurate; however, additional stands were noted in the Laguna Hills – Aliso Canyon Focus Area.
- Models based on the location of the two tree willow stands were accurate about ¾ of the time; at times however, verification noted mapped stands to the *Salix lasiolepis* shrub willow Alliance.

### C. Mapping Process

Just as the use of biogeographical models by experienced photo interpreters contributed to the production of a high-quality vegetation map, the use of reliable mapping procedures allowed the map to be produced in a highly efficient manner. For example, the study area was divided into eight modules. This expedited project workflow by enabling several staff members to work on the mapping effort simultaneously. Note that the six focus areas described above in section 1A were used primarily for training purposes and were designated for their floristic and biogeographical similarity.

Using an on-screen heads-up digitizing method, the photo interpreters had at their disposal a suite of standard and custom ArcMap tools to facilitate the creation of polygons. The photo interpreters generally viewed the imagery at scales ranging from 1:1000 to 1:4000. They used variations in signature to draft boundaries separating areas of different vegetation types and/or distinct categories of percent cover of several stature levels. To assist in boundary placement and coding decisions, photo interpreters also referenced supplemental imagery, field reconnaissance data, and other ancillary data. These sources were displayed in the ArcMap session as needed.

Photo interpreters assigned each polygon the following attribute code string:

<b>Vegetation Mapping Attributes</b>
VegCode
ConDensity
HWDensity
ShrubDensity
HerbDensity
Disturbance
Exotic
LandUse
Comment

Two additional attributes were assigned using the VegCode field and related to an excel table:

<b>Vegetation Mapping Attributes</b>
VegLongName

The Vegetation Mapping Classification is located in Appendix A. The vegetation codes were entered into the database as numeric values, which are easier to input and manipulate than alphanumeric codes. Numeric code values also allow for the hierarchical grouping of like vegetation communities, assisting the mapper to know at a glance, which alliances are found in a particular hierarchical grouping. A custom menu was developed by GIS staff that enabled code values to be assigned to their corresponding spatial extent efficiently and minimizing the possibilities for entry errors. Once the geodatabase neared completion, the numeric code values were correlated with the actual vegetation type names.

The eight modules were edge-matched and checked for invalid codes and topology errors. Once finished, they were joined into one seamless geodatabase. The geodatabase was subject to further processing and review by a senior staff member before being delivered to the client. Quality control procedures implemented during the mapping effort and before final delivery of the data improved the consistency and accuracy of the overall geodatabase.

#### **D. Mapping Criteria**

As discussed above, appropriate tools and reference sources, photo interpretation training, and knowledge of vegetation communities are all essential in creating a quality vegetation map. However, without the establishment and refinement of mapping criteria, a given vegetation map could be riddled with discrepancies, as different photo interpreters approach the task with different assumptions and styles. Guidelines and rules regarding exceptions, special situations, and minimum feature size are discussed and disseminated to all staff members before and during the mapping effort, which helps to create a clear and consistent product. Establishing criteria also makes the mapping process more efficient, as individual photo interpreters do not have to pause too long to consider how best to capture the more commonly occurring ambiguous situations that are confronted.

The specific criteria for each attribute for the final deliverables before AA analysis are discussed below under the appropriate heading.

#### **E. Mapping Attributes**

The following section describes each of the attributes mapped for the all of the vegetation within the defined study area.

### **PI Attribute**

This is the 4-digit code that corresponds to a vegetation type (e.g. Mapping Unit, Alliance, Group, or Macrogroup) or miscellaneous class (e.g. urban disturbance, water) in the Vegetation Mapping Classification. The PI attribute is assigned to all the vegetation polygons in the geodatabase.

Each vegetation type is described in Appendix D; the Vegetation Mapping Classification is presented in Appendix A; and a summary table of vegetation acreage by vegetation map unit is presented in Appendix C.

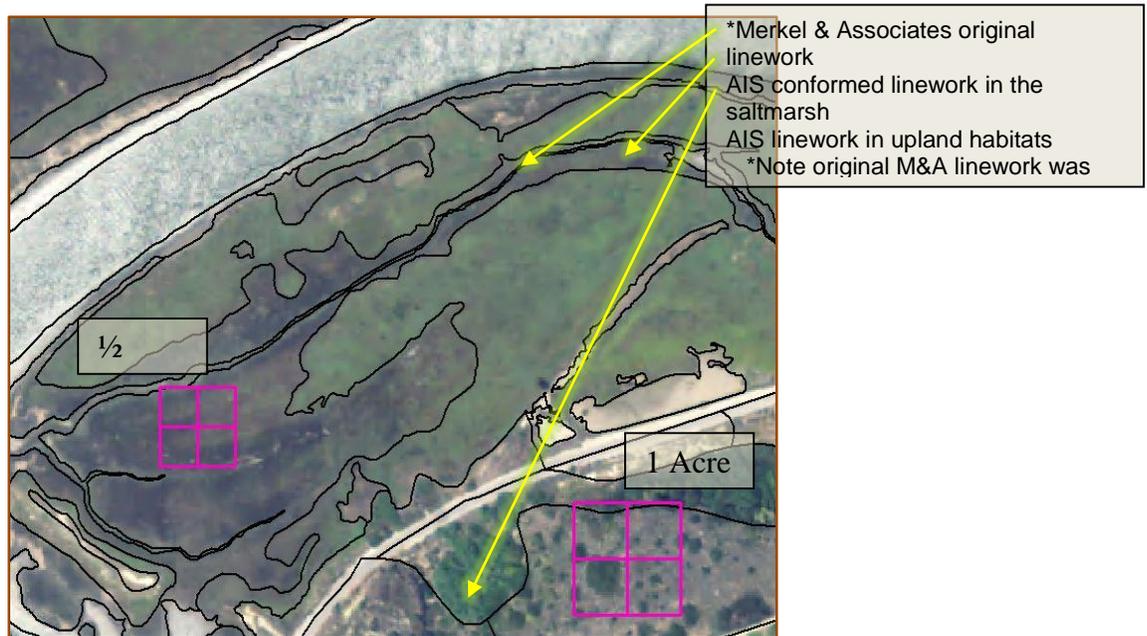
### ***Vegetation Mapping Considerations***

When the photo interpreter could not confidently classify a polygon at the alliance-level, or the vegetation was a mix that did not fit into an alliance-level or mapping unit, the polygon was assigned a broader group-level code. All mapping unit codes, with the exception of 6001 (Meadow (*Carex* – *Juncus* – *Eleocharis*) Mapping Unit) and 6101 (Fresh Water Marsh (bulrush – cattail) Mapping Unit) were subsequently cross-walked into an appropriate alliance or group level code as defined by the MCV2.

For vegetation mapping, a minimum polygon size is an important consideration when creating and viewing a vegetation geodatabase. A minimum mapping unit (MMU) is established to ensure the map contains polygons of a workable, meaningful size. The choice of an MMU is influenced by the clarity of the imagery, the detail of the mapping classification, the purpose of the data, and time and budget constraints. MMU can vary for different categories of features being mapped. The Statewide mapping criteria has established different MMUs depending on the area being mapped (e.g., Desert mapping MMUs are different from Sierra Foothills MMUs). For this project, there were two established MMUs: 1 acre for uplands and .5 acre for special & wetland features. In mapping the Upper Newport Bay and the Irvine marsh, the MMU was lowered in order to delineate the intricate patterning and small stands of vegetation that occurred across the landscape in both areas. The MMU rule was also lowered to conform to the linework, which was taken from the April 2012 Upper Newport Bay Habitat Map by Merkel & Associates, Inc.

The establishment of a MMU requires the need for guidelines when aggregating vegetation that occurs below that defined MMU. In general, similar life forms are aggregated together: tree-dominated types are aggregated with other tree-dominated types, shrub types with other shrub types, and herbaceous types with other herbaceous vegetation types. However, if possible, wetland vegetation types are not aggregated with upland types, even if they are in the same life form. Another guideline is used when a vegetation unit below MMU is aggregated with the vegetation type that completely surrounds it. This is known as a mapping or vegetation inclusion. Finally, if a vegetation unit that is below MMU is the same life form as two adjacent larger stands, and the adjacent stand types are very dissimilar

in environment, the unit may be aggregated with the more environmentally similar adjacent type.



In addition to establishing MMU size, guidelines were established for the minimum width (MW) of a map polygon. The rule of thumb was to make the MW roughly half the width of an MMU square. For the .5 acre MMU, the MW is approximately 70 feet and for the 1 acre MMU, the MW is approximately 135 feet. This guideline did not preclude the creation of polygons where a small section fell below the minimum width, as long as the greater portion of the polygon met the stated criteria. This is most common when a narrow stream or riparian polygon was mapped and below MMU or MW portions were included in order to keep the continuity of the stream or riparian vegetation. As mentioned above regarding overall MMU, AIS opted to map below these limitations where structural, floristic and or ecological characteristics were significantly different from the adjacent vegetation.

Another type of mapping consideration pertains to sparsely vegetated or nonvegetated areas. Polygons assigned to a floristic type in the NVCS often contain small areas of unvegetated surface that is too small to delineate. These sparsely vegetated to nonvegetated areas were not coded in the database unless they met the minimum mapping resolution and could be mapped as separate polygons. The most common examples are small rock outcroppings in shrub dominated communities, small riverine flats or wash channels in riparian stands of vegetation.

## Percent Cover Attributes

The percent cover attributes include the following:

- DensityConifer
- DensityHardwood
- DensityShrub
- DensityHerbaceous

Percent cover, also referred to as density, is a quantitative estimate of the aerial extent of the living plants for each vegetation layer mapped within a stand. Absolute percent cover, based on a birds-eye (what a photo interpreter can see from the sky looking down) view, is the primary metric used to quantify the importance or abundance of a life form and/or species.

It should be noted that the cover of a stand could be considered a more significant attribute than the floristic assignment depending on the end use of the map. A mapped line dividing a break between a shrub cover density of 60% to a cover density of 10% can be more important than a polygon separating close floristic types (such as between an *Artemisia californica* alliance and an *Artemisia californica* – *Eriogonum fasciculatum* Alliance). More often than not, the cover of a stand will change following one or more severe burn events. Therefore, in studying a change that has occurred between vegetation maps completed at different times, it is, in most cases, more likely that the vegetative cover will drop rather than the actual vegetation type change.

The percent cover was estimated separately for conifer, hardwood, shrub and herbaceous layers. Density was assessed and then assigned to a percent cover range category (see Appendix B) for each layer and recorded in the database.

To determine the vegetative density, photo interpreters assigned percentages to the different life forms visible on the imagery, including nonvegetated areas. The cover percentages were then converted into the appropriate cover category for each of the life forms being mapped. For example, if a hardwood density was 5%, then it was assigned the range of 2-9%. These values are listed in Appendix B.

Photo interpreters formed separate polygons when there were changes from one cover class to another within a vegetation mapping type. A given vegetation polygon would have been subdivided due to cover differences regardless of which strata the cover difference occurred in. For example, two adjacent polygons in the geodatabase may have had the same shrub vegetation type assigned but different cover categories for conifers (for example, 2-9% versus <2%).

Most standardized vegetation mapping efforts have a set of criteria regarding percent cover. The Orange County mapping effort follows the same criteria as the CA Statewide criteria, where a life form generally needs to account for at least 8 to 10 percent cover in order for an alliance of that life form to be mapped.

### **Percent Cover Mapping Considerations**

It is important to note that the photo interpreters could only accurately quantify the vegetation that is visible on the aerial imagery. Therefore, in this project, only “bird’s eye” total cover was mapped. Thus, the cover of understory layers, which were obscured by overstory layers were not included in this analysis. For this reason, total cover of understory vegetation may be underestimated, especially if their extent was hidden under the crowns of trees. In addition, cover estimates may differ from assessments done on the ground because of the aforementioned reasons.

Stands of riparian vegetation, along with adjacent unburned chaparral and coastal scrub, often occur in dense cover over 60%. Where the overstory cover exceeded 40%, it was considered too dense to give a reliable estimate of lower tier canopy or understory percent cover. In these situations, the code assigned for percent cover for the understory life forms would be given a value of “Not applicable/Not assigned”. This same criterion has been used in numerous statewide mapping efforts. For example, if a conifer tier cover exceeded 40%, then the other tiers below (hardwood and shrub) were not evaluated for cover. If the conifer tier cover was <40% but together with the hardwood tier the combined cover was >40%, then the shrub cover was not estimated. Appendix B includes tables that present the ranges of percent cover used for each of these categories, along with any relevant notes.

The date that the aerial photography mission is flown influences the percent cover assigned to vegetation types. Subsequent field reconnaissance and field verification efforts must take into consideration the following factors that can cause apparent discrepancies between the percent cover evident on the imagery and percent cover seen in the field:

- Seasonality - The percent cover of most plants is variable due to their annual growth cycle. Depending on whether the aerial imagery was taken during the wet season or the dry season, a mapped unit could show a different percent cover on the aerial imagery than is observed during an on-site visit at a different time of the year. Differences in leaf phenology (cold-season deciduous, drought deciduous, facultatively deciduous) can affect plant cover determination. Leaf-on conditions obscure the understory. Imagery of leaf-off conditions would allow photo interpretation of the understory, but make it difficult to identify the overstory species since there is no foliage present.
- Annual variability - The environmental conditions at the time of the imagery (wet vs. drought years, flooding, etc.) may affect the percent cover seen during the on-site field visits.

**Land Use Attribute**

This field identifies whether or not a polygon is in land use (either built-up or in agriculture). The field gives the user an opportunity to refine the map with a higher-level land use classification at a future date, such as differentiating a commercial from a residential area. The field also notes the presence of special linkage areas whether or not they are built-up or naturally vegetated.

**Comment Attribute**

This field is considered a catchall for significant information regarding a polygon and generally contains “value added” information that cannot be statistically quantified by the photo interpreter. An example of this “value added” information is the photo interpreter noting predominant species present in the stand other than the vegetation type being mapped. Polygons are not created or split based on this field.

Examples of important information that can be derived from this field are noted below:

- Stands assigned to the Xeric chaparral group that are noted with the presence of post burn cypress regeneration
- Stands of *Malosma laurina* noting the presence of small amounts of other shrubs such as *Adenostoma fasciculatum* or *Artemisia californica*.
- Native grasslands noted in the comments field as to ancillary databases that aided in the mapping of the stand – Notably IRC surveys.
- Post fire stands noted with a high cover of *Acmispon glaber*

**Disturbance Attribute**

This field denotes vegetation removal by road impact, scraping or other human-related processes. The intensity is measured as a percent of the polygon affected, and is given general categories of low, medium and high. Polygons are not created or split based on this field. Specific values are noted in Appendix B.

**Exotics Attribute**

This field denotes vegetation that has an exotic component in the stand. Exotics may consist of woody or herbaceous vegetation and is measured as a relative component to the total cover. General categories are assigned to low intensity when patches of exotic vegetation are visible but cover is not significant. Moderate to severe cover is assigned to a polygon where cover may exceed dominant vegetation. A severe category is assigned to the polygon when the vegetative type itself is an exotic type (*Eucalyptus*). Polygons are not created or split based on this field. Specific values are noted in Appendix B.

**Riparian Attribute**

This field identifies all riparian vegetation in the mapping area. This includes alliances within the following Groups:

- 1600 – Vancouverian riparian deciduous forests
- 1700 – SW North American riparian woodlands

- 1800 – SW North American riparian/was scrub
- 1900 – SW North American Introduced Riparian Scrub

The riparian attribute is also assigned to the *Quercus agrifolia* riparian type (1121). The field enables users to quickly identify or locate all 4433 acres of riparian vegetation types mapped in the study area.

## **F. Quality Control and Delivery of the Final Product**

Quality control steps were used throughout the duration of the project in order to make sure the map followed set guidelines and consistency among the photo interpreters. Once the initial photo interpretation phase was completed, a comprehensive quality control was performed by a different photo interpreter. Checks were then run for invalid vegetation codes, invalid densities for each life form, and topology-related problems.

Quality control checks for illogical coding combinations were also run on polygons. An example of an illogical coding combination is “a dense coast live oak woodland with a high conifer component in the conifer density field.” After the final changes from the accuracy assessment phase were implemented into the geodatabase, one last round of quality control checks were run on the geodatabase before it was delivered to the client.

## **G. Accuracy Assessment**

To validate the vegetation map, an accuracy assessment (AA) effort was conducted using field verification. CNPS, in consultation with Todd Keeler-Wolf at the California Department of Fish and Wildlife (CDFW), estimated that at least 420 AA surveys would be needed to test the accuracy of the mapped units. (California Native Plant Society 2015) These 420 AA survey points were collected by CNPS field ecologists using only the polygon boundaries of the vegetation map. Scoring of the polygons was done by CDFW (as a third party) using a system of fuzzy logic from 0 to 5, with 5 being a perfect match to the alliance identified in the field.

Accuracy of the new vegetation map was assessed, using a field-based sampling approach of collecting basic vegetation data pertaining to specific map polygon and map units. An accuracy assessment analysis helps map users determine how much confidence can be assigned to each of the map units, and provides an understanding of the map’s appropriateness for various applications, such as species habitat modeling and other uses. (CNPS 2015 AA Report)

After completion of the AA, CDFW delivered the preliminary results to the photo interpreters. Each point was reviewed and an Excel spreadsheet generated with comments on each of the AA points. AA points were noted by photo interpreters as to whether or not they were in agreement with the final call made by the AA field ecologists. If the call was in question or disputed, it was noted in the database along with the reason for its question. The database was sent to CDFW for final

review. The final results of the AA (with questions or disputes resolved) were then delivered back to AIS photo interpreters for input. Photo interpreters used these points to evaluate trends and make additional corrections to the map. Some significant changes were made to the vegetation map based on the photo interpreters review of the AA points and are noted below:

- Stands mapped to the *A. californica* Alliance were reviewed for possible change to the mixed *A. californica* – *E. fasciculatum* Alliance
- Stands mapped to the mixed *S. mellifera* – *A. californica* Alliance were reviewed for possible change to the *S. mellifera* Alliance
- Stands mapped to *Malosma laurina* Alliance scored low in inland areas of the study. Many of these stands were identified to *R. integrifolia*. Visited polygons were updated; extrapolation to adjacent stands however proved difficult based on similar signature characteristics between the two alliances in inland settings.

Although the final product is more accurate from the final accuracy assessment process, it cannot be determined how much more accurate the vegetation map is without further evaluation.

The Federal Geographic Data Committee standards (FGDC 2008) require that a vegetation map should achieve an overall accuracy of 80%. After final scoring, the new Orange County vegetation map received an overall accuracy of 87%. The new fine-scale vegetation map and supporting field survey data provide baseline information for long-term land management and conservation within the remaining natural lands of Orange County.

The methodologies and results of the accuracy assessment are treated in a separate report by the California Native Plant Society.

## V. References

- AECOM. 2013. Vegetation Classification Report for Orange County. Unpublished report prepared for the Nature Reserve of Orange County.  
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- Buck-Diaz, J & Julie M. Evens. 2015. California Native Plant Society (CNPS), Accuracy Assessment Report for the 2012 Orange County Vegetation Map.
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- Dave Bramlett & Jones & Stokes Associates, Inc. 1993. Methods Used to Survey the Vegetation of Orange County Parks and Open Space Areas and The Irvine Company Property. Unpublished report prepared for County of Orange, Environmental Management Agency. Santa Ana, CA
- Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. Maps used as backdrops in this report.
- Irvine Ranch Conservancy 2003. IRC Native Grasslands Survey & Polygon Map
- Merkel & Associates, Inc. Habitat Map – April 2012. Upper Newport Bay Ecosystem Restoration Project – Post-restoration Monitoring Program
- Sawyer, J.O., T. Keeler-Wolf, and J. Evens. 2009. A Manual of California Vegetation. California Native Plant Society, Sacramento, CA.
- USDA Forest Service, Pacific Southwest Region Native Plant Materials Program and the Riverside-Corona Resource Conservation District; in partnership with the CNPS Vegetation Program, Riverside Fire Lab, PSW-4403 and the Riverside-Corona RCD for data collection. Alluvial Scrub Data for Riverside & Orange County.

## APPENDIX A: Orange County Mapping Classification

PI Code	Alliance	Group
1110	<i>Juglans californica</i>	California Broadleaf Forest & Woodland
1120	<i>Quercus agrifolia</i>	California Broadleaf Forest & Woodland
1121	<i>Quercus agrifolia riparian</i>	California Broadleaf Forest & Woodland
1210	<i>Hesperocyparis forbesii</i>	California Conifer Forest & Woodland
1410	<i>Pseudotsuga macrocarpa</i>	California Montane Conifer Forest & Woodland
1510	<i>Eucalyptus (globulus, camaldulensis)</i>	Californian Semi-natural Forest
1730	<i>Salix laevigata</i>	Sonoran-Chihuahuan Warm Desert Riparian Woodland
1610	<i>Alnus rhombifolia</i>	Sonoran-Chihuahuan Warm Desert Riparian Woodland
1710	<i>Platanus racemosa</i>	Sonoran-Chihuahuan Warm Desert Riparian Woodland
1740	<i>Populus fremontii</i>	Sonoran-Chihuahuan Warm Desert Riparian Woodland
1720	<i>Salix gooddingii</i>	Sonoran-Chihuahuan Warm Desert Riparian Woodland
2130	<i>Ceanothus megacarpus</i>	California Xeric Chaparral
2120	<i>Ceanothus crassifolius</i>	California Xeric Chaparral
2110	<i>Adenostoma fasciculatum</i>	California Xeric Chaparral
2140	<i>Adenostoma fasciculatum-Salvia mellifera</i>	California Xeric Chaparral
2210	<i>Malosma laurina</i>	California Maritime Chaparral
2230	<i>Quercus dumosa</i>	California Maritime Chaparral
2220	<i>Rhus integrifolia</i>	California Maritime Chaparral
2330	<i>Heteromeles arbutifolia</i>	California Mesic & Pre-montane Chaparral
2350	<i>Quercus berberidifolia-Adenostoma fasciculatum</i>	California Mesic & Pre-montane Chaparral
2340	<i>Quercus berberidifolia</i>	California Mesic & Pre-montane Chaparral
2320	<i>Cercocarpus montanus</i>	California Mesic & Pre-montane Chaparral
2410	<i>Arctostaphylos glandulosa</i>	California Mesic & Pre-montane Chaparral
2310	<i>Ceanothus tomentosus</i>	California Mesic & Pre-montane Chaparral
3110	<i>Artemisia californica</i>	Central & Southern California Coastal Sage Scrub
3120	<i>Artemisia californica-Eriogonum fasciculatum</i>	Central & Southern California Coastal Sage Scrub
3130	<i>Artemisia californica-Salvia mellifera</i>	Central & Southern California Coastal Sage Scrub
3220	<i>Diplacus aurantiacus</i>	Central & Southern California Coastal Sage Scrub
3140	<i>Encelia californica</i>	Central & Southern California Coastal Sage Scrub
3150	<i>Eriogonum fasciculatum</i>	Central & Southern California Coastal Sage Scrub
3160	<i>Eriogonum fasciculatum-Salvia apiana</i>	Central & Southern California Coastal Sage Scrub
3170	<i>Keckiella antirrhinoides</i>	Central & Southern California Coastal Sage Scrub
8120	<i>Opuntia littoralis</i>	Central & Southern California Coastal Sage Scrub
3180	<i>Salvia apiana</i>	Central & Southern California Coastal Sage Scrub
3190	<i>Salvia leucophylla</i>	Central & Southern California Coastal Sage Scrub
3210	<i>Salvia mellifera</i>	Central & Southern California Coastal Sage Scrub
3340	<i>Acmispon glaber</i>	Central & South Coastal California Seral Scrub
3310	<i>Ericameria palmeri</i>	Central & South Coastal California Seral Scrub
3330	<i>Isocoma menziesii</i>	Central & South Coastal California Seral Scrub
3350	<i>Malacothamnus fasciculatus</i>	Central & South Coastal California Seral Scrub
5310	<i>Baccharis pilularis</i>	California North Coastal & Mesic Scrub
5210	<i>Toxicodendron diversilobum</i>	California North Coastal & Mesic Scrub
4110	<i>Leymus condensatus</i>	California Native Perennial Grassland

PI Code	Alliance	Group
4120	<i>Stipa lepida</i>	California Native Perennial Grassland
4130	<i>Stipa pulchra</i>	California Native Perennial Grassland
4210	<i>Avena (barbata, fatua)</i>	California Semi-natural Grassland & Forb Meadow
4220	Brassica nigra and other mustards	California Semi-natural Grassland & Forb Meadow
4230	<i>Bromus (diandrus, hordeaceus)- Brachypodium distachyon</i>	California Semi-natural Grassland & Forb Meadow
4250	<i>Cynara cardunculus</i> Provisional	California Semi-natural Grassland & Forb Meadow
4290	<i>Erodium</i> spp.	California Semi-natural Grassland & Forb Meadow
4280	<i>Lolium perenne</i>	California Semi-natural Grassland & Forb Meadow
4260	<i>Cortaderia (jubata, selloana)</i>	Southern Vancouverian Lowland Semi-natural Grassland & Shrubland
5410	<i>Carpobrotus edulis</i> or Other Ice Plants	North Pacific Maritime Coastal Sand Dune Semi-natural Scrub & Herb
6110	<i>Schoenoplectus acutus</i>	Arid West Interior Freshwater Emergent Marsh
6130	<i>Schoenoplectus californicus</i>	Arid West Interior Freshwater Emergent Marsh
6140	<i>Scirpus robustus</i>	Arid West Interior Freshwater Emergent Marsh
6120	<i>Typha (angustifolia, domingensis, latifolia)</i>	Arid West Interior Freshwater Emergent Marsh
1910	<i>Arundo donax</i>	Western North American Semi-natural Wet Shrubland, Meadow & Marsh
6310	<i>Lepidium latifolium</i>	Western North American Semi-natural Wet Shrubland, Meadow & Marsh
1820	<i>Salix lasiolepis</i>	North American Warm Desert Riparian Low Bosque & Shrubland
1830	<i>Sambucus nigra</i>	North American Warm Desert Riparian Low Bosque & Shrubland
1810	<i>Baccharis salicifolia</i>	North American Warm Desert Riparian Low Bosque & Shrubland
7140	<i>Distichlis spicata</i>	Temperate Pacific Tidal Salt & Brackish Marsh
7110	<i>Sarcocornia pacifica (Salicornia depressa)</i>	Temperate Pacific Tidal Salt & Brackish Marsh
7120	<i>Spartina foliosa</i>	Temperate Pacific Tidal Salt & Brackish Marsh
7130	<i>Bolboschoenus maritimus</i>	Temperate Pacific Tidal Salt & Brackish Marsh
7210	<i>Atriplex lentiformis</i>	North American Desert & Semi-Desert Alkaline-Saline Shrub Wetland
8220	<i>Bebbia juncea</i>	Warm Semi-Desert Shrub & Herb Dry Wash
8210	<i>Lepidospartum squamatum</i>	Warm Semi-Desert Shrub & Herb Dry Wash
3410	<i>Acacia (cyclops)</i>	North American Warm Desert Semi-natural & Planted Scrub & Grassland

## APPENDIX B: Attributes in the Orange County Vegetation Map

### PI

The values for this attribute are found in the Orange County Mapping Classification (Appendix A).

#### DensityConifer

0 =<2%

1 =2-9%

2 =10-24%

3 =25-39%

4 =40-59%

5 =>60%

9 =Not applicable/Not assigned

#### DensityHardwood

0 =<2%

1 =2-9%

2 =10-24%

3 =25-39%

4 =40-59%

5 =>60%

9 =Not applicable/Not assigned

#### DensityShrub

0 =<2%

1 =2-9%

2 =10-24%

3 =25-39%

4 =40-59%

5 =>60%

9 =Not applicable/Not assigned

#### DensityHerbaceous

0 =<2%

1 =<20%

2 =20-40%

3 =40-60%

9 = Not applicable/Not assigned

#### Comment\_2010

Contains text added at discretion of photo interpreter to add extra information about the vegetation polygon as well as the results of the field checks.

LandUse
0 =No Land use mapped
1000 =Urban Built Up
1800 =Special Linkage Areas
2000 =Agriculture
9800 =Water

Disturbance
0 =No Disturbance Noted
1 =Low: 5% to 25% of the polygon affected
2 =Moderate: 25% to 50% of the polygon affected
3 =High: Over 50% of the polygon affected
9 = Not applicable/Not applied

Exotics
0 =No exotics detected
1 =Low <33%
2 =Moderate-High <66%
3 =Reserved primarily for exotic types
9 = Not applicable/Not applied

Riparian
0 =Not defined as a riparian vegetation type
1 =Defined as a riparian vegetation type

## APPENDIX C: Area Reports by Floristic Type

Veg Code	Vegetation Name	Area (acres)	Area (hectares)	% of Total Area
9300	Urban/Disturbed	14,707.7	5,952.0	17.2%
4200	Mediterranean CA Naturalized Annual and Perennial Grassland Gp (Weedy)	10,218.7	4,135.4	11.9%
3120	Artemisia californica - Eriogonum fasciculatum Alliance	9,274.5	3,753.2	10.8%
3130	Artemisia californica - Salvia mellifera Alliance	8,313.1	3,364.2	9.7%
3110	Artemisia californica Alliance	4,571.3	1,849.9	5.3%
2110	Adenostoma fasciculatum Alliance	4,470.9	1,809.3	5.2%
2210	Malosma laurina Alliance	2,688.1	1,087.8	3.1%
1120	Quercus agrifolia Alliance	2,455.6	993.7	2.9%
3210	Salvia mellifera Alliance	2,154.1	871.7	2.5%
3340	Acmispon glaber Alliance	1,549.7	627.1	1.8%
2340	Quercus berberidifolia Alliance	1,289.4	521.8	1.5%
2220	Rhus integrifolia Alliance	1,237.3	500.7	1.4%
2130	Ceanothus megacarpus Alliance	1,234.8	499.7	1.4%
9320	Fuel Mod Zone	1,158.7	468.9	1.4%
2120	Ceanothus crassifolius Alliance	1,153.1	466.7	1.3%
3100	Central & South Coastal Californian CSS Gp	1,123.4	454.6	1.3%
2140	Adenostoma fasciculatum - Salvia mellifera Alliance	1,077.7	436.1	1.3%
1121	Quercus agrifolia Riparian	1,053.6	426.4	1.2%
3150	Eriogonum fasciculatum Alliance	980.3	396.7	1.1%
9820	Reservoirs and other Artificial Water Features	888.3	359.5	1.0%
8120	Opuntia littoralis Alliance	831.1	336.3	1.0%
1810	Baccharis salicifolia Alliance	814.4	329.6	1.0%
9200	Agriculture	800.2	323.8	0.9%
9800	Water Body	733.4	296.8	0.9%
9340	Vegetation Restoration Areas	700.8	283.6	0.8%
1820	Salix lasiolepis Alliance	680.6	275.4	0.8%
1720	Salix gooddingii Alliance	646.8	261.8	0.8%
4130	Stipa pulchra Alliance	597.9	242.0	0.7%
9100	Introduced Trees, Shrubs (not in hierarchy)	581.1	235.1	0.7%
9330	Anthropogenic Areas of Little or No Vegetation	575.9	233.0	0.7%
1710	Platanus racemosa Alliance	472.5	191.2	0.6%
3190	Salvia leucophylla Alliance	408.5	165.3	0.5%
1830	Sambucus nigra Alliance	403.2	163.2	0.5%
5310	Baccharis pilularis Alliance	396.2	160.3	0.5%
9420	Cliff, bluffs, scree, and rock outcrop	350.1	141.7	0.4%
3350	Malacothamnus fasciculatus Alliance	322.8	130.6	0.4%
2410	Arctostaphylos glandulosa Alliance	316.2	127.9	0.4%
3410	Acacia (cyclops) Semi-natural Stands	284.5	115.2	0.3%
7100	Temperate Pacific Tidal Salt & Brackish Marsh Gp	271.3	109.8	0.3%
2330	Heteromeles arbutifolia Alliance	255.1	103.2	0.3%
9431	Streambed	227.2	92.0	0.3%
2100	California Xeric Chaparral Gp	221.3	89.5	0.3%
3180	Salvia apiana Alliance	215.8	87.3	0.3%
3140	Encelia californica Alliance	199.9	80.9	0.2%
2350	Quercus berberidifolia - Adenostoma fasciculatum Alliance	171.3	69.3	0.2%
1510	Eucalyptus (globulus, camaldulensis) Semi-natural Woodland Stands	167.9	68.0	0.2%
9440	Tidal mudflat	159.0	64.4	0.2%
7120	Spartina foliosa Alliance	130.6	52.9	0.2%
1700	SW N. Amer. Rip. Woodland Gp	124.1	50.2	0.1%
9412	Beach sand	122.7	49.6	0.1%
2230	Quercus dumosa Alliance	121.6	49.2	0.1%
8210	Lepidospartum squamatum Alliance	110.4	44.7	0.1%
3220	Diplacus aurantiacus Alliance	103.1	41.7	0.1%
4290	Erodium	99.4	40.2	0.1%
2310	Ceanothus tomentosus Alliance	98.0	39.7	0.1%
1730	Salix laevigata Alliance	93.7	37.9	0.1%
6100	Arid West Freshwater Emergent Marsh Gp	88.7	35.9	0.1%
3300	Central & South Coastal Californian Seral Scrub Gp	86.6	35.0	0.1%
4120	Stipa lepidia Alliance	85.3	34.5	0.1%
4230	Bromus (diandrus, hordeaceus) - Brachypodium distachyon Alliance	84.2	34.1	0.1%

Veg Code	Vegetation Name	Area (acres)	Area (hectares)	% of Total Area
1910	Arundo donax Semi-natural Stands	79.0	32.0	0.1%
5210	Toxicodendron diversilobum Alliance	56.2	22.7	0.1%
4100	California Perennial Grassland Gp	53.5	21.7	0.1%
3310	Ericameria palmeri Alliance	50.6	20.5	0.1%
2300	California Mesic Chaparral Gp	42.8	17.3	0.0%
2200	California Maritime Chaparral Gp	39.3	15.9	0.0%
3330	Isocoma menziesii Alliance	37.9	15.4	0.0%
7110	Sarcocornia pacifica (Salicornia depressa) Alliance	36.0	14.6	0.0%
9411	Rocky shore	35.3	14.3	0.0%
1210	Hesperocyparis forbesii Alliance	33.4	13.5	0.0%
8000	Xeromorphic Scrub & Herb Vegetation	32.9	13.3	0.0%
6101	Fresh Water Marsh (bulrush - cattail) MU	32.1	13.0	0.0%
7200	SW North American Salt Basin & High Marsh Gp	31.9	12.9	0.0%
9810	Perennial Stream Channel	31.0	12.5	0.0%
7210	Atriplex lentiformis Alliance	30.9	12.5	0.0%
1800	SW North American Riparian/Wash Scrub Gp	29.8	12.1	0.0%
1740	Populus fremontii Alliance	26.3	10.6	0.0%
2320	Cercocarpus montanus Alliance	25.9	10.5	0.0%
8100	Coastal Baja Calif. Norte Maritime Succulent Scrub Gp	25.8	10.5	0.0%
6120	Typha (angustifolia, domingensis, latifolia) Alliance	25.5	10.3	0.0%
1610	Alnus rhombifolia Alliance	21.5	8.7	0.0%
6310	Lepidium latifolium Semi-natural Herbaceous Stands	19.7	8.0	0.0%
6140	Scirpus robustus Alliance	17.4	7.1	0.0%
3170	Keckiella antirrhinoides Alliance	17.4	7.0	0.0%
4260	Cortaderia (jubata, selloana) Semi-natural Herbaceous Stands	16.3	6.6	0.0%
1110	Juglans californica Alliance	14.7	5.9	0.0%
5410	Carpobrotus edulis or Other Ice Plants Semi-natural Stands	11.3	4.6	0.0%
6110	Schoenoplectus acutus Alliance	10.1	4.1	0.0%
9450	Salt panne	9.1	3.7	0.0%
4210	Avena (barbata, fatua) Alliance	8.8	3.6	0.0%
6130	Schoenoplectus californicus Alliance	8.2	3.3	0.0%
4000	California Annual & Perennial Grasslands MG	6.9	2.8	0.0%
6000	Temperate & Boreal Freshwater Marsh Formation	6.0	2.4	0.0%
1410	Pseudotsuga macrocarpa Alliance	4.9	2.0	0.0%
6001	Meadow (Carex - Juncus - Eleocharis) MU	4.3	1.7	0.0%
2000	California Chaparral MG	3.8	1.5	0.0%
9430	Riverine & Lacustrine	3.5	1.4	0.0%
9400	Sparsely vegetated to non-vegetated	2.3	0.9	0.0%
4110	Leymus condensatus Alliance	2.3	0.9	0.0%
3160	Eriogonum fasciculatum - Salvia apiana Alliance	2.0	0.8	0.0%
8220	Bebbia juncea Alliance	2.0	0.8	0.0%
4280	Lolium perenne Alliance	1.6	0.6	0.0%
1200	Calif. Evergreen Coniferous Forest & Woodland Gp	0.9	0.4	0.0%
7130	Bolboschoenus maritimus Alliance	0.8	0.3	0.0%
7140	Distichlis spicata Alliance	0.1	0.0	0.0%
<b>Totals</b>		85,705.3	34,683.7	100.0%

## APPENDIX D: Orange County Mapping Descriptions

### Explanation of the Descriptions

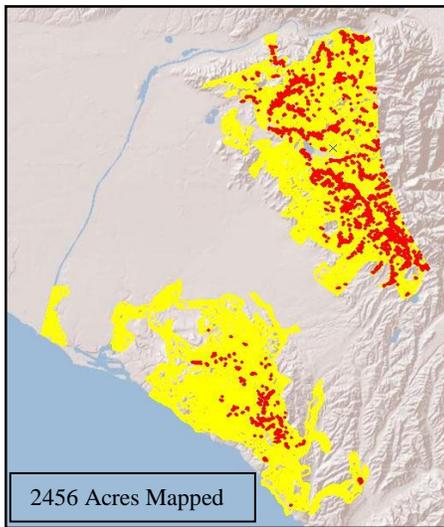
This section of the report contains descriptions for each of the vegetation types (Alliances & Map Units) represented in the final geodatabase for this project.

Most vegetation types have a detailed written description containing the following components:

- **Screenshots:** These are digital images (using the 2012 1-meter natural color NAIP imagery) showing aerial views of the vegetation stands. The screenshots give the reader a sense of the overall photo signature. Most examples represent only a portion of the stand mapped depicting pieces of the delineated polygon (in red). When the stand occupies only a portion of the imagery, an arrow denotes its proper location.
- **Ground photos:** These are digital pictures taken during the reconnaissance effort. They are a snapshot in time showing the plants in their landscape. They usually represent only a portion of the actual mapped stand.
- **Descriptions:** The descriptions discuss the expected locations, cover characteristics, species composition and other pertinent information. Species cover characteristics and relative abundance conforms to those presented in the second edition of *The Manual of California Vegetation* (MCV), but is specifically tailored to the Orange County Study. For example, where *Quercus berberidifolia* is described in the MCV as occurring primarily on steep north facing slopes, the descriptions in this document are more restrictive because within the mapping area, they are more likely to be found on protected lower slopes of variable steepness, often adjacent to small bands of riparian vegetation. Specific rules regarding definitive cover and floristic characteristics of the stand are derived from the Second Edition of the Manual of California Vegetation (MCV2) floristic descriptions and plot data and analysis. Descriptions in this section refer to common and/or likely settings within the Orange County mapping area.
- **Photo Interpretation Signature:** These descriptions help the reader identify the vegetation from an aerial perspective. Since most of the Alliance-level assignments come from the improved color balancing of the 2012 NAIP imagery, signature descriptions come from this dataset, unless otherwise noted.
- **Distribution Maps:** The distribution maps show the mapped polygons of the vegetation types within the overall study area and give the user an overall range of the species distribution in the study. Depictions of mapped types are enhanced to help the reader see the locations.

Some vegetation types have a very limited presence in the study area at sizes above the MMU. For these types, it was not possible to formulate the standard in-depth descriptions. Instead, they are represented only with a short description of their location within the study area. These will be noted at the end of the descriptions within this Appendix.

## 1120 *Quercus agrifolia* Alliance



The above example depicts a low to mid-slope setting near the junction of state highway 133 and El Toro Road. The elevation here is approximately 250'. The stand contains an emergent *Q. agrifolia* canopy over a mixed maritime chaparral community of *H. arbutifolia* & *R. integrifolia*.

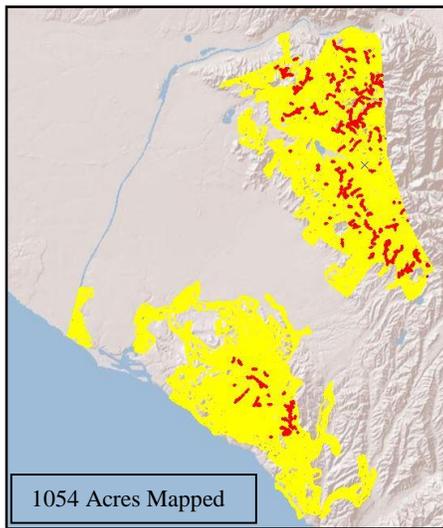
### DESCRIPTION:

The *Quercus agrifolia* Alliance occurs in widely distributed areas throughout all but the near coastal regions of the mapping area. Stands are specifically mapped in non-riparian settings (see type 1121 on the following page for riparian stands) in sparse to dense woodland settings, with a grassy or shrubby understory. Stands with a shrub understory are dominated by either drought-deciduous or sclerophyllous shrubs. Stands vary considerably in size and occupy low, middle and occasionally upper slopes.

### PHOTO INTERPRETATION SIGNATURE:

*Quercus agrifolia* forms a fairly uniform signature across the mapping area. In all but the densest woodland settings, crowns are generally rounded and form multiple sub-crowning, especially in mature trees. Crown edges form distinct margins. Signature color ranges from medium to dark tones of green depending mainly on the leaf age and health.

## 1121 *Quercus agrifolia* Riparian Association



Above example depicts the uppermost reaches of Fremont Canyon, a riparian setting with a small component of *Platanus racemosa* with dense *Q. agrifolia*. The elevation here is approximately 1900'.

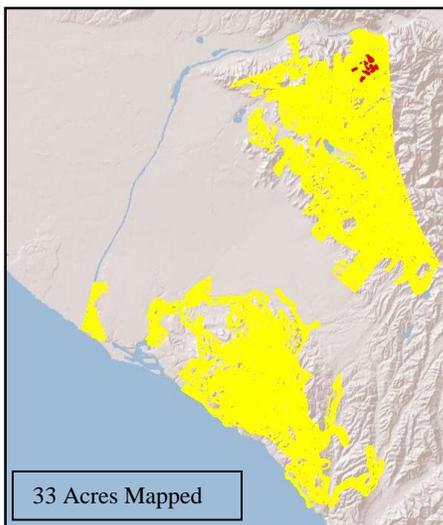
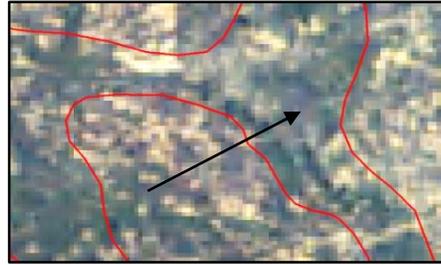
### DESCRIPTION:

The *Quercus agrifolia* Riparian Association occurs in widely distributed areas throughout all but the near coastal regions of the mapping area. Stands occur in narrow canyons that are temporarily, intermittently or seasonally flooded. Stands vary considerably in size but are generally narrow, occupying lower to occasionally lower-middle slope positions. The Association is mapped primarily where *Quercus agrifolia* spp. dominates the canopy, occasionally with small amounts of *Platanus racemosa* in larger seasonally flooded stands. Canopy cover is generally over 40%; sparser canopies have a visible shrub understory containing riparian species such as *Baccharis salicifolia* and/or *Salix lasiolepis*. Riparian presence is diagnostic but may be absent. In stands where riparian species are not present, other cold-season deciduous species are present in the understory.

### PHOTO INTERPRETATION SIGNATURE:

Similar to the more xeric *Q. agrifolia* alliance, but often with higher canopy cover. Mapped polygons are generally narrow and linear and stands are limited in their upslope extent. Mesic chaparral or coastal scrub may be a component along the drier margins of the stand.

## 1210 *Hesperocyparis forbesii* Alliance



The above example depicts several small individuals occurring with mixed chaparral in an area that burned in 2006. The stand is located near the Claymont Clay Mine at the 1350' elevation level just south of Coal Canyon in the Santa Ana Mountains. Note the presence of *H. forbesii* in the imagery as a small linear dark band as depicted by the arrow. The stand here contains about 5% conifer cover in the same stature as the adjacent chaparral. Individuals are scattered throughout the stand beyond the core area denoted by the arrow.

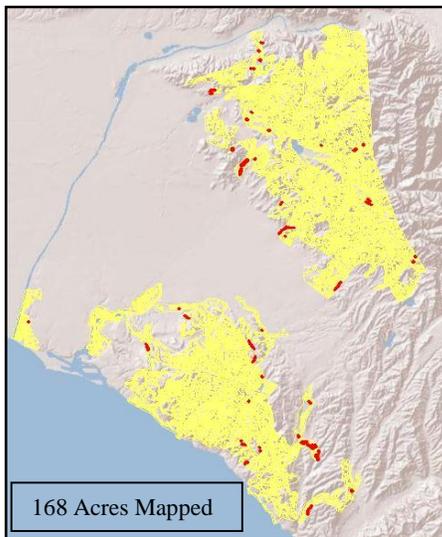
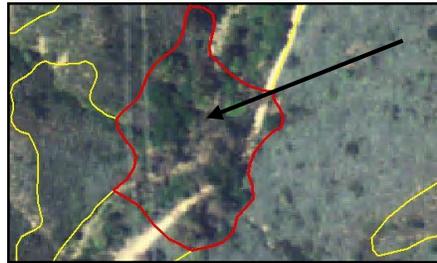
### DESCRIPTION:

The *Hesperocyparis forbesii* Alliance is restricted to the northwestern most portions of the mapping area in the middle elevations of the Santa Ana Mountains. Stands have undergone multiple burns and occur in settings where dense stands of chaparral dominate and sometimes strongly dominate the stand. Stands are very small and generally occupy lower to middle side-slope positions in the upper reaches of small draws. The Alliance is mapped where *H. forbesii* generally occurs in the same canopy layer as the adjacent chaparral, only on occasion seen forming a minor emergent stature. It should be noted that several polygons coded to the xeric chaparral group contain a component of this conifer as denoted in the conifer cover field.

### PHOTO INTERPRETATION SIGNATURE:

*H. forbesii* is difficult to see because it is usually a minor component and is similar in height to the adjacent chaparral. Crowns are narrow and conical, even in young recovering post burn settings. Where more than about 10-15 individuals occur in close proximity to one another, they generally appear significantly darker than the adjacent chaparral.

## 1510 *Eucalyptus (globulus, camaldulensis)* Semi-natural Woodland Stands



The above example depicts a small stand of *Eucalyptus* invading riparian vegetation at the 1000' level in Black Star Canyon. The stand has a minor component of *Quercus agrifolia* & *Platanus racemosa*.

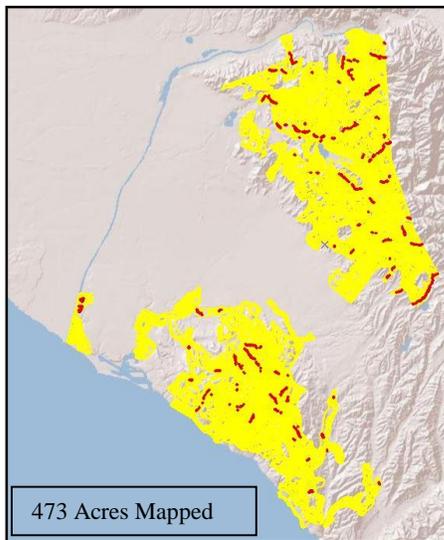
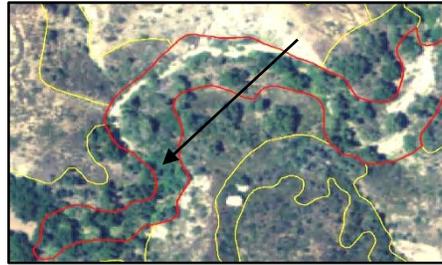
### DESCRIPTION:

*Eucalyptus (globulus, camaldulensis)* Semi-natural Stands occur in scattered areas inconsistently throughout the mapping area; most often as linear polygons along urban thoroughfares, city parks and other developed areas. Naturalized stands are rare in the mapping area. The Alliance is mapped where *Eucalyptus* spp. dominates or co-dominates the stand when occurring with other exotic trees in the canopy. In uncommon circumstances where it mixes with native vegetation, (especially riparian woodlands) *Eucalyptus* spp. must strongly dominate the stand. Stand cover ranges from well-spaced to a dense cover that can exceed 60%.

### PHOTO INTERPRETATION SIGNATURE:

*Eucalyptus* has a distinct signature (especially *E. globulus*) in both color and crown shape and texture. Mature trees exhibit an open irregularly shaped crown with indistinct margins. Colors tend to be brown with dark orange hues. Crown texture tends to be feathery.

## 1710 *Platanus racemosa* Alliance



The above example depicts *P. racemosa* in an open stand burned in 2006. *Q. agrifolia* forms the outer margins of the stand and is denoted by polygons adjacent to the one highlighted. The area is located in the middle to upper reaches of Fremont Canyon just below 1300' elevation.

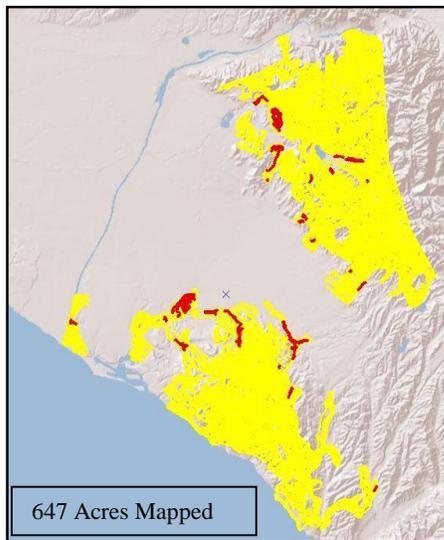
### DESCRIPTION:

The *Platanus racemosa* Alliance occurs in widely scattered locations throughout all but the near coastal regions of the mapping area. Stands occur almost exclusively in riparian zones generally adjacent to larger seasonally or semi-permanently flooded watercourses. Smaller stands may originate from small canyons below seeps in rock outcroppings. The Alliance is mapped in rather open to dense settings where *Platanus racemosa* dominates the canopy or occasionally shares dominance with *Q. agrifolia*. *Q. agrifolia* often forms stands along the margins of this type in larger canyons.

### PHOTO INTERPRETATION SIGNATURE:

*Platanus racemosa* yields a consistent signature across the mapping area but can be difficult to discern from younger individuals of *Q. agrifolia* where they share dominance. They frequently form only a subdominant canopy component to riparian stands of *Q. agrifolia*. *P. racemosa* has a smaller, more irregularly shaped, and less well defined crown than *Q. agrifolia*. Signature color ranges only slightly, usually a light to medium tone of yellow-green.

## 1720 *Salix gooddingii* Alliance



The above stand depicts *S. gooddingii* in moderately dense cover showing multiple age statures in the canopy. The stand continues to the east and is located just upstream from the Santiago Reservoir.

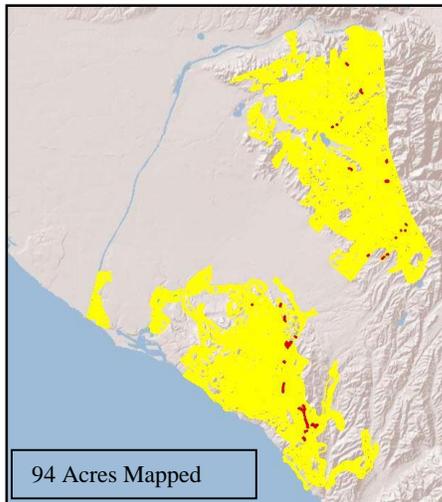
### DESCRIPTION:

The *Salix gooddingii* Alliance is restricted to the lower portions of semi-permanently to perennially flooded lower stream courses; often in artificially restricted flooding regimes or above major reservoirs. Stands often form canopies containing multiple stature individuals. *Salix gooddingii* dominates or co-dominates the stand with *S. laevigata* or in some cases such as along the Santiago Creek with *Alnus rhombifolia*.

### PHOTO INTERPRETATION SIGNATURE:

*Salix gooddingii* is difficult to distinguish from other tree willow species; within the mapping area, its signature and bio-geographical setting overlaps considerably with *S. laevigata*. Generally, *S. gooddingii* has a slightly lighter green signature than other willow species, especially *S. lasiolepis*. Modeling stands in close proximity to reservoirs is approximate at best. As with all riparian vegetation, younger stands in their sapling stage are indistinguishable at the alliance level.

## 1730 *Salix laevigata* Alliance



The above stand depicts *S. laevigata* in a dense cover mixing with *S. lasiolepis*. The area is located along Wood Canyon west of the Sheep Hills.

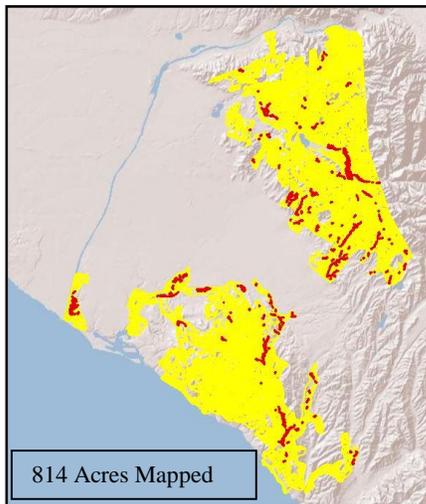
### DESCRIPTION:

The *Salix laevigata* Alliance is found in semi-permanently to perennially flooded stream courses in narrow to fairly broad canyons. It is common along Aliso and Laguna Creek, elsewhere it is scattered in small patches. Stands often form canopies containing multiple stature individuals with other willow species, especially *S. lasiolepis*. *Salix laevigata* dominates or co-dominates the stand in mixed settings with *S. lasiolepis*. In lower slope settings, both *S. laevigata* and *S. gooddingii* co-occur.

### PHOTO INTERPRETATION SIGNATURE:

*Salix laevigata* is difficult to distinguish from other tree willow species; within the mapping area, its signature and bio-geographical setting overlaps considerably with *S. gooddingii*. Stands are generally more species diverse than those dominated by *S. gooddingii* and therefore yield a more variable PI signature across the mapped polygon. As with all riparian vegetation, younger stands in their sapling stage are indistinguishable at the alliance level.

## 1810 *Baccharis salicifolia* Alliance



The picture depicts *B. salicifolia* in a variable setting along the drier margins of Aliso Creek just below a small dam. Willow is scattered in the stand and dominates areas to the south as depicted by the greener signature.

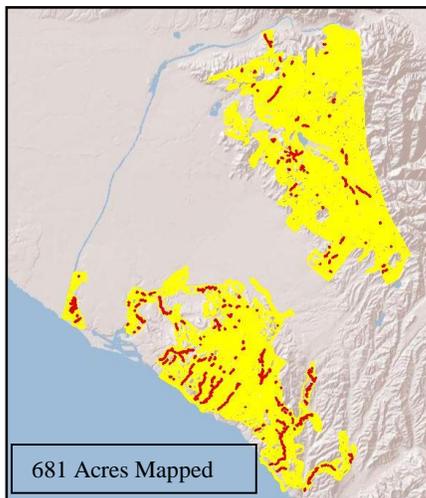
### DESCRIPTION:

The *Baccharis salicifolia* Alliance is found in temporarily flooded to perennially flooded stream courses in narrow to fairly broad canyons. Stands vary in cover and occasionally mix with some willow in wetter settings and with *B. pilularis* in drier more open grassy areas. *Baccharis salicifolia* generally dominates the stand. It is common throughout much of the region, especially in Aliso, Laguna, and Santiago Creek.

### PHOTO INTERPRETATION SIGNATURE:

*Baccharis salicifolia* has a highly variable signature depending primarily on the cover characteristics of the stand. Denser stands are generally dark brown with a greenish tint and have a smooth to slightly stippled texture. Sparser stands tend to form a more mottled texture and can appear patchy. Background setting can vary based on the density of the herbaceous understory. In frequently flooded settings where herbaceous cover is low, sparse shrub cover is distinct against the white background. In drier settings, herbaceous cover is often high and contrasts less with the shrub overstory.

## 1820 *Salix lasiolepis* Alliance



In this example, *S. lasiolepis* forms a dense shrub cover along a narrow canyon just above Abalone Point. This is a common setting in many of the canyons less than a mile from the coast.

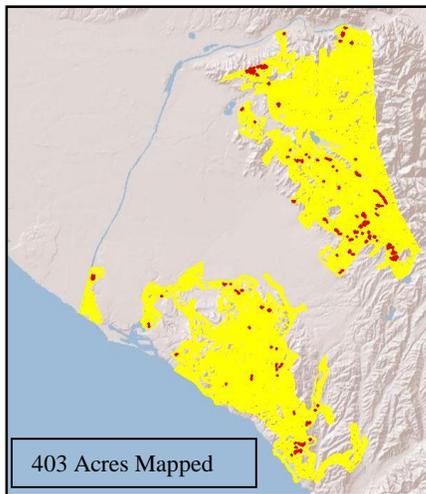
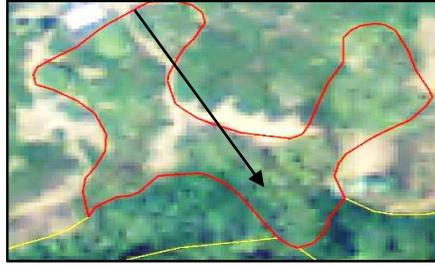
### DESCRIPTION:

The *Salix lasiolepis* Alliance is found in seasonally flooded to perennially flooded stream courses as a sole dominant in narrow canyons and along the drier margins of mixed willow stands in larger watersheds. Inland stands frequently mix with a small component of *S. laevigata*; closer to the coast, *S. lasiolepis* often strongly dominates.

### PHOTO INTERPRETATION SIGNATURE:

*Salix lasiolepis* can best be identified by its setting where it prefers steeper canyons close to the coast. In these settings, it is often the sole dominant and has a fairly uniform dark green color with a relatively smooth texture with minimal structural variability. Inland, it is extremely difficult to separate out from adjacent tree willow species but at times can be noted along the drier margins of the riparian corridor.

## 1830 *Sambucus nigra* Alliance



*S. nigra* is depicted above in a dense cover south of Awana Road upslope from Aliso Creek. The above example is a less common setting than its typical presence as an overstory to coastal scrub or as a sparse emergent to annual grasslands.

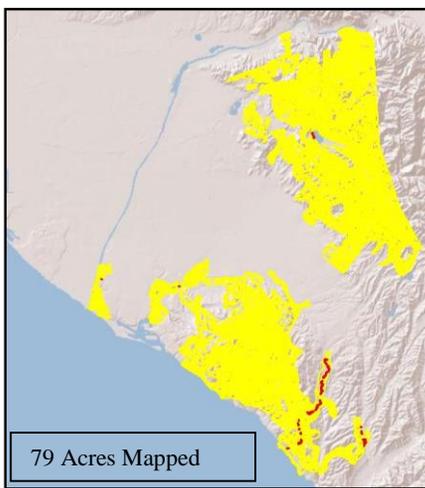
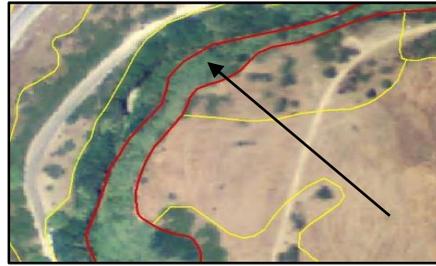
### DESCRIPTION:

The *Sambucus nigra* Alliance is found in fairly mesic settings either as an emergent to coastal scrub (especially dense stands of *Artemisia californica*) or as a sparse emergent tall shrub over annual grasses and forbs. In steeper settings where it is associated with coastal scrub, *S. nigra* generally is mapped to the scrub type since the smaller stature scrubs usually strongly dominate. In herbaceous settings, it is mapped with as little as 5% cover; stands within the mapping area typically between 5 and 15% cover. Within the mapping area, it is noted in small to very small stands, especially on mesic slopes near Niguel Hill and in the inland southern portions of the mapping area in the Limestone Canyon management area and the Irvine Open Space Preserve.

### PHOTO INTERPRETATION SIGNATURE:

In all settings, *Sambucus nigra* is distinct from its associated understory but more so when the species is emergent to herbaceous vegetation. Individuals appear more like small trees with rounded crowns with a green to yellow-green color.

## 1910 *Arundo donax* Semi-natural Herbaceous Stands



In this example, *A. donax* forms dense patches along Aliso Creek just below the Sheep Hills. Willow species are mapped adjacent along the northwest margins of the *Arundo* and appear darker green.

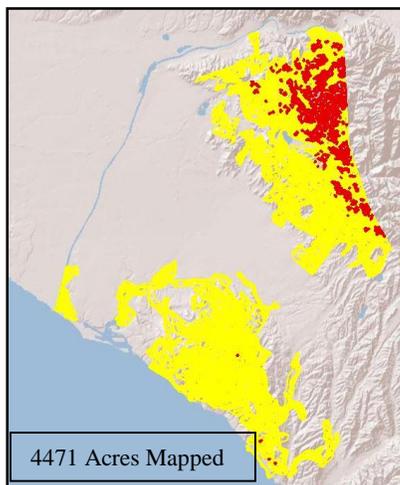
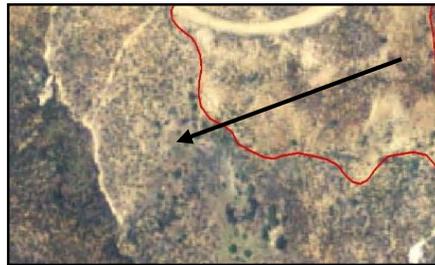
### DESCRIPTION:

Mappable stands of *Arundo donax* are found almost exclusively along Aliso Creek in the southeastern portion of the mapping area. In these examples, stands form dense uniform cover and strongly dominate the tall herbaceous layer in similar statures to the adjacent willow. Stands appear to occupy both the near margins of the active stream channel and the outer margins of the riparian fringe.

### PHOTO INTERPRETATION SIGNATURE:

*Arundo donax* has a distinct signature when found in dense stands, which is the most frequent setting in the mapping area. Adjacent riparian vegetation appears much darker green and texture less uniform. Texture within the *A. donax* vegetation is consistent and stipple-like. Smaller patches significantly below the MMU form mottled textures with the adjacent willow.

## 2110 *Adenostoma fasciculatum* Alliance



In the above example, *A. fasciculatum* occurs in multiple cover settings and is separated out (note red line) based on cover density classes. This stand occurs at the 1850' level just above Fremont Canyon. The region was burned in both 2002 and 2006.

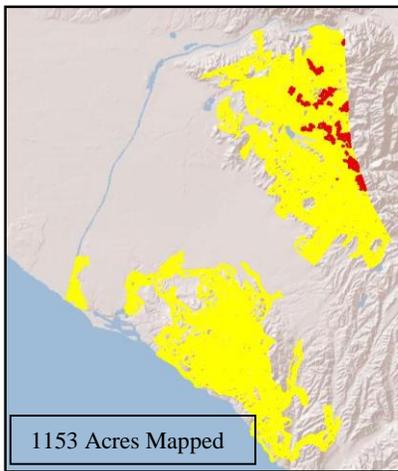
### DESCRIPTION:

Although stands of *Adenostoma fasciculatum* occur almost exclusively in the northern section of the mapping area, it is still the most commonly occurring chaparral type. The Alliance is mapped in chaparral settings where *A. fasciculatum* generally dominates the stand or in mixed settings with coastal scrub where it can co-dominate with various drought deciduous shrub types. Stands vary considerably in cover from open to very dense depending primarily on fire history. Stands generally occur on xeric sites on lower mid to upper slopes. Stand distribution is more restricted on north trending slopes.

### PHOTO INTERPRETATION SIGNATURE:

*Adenostoma fasciculatum* yields a highly variable signature but has a fairly consistent defined mode that remains true across its extensive range in California. Signature variability is determined primarily by three aspects of the vegetation: 1) the cover density, 2) the relative cover of other shrub species and 3) the associated understory components whether vegetative or not. In the mapping area, pure stands appear stippled in texture; in mixed chaparral, the texture is more hummocky. Modal color is a medium to dark brown with a slightly greenish hue.

## 2120 *Ceanothus crassifolius* Alliance



In the above example, *Ceanothus crassifolius* dominates the stand. The area is located on a lower slope just above the Santiago Reservoir.

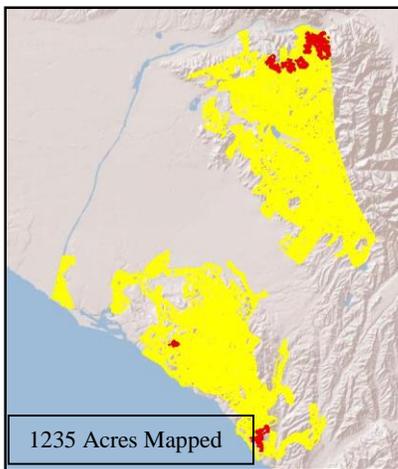
### DESCRIPTION:

The *Ceanothus crassifolius* Alliance is found exclusive in the northern mapping area in a similar but more limited range than *A. fasciculatum*. In the mapping area, *C. crassifolius* usually shares dominance with *A. fasciculatum* in variable cover depending primarily on fire history. Stands generally occur on xeric sites on gently to moderately sloping lower-mid to upper slopes. Mapped where *C. crassifolius* dominates or co-dominates the stand with other chaparral species. Unlike *A. fasciculatum*, there is minimal mixing of this type with coastal scrub types.

### PHOTO INTERPRETATION SIGNATURE:

Like *A. fasciculatum*, this alliance has a variable signature, which is determined primarily in the mapping region by fire history. Recent post burn stands are difficult to distinguish from *A. fasciculatum*, especially where cover falls below 20-30%. Dense mature stands trend medium tones of gray with a tint of blue-green. Texture is hummocky (crown margins are partially discernable even in closed cover) rather than stippled.

## 2130 *Ceanothus megacarpus* Alliance



In the above example, *Ceanothus megacarpus* dominates the stand with a small component of *Rhus ovata*. The stand is located just upslope from the lower portions of Coal Canyon just south of the Santa Ana River.

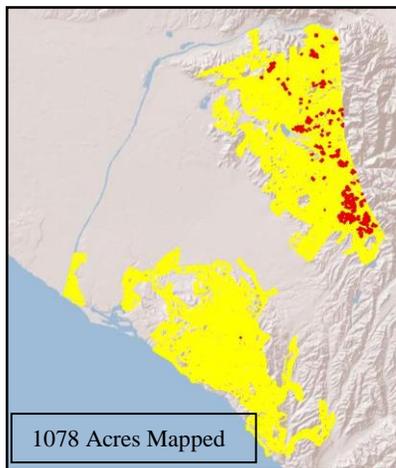
### DESCRIPTION:

The *Ceanothus megacarpus* Alliance is found in two settings; one in a maritime chaparral zone on the hills above South Laguna and Los Trancos Canyon and a more interior location on the lower slopes of the northern edge of the Santa Ana Mountains. Maritime stands have not recently burned; portions of stands in the north burned in 2006. Stands generally occur on xeric sites on gently to moderately sloping lower mid-to-upper slopes. Mapped where *C. megacarpus* generally dominates the stand. Several stands along the eastern edge of the mapping area near the county line occasionally co-dominate with *Rhus ovata*. Cover varies considerably; inland stands often have a dense herbaceous understory of annual grasses.

### PHOTO INTERPRETATION SIGNATURE:

*Ceanothus megacarpus* in most circumstances has a hummocky texture since it rarely co-dominates with other chaparral species in the mapping area (southern coastal maritime stands less so due to some mixing). Signature color is similar to *C. crassifolius*. Overlap between the two species is minimal; where the two species are mapped in close proximity to one another, differentiation is extremely difficult.

## 2140 *Adenostoma fasciculatum* – *Salvia mellifera* Alliance



In this example, *A. fasciculatum* shares dominance with *S. mellifera* in an open stand burned in 2007. The stand is located in the upper portions of Borrego Canyon in the Santa Ana Mountains.

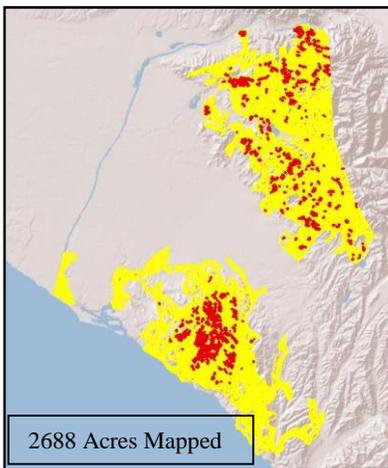
### DESCRIPTION:

The *Adenostoma fasciculatum* – *Salvia mellifera* Alliance occurs exclusively in the northern portion of the mapping area in post burn settings. Stands generally occur on xeric sites on gently to moderately sloping lower mid-to-upper slopes, closer to the margins of the coastal scrub. Mapped where *A. fasciculatum* and *S. mellifera* co-dominate the shrub layer in widely varying cover.

### PHOTO INTERPRETATION SIGNATURE:

Differentiating this alliance from the *A. fasciculatum* alliance proved difficult with accuracy assessment depicting confusion between the two. Post burn chaparral can be difficult to classify to Alliance levels in the classification. In ideal settings, *S. mellifera* yields a typical light green to yellow to darker brown signature depending on the phenology of the leaf. Early summer NAIP imagery reveals all phenological possibilities in these settings. *A. fasciculatum* maintains a modal dark to light brown (cover dependent) stipple-like texture. The mixed alliance was mapped when both signatures were present in the stand.

## 2210 *Malosma laurina* Alliance



In this example, *Malosma laurina* strongly dominates the shrub layer in varying degrees of drought and/or freeze related stress. The stand occurs on a northeast trending slope above Shady Canyon in the San Joaquin hills.

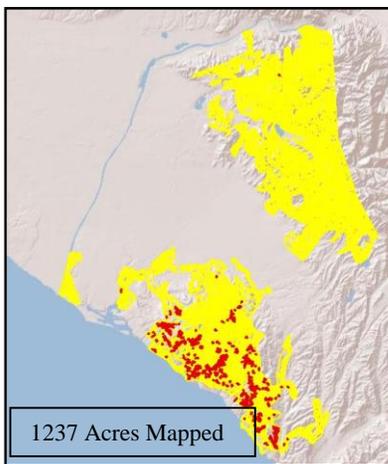
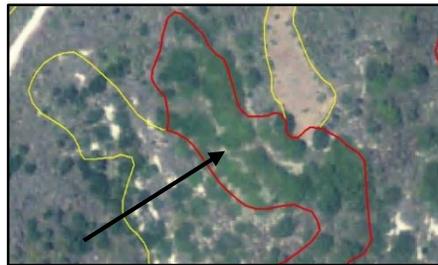
### DESCRIPTION:

The *Malosma laurina* Alliance is widespread in both the northern and southern portions of the mapping area on a wide variety of slope configurations. Mapped where maritime chaparral (*M. laurina*) dominates or strongly dominates in areas where a coastal scrub species is present. Cover in these setting is generally over 60%. In grassy settings, *M. laurina* strongly dominates the shrub canopy with cover generally under 30%. Stands where it co-dominates with xeric chaparral alliances are generally mapped to the xeric chaparral type.

### PHOTO INTERPRETATION SIGNATURE:

Key in separating out this maritime chaparral type is the strong presence of *M. laurina*. In areas of dense cover, there is often a wide variability in signature color due to phenological stress. Healthier portions of the stand trend a medium to light green with a billowy texture. Stressed stands yield a mottled pattern with increasing dark to medium gray colors.

## 2220 *Rhus integrifolia* Alliance



In this example, *Rhus integrifolia* strongly dominates the stand. Adjacent stands contain a component of *R. integrifolia* but are mapped to a coastal scrub type. This stand is located above Wood Canyon in the San Joaquin Hills.

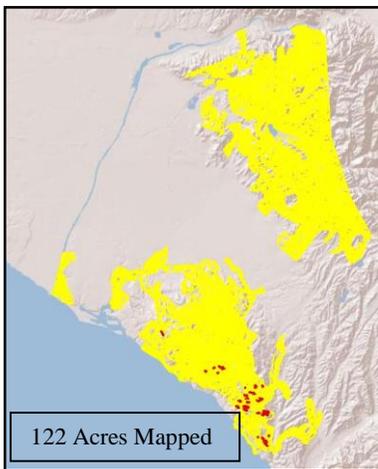
### DESCRIPTION:

The *Rhus integrifolia* Alliance is restricted to the southern portion of the mapping area although individuals were noted throughout the mapping area as a component to other types. Mapped where maritime chaparral (*R. integrifolia*) dominates or strongly dominates in areas where a coastal scrub species is present. Cover in these setting is generally over 60%. Stands where *R. integrifolia* co-dominates with coastal scrub types are generally assigned one of the alliances containing varying components of *Artemisia californica*, *Salvia mellifera* or *Eriogonum fasciculatum*. When *R. integrifolia* co-dominates with *Q. dumosa* or other maritime chaparral types, in most cases it is assigned to that particular alliance.

### PHOTO INTERPRETATION SIGNATURE:

Key in separating out this maritime chaparral type is the strong presence of *R. integrifolia*. It is difficult to distinguish the two maritime types (*R. integrifolia* & *M. laurina*); stands containing the latter tend to exhibit a higher component of stressed and dead vegetation. There is a general trend for *R. integrifolia* forming stands closer to the coast and overall signature color of the same tends to yield a darker green color. *R. integrifolia* tends to have a broader less rounded crown and somewhat lower stature. Adjacent coastal scrub vegetation is often somewhat more mesic, often dominated by *Artemisia* with some *Diplacus aurantiacus*.

## 2230 *Quercus dumosa* Alliance



In this example, *Quercus dumosa* dominates a dense shrub layer with components of *R. integrifolia* and *Heteromeles arbutifolia*. The stand is located along Pacific island drive about one mile from the coast.

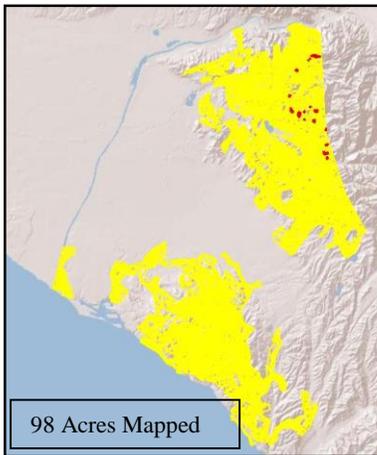
### DESCRIPTION:

The *Quercus dumosa* Alliance is restricted to small stands mostly under 15 acres, generally within 1-2 miles from the coast. Mapped where maritime chaparral (*Q. dumosa*) dominates or co-dominates the shrub layer. Mapped stands were noted where *Q. dumosa* was a sole dominant or with components of other maritime chaparral species. Cover in these setting is commonly over 60%.

### PHOTO INTERPRETATION SIGNATURE:

Separating out the two scrub oak alliances in the mapping area (*Quercus dumosa* & *Q. berberidifolia*) is not possible on signature characteristics alone. Photo interpreters modeled stands using adjacent vegetation (in this alliance adjacent stands of *R. integrifolia*, *M. aurantiacus*, and other mesic coastal scrub types) and proximity to the coast.

## 2310 *Ceanothus tomentosus* Alliance



In this example, *Ceanothus tomentosus* co-dominates with *Adenostoma fasciculatum* in a dense cover over 60%. The stand is located on gently sloping terrain at the 2000' elevation above Black Star Canyon in the Santa Ana Mountains.

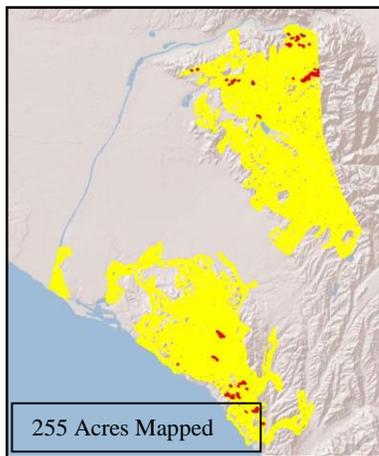
### DESCRIPTION:

The *Ceanothus tomentosus* Alliance is a mesic chaparral found on gentle to moderate slopes in higher elevations within the mapping area. The Alliance is mapped where *Ceanothus tomentosus* co-dominates the stand, in most cases with *Adenostoma fasciculatum*. Nearly all mapped stands contain greater than 60% cover.

### PHOTO INTERPRETATION SIGNATURE:

*Ceanothus tomentosus* is a difficult type to identify. Stands of mesic chaparral often contain a component of this species along with other species of *Ceanothus*, in addition to *Heteromeles arbutifolia* and *Quercus berberidifolia*, making it difficult to key out. In these settings, signature colors overlap considerably between the abovementioned species. Noted more frequently than other mesic types on gentler slopes and often with the more xeric trending chamise. Modal signature color trends very dark brown with green tints; texture is smooth with some mottling.

## 2330 *Heteromeles arbutifolia* Alliance



In this example, *Heteromeles arbutifolia* occurs on a steep slope co-dominating with *Fraxinus dipetala*. This is a mesic chaparral example located just above Fremont Canyon at the 1300' level in the Santa Ana Mountains.

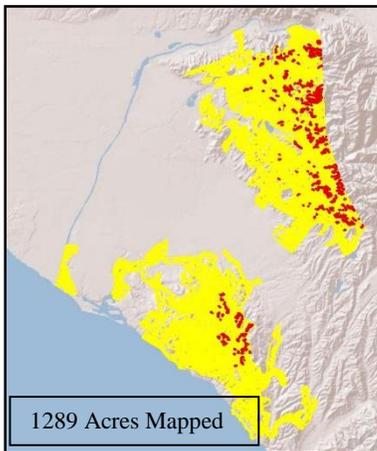
### DESCRIPTION:

The *Heteromeles arbutifolia* Alliance is a mesic chaparral type occurring on steep north trending slopes in two distinct regions of the mapping area: a northern study type where it occurs with other mesic chaparral species and a coastal type where it shares dominance with maritime chaparral. The Alliance is mapped where *Heteromeles* dominates or at times co-dominates the stand with *Rhus integrifolia* in maritime settings or with *Fraxinus dipetala* in mesic chaparral settings. Stands usually contain greater than 60% cover except in post burn areas in the north.

### PHOTO INTERPRETATION SIGNATURE:

This alliance is difficult to identify in most settings. In coastal maritime settings, *Heteromeles arbutifolia* has a similar stature and growth form to both *Rhus integrifolia* and *Malosma laurina*. Northern inland stands often mix with other mesic species making relative cover estimates difficult. *H. arbutifolia* has rounded well-defined crowns trending light to medium-dark green. Inland stands tend to occur with mesic chaparral in dense cover; similar stature *M. laurina* tends to grow in more open xeric conditions.

## 2340 *Quercus berberidifolia* Alliance



In the above example, *Q. berberidifolia* co-dominates with *H. arbutifolia* in a dense setting recovering from a burn in 2007. Post burn recovering mesic chaparral typically has a uniform texture as noted in the imagery above; leaf phenology is young with minimal sclerophyllous characteristics. The stand is located on steep terrain above Modjeska Road.

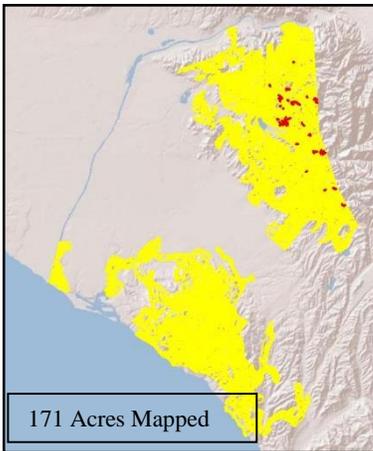
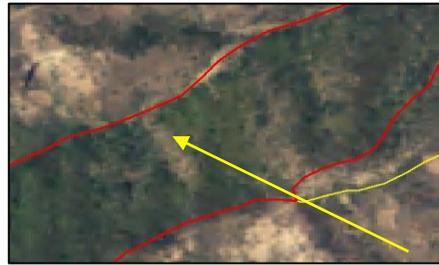
### DESCRIPTION:

*Quercus berberidifolia* is a frequently occurring alliance throughout the Santa Ana Mountains in the northern portion of the mapping area and in interior mesic slopes in the San Joaquin Hills closer to the coast. It is mapped where *Q. berberidifolia* dominates or co-dominates the stand with other mesic chaparral (or at times in the south with maritime chaparral) species, usually in cover greater than 60%. Stands are mapped on gently to moderately steep slopes, especially in low to mid positions trending northerly.

### PHOTO INTERPRETATION SIGNATURE:

*Quercus berberidifolia* has a wide variation of textural qualities, but more often than not trends toward a hummocky texture in a closed crown setting where crown margins are somewhat discernable. In post burn settings, the recovering stand yields a smooth texture. Mature stands trend toward darker greens with a slightly blue tint. In stands that mix with other mesic chaparral, shrub crowning is less distinct yielding a smoother texture.

## 2350 *Quercus berberidifolia* – *Adenostoma fasciculatum* Alliance



In the above example, *Q. berberidifolia* and *A. fasciculatum* co-dominate the shrub layer. This stand is located downslope from the *A. fasciculatum* alliance where the latter follows the top of the ridgeline. The stand is found just west of the upper reaches of Limestone Canyon at 1200' elevation.

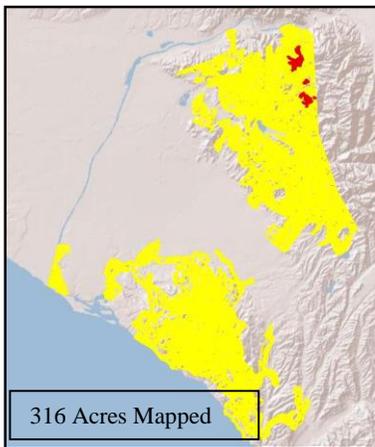
### DESCRIPTION:

The *Quercus berberidifolia* – *Adenostoma fasciculatum* Alliance is mapped where both species co-dominate the stand; generally in dense cover. The Alliance is an intermediate type to the two single alliance types in almost all aspects including slope characteristics, moisture requirements and species composition. This type, with its component of *A. fasciculatum*, is mapped exclusively in the northern portion of the study at mid to higher elevations in the Santa Ana Mountains.

### PHOTO INTERPRETATION SIGNATURE:

This alliance shares signature characteristic of both of the single species types. Mixing can be gradational with more scrub oak toward the lower slopes and chamise higher up; many stands have more random mixing of the two species. Defining the precise margins of the stand is often problematic due to difficulties in estimating relative cover of the two species.

## 2410 *Arctostaphylos glandulosa* Alliance



In the above example, *Arctostaphylos glandulosa* & *Adenostoma fasciculatum* co-dominate in a region that burned in both 2002 & 2006. The area shown above represents only a small portion of an extensive stand (over 140 acres) and is located on a major ridgeline at the 2400' elevation level above the upper reaches of Fremont Canyon.

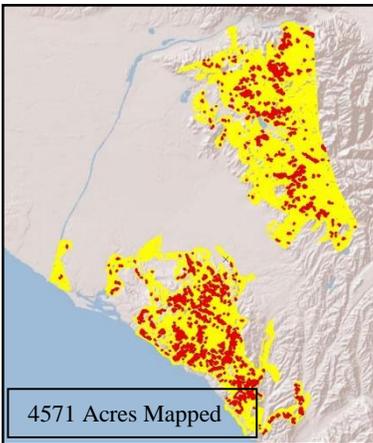
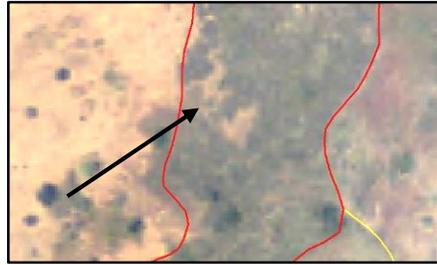
### DESCRIPTION:

Within the mapping area, the *Arctostaphylos glandulosa* Alliance usually co-dominates with *Adenostoma fasciculatum*; most of which has been burned at least once since 2000. Stand cover averages between 10-25%; mapped polygons include complex matrixes where significant areas fall below 10%. Most all stands were mapped on upper slopes, small spur lines and major ridges. This is one of the highest elevation types in the mapping area.

### PHOTO INTERPRETATION SIGNATURE:

Sparsely covered portions of the stand show a high degree of bedrock substrate following the Silverado Formation, which yield a yellow to yellow-brown signature color. Where shrub cover increases, signatures trend medium green with a smooth to slightly hummocky signature characteristic of many species of *Arctostaphylos*. Key to mapping to this alliance is the topographical setting and substrate characteristics.

### 3110 *Artemisia californica* Alliance



The above example depicts a small stand of dense *A. californica* with a few emergent tall *Sambucus nigra* shrubs. There is a small component of *Diplacus aurantiacus*. The stand is located on a steep north-facing slope above Aliso Creek.

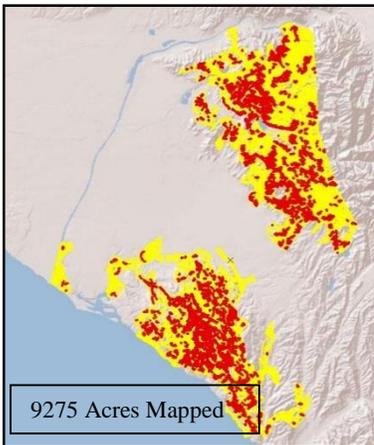
#### DESCRIPTION:

The *Artemisia californica* Alliance was mapped where *A. californica* strongly dominates or dominates the shrub layer in varying cover when present with other drought deciduous species. Most stands mapped are on north trending low to upper mesic slopes with greater than 40% cover. When other coastal scrub species (generally *Salvia mellifera* or *Eriogonum fasciculatum*) was consistently visible on the imagery, the stand was mapped to one of the mixed coastal scrub alliances containing both species. In all settings, the lower cover sage scrub species has to be consistently present throughout the polygon before mapping to a mixed *A. californica* – coastal scrub type. The *A. californica* alliance was also mapped as a co-dominant or at times sub-dominant when present with *Rhus integrifolia*, *Malosma laurina*, or *Diplacus aurantiacus*.

#### PHOTO INTERPRETATION SIGNATURE:

The signature for *A. californica* is fairly consistent in all settings and cover with a light to medium-dark gray color of slight to moderately hummocky texture. Stand color varies depending on species composition; stands co-dominating with *Diplacus* have a yellow component.

### 3120 *Artemisia californica* – *Eriogonum fasciculatum* Alliance



The above example co-dominates with the two species and may contain a minor component of *Opuntia* spp. Note the openings in the canopy; in these areas, *Eriogonum* dominates.

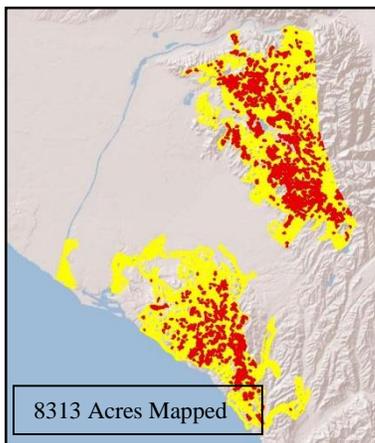
#### **DESCRIPTION:**

The *Artemisia californica* – *Eriogonum fasciculatum* Alliance covers greater than 10% of the entire mapping area and is widespread in all regions. The Alliance is mapped where both species co-dominate; in certain situations when an *Opuntia* species is scattered in the stand, *E. fasciculatum* can occur as a consistently scattered sub-dominant species. Cover is generally lower than areas mapped to the *A. californica* alliance.

#### **PHOTO INTERPRETATION SIGNATURE:**

This mixed alliance characteristically contains areas of sparser cover and small openings in the canopy where *E. fasciculatum* locally concentrates; in these areas, the substrate color is a bright white color contrasting with the deep browns of the *Eriogonum*. Where cover increases and exposed substrate is not visible, *Artemisia* locally dominates and the signature yields a gray color. This patterning is generally consistent across much of the stand.

### 3130 *Artemisia californica* – *Salvia mellifera* Alliance



In the above example, *S. mellifera* & *A. californica* co-dominate the stand with dense cover. Small amounts of *R. integrifolia* & *E. fasciculatum* are also present in the stand. This stand is located on Multon hill east of Laguna Canyon

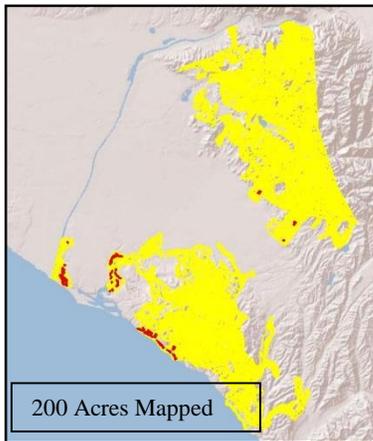
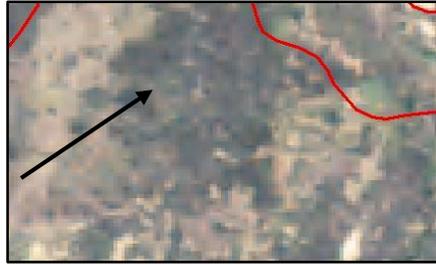
#### DESCRIPTION:

The *Artemisia californica* – *Salvia mellifera* Alliance is widespread throughout the mapping area. The alliance is mapped where both species co-dominate; generally in cover greater than 40%. Drier stands will often contain a component of *Eriogonum fasciculatum*; stands near the coast generally contain small amounts of *R. integrifolia*. When all three major coastal scrub species share dominance in the stand (*A. californica*, *S. mellifera* & *E. fasciculatum*), photo interpreters look for the presence of succulent species (this may incline the call toward the *A. californica* – *E. fasciculatum* alliance) and the overall setting to determine which mixed alliance type is more diagnostic.

#### PHOTO INTERPRETATION SIGNATURE:

This mixed alliance contains on average a slightly higher cover than the *A. californica* – *E. fasciculatum* alliance and usually does not contain the scattered openings in shrub canopy. Overall signature is a mix of green and grey hues creating a mottled patchy appearance. The gradient between the two colors in this alliance is less distinct than that of the *A. californica* – *E. fasciculatum* alliance.

### 3140 *Encelia californica* Alliance



In the above example, *Encelia californica* dominates the stand with a small component of *E. fasciculatum* & *A. californica*. The stand is located on above a coastal bluff off Pelican Point.

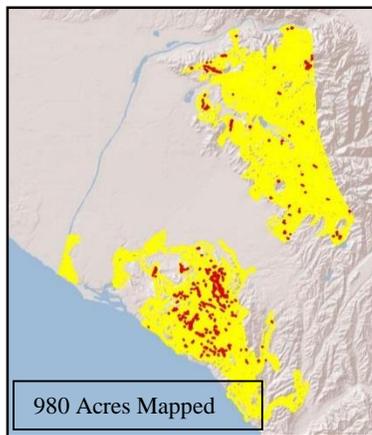
#### DESCRIPTION:

The *Encelia californica* Alliance for the most part is limited to the coastal fringe, located on steep bluffs and the adjacent terraces. Small stands of this alliance were however mapped on bluffs adjacent to Upper Newport Bay and along the bluffs southwest margins of Costa Mesa further inland. The Alliance was mapped where *Encelia californica* dominates the stand. Other coastal strand species were present in all stands mapped including one or more of the following: *A. californica*, *E. farinosa*, *S. mellifera*, *R. integrifolia* and *Lycium californicum*.

#### PHOTO INTERPRETATION SIGNATURE:

The signature color of *Encelia californica* varies considerably during its seasonal phenological change from young growth in early spring to complete senescens in late summer. Base NAIP 2012 imagery yields a signature that is in its early deciduous phase where the leaf die-off is nearly complete but still remaining on the plant. This phase typically yields a very dark signature in relation to other coastal scrub types adjacent.

## 3150 *Eriogonum fasciculatum* Alliance



In the above example, *E. fasciculatum* dominates on a steep south trending slope with characteristic openings in the canopy yielding a light colored substrate. *Malosma laurina* is a component to this stand located west of Laguna Canyon Road

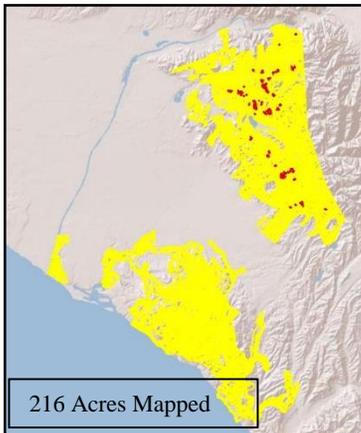
### DESCRIPTION:

The *Eriogonum fasciculatum* Alliance is widespread throughout the mapping area; however, it is much more abundant in the San Joaquin Hills in the south. This Alliance was mapped where *E. fasciculatum* dominates the stand when other coastal scrub species were noted such as *A. californica*, and *Salvia mellifera*. In inland stands where *Malosma laurina* or *Acemison glaber* were noted, *E. fasciculatum* was mapped when it was a co-dominant and at times even a sub-dominant shrub. Cover averages the lowest of the three extensively mapped species, the other two being *A. californica* & *S. mellifera*.

### PHOTO INTERPRETATION SIGNATURE:

The signature color of *E. fasciculatum* is fairly consistent throughout the mapping area and maintains a dark brown to dark gray-brown signature on all topographical settings. In most stands, substrate color is white to light gray.

### 3180 *Salvia apiana* Alliance



In the above example, *Salvia apiana* dominates the stand in sparse cover over a dense annual grass understory on an upper slope and ridge. The stand is a typical setting for this alliance and is located about a half mile east of the Laguna Toll Road.

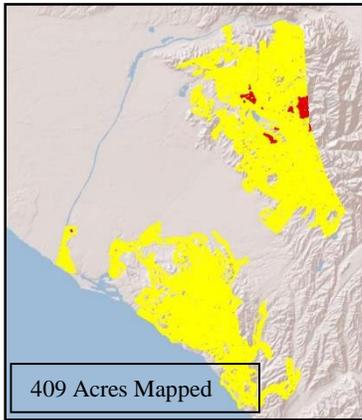
#### **DESCRIPTION:**

The *Salvia apiana* Alliance is restricted to the northern portion of the mapping area, frequently occurring on grassy upper slopes and ridgelines. This Alliance was mapped where *Salvia apiana* dominates or co-dominates the stand, most frequently with *A. californica* or *Eriogonum fasciculatum*. In most stands, *S. apiana* was the sole dominant with a sparse cover, generally under 25%.

#### **PHOTO INTERPRETATION SIGNATURE:**

The signature color of *Salvia apiana* is distinct and can be confused only with one other shrub, *Salvia leucophylla*. Existing higher resolution imagery (3" resolution flown by Eagle Aerial) was necessary in mapping this type due to its extremely sparse cover. In most settings, the taller stature of this species helps to differentiated from *S. leucophylla* on the high-resolution imagery.

### 3190 *Salvia leucophylla* Alliance



In the above example, *Salvia leucophylla* co-dominates with *A. californica* in a dense cover. This stand is located on an extensive slope above Black Star Canyon ranging from 1000' to 1700' elevation.

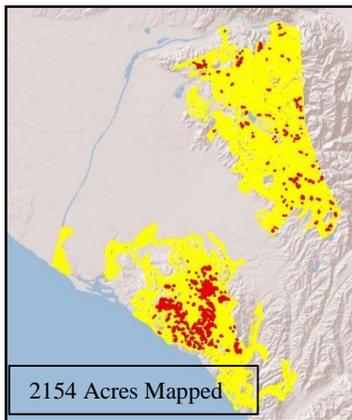
#### **DESCRIPTION:**

The *Salvia leucophylla* Alliance is restricted to three core regions in the northern portion of the mapping area all within a few miles of the Santiago Reservoir. Stands were mapped where *Salvia leucophylla* dominated or co-dominated the shrub layer. *Artemisia californica* is a commonly occurring co-dominant in mapped stands. Most stands mapped were assigned cover values greater than 40%.

#### **PHOTO INTERPRETATION SIGNATURE:**

The signature color of *Salvia leucophylla* is somewhat similar to *Artemisia californica* but tends to have more of a bluish-green as opposed to a bluish-gray color. Unlike the latter alliance, this type's signature tends to remain consistent across varying topographical features. Portions of the stand on protected settings are similar in signature than stands occupying more xeric sites. Stands average much higher in cover than the other sage alliance (*S. apiana*) which has a similar signature.

## 3210 *Salvia mellifera* Alliance



In the above example, *Salvia mellifera* dominates the stand. Note signature color variability in both the image and ground photo based on leaf phenology. The stand is located on the southern slopes of the Sheep Hills above Aliso Creek

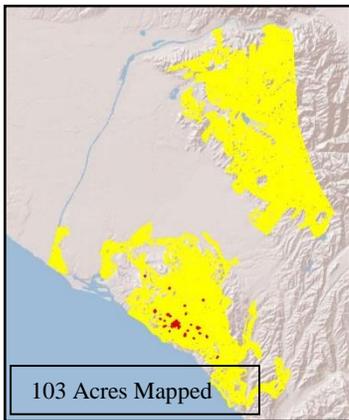
### DESCRIPTION:

The *Salvia mellifera* Alliance is widespread in most regions of the mapping area. Stands are however somewhat more localized in the southern portion of the San Joaquin Hills west of Laguna Canyon. This Alliance was mapped in moderately dense to dense cover where *Salvia mellifera* dominated or co-dominated the stand. Numerous stands were mapped where the plant co-dominates with *E. fasciculatum*. In these settings, cover tends to be somewhat lower.

### PHOTO INTERPRETATION SIGNATURE:

*Salvia mellifera* photo signature characteristics are highly variable depending on the phenology of the plant during its growing season. NAIP imagery depicts the plant in transitional phenology corresponding with the early onset of the dry season. Plants in more protected settings are yellow-green; those on more exposed slopes trend towards a light brown signature color. Confusion exists where small amounts of *Artemisia californica* consistently occurring in the stand may be classified to the mixed species alliance. It can be difficult to determine relative cover of the two species across the stand.

## 3220 *Diplacus aurantiacus* Alliance



This example depicts a steep protected slope where *Diplacus aurantiacus* strongly dominates the shrub layer with a small and inconsistent component of *A. californica*. The stand is located upslope from Moro Canyon

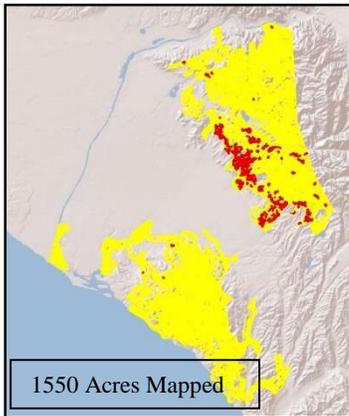
### DESCRIPTION:

The *Diplacus aurantiacus* Alliance is restricted to isolated on very mesic protected slopes within several miles of the coast. Elsewhere, *D. aurantiacus* is a fairly common component to mesic stands of *A. californica*. This Alliance was mapped in dense cover settings where *D. aurantiacus* strongly dominates the shrub layer. *Toxicodendron diversilobum* and *A. californica* are often scattered in the stand.

### PHOTO INTERPRETATION SIGNATURE:

*Diplacus aurantiacus* has a fairly easily identifiable signature on the NAIP imagery that portrays dense cover stands as medium green with areas of yellow scattered throughout. Texture is smooth to slightly hummocky. Scattered presence of *A. californica* adds variability to the texture.

### 3340 *Acmispon glaber* Alliance



This example depicts a post 2007 burn area dominated by *A. glaber*. In 2012, components of this short-lived type were still alive as depicted on the imagery with the characteristic brown signature. The 2013 reconnaissance photo shows the same area where most of the *A. glaber* has died back. The stand is located just south of Serrano Creek.

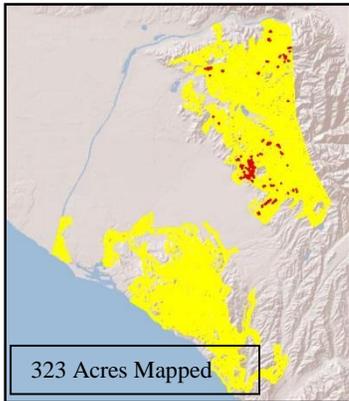
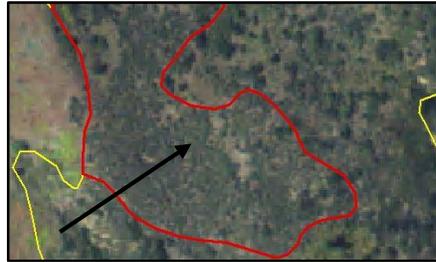
#### DESCRIPTION:

The *Acmispon glaber* Alliance is concentrated almost entirely in the lower foothills of the Santa Ana Mountains near the urban fringe that was burned in 2007. Stands may be maturing back to coastal scrub and chaparral types as noted in the discrepancy between the 2013 field and 2012 NAIP imagery. This Alliance was mapped in areas where *A. glaber* dominated or strongly dominated the shrub layer, generally in partially senesced phenology. Numerous stands of vegetation in the northern portion of the mapping area were assigned to coastal scrub or chaparral types even though they had a high component of *A. glaber*. These stands did have a consistent presence (generally locally co-dominating) of pre-burn coastal scrub or chaparral throughout the mapped polygon, however.

#### PHOTO INTERPRETATION SIGNATURE:

*Acmispon glaber* yields a brown signature color with a slight reddish tint. Texture is stipple-like with high variability across the stand. This signature reflects this species phenology 4-5 years after the 2007 burn.

### 3350 *Malacothamnus fasciculatus* Alliance



This example depicts a small but dense stand of *Malacothamnus fasciculatus* above Borrego Canyon in a post 2007 burn setting.

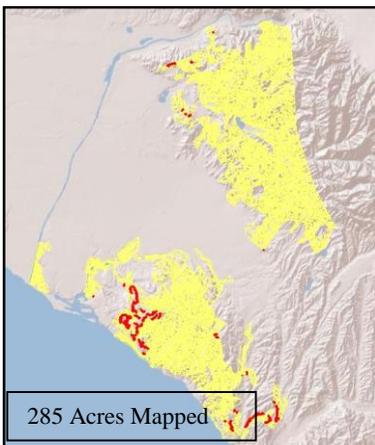
#### **DESCRIPTION:**

The *Malacothamnus fasciculatus* Alliance is concentrated primarily in two post burn areas of the Santa Ana Mountains, one to the south that burned in 2007 and one in the north where it burned in 2006. Unlike the *A. glaber* Alliance, this type appears to consist of uniform monotypic stands that during the 2013 reconnaissance appeared relatively healthy. This Alliance was mapped in widely varying cover in areas where *M. fasciculatus* dominates or strongly dominates the shrub layer. The Alliance was more often seen in higher chaparral settings than the *A. glaber* Alliance where it was noted adjacent to coastal scrub types and chamise coastal scrub mixes.

#### **PHOTO INTERPRETATION SIGNATURE:**

This Alliance has a stipple-like texture that accounts for its sparse and feathery crown shape. Signature variability is high, reflecting the broad cover range in which it was mapped. Signature color varied from gray to dull green.

### 3410 *Acacia* (cyclops) Semi-natural Stands



This example depicts a narrow band of roadside *Acacia* spp. located above Newport Coast Drive.

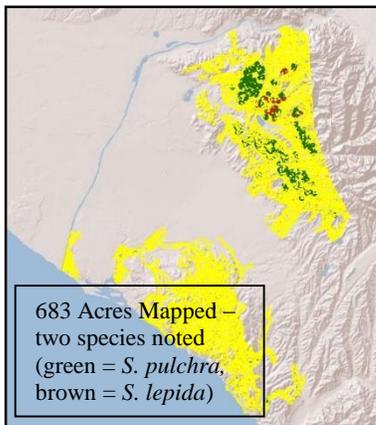
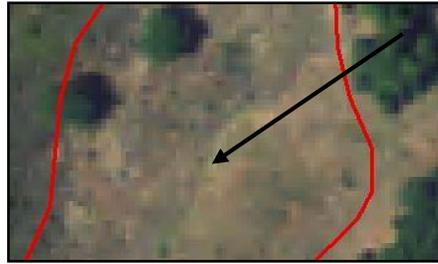
#### DESCRIPTION:

The *Acacia* (*cyclops*) Semi-natural Stands occurs almost exclusively along roadside thoroughfares and along the margins of newer urban developments. Stands are generally long and narrow and are frequently a sole dominant. Naturalized stands are rare in the mapping area; however, reconnaissance trips noted *Acacia* in some native coastal scrub vegetation. The category is mapped where *Acacia* spp. strongly dominates the shrub layer. Exotic trees (pines, *Eucalyptus*, and others) may be an emergent component to the shrub layer in cover up to 10%. Stands consistently form a dense cover. This category mapped only along the fringes of urban development; linear bands of *Acacia* are not mapped when they continue into the urban development.

#### PHOTO INTERPRETATION SIGNATURE:

*Acacia* has a monotypic signature in nearly all settings. The nearly always-dense cover exhibits a uniformly smooth texture across the stand. Colors range from a grayish brown to grayish blue, which tends to vary within the mapped polygon. Patterns are linear and follow roads and the urban fringe.

## 4120 & 4130 – *Stipa (Nassella) lepida* & *Stipa (Nassella) pulchra* Alliances



This example depicts a small patch of *Stipa pulchra* with a scattering of *Ericameria palmeri* adjacent to a coast live oak woodland. The stand contains a high component of non-native annual grasses.

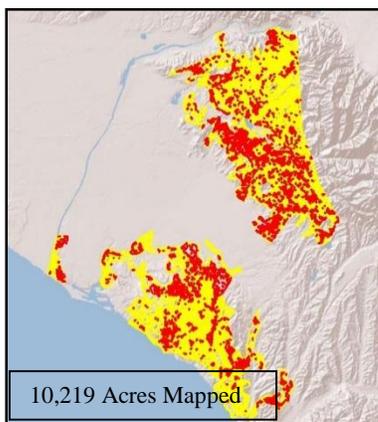
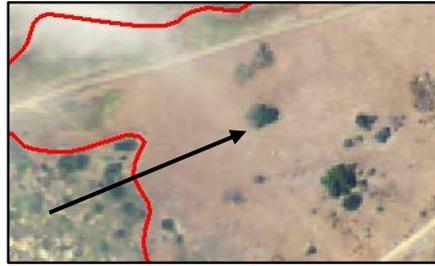
### DESCRIPTION:

The two *Stipa* grasses (*Stipa lepida* & *Stipa pulchra*) occur throughout the mapping area. These two Alliances were not discernable from the non-native annual grasses that were often a high component to the stands. Photo interpreters used polygon data from the Irvine Ranch Conservancy and integrated the data into the current vegetation map. Stands were modified where shrub cover may have increased since the time of the sampling. At the time of the mapping effort, there was no data for the southern portion of the study. All polygons classified to these types are noted in the comments field with the source data and whether or not the original polygon boundaries were adjusted to adhere to the National Vegetation Classification Standards.

### PHOTO INTERPRETATION SIGNATURE:

These two native grass types were not separable using existing imagery and therefore were not mapped using photo interpretive techniques.

## 4200 Mediterranean California Naturalized Annual and Perennial Grassland Group



This example depicts an east-facing hillside with annual grasses; the dark green shrubs are emergent *Rhus integrifolia*; patches of mustard are scattered in the lower portions of the stand.

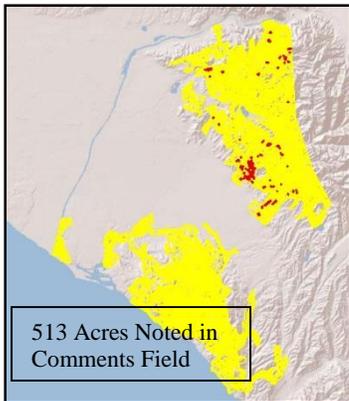
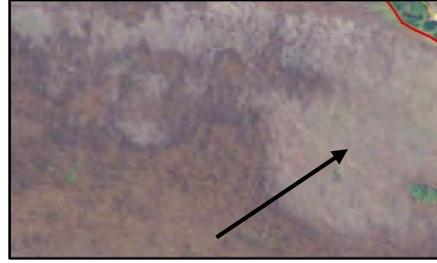
### DESCRIPTION:

This group-level herbaceous type is the photo interpreter's standard unit for mapping most of the non-native herbaceous vegetation occurring in California. Mapped stands occur throughout the study. Included in this category are the annual grasses, specifically from the *Avena* and *Bromus* genera, and weedy forbs including any combination of the following: *Brassica*, *Centaurea*, *Conium*, and *Cortaderia*. Stand composition is highly variable, and changes significantly from year to year. Shrub cover within a mapped stand can be as high as 8% cover.

### PHOTO INTERPRETATION SIGNATURE:

Signature color varies considerably depending on the species composition (specifically the amount of weedy forbs mixing with the annual grasses), and phenology of the plant at the time the imagery was flown. Texture likewise is variable and can be highly mottled based on the presence of weedy forbs, especially *Brassica* and *Cortaderia*. Texture variability is a reflection of species composition, not differing vegetative stature.

**\*4220 *Brassica nigra* & other mustards Semi-natural Stands**



This example depicts a hillslope dominated by *B. nigra* mixing with annual grasses. The stand is located just south of the State route 261 junction.

**DESCRIPTION:**

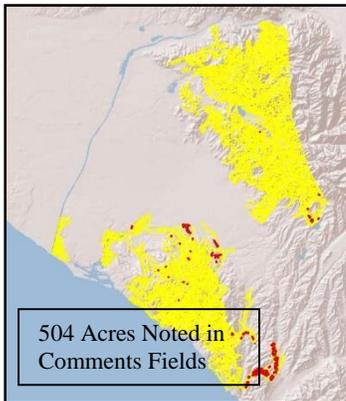
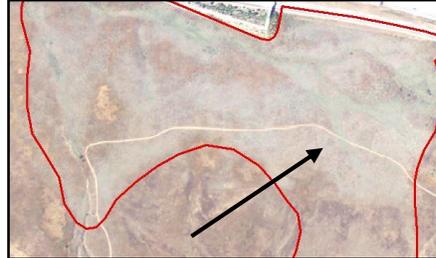
**\*Note:** Stands are assigned to the group-level category (*Mediterranean California Naturalized Annual and Perennial Grassland Group*) and noted in the comments field as **the *Brassica nigra* and other mustards semi-natural stands category**. Stands noted by this type in the comments field occur when *B. nigra* dominates the herbaceous layer. Mapped stands were often patchy and include small areas where annual bromes locally dominated.

**PHOTO INTERPRETATION SIGNATURE:**

This type displays a light gray signature on the NAIP imagery. The distribution is patchy with core areas surrounded by fringes where annual grasses and mustard share dominance. In these fringe zones, the texture is stipple-like. The margins of these mustard stands do not appear to conform to any topographical relationships.

## \*4250 *Cynara cardunculus* Provisional Semi-natural Stands

This stand had been cleared after the 2012 NAIP imagery – ground photography not available



This example depicts a large stand of *Cynara cardunculus* subsequently cleared after 2012. The stand is located south of the San Diego Freeway.

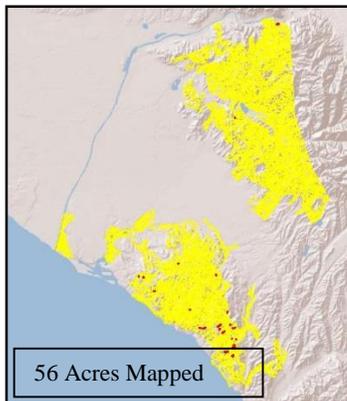
### DESCRIPTION:

**\*Note: Stands are assigned to the group-level category (Mediterranean California Naturalized Annual and Perennial Grassland Group) and noted in the comments field as the *Cynara cardunculus* provisional semi-natural stands category.** Stands assigned to this type in the comments field occur when *C. cardunculus* dominated the herbaceous layer. Stands noted by this category were often patchy and include small areas where annual bromes locally dominated. Numerous stands noted in 2012 have been since cleared and may be re-classified to one of the Bromus alliances.

### PHOTO INTERPRETATION SIGNATURE:

This type displays a light gray to light green signature on the NAIP imagery. The distribution is patchy with core areas surrounded by fringes where annual grasses and thistle share dominance. In these fringe zones, the texture is mottled and patchy. These stands do not appear to conform consistently to any topographical patterns except they may be more extensive on level to gently sloping terrain.

## 5210 *Toxicodendron diversilobum* Alliance



This example depicts a very small 1-acre patch of dense *T. diversilobum* on a steep mesic north trending slope above Aliso Creek.

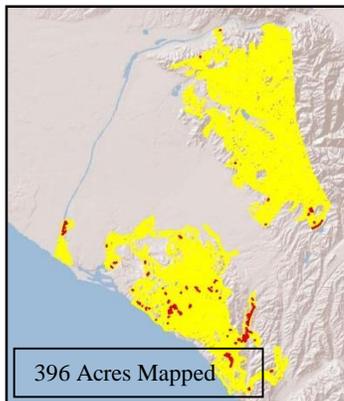
### DESCRIPTION:

Although the *Toxicodendron diversilobum* Alliance is mapped in only a few scattered locations primarily within a mile of the coast, is a frequent component to mesic stands of coastal scrub. Stands assigned to this type were mapped where *T. diversilobum* dominated. Other species such as *Artemisia californica*, *Diplacus aurantiacus*, and emergent *Sambucus nigra* were present in most of the mapped polygons. Stands are quite small, most are about an acre in size.

### PHOTO INTERPRETATION SIGNATURE:

At the time the NAIP imagery was flown, *Toxicodendron diversilobum* had a light to medium green signature depicting the young leaf phenology of early summer. Texture across the limited extend of the stand is smooth to slightly mottled; stand edges are generally distinct and abrupt.

## 5310 *Baccharis pilularis* Alliance



The example above depicts *Baccharis pilularis* in open grassy cover (with small dense patches) dominating the shrub layer. The stand is just west of Alicia Parkway.

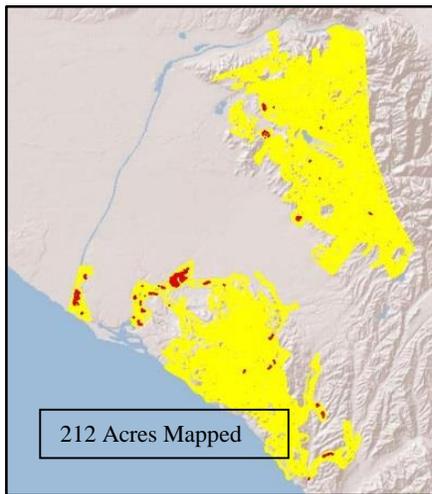
### DESCRIPTION:

The *Baccharis pilularis* Alliance was mapped where it dominated the shrub layer, generally in open grassy settings. Several stands were mapped where *B. pilularis* co-dominated with *Artemisia californica*, in these settings, cover was generally higher. The type is widespread in the southern section of the mapping area, especially on level to nearly level sites in the Aliso Creek floodplain.

### PHOTO INTERPRETATION SIGNATURE:

*Baccharis pilularis* has a dark green color, occasionally with a brownish hue. Crown margins are more definitive than *B. salicifolia*, and are frequently an emergent to annual grasses, which enable distinct recognition of the shrub layer. *B. pilularis* can be difficult to distinguish from the drier riparian margins containing *B. salicifolia* and *Salix lasiolepis* when the two types are adjacent to one another.

## 6000 Temperate & Boreal Freshwater Marsh Formation Types



The distribution map shows the range of the nine alliances and more generalized groups mapped in the study. The picture below depicts a common interface between species of *Schoenoplectus* (bulrush) and *Typha* (cattail marsh).



### 6000 – Temperate & Boreal Freshwater Marsh Formation

11 polygons were mapped to the formation level category totaling six acres. Mapped where photo interpreters could not determine herbaceous vegetation to finer levels in the classification, even to the point where the emergent vegetation was marsh like (containing *Typha* spp. or *Schoenoplectus*) or meadow trending with obligate wetland grasses. Several polygons were mapped in the Fairview Park Restoration Project (vernal pools) just west of Placentia Avenue.

### 6001 – Meadow (*Carex* – *Juncus* – *Eleocharis*) Mapping Unit

Only 5 polygons mapped in the study area totaling slightly over four acres. Signature and biogeographical correlations are not developed for these types due to their rarity in the mapping area. Three of the mapped polygons occur west of Santiago Canyon road in an area noted on the USGS topo map as “The Sinks” and are depicted as water features on the quad. Accuracy assessment did not include polygons of this type.

### **6100 – Arid West Freshwater Emergent Marsh Group**

74 polygons were mapped totaling nearly 90 acres. In most cases, alliance level mapping within this group proved too problematic based on the results from the accuracy assessment. Alliance-level mapping of freshwater marsh types often do not yield consistent signatures or biogeographical trends that aid the photo interpreter in mapping at an acceptable accuracy. Mapping to the alliance level within this group was only done where either ground based evaluations through AA or field reconnaissance were present in the stand. Unconfirmed polygons were noted in the comments field as to the likely alliance where photo interpreters had a reasonable confidence in the call.

### **6101 – Fresh Water Marsh (bulrush – cattail) Mapping Unit**



16 polygons totaling 32 acres were mapped to this “back-off” category- mapping unit when photo interpreters could distinguish that the marsh vegetation was either a species of *Schoenoplectus* or *Typha*. Often, both genera were represented in the stand but it was difficult to ascertain dominance. In these circumstances, the 6101 category was assigned to the polygon. The stand depicted to the left is an example of the lighter toned *Typha* co-dominating with the darker *Schoenoplectus* spp.

### **6110 – *Schoenoplectus acutus* Association**

4 polygons totaling 10 acres were mapped and verified to this Alliance. The stand was mapped on adjacent to small lakes and reservoirs on inland areas of the study. Verified and comments-noted polygons were mapped in Laguna Canyon and along the Peters Canyon, Siphon, and Sulphur Creek Reservoirs. Most stands contained small components of *Typha* spp.

### **6120 – *Typha (angustifolia, domingensis, latifolia)* Alliance**

10 polygons mapped and verified, totaling approximately 25 acres; at the mouth of small canyons mainly west of Upper Newport Bay and along the duck ponds at the U.C. Irvine managed wetlands site (San Joaquin Wildlife Sanctuary). Most stands contained small inclusions of *Schoenoplectus* spp.

### **6130 – *Schoenoplectus californicus* Association**

9 polygons were mapped and verified totaling 8 acres of marshland located primarily along the fringes of Upper Newport Bay and along the duck ponds and northern portions of the U.C. Irvine managed wetlands site. Stands surrounding the duck ponds were extremely narrow, often below 7 meters in width. Broader stands along the perimeters of the site were larger, often containing small patches of *Typha* spp. forming a matrix within the stand.

### **6140 – *Scirpus robustus* Alliance**

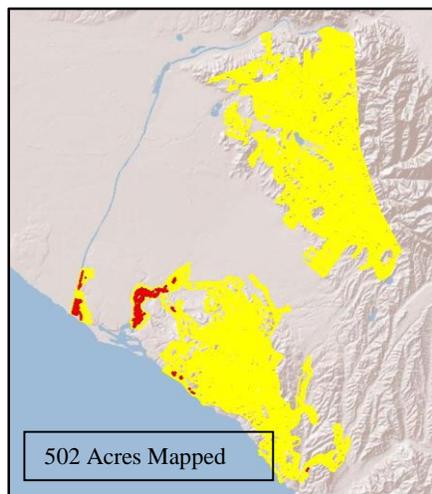
1 sinuous polygon was mapped and verified along the roadside margins bordering a dozen or so duck ponds of the U.C. Irvine site. The area is frequently mowed in late in the growing cycle. The mapped polygon includes the road proper.

### 6310 – *Lepidium latifolium* Semi-natural Herbaceous Stands

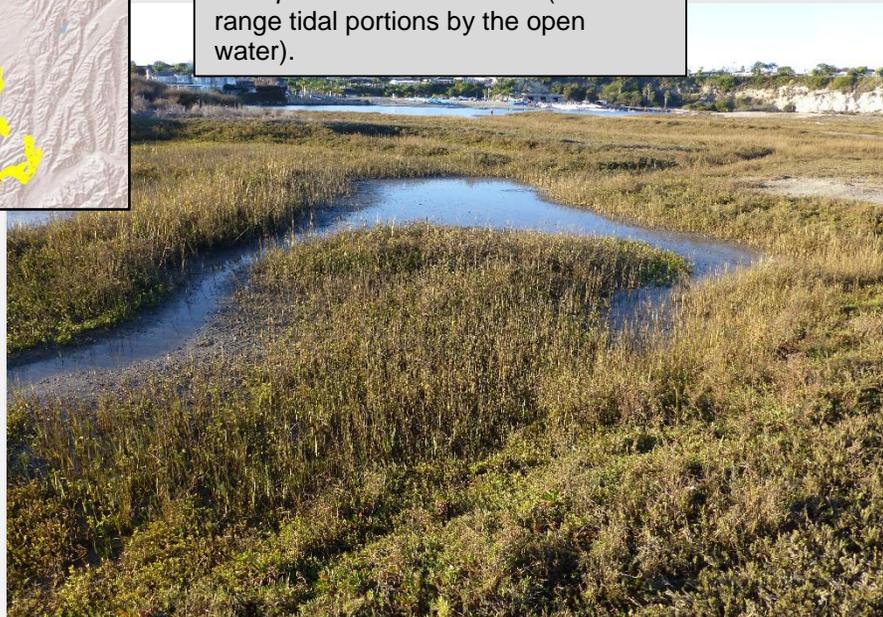
13 polygons were mapped totaling slightly under 20 acres below the Costa Mesa Bluffs west of the Santa Ana River. Stands are located on disturbed weedy sites; previous management efforts in the area have not succeeded and in these sites, *Lepidium* has since occupied most of the area. Mapped stands had small components of *Baccharis pilularis*.

### 7000 Temperate & Boreal Salt Marsh Formation Types

**\*Note** – Original linework was extracted from a study done in April of 2012 for the Upper Newport Bay Ecosystem Post-restoration Monitoring Program done by Merkel & Associates, Inc. The linework was modified slightly to conform to the 2012 NAIP imagery, and in areas where vegetation breaks between the salt marsh types were noted. The two intertidal mudflat breaks were aggregated into one corresponding to the intertidal mudflat (code 9440) in the classification.



The distribution map shows the range of the seven alliances and more generalized groups mapped in the study. The picture below depicts a common interface between the *Sarcocornia pacifica* alliance (higher range tidal portions of the marsh) and the *Spartina foliosa* alliance (lower range tidal portions by the open water).



### **7100 – Temperate Pacific Tidal Salt & Brackish Marsh Group**

122 polygons were mapped totaling 271 acres. In most cases, alliance level mapping within this group was insufficiently sampled or proved too problematic based on the results from the accuracy assessment. Alliance-level mapping of saltmarsh types often do not yield consistent signatures or biogeographical trends that aid the photo interpreter in mapping at an acceptable accuracy. With the exception of the *Spartina foliosa* alliance, mapping to the alliance level within this group was only done where either ground based evaluations through AA or field reconnaissance were present in the stand. Unconfirmed polygons were noted in the comments field as to the likely alliance where photo interpreters had a reasonable confidence in the call.

Saltmarsh communities often form an extremely fine matrix between alliances making accurate delineations highly ambiguous for this effort. A typical example of this vegetation complexing is visible on the ground photo above; in this case, a very fine matrix of *Sarcocornia pacifica* & *Spartina foliosa*, forms patches of saltmarsh types below 1/10 of an acre in size. Other alliances within this group were noted during reconnaissance, however they formed patches consistently too small to reliably photo interpret with even finer sub-meter imagery. These included *Frankenia salina*, and *Distichlis spicata*, both of which often were adjacent to larger areas forming the *Sarcocornia pacifica* Alliance.

### **7110 – *Sarcocornia pacifica* (*Salicornia depressa*) Alliance**

10 polygons totaling 36 acres were mapped and verified to this Alliance, occurring in two regions of the study. Most of the stands defining this type were mapped in the Upper Newport Bay totaling 218 acres. The remaining areas occur in the restoration effort adjacent to the mouth of the Santa Ana River. This Alliance was mapped where *S. pacifica* dominated or co-dominated the stand. Included in this alliance are related species such as *Batis maritima*, *Suaeda* spp., and *Jaumea carnosa* all of which may at times locally dominate the stand. Common associate species that occurred within the mapped polygons also include *Frankenia salina* and *Distichlis spicata*.

### **7120 – *Spartina foliosa* Alliance**

94 polygons totaling 131 acres rim the tidal mudflats and open channels on the Upper Newport Bay; an additional 7 acres of restored saltmarsh defined to this type are found just west of the Santa Ana River mouth. The alliance was mapped where *Spartina foliosa* dominated the stand or co-dominate the stand with an understory of *S. pacifica*. This type was adequately sampled and accuracy was acceptable to the point of retaining these polygons to the alliance level in the classification.

### **7130 – *Bolboschoenus* (*Scirpus*) *maritimus* Alliance**

3 polygons totaling slightly less than an acre (25 polygons noted as probable in the comments) form extremely small patches along the margins of the Upper Newport Bay saltmarsh. Mapped stands are sometimes less than 5 meters in width. Most stands line the road along the east side of the bay. Mapped stands are often monotypic and are overwhelmingly dominated by *B. maritimus*. Several stands are immediately adjacent to less brackish marsh types such as *Typha* & *Schoenoplectus* spp. Boundaries of this type to the *Sarcocornia pacifica* alliance are quite distinct.

#### **7140 – *Distichlis spicata* Alliance**

Only one polygon was substantiated (out of two mapped) in this effort totaling less than a fraction of an acre. Most *D. spicata* patches, which could possibly be defined to this alliance, occurred within the *S. pacifica* Alliance and could not reliably be pulled out with existing imagery.

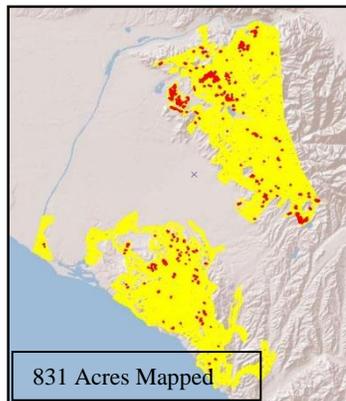
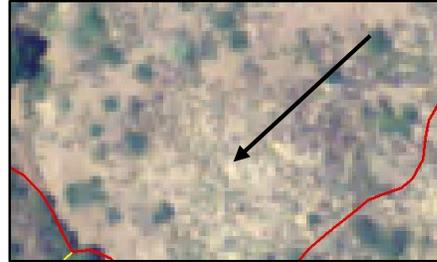
#### **7200 – Southwest North American Salt Basin & High Marsh Group**

Stands mapped to this level of the classification (11 polygons) were dominated by an *Atriplex* shrub. It was not possible to separate out *Atriplex lentiformis* and other species identified on the bluffs adjacent to the Upper Newport Bay such as *A. semibaccata* or *A. lentiformis* ssp. *breweri*.

#### **7210 – *Atriplex lentiformis* Alliance**

8 polygons mapped totaling slightly over 30 acres were mapped to this type along the base of coastal bluffs and adjacent terraces from mouth of the Santa Ana River south to Reef Point. Stands mapped on the bluffs to this type are monotypic, strongly dominated by *Atriplex lentiformis*, while stands on the terrace tend to have a variety of coastal bluff scrub species as a minor component to the stand.

## 8120 *Opuntia littoralis* Alliance



The example above depicts a stand of *Opuntia littoralis* dominating (or possibly strongly co-dominating) with *Eriogonum fasciculatum* on a steep south facing slope above Weir Canyon near the Villa Park Dam spillway.

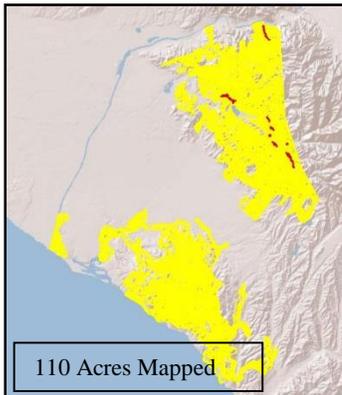
### DESCRIPTION:

Stands assigned to the *Opuntia littoralis* Alliance were mapped on steep, exposed slopes, generally trending southerly. This Alliance was mapped when *Opuntia littoralis* dominated or co-dominated the stand with *Eriogonum fasciculatum* and/or *Artemisia californica*. Stands containing sub-dominant *Opuntia* with coastal scrub species were usually mapped to the coastal scrub alliance. The above settings (where several coastal scrub species co-dominated with *Opuntia*) were common on xeric slopes throughout the study area. *Opuntia littoralis* was mapped on occasion in open grassland settings where it was a strong dominant or sole component to the stand. Some stands contained a sparse emergent of *Sambucus nigra*, generally below 5% cover. A separate effort identifying *Opuntia littoralis* and other species of cactus generated by The Nature Conservancy and NROC from 2006 – 2011 identifies more polygons but were not mapped to the descriptions and key defined in this effort. Many of the polygons defined in this study had too high of a coastal scrub component and are assigned in most cases to either the *Eriogonum fasciculatum* or the *Artemisia californica* – *Eriogonum fasciculatum* Alliances.

### PHOTO INTERPRETATION SIGNATURE:

*Opuntia littoralis* has a very light green signature that forms a mottled pattern with light colored substrate and the dark brown *E. fasciculatum*. Stands that were under 1 acre in size and where the cactus was not a strong dominant in fairly high cover were difficult to identify using only the 2012 NAIP imagery. Supplemental 3" resolution imagery flown by Eagle Aerial aided in determining the relative cover of *Opuntia* and coastal scrub.

## 8210 *Lepidospartum squamatum* Alliance



The example above depicts a stand of *Lepidospartum squamatum* in sparse cover with a small component of *B. salicifolia* & *Bebbia juncea*. The stand is located along a sandy portion of the Santiago Creek just below the Santiago reservoir.

### DESCRIPTION:

Stands assigned to the *Lepidospartum squamatum* Alliance were mapped on well drained, sandy to gravelly substrate in seasonal to temporarily flooded washes in cover ranging from as little as 2-5%. The Alliance was mapped where *L. squamatum* was present in the defined polygon (sometimes just a few individuals) to where it co-dominated with other shrubs including *Baccharis salicifolia*, *Eriogonum fasciculatum*, *Bebbia juncea* and/or *Brickellia incana*. \*Note – The identification of several stands was accomplished from the funding through the USDA Forest Service, Pacific Southwest Region Native Plant Materials Program and the Riverside-Corona RCD; in partnership with the CNPS vegetation program, Riverside Fire Lab, & the Riverside-Corona RCD for data collection.

### PHOTO INTERPRETATION SIGNATURE:

Key in identifying this Alliance is recognizing the photo signature of the landform and substrate that characterize this species modal habitat. In the mapping area, shrub cover is too sparse to ascertain a reliable photo signature of the actual vegetation. The substrate in temporarily flooded washes is highly reflective. In seasonally flooded systems, *L. squamatum* is often located adjacent to the active wash. In these settings, vegetative cover is usually higher, (often with some annual grasses in the understory) and the substrate reflectance is lower.

## **Generalized Vegetation types and types with a limited presence in the Mapping Area**

### **1110 – *Juglans californica* Alliance**

2 Polygons (~15 acres) – Disturbed sites with an exotic component were mapped off of Camino Grande Road in Anaheim. Stands increase to the north of the Santa Ana River in the Chino and Puente Hills.

### **1200 – California Evergreen Coniferous Forest & Woodland Group**

2 polygons (Less than 1 acre total) were mapped containing planted pine in the Fairview Park restoration site along the Santa Ana River.

### **1410 – *Pseudotsuga macrocarpa* Alliance**

2 polygons (~5 acres) mapped in steep canyons in the northeastern portion of the mapping area in the upper portions of Gypsum & Coal canyon near the 1800' level.

### **1610 – *Alnus rhombifolia* Alliance**

3 polygons (~21.5 acres) mapped along Santiago Creek just above the Santiago Reservoir. Mapped stands have a component of *Salix gooddingii* & *S. lasiolepis*.

### **1700 – Southwest North American Riparian Woodland Group**

29 polygons totaling approximately 124 acres are assigned to this riparian group category for one or more of several reasons, which make it difficult for photo interpreters to refine to an alliance level:

1. Stands are young, generally in sapling stature, making it difficult to establish a reliable PI signature.
2. Stands are heavily influenced by disturbance, making the vegetation cover very low (often below 15%). This low cover makes it difficult to ascertain a reliable stand-based photo signature.
3. Stands have a high component of non-native vegetation (palms, *eucalyptus*, etc.) which affect the photo signature of the native component.

### **1740 – *Populus fremontii* Alliance**

10 polygons mapped totaling approximately 26 acres were mapped where *Populus fremontii* dominated or co-dominated the stand with *Salix laevigata* and/or *S. gooddingii*. Other stands mapped to a tree willow alliance often had small components of *P. fremontii*.

### **1800 – Southwest North American Riparian/Wash Scrub Group**

22 polygons totaling approximately 30 acres are assigned to this “thicket” type group for similar reasons as stated for type 1700. Stands often contain young sapling tree species (without an emergent tree-stature component) and often mix with *Baccharis salicifolia*.

### **2000 – California Chaparral Macrogroup**

1 polygon (~4 acres) mapped adjacent to an excavation site in Baker Canyon – difficult to distinguish between the various chaparral species at the site.

### **2100 – California Xeric Chaparral Group**

20 polygons totaling approximately 221 acres were mapped in the higher elevations of the study along the eastern fringes in the Santa Ana Mountains. Approximately  $\frac{3}{4}$  of the total acreage mapped to this category were in areas where regenerating cypress is a component to a dense chaparral layer. The polygons are noted in the comments field and assigned a cover class value of 2-9% in the conifer field. Other stands noted to this level in the hierarchy were difficult to classify to the alliance level for reasons of disturbance from fire, unusual species composition or overall low shrub cover.

### **2200 – California Maritime Chaparral Group**

5 polygons (~39 acres) were mapped in the southernmost portion of the study area near the vicinity of Niguel Hill in South Laguna. These stands were never verified during the mapping or accuracy assessment phase of the study. Some are noted in the comments field and may contain components of *Adenostoma fasciculatum*, *Rue*, *Ceanothus megacarpus* with components of coastal scrub species.

### **2300 – California Mesic Chaparral Group**

10 polygons totaling approximately 43 acres were mapped where it was not possible to estimate mixed cover of species including *Heteromeles arbutifolia*, *Fraxinus dipetala*, *Quercus berberidifolia*, *Ceanothus tomentosus* and in steeper areas, *Cercocarpus montanus*. Possible components to the stand are noted in the comments field for most of the polygons.

### **2320 – *Cercocarpus montanus* Alliance**

1 polygon (~26 acres) was mapped on steep terrain just below the Claymont Clay Mine off a small tributary of Coal Canyon. The polygon was not verified by accuracy assessment, nor was it visited during the mapping phase of the project.

### **3100 – Central & South Coastal Californian CSS Group**

This is by far the most commonly mapped group-level category in the vegetation mapping effort, with 161 polygons mapped totaling approximately 1123 acres throughout the study region. This category is frequently referred to as “coastal sage scrub” but more often than not in the mapping area will contain a minimal component of *Salvia spp.* Common mixes do sometimes include either *Salvia mellifera*, *S. apiana*, or *S. leucophylla*, along with *Artemisia californica* and/or *Eriogonum fasciculatum*. Most stands include varying amounts of drought deciduous species that cannot for one or more reasons be accurately estimated and identified to an alliance level in the hierarchy. The most common reason for unreliable alliance-level determinations is the stands short length of recovery time after fire. Stands affected by recent burn often contain components of seral scrub such as *Acmispon glaber* and/or *Malacothamnus fasciculatus* making an alliance level determination even more difficult.

### **3160 – *Eriogonum fasciculatum* – *Salvia apiana* Alliance**

Only 1 polygon mapped totaling 2 acres based on ground-based reconnaissance. This alliance may occur more frequently. Photointerpreters assigned polygons to either of the single-species alliance. It was not possible to accurately estimate the relative cover of these two species in order to confidently map to this mixed-species alliance.

### **3170 – *Keckiella antirrhinoides* Alliance**

7 polygons totaling approximately 17 acres were mapped to this alliance. Field reconnaissance justified over half of the stands, all of which occurred on steep mid to lower slopes; mostly in the

Black Star Canyon watershed and above Santiago Creek. This type possibly is under-mapped due to its topographical setting (steep northerly settings often in poor image quality zones).

### **3300 – Central & South Coastal Californian Seral Scrub Group**

13 polygons totaling approximately 86 acres were mapped primarily in post burn environments in the northern section of the study area in areas that were burned in 2006 or 2007. They often contain varying amounts of species from this group (*A. glaber*, *M. fasciculatus*) with components of species from the CSS group (3100). The above mixes are mapped to the group level when it is not possible to ascertain relative cover of the stands diagnostic and co-dominant species.

### **3310 – *Ericameria palmeri* Alliance**

24 polygons totaling approximately 50 acres are mapped to this type, primarily in low cover adjacent to and in small openings in coast live oak stands. Numerous stands contained components of *Stipa pulchra* in the stand based on surveys done by the Irvine Ranch Conservancy. Stands identified to this alliance have *E. palmeri* dominating the low shrub layer; generally in cover below 15%; with a dense herbaceous layer nearly the same height.

### **3330 – *Isocoma menziesii* Alliance**

11 polygons totaling approximately 38 acres were mapped in disturbance settings mainly in the southern portion of the study area. Several polygons were noted as part of vegetation restoration sites, which were observed during the mapping phase of the project. The Alliance was mapped where *Isocoma menziesii* dominated the shrub layer, often with a component of *B. pilularis*. Annual grasses were generally a dense component to the vegetation.

### **4000 – California Annual & Perennial Grasslands Macrogroup**

4 polygons totaling just under 7 acres were mapped primarily along the road along the east side of Newport Bay. These stands are very narrow bands between the road and the tidal marsh adjacent to the west. Species identification in these small patches are not possible to an alliance or group level.

### **4100 – California Perennial Grassland Group**

5 polygons totaling slightly under 54 acres were mapped where field reconnaissance noted the presence of native grasslands from a distance but not to a species level. All polygons viewed had a high component of non-native annual grasses.

### **4110 – *Leymus condensatus* Alliance**

Although occasionally noted as a component to mesic stands of *Artemisia californica*, stands where this tall grass dominated the vegetation with less than 5% shrub cover were mapped on only two occasions totaling just over 2 ¼ acres.

### **4210 – *Avena (barbata, fatua)* Semi-natural Herbaceous Stands**

2 polygons totaling approximately 9 acres were defined to this alliance based on CNPS accuracy assessment visits.

### **4230 – *Bromus (diandrus, hordeaceus)* - *Brachypodium distachyon* Semi-natural Herbaceous Stands**

6 polygons totaling approximately 84 acres were defined to this alliance based on AECOM Technology Corporation's plot sampling effort conducted in 2013 and CNPS's accuracy assessment completed in the fall of 2014.

**4260 – *Cortaderia (jubata, selloana)* Semi-natural Herbaceous Stands**

14 polygons were identified in the mapping area, mainly around the restoration sites adjacent to the Santa Ana River, totaling approximately 16 acres. Stands were strongly dominated with this grass, generally in very small but dense patches. Other patches were noted within several hundred meters from the coast but were well under ¼ acre in size.

**4280 – *Lolium perenne* Semi-natural Herbaceous Stands**

One polygon noted (~ 1 ½ acre in size) identified based on CNPS's accuracy assessment effort)

**4290 – *Erodium* Fields (Not identified in the MCV2)**

11 polygons mapped totaling approximately 100 acres of this herbaceous type were mapped on the El Toro Habitat Site (Federal Aviation Administration) just north of the lower reaches of Borrego Canyon. Noted on gravelly soils in level to near level topography. Noted by Orange County Staff as possible sites for native herbaceous restoration.

**5410 – *Carpobrotus edulis* or other Ice Plants Semi-natural Stands**

13 polygons mapped totaling approximately 11 acres were mapped along the steep bluffs that form the southwest edge of the city of Costa Mesa. Mapped stands were strongly dominated by ice plant in dense cover.

**8000 – Xeromorphic Scrub & Herb Vegetation**

3 polygons were mapped totaling approximately 33 acres. This generalized category was used to denote stands noted with a presence of *Nolina cismontane*. Overall shrub cover in the mapped stands was low and therefore not possible to estimate relative species cover in determining an alliance level call.

**8100 – Coastal Baja California Norte Maritime Succulent Scrub Group**

17 polygons were mapped to this sparsely vegetated group level category (totaling approximately 26 acres). The category is used to denote the coastal bluffs adjacent to the mean high tide and above portions of the Upper Newport Bay. Vegetation along portions of the bluffs may exceed 5% over small areas; however, cover is never high enough to reliably assign vegetation to an alliance level floristic call. Common associate species noted along the bluffs include *Encelia californica*, *Lycium californicum*, *Eriogonum fasciculatum* and *Carpobrotus spp.*

**8220 – *Bebbia juncea* Alliance**

1 polygon mapped (2 acres) based on CNPS Accuracy Assessment Point 9543. The site is located adjacent to the active portion of a seasonally flooded wash (Santiago Creek) 300 meters below the Santiago Dam.

**Miscellaneous Classes not defined by the Manual of California Vegetation (MCV2)****9100 – Introduced Trees, Shrubs (not in hierarchy)**

Mapped where exotic trees (other than *Eucalyptus spp.*) and/or shrubs dominate the canopy, approximately 581 acres total. Native planted species can be a component to the canopy, especially *Quercus agrifolia* and *Platanus racemosa*. Mapped throughout the study area but most frequently adjacent to or near urban areas and regional parks. In regional parks, the comments field will mention species identified during reconnaissance, especially if they are native to adjacent open space.

### **9200 – Agriculture (Land Use Code Field = 2000)**

Based on the 2012 NAIP imagery, there are approximately 800 acres under agricultural use within the mapping area. These include areas planted with orchard crops (citrus & avocado) which were producing at the time of the imagery or possibly in transition (new plants or in the process of abandonment). Also included in this category are vineyards, field, vegetable and fruit crops and recently fallow fields that have been in use within the past 5 years.

### **9300 – Urban/Disturbed (Land Use Code Field = 1000)**

Approximately 14,707 acres (just over 17% of the total study area) are mapped to this category as urban regions that are built up along with their adjacent surfaced areas directly associated with the built up portions of the parcel. Generally included in this category also are the unsurfaced landscaped areas associated with the mapped urban polygon. Areas of exotic vegetation within the large urban window are not separated out from the urban polygon unless they form an extensive fringe with the adjacent open space.

#### **Land Use Code Field - 1800 – Special Linkage Areas**

This is a dual-use code designed to note areas such as regional parks, golf courses and highway underpasses linking natural areas of vegetation. The PI code field identifies the area as urban built up (Code 9300) when there is no naturally occurring vegetation present. The PI code field is assigned to the appropriate floristic type when natural vegetation is present. The Land use code field is assigned to a value of 'Special Linkage' (Code 1800) when the area is defined as such. Codes defined to 1800 in the land use field may be assigned to either an urban built up (9300) or to a vegetation type in the PI code field.

### **9320 – Fuel Mod Zones**

127 polygons totaling approximately 1159 acres were mapped. This is a special category where some vegetation (generally annual grasses or exotic species) can be present within the mapping unit. This category is mapped along the fringes of urban areas and is designed as a buffer to natural vegetation. The buffer serves as a fire protection zone to the adjacent urban development. Generally, vegetative cover is below 10%, but often varies depending on vegetation removal intervals. At times, some natural vegetation may colonize these zones; more frequently, the areas contain patches of exotic vegetation including pines, *Eucalyptus* and *Acacia*.

### **9330 – Anthropogenic Area of Little or No Vegetation**

The study area contains approximately 176 acres of this category. Polygons mapped to this type contain little or no build up land; however, the surface has been scraped or otherwise denuded of most of the natural vegetation. Vegetation generally falls below 10% overall cover.

### **9340 – Vegetation Restoration Zones**



Vegetation restoration zones total approximately 700 acres throughout the mapping area in widely ranging sizes and species composition. This type is mapped when efforts of restoring natural landscape has or is in the process of occurring. Restoration efforts include the colonization of coastal scrub types, chaparral habitats and riparian vegetation. The example in this picture includes restoration of several coastal scrub species, elderberry and red willow. Vegetation is mapped to this category because the actual sites rarely form defined alliances, but often contain a high variety of species composition within

small areas that are difficult to classify.

### **9400 – Sparsely vegetated to non-vegetated**

2 polygon (~2 acres) mapped to this higher-level category since they do not fit into a finer level of the classification. One, a Least Turn Nesting Island in the Upper Newport Bay, another, a possible salt panne which photointerpreters could not confidently call out to type 9450.

### **9411 – Rocky shore**

Both the Rocky Shore and Beach Sand were mapped from the closest interpretation of the mean high water line (generally the seaward margin of the coastal bluff vegetation as viewed on the NAIP imagery) out to a buffer distance of approximately 60 meters. The two categories are not to be used as accurate representations of high and low tidal zones, but are denoted to designate rocky or sandy beach substrate for habitat value only. 14 polygons were mapped to this category. Acreage counts are not given in this report due to the approximation of high and low tide determinations.

### **9412 – Beach Sands**

Mapping to this type follows the parameters of the 9411 type described above. 13 polygons mapped to this substrate category.

### **9420 – Cliff, Bluffs, Scree, and Rock Outcroppings**

221 polygons were mapped to this category totaling nearly 350 acres across both the northern and southern sub-regions of the study area, some below  $\frac{1}{4}$  acre in size. These were deemed important by ecologists as habitat nesting sites for raptors. These sparsely vegetated areas are mapped when vegetative cover generally falls below 8-10%.

### **9430 – Riverine & Lacustrine**

Only 3 polygons totaling approximately 3 acres were mapped in areas that form small areas of open water where the stream channel empties into the Pacific Ocean. They include a small area near Crystal Cove, an area just to the south at the mouth of Muddy Canyon and at the mouth of Aliso Creek. This category is reserved for perennial water occupying natural stream courses or lakes. Within the mapping area, this occurs only on the three small intertidal areas mentioned above.

#### **9431 – Streambed**

Polygons are mapped to this category in settings where intermittent to seasonally flooded stream channels contain less than 10% vegetative cover. These streambeds are naturally pervious and contain all or portions of their adjacent floodplain. They encompass nearly 20 linear miles of riverbeds in the study area, totaling 227 acres, over half of which are assigned to Santiago Creek in the northern portion of the study. Not included in this study are the concrete lined channels of the Santa Ana River along the northern and western margins of the study area in addition to other contained channels within the study.

#### **9440 – Tidal Mudflat**

7 polygons totaling approximately 160 acres were mapped within the Upper Newport Bay, generally on the lower tidal margins of the adjacent saltmarsh. The boundaries were copied directly from the April 2012 Habitat Map produced for the Post-restoration Monitoring Program by Merkel & Associates, Inc. into the vegetation map and integrated into the existing classification system. The existing habitat map produced by Merkel & Associates defined two zones within the intertidal mudflat. These zones were subsequently dissolved into one unit and the original linework was modified slightly to conform to the existing margins of the salt marsh as depicted on the 2012 NAIP imagery.

#### **9450 – Salt panne**

40 very small polygons totaling only 9 acres of land have been assigned to this sparsely to unvegetated category; mainly in the upper Newport bay and nearby mouth of the Santa Ana River. Most of these features are probably above the mean high tide and nearly all are surrounded by stands of *Sarcocornia pacifica*. Vegetative cover is below 10% and often below 1%. *Distichlis spicata* was noted during reconnaissance as a sparse component, increasing along the fringes of the panne.

#### **9800 – Water Body (Land Use Code Field 9800)**

157 polygons totaling approximately 733 acres were mapped including all water features not defined to a more refined category in the mapping area. Out of this total, approximately 515 acres were temporarily to permanently flooded water features while the remaining 218 acres were in the Pacific Ocean. Most are tidally influenced, and include the Upper Newport Bay and the Santa Ana River. Also included in this broad category are water bodies which are intermittently or temporarily flooded that were not flooded at the time of the NAIP 2012 Imagery.

#### **9810 – Perennial Stream Channel (Land Use Code Field 9800)**

A small portion of the San Diego Creek channel, totaling 31 acres, north of Campus Drive in Irvine was included into this category. It was noted on the 2012 NAIP as being flooded (NAIP was flown in late spring through mid-summer season).

#### **9820 – Reservoirs and other Artificial Water Features (Land Use Code Field 9800)**

48 polygons (~890 acres) were mapped to this category and include large reservoirs such as Silverado and San Joaquin Reservoirs, and smaller water features with only a minor earthen dam used to contain the flow of intermittent stream channels. Flooding regimes range from intermittently to permanently flooded.