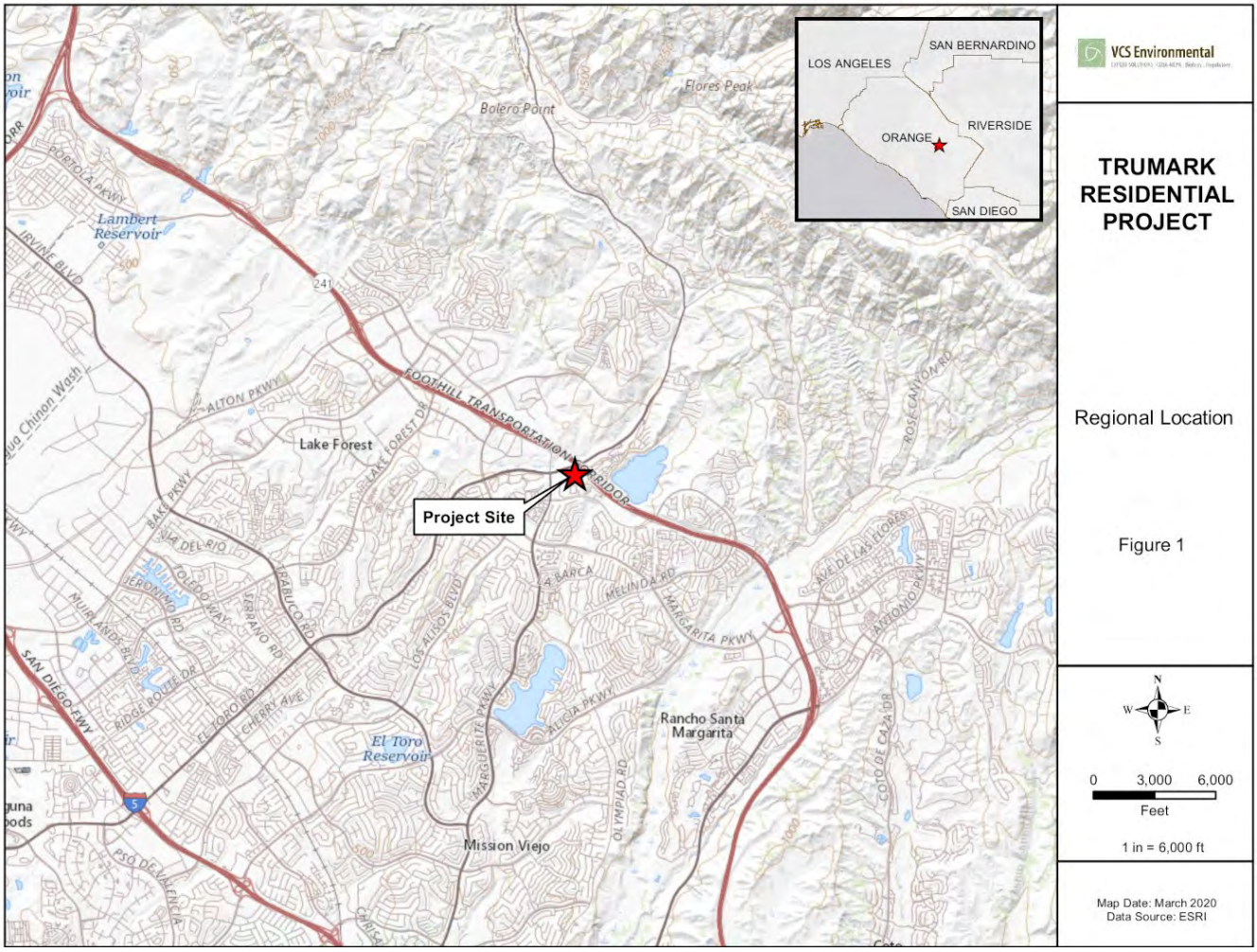
General Botanical and Focused Rare Plant Report
for
The Trumark Residential Project

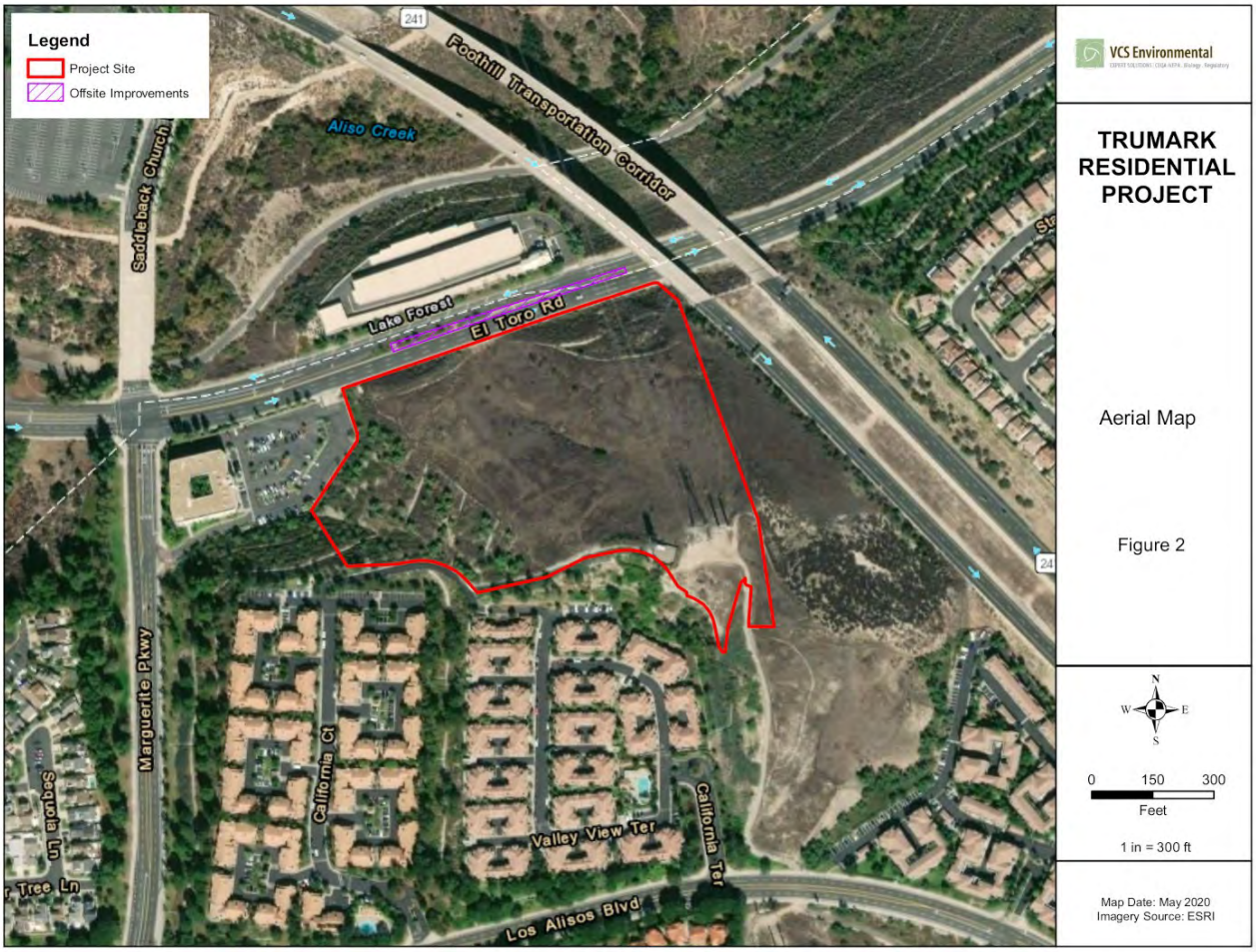
CJ Fotheringham
Botanical Consultations

Table of Contents

1. Site Description

The Trumark Residential Project in Mission Viejo, Ca (Figure 1) is located at the southwest corner of the 241 Toll Road and El Toro Road (Figure 2). The site is 13.4 acre parcel that is hilly with NNW aspect with elevation ranging from ~260m at the northwest corner to ~316m at the southeast corner.




Legend
Project Site
Offsite Improvements
241
Foothill Transportation Corridor
Aliso Creek
Saddleback Church
Lake Forest
El Toro Rd
Marguerite Pkwy
California Ct
Valley View Ter
California Ter
Los Alisos Blvd
Sequoia Ln
Tree Ln
24
VCS Environmental
TRUMARK RESIDENTIAL PROJECT
Aerial Map
Figure 2
N
W
E
S
0
150
300
Feet
1 in = 300 ft
Map Date: May 2020
Imagery Source: ESRI

2. Methodology

2.1 Databases review

Both the California Native Diversity Database (CNDDB) and the California Native Plant Society Inventory of Rare and Endangered Plants of California (CNPS inventory) were queried for special status. The The Consortium of California Herbaria (CCH) and the Calflora Database were queried for plants collected in the general area.

The Manual of California Vegetation Online was consulted in determining vegetation communities that occurred on site.

The USDA Web Soil Survey was also queried to determine soil types that occur on site. Many special status plants are restricted to specific soil types. Soils on site are clay, well drained and non-saline to slightly saline (AppendixII).

2.2 Site visit

The site was visited two times to maximize plant detection and identification. Weather during the first visit on 30 April 2020 was clear with light breezes and a high of 28°C (82°F). The second visit on 2 June 2020 cloudy with some clearings, gusty with a high of 28°C (82°F).

Surveying the site was accomplished on foot in a manner that allowed visual access of all accessible areas. The mustard stand was dense and had little understory so surveys in this area was limited to a few areas, The Coastal sage scrub and more open areas were surveyed with the greatest detail as they represent potential habitat for special status species.

3. Observed Plant Species

On the Trumark Residential Project site as a whole, a total of 54 species were identified, 28 (52%) of which were native (Table 1).

Table 1: Species encountered during surveys. Check boxes on the right indicate in which community a species occurred. M=Upland mustards and other ruderal forbs; O=Ornamental landscaping; CE=California sagebrush - California buckwheat scrub ;CS=California sagebrush scrub; D=Disturbed/Developed; H=Poison hemlock patches.

Latin Binomial	Vernacular Name	Lifeform	Status	Family	Bloom Period	M	O	CS	CE	D	H
Schinus molle	Peruvian pepper tree	Tree	invasive	Anacardiaceae	Mar - Jun		x				
Conium maculatum	Poison hemlock	Perennial herb	invasive	Apiaceae	Apr - Sep	x			x		x
Foeniculum vulgare	Fennel	Perennial herb	invasive	Apiaceae	May - Sep	x					
Centaurea melitensis	Tocalote	Annual herb	invasive	Asteraceae	Apr - Aug	x	x	x	x	x	
Cirsium vulgare	Bullthistle	Perennial herb	invasive	Asteraceae	Jun - Sep	x			x		
Cynara cardunculus	Cardoon	Perennial herb	invasive	Asteraceae	Apr - Jul	x			x		x
Hypochaeris glabra	Smooth cats ear	Annual herb	invasive	Asteraceae	Mar - Jun		x	x	x		
Silybum marianum	Milk thistle	Annual, Perennial	invasive	Asteraceae	Apr - Jul	x			x		
Sonchus asper ssp. asper	Sow thistle	Annual herb	invasive	Asteraceae	Feb - Oct	x	x		x		
Taraxacum officinale	Red seeded dandelion	Perennial herb	invasive	Asteraceae	Feb - Mar				x		
Brassica nigra	Black mustard	Annual herb	invasive	Brassicaceae	Apr - Jul		x	x	x	x	x
Hirschfeldia incana	Mustard	Perennial herb	invasive	Brassicaceae	Jan - Dec		x	x	x	x	x
Erodium cicutarium	Coastal heron's bill	Annual herb	invasive	Geraniaceae	Feb - Jun	x	x	x	x	x	
Marrubium vulgare	White horehound	Perennial herb	invasive	Lamiaceae	May - Aug	x	x		x	x	
Bromus diandrus	Ripgut brome	Annual grass	invasive	Poaceae	Apr - Jun	x	x		x	x	
Festuca myuros	Rattail sixweeks grass	Annual grass	invasive	Poaceae	Feb - May		x	x	x		
Hordeum murinum	Foxtail barley	Annual grass	invasive	Poaceae	Apr - May	x	x		x		
Sambucus nigra	Black elderberry	Shrub	native	Adoxaceae	Mar - May	x			x		
Rhus integrifolia	Lemonade berry	Shrub	native	Anacardiaceae	Feb - May			x			

Table 1 (cont.)*:* Species encountered during surveys. Check boxes on the right indicate in which community a species occurred. M=Upland mustards and other ruderal forbs; O=Ornamental landscaping; CE=California sagebrush - California buckwheat scrub ;CS=California sagebrush scrub; D=Disturbed/Developed; H=Poison hemlock patches.

Artemisia californica	Coastal sage brush	Shrub	native	Asteraceae	Apr - Oct	x	x	x	x		
Artemisia dracunculus	Tarragon	Perennial herb	native	Asteraceae	Aug - Oct				x		
Baccharis pilularis	Coyote brush	Shrub	native	Asteraceae	Sep - Jan			x			
Encelia californica	Bush sunflower	Shrub	native	Asteraceae	Feb - Jun			x	x		
Eriophyllum confertiflorum	Yellow yarrow	Shrub	native	Asteraceae	Feb - Aug			x	x		
Hazardia squarrosa	Saw toothed goldenbush	Shrub	native	Asteraceae	Jun - Oct			x	x		
Isocoma menziesii	White flowered goldenbush	Shrub	native	Asteraceae	Apr - Nov			x	x		
Pseudognaphaliu m californicum	Ladies' tobacco	Annual, Perennial herb	native	Asteraceae	Jan - Jul		x	x	x		
Cryptantha sp	popcorn flower	Annual herb	native	Boraginaceae	Mar - May			x	x		
Eucrypta chrysanthemifolia	Spotted eucrypta	Annual herb	native	Boraginaceae	Mar - Jun	x		x	x		
Phacelia cicutaria	Caterpillar phacelia	Annual herb	native	Boraginaceae	Mar - May			x			
Cuscuta californica	California dodder	Annual herb, Vine (parasitic)	native	Convolvulaceae	Feb - Aug			x			
Lathyrus vestitus	Common pacific pea	Perennial herb	native	Fabaceae	Jan - May			x			
Sisyrinchium bellum	Blue eyed grass	Perennial herb	native	Iridaceae	Mar - May						
Salvia apiana	White sage	Shrub	native	Lamiaceae	Apr - Jul			x			
Salvia mellifera	Black sage	Shrub	native	Lamiaceae	Mar - Jul			x			
Diplacus aurantiacus	Sticky monkeyflower	Shrub	native	Phrymaceae	Mar - Aug			x			
Diplacus puniceus	Sticky monkeyflower	Shrub	native	Phrymaceae	Mar - Aug			x			
Keckiella cordifolia	Heart leaved keckiella	Shrub	native	Plantaginaceae	Mar - Aug			x			
Eriogonum fasciculatum	California buckwheat	Shrub	native	Polygonaceae	Apr - Sep		x	x	x		

Table 1 (cont.)*:* Species encountered during surveys. Check boxes on the right indicate in which community a species occurred. M=Upland mustards and other ruderal forbs; O=Ornamental landscaping; CE=California sagebrush - California buckwheat scrub ;CS=California sagebrush scrub; D=Disturbed/Developed; H=Poison hemlock patches.

Latin Binomial	Vernacular Name	Lifeform	Status	Family	Bloom Period	M	O	CS	CE	D	H
Heteromeles arbutifolia	Toyon	Shrub	native	Rosaceae	Jun - Aug		x	x	x		
Galium angustifolium	Narrow leaved bedstraw	Perennial herb	native	Rubiaceae	Mar - Jul			x			
Galium aparine	Cleavers	Annual herb	native	Rubiaceae	Apr - May	x		x	x	x	
Solanum douglasii	Douglas' nightshade	Perennial herb	native	Solanaceae	Jan - Dec			x	x		
Stellaria media	Chickweed	Annual herb	non-native	Caryophyllaceae	Feb - Sep			x	x		
Cistus incanus	Hairy rockrose	Shrub	non-native	Cistaceae	Apr - Jun			x			
Acacia redolens	Bank catclaw	Tree, Shrub	non-native	Fabaceae	Feb - May		x			x	
Melilotus indicus	Annual yellow sweetclover	Annual herb	non-native	Fabaceae	Apr - Oct	x	x		x	x	x
Liquidambar styraciflua	Sweetgum	Tree	non-native	Hamamelidaceae	Apr - May		x		x		
Eucalyptus sp.	gum tree	Tree	non-native	Myrtaceae	-		x				
Pinus canariensis	Canary Island pine	Tree	non-native	Pinaceae	-		x			x	
Pinus halepensis	Afghan pine	Tree	non-native	Pinaceae	-		x			x	
Bromus madritensis	Foxtail chess, foxtail brome	Annual grass	non-native	Poaceae	Feb - Mar	x	x	x	x	x	

While all six plant alliances had non-native species, cover of non-natives was not equal in each. In both the Upland mustards and other ruderal forbs alliance and the Poison hemlock patch natives accounted for little of the cover and/or biomass present. Non-natives accounted for the majority of species diversity in all communities except for the California sagebrush - California buckwheat scrub (Table 2).

Table 2: Diversity segregated by native and non-native plant species. M=Upland mustards and other ruderal forbs; O=Ornamental landscaping; CESS=California sagebrush - California buckwheat scrub ;CSS=California sagebrush scrub; D=Disturbed/Developed; H=Poison hemlock patches.

	All	Must	Orn	CESS	CSS	Dev	Hem
Total Spp	54	17	24	34	33	12	5
Non-native Spp	28 (52%)	13 (76.5%)	19 (79.2%)	19 (55.9%)	9 (27.3%)	11 (91.7%)	5 (100%)
Native Spp	26 (48%)	4 (23.5%)	5 (20.8%)	15 (44.1%)	24 (72.7%)	1(8.3%)	0

4. Vegetation Communities

4.1 *Brassica nigra - Raphanus spp*. Herbaceous Semi-Natural Alliance

Upland mustards and other ruderal forbs

Photo 1: Brassica nigra (black mustard) */Hirschefeldia incana* (mustard) stand on the Trumark Residential Project site.

The majority of the site (7.1 ac) is vegetated with dense herbaceous canopies of *Brassica nigra* (black mustard) *Hirschfeldia incana* (mustard) (Photo 1), with some isolated patches of *Cynara cardunculus* (Cardoon), *Foeniculum vulgare* (poison hemlock) and *Centaurea melitensis* (Photo 2).

Photo 2: Cynara cardunculus (Cardoon) patch in foreground, , Mustard/black mustard stand with emergent Sambucus nigra (black elderberry) top left of center.

Photo 3: Pseudognaphalium californicum (California everlasting) in mustard stand.

There are occasional remnant sage scrub elements such as *Sambucus nigra* (black elderberry), *Artemesia califorcornia* (coastal sage brush), and *Psuedognapthalium californicum* (Ladies' tobacco). (Photo 3, 4) There are few lower stature plants that grows within dense mustard stands but occasional *Bromus sp*, (brome grass), *Centaurea melitensis* and *Galium aparine* (cleavers) were encountered. See table 1 for observed species.

Photo 4: Sambucus nigra in mustard stand on the Trumark Residential Project site(indicated by red arrows)

4.2 Ornamental landscaping

Photo 5: Feral ornamental vegetation on the Trumark Residential Project site. A *Heteromeles arbutifolia* (toyon) is visible along the right margin.

Ornamental landscaping on the Trumark Residential Project site contained planted species such as *Eucalyptus sp* (gum tree). *Pinus sp* (pine tree)*, Acacia redolens* (bank catclaw) and *Schinus molle* (peruvian pepper tree) (Photo 5, 6). This appears to have been neglected or abandoned and is no longer being irrigated (broken pipes, dead trees photo 6). The area has a lot of native and weedy herbaceous species and a few scattered native shrub species, primarily *Heteromeles arbutifolia* (toyon) and coastal sage brush (Photo 6). This latter may have been part of the planted Not all planted ornamental species were identified. See table 1 for observed species.

Photo 6: Dead plants and colonization by native and weedy species of abandoned ornamental vegetation on the Trumark Residential Project site.

4.3 *Artemisia californica* Shrubland Alliance

California sagebrush scrub

Photo 7: Artemisia californica Shrubland Alliance on the the Trumark Residential Project site. California sagebrush scrub on the site is disturbed with low diversity of native plants and a large component of non-native herbaceous species.

Three patches (totaling 1.61ac) of California sagebrush scrub (Photo 7) occurs in a band between the ornamental planting and the mustard stand, along the eastern margin and a small patch in the middle of the the mustard stand. These areas are more disturbed than the *Artemisia californica* - *Eriogonum fasciculatum* Shrubland Alliance (below) with much lower native plant diversity and a large component of non-native herbaceous species.

Photo 8: Artemisia californica Shrubland Alliance in the foreground with Ornamental vegetation in the background on the the Trumark Residential Project site.

4.4 *Artemisia californica - Eriogonum fasciculatum* Shrubland Alliance

California sagebrush - California buckwheat scrub

Photo 9: California sagebrush - California buckwheat scrub on the Trumark Residential Project site.

California sagebrush - California buckwheat scrub (Photo 9-10) occurs adjacent to El Toro (1.37 ac, green on map) that has high species diversity an relatively low cover of non-native herbaceous species. This area was the most likely to have special status species.

Photo 10: California sagebrush - California buckwheat scrub on the Trumark Residential Project site.

4.5 Disturbed/Developed

Photo 11: Devolped/disturbed area on the Trumark Residential Project site. Powerline tower and poles with bare ground and non-native species in the foreground.

Near the southern tip of the property there is a small structure, powerline tower and associated disturbed area (0.67ac), This is largely ornamental plantings, weeds and bare ground (Photo 9-10).

Photo 12: Devolped/disturbed area on the Trumark Residential Project site. Small structure and cell tower with non-native species in the foreground.

4.6 *Conium maculatum* Herbaceous Semi-Natural Alliance

Poison hemlock patches

Photo 13: Poison hemlock patch on the Trumark Residential Project site.

Both poison hemlock and fennel occur scattered throughout the mustard stand but there is a small patch (0.09 ac) that is dominated by Poison hemlock (Photo 13)

5. Special status species

5.1 Potential rare species.

A search of of the CNDDB produced 16 special status plant species that occur in the area while the CNPS inventory had an additional eight specie. Of these 25 species, there was at least nominal habitat on site for six (Table 3). These six are discussed in more detail below.

Table 3: Results of database queries for special status plant species in the El Toro an Santiago USGS 7.5' quadrangles.

California Native Diversity Data Base Results						
Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	Habitat	Potential to Occur on The Trumark Residential Project site.
Brodiaea filifolia	thread-leaved brodiaea	Threatened	Endangered	1B.1	Grassland, vernal pools at elevations between 25--860 m.	Low potential to occur. Vernal pool species and there are no vernal pools or other wetlands on site.
Calochortus weedii var. intermedius	intermediate mariposa-lily	None	None	1B.2	Dry, rocky, open slopes at elevations below 680 m.	Low moderate potential to occur. Site is not rocky and there are few openings.
Clinopodium chandleri	San Miguel savory	None	None	1B.2	Rocky slopes, chaparral at elevations below 1100 m.	Low potential to occur. Generally found in more mesic oak woodland and chaparral which are not found on site.
Comarostaphylis diversifolia ssp. diversifolia	summer holly	None	None	1B.2	Chaparral at elevations between 100-550 m. (800m)	Low potential to occur. Nearest occurrences (3.5miles NW) occur at higher elevation (725m-792m) with different species that occur on the site.
Dudleya multicaulis	many-stemmed dudleya	None	None	1B.2	Heavy, often clay soils, coastal plains, sandstone outcrops at elevations below 600 m.	Low moderate potential to occur. Sage scrub occurs on site and soils are clay but lack sandstone outcroppings. No nearby occurrences.
Hesperocyparis forbesii	Tecate cypress	None	None	1B.1	Chaparral at elevations between 450-1500 m.	Low potential to occur. Generally found in more mesic environments than found on site and site is below elevational range.
Lepechinia cardiophylla	heart-leaved pitcher sage	None	None	1B.2	Chaparral at elevations between 600-1200 m.	Low potential to occur. Generally found in more mesic environments than found on site and site is below elevational range. No nearby occurrences.
Lepidium virginicum var. robinsonii	Robinson's pepper-grass	None	None	4.3	Dry, disturbed areas, bottomland, riverbanks, meadows, fields, pastures, cliffs, scrub at elevations below 2800 m	Low-moderate potential to occur. Disturbed areas on site are dense mustard, hemlock and/or thistle with no few openings.
Monardella hypoleuca ssp. intermedia	intermediate monardella	None	None	1B.3	Chaparral, oak woodland, occasionally conifer forest, dry slopes at elevations between 200-1250 m.	Low potential to occur. Generally found in more mesic environments than found on site. No nearby occurrences.
Monardella macrantha ssp. hallii	Hall's monardella	None	None	1B.3	Chaparral, woodland at elevations between 600-2000 m.	Low potential to occur. Generally found in more mesic environments than found on site. No nearby occurrences.

Table 3 (cont)*:* Results of database queries for special status plant species in the El Toro an Santiago USGS 7.5' quadrangles.

California Native Diversity Data Base Results						
Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	Habitat	Potential to Occur on The Trumark Residential Project site.
Nama stenocarpa	mud nama	None	None	2B.2	Intermittently wet areas at elevations below 810 m.	Low potential to occur. Vernal pool species and there are no vernal pools or other wetlands on site.
Nolina cismontana	chaparral nolina	None	None	1B.2	Dry chaparral of coastal mountains at elevations between 200-1300 m.	Moderate potential to occurr. Appropriate habitat on site and nearby occurrences.
Pentachaeta aurea ssp. Allenii	Allen's pentachaeta	None	None	1B.1	Grassy areas at elevations below 500 m.	Low-moderate potential to occur. Disturbed areas on site are dense mustard, hemlock and/or thistle. Only small patches of non-naive grasses were found.
Phacelia keckii	Santiago Peak phacelia	None	None	1B.3	Open chaparral at elevations between 500-1600 m.	Low potential to occur. Generally found in more mesic environments than found on site and site is below elevational range. No nearby occurrences.
Senecio aphanactis	chaparral ragwort	None	None	2B.2	Alkaline flats, dry open rocky areas; at elevations between 10-550 m.	Low potential to occur. Site does not have alkaline flats or open rocky areas.
Sidalcea neomexicana	salt spring checkerbloom	None	None	2B.2	Alkaline springs, marshes at elevations generally below 1500 m.	Low potential to occur. No springs or marshes on site.
California Native Plant Society Inventory of Rare and Endangered Plants of California additional results						
Scientific Name	Common Name	Federal Status	State Status	CRPR	Habitat	Potential to Occur on The Trumark Residential Project site.
Atriplex coulteri	Coulter's saltbush	None	None	1B.2	Alkaline or clay soils, open sites, scrub, coastal bluff scrub <500m elevation.	Low potential to occur. Sage scrub occurs on site and soils are clay but species does not occur as far inland as project site. No nearby occurrences.
Atriplex pacifica	South Coast saltscale	None	None	1B.2	Coastal bluff scrub, Coastal dunes, Coastal scrub, Playas	Low potential to occur. No no bluff, dunes or playas on site.
Atriplex serenana var. davidsonii	Davidson's saltscale	None	None	1B.2	Coastal bluff scrub, Coastal scrub, alkaline soils. 10-200m elevation.	Low potential to occur. Site is above elevational range of the species and no nearby occurrences.
Centromadia parryi ssp. australis	southern tarplant	None	None	1B.1	Marshes and swamps (margins), Valley and foothill grassland (vernally mesic), Vernal pools.up to 480m elevation.	Low potential to occur. No habitat on site and no nearby occurrences.
Dodecahema leptoceras	slender-horned spineflower	None	None	1B.1	Chaparral, Cismontane woodland, Coastal scrub (alluvial fan) 200-700m elevation.	Low potential to occur. No habitat on site and no nearby occurrences.
Lasthenia glabrata ssp. coulteri	Coulter's goldfields	None	None	1B.1	Marshes and swamps (coastal salt), Playas, Vernal pools. (1-1220m)	Low potential to occur. No habitat on site and no nearby occurrences.
Nasturtium gambelii	Gambel's water cress	None	None	1B.1	Marshes and swamps (freshwater or brackish) 5-330m elevation.	Low potential to occur. No habitat on site and no nearby occurrences.
Symphyotrichum defoliatum	San Bernardino aster	None	None	1B.2	Meadows and seeps, Marshes and swamps, Valley and foothill grassland near ditches, streams, springs. 2-2040m (vernally mesic).	Low potential to occur. No habitat on site. Recent collection in the area are at much higher elevation (>900m)

5.2 Detailed descriptions and discussion of moderate to high potential species

Calochortus weedii* var. *intermedius (intermediate mariposa lily)

Calochortus weedii var. *intermedius* is a perennial geophyte (bulb-bearing) in the Liliaceae plant family. It is 1-stemmed at base and typically branched above growing to a height 30–90 cm with 1 basal leaf and several cauline leaves. Flowers typically occurin an open cyme of 2–6 flowers. Flowers are 45−70 mm across broadly bell-shaped three narrow sepals that are light purplish pink with darker parallel veins above middle 30 yellow with purplish tips hairs near base. There are three roughly round petal, deep reddish purple markings at base creamy white middle band rose lavender to light purple at the top with a cilliate or hairy margin. Fruit are dry capsule 60-70mm long with roundish tan, flat 3.5-4.3 mm seeds.

C. weedii var. *intermedius* has a limited range and is only known to occur in Los Angeles, Orange and Western Riverside counties of southern California.

Calochortus weedii var. *intermedius* is threatened by development, non-native plants, road construction, and fuel modification. Potentially threatened by frequent wildfires and horticultural collecting.

While there was potential habitat on the Trumark Residential Project site the species was not found during surveys. The chances that it occurs on this site undetected is low as surveys were conducted the appropriate time for maximum detection and the nearest occurrence is ~2 miles ENE of the site in very different habitat.

Dudleya multicaulis (many-stemmed dudleya**)**

Dudleya multicaulis is herbaceous perennial succulent in the Crassulaceae plant family. Leaves are few short, fingerlike cylinders with pointed tips. It is dominated by its erect stem, which is topped with a branching inflorescence bearing up to 15 flowers on each long, thin branch. The flowers have pointed yellow petals up to a centimeter long. Many small seeds are produced in follicle fruit.

Dudleya multicaulis is endemic to southern California, with most of its known occurrences in Orange County, where it lives mostly along the coastal plain in heavy clay soils. It is threatened by development, road construction, and recreational activity.

The Trumark Residential Project site has nominal habitat for *Dudleya multicaulis* with clay soils but lacks rock outcroppings. This species is unique and readily identifiable but was not found on site in survey. The chances that it occurs on this site undetected is low as surveys were conducted the appropriate time for maximum detection.

Nolina cismontana (chaparral nolina)

is a perennial species in the Ruscaceae plant family. N. cismontana has thick, woody stem that is below ground. and a rosette of 30-90 stiff, sword-like leaves up to 30-60 cm tall. Numerous small white flowers are produced on a central stalk up to 1.5m tall. 1-3 seeds are produced in papery capsule fruits.

Nolina cismontana is limited to the coastal mountain areas of southern California. N. cismontana is threatened by development, agriculture, road construction, and recreational activities.

The Trumark Residential Project site has nominal habitat for *Nolina cismontana* in the coastal sage area, particularly in the California sagebrush - California buckwheat scrub along El Toro road. This species is unique and readily identifiable but was not found on site in survey. The chances that it occurs on this site undetected is exceedingly low as surveys were conducted the appropriate time for maximum detection.

Pentachaeta aurea ssp. Allenii **(**Allen's pentachaeta)

Pentachaeta aurea ssp. allenii is an annual species in the Asteraceae plant family. P. a. ssp. allenii is grows to a height of 5-36 cm, with narrow leaves up to 5.5 cm long. Plants produce up to 22 flower heads per plant. Heads have 30-45 ray flowers that are yellow but the outer 2/3 turns white after a couple hours of sun. Fruit is an achene with a pappus of bristles.

Pentachaeta aurea ssp. allenii is a newly discribed species that is known from three locations, all in Orange county. This species is threatened by development, habitat alteration, and vehicles. Possibly threatened by non-native plants.

The Trumark Residential Project site has nominal habitat for *Pentachaeta aurea ssp. allenii* in the more open areas of the sage scrub, This species is similar in size and general aspect to several species that also occur in the area but none of these were found on site in survey. The chances that it occurs on this site undetected is exceedingly low as surveys were conducted the appropriate time for maximum detection.

6.0 Recommendations based on survey results.

No special status species were found on site so there are no recommendations in this regard.

7. Bibliography

CNPS. [2020]. A Manual of California Vegetation, Online Edition. http://www.cnps.org/cnps/vegetation/; searched on [05/05/2020]. California Native Plant Society, Sacramento, CA.

Calflora: Information on California plants for education, research and conservation. [web application]. 2020. Berkeley, California: The Calflora Database [a non-profit organization]. Available: http://www.calflora.org/.

California Natural Diversity Data Base (CNDDB). Annotated record search for special animals, plants and natural communities. Natural Heritage Division, Sacramento, California. Searched 27 March 2020.

Consortium of California Herbaria available at ucjeps.berkeley.edu/consortium/. Searches conducted during May, 2020.

Appendix I

Soil Report

Soil Map—Orange County and Part of Riverside County, California
(Saddleback)

Map Scale: 1:2,330 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 13, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 11, 2018—May 5, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
102	Alo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20	0.5	3.9%
128	Bosanko clay, 30 to 50 percent slopes	10.6	82.7%
134	Calleguas clay loam, 50 to 75 percent slopes, eroded	1.7	13.4%
Totals for Area of Interest		**12.8**	**100.0%**

Orange County and Part of Riverside County, California

102—Alo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20

Map Unit Setting

National map unit symbol: 2tyzn
Elevation: 10 to 1,890 feet
Mean annual precipitation: 12 to 21 inches
Mean annual air temperature: 63 to 65 degrees F
Frost-free period: 300 to 360 days
Farmland classification: Not prime farmland

Map Unit Composition

Alo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alo

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and shale

Typical profile

A - 0 to 15 inches: clay
Bkss - 15 to 22 inches: clay
Cr - 22 to 79 inches: bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 20 to 30 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Anaheim
Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Balcom
Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Calleguas
Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Bosanko
Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 13, Sep 16, 2019

Orange County and Part of Riverside County, California

128—Bosanko clay, 30 to 50 percent slopes

Map Unit Setting

National map unit symbol: 2xm5x
Elevation: 160 to 1,320 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 64 to 65 degrees F
Frost-free period: 362 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Bosanko and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bosanko

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite

Typical profile

Ap - 0 to 5 inches: clay
Bss - 5 to 25 inches: clay
Bk - 25 to 31 inches: clay
Cr - 31 to 79 inches: bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 22 to 32 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): 6e

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Balcom

Percent of map unit: 8 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Alo

Percent of map unit: 7 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 13, Sep 16, 2019

Orange County and Part of Riverside County, California

134—Calleguas clay loam, 50 to 75 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2xm62
Elevation: 220 to 2,110 feet
Mean annual precipitation: 13 to 18 inches
Mean annual air temperature: 64 to 65 degrees F
Frost-free period: 353 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Calleguas and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Calleguas

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from calcareous shale

Typical profile

A1 - 0 to 7 inches: clay loam
A2 - 7 to 11 inches: clay loam
A3 - 11 to 15 inches: very channery clay loam
Cr - 15 to 59 inches: bedrock

Properties and qualities

Slope: 50 to 75 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: SHALLOW CLAYEY (1975) (R019XD071CA)
Hydric soil rating: No

Minor Components

Cieneba

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Balcom

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Anaheim

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 13, Sep 16, 2019

Appendix II

Plant Associations

Brassica nigra - *Raphanus* spp. Herbaceous Semi-Natural Alliance

Upland mustards and other ruderal forbs

Characteristic Species

Brassica nigra, *Brassica rapa*, *Cynara cardunculus*, *Euphorbia terracina*, *Hirschfeldia incana*, *Isatis tinctoria* or *Raphanus sativus* or similar ruderal forb is dominant in the herbaceous layer. Emergent trees and shrubs may be present at low cover.

Vegetation Layers

Herbs < 3 m; cover is open to continuous.

Membership Rules

- *Brassica nigra, Hirshfeldia incana, Raphanus sativus*, or other mustards occur with non-native plants at > 80%

USDA Ecological Section Map

Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

relative cover in the herbaceous layer, and mustards are the dominant herbs (Keeler-Wolf and Evens 2006, Sproul et al. 2011, Buck-Diaz et al. 2012, VegCAMP 2013, Klein et al. 2015).

- *Euphorbia terracina* > 30% relative cover in the herbaceous layer with other non-natives, including *Brassica nigra* (Keeler-Wolf and Evens 2006, Verdone and Evens 2010).
- *Euphorbia terracina* or *Cynara cardunculus* > 50% relative cover in the herbaceous layer with other non-natives, including *Brassica nigra* and *Bromus diandrus* (Buck-Diaz and Evens 2015).

Habitats

Fallow fields, grasslands, roadsides, levee slopes, disturbed coastal scrub, riparian areas, cleared roadsides, waste places.

Other Habitat, Alliance and Community Groupings

MCV (1995): California annual grassland series

Summary Information

- **Primary Life Form:** Herb
- **Elevation:** 0-1500 m
- **State Rarity:** SNA
- **Global Rarity:** GNA
- **Distribution:** USA: CA.
- **Endemic to California:** No
- **Invasive species rank:** See remarks
- **Endemic to California Floristic Province and Deserts:** No
- **Date Added:** 2009/09/01

NVCS (2009):	Not treated
Calveg:	Annual grasses and forbs, Non-native/invasive forb, Non-native/ornamental grass
Holland:	Non-native grassland
Munz:	Valley grassland
WHR:	Annual grassland, Perennial grassland
CDFW CA Code:	42.011.00

National Vegetation Classification Hierarchy

Formation Class:	Mesomorphic Shrub and Herb Vegetation (Shrubland and Grassland)
Formation Subclass:	Mediterranean Scrub and Grassland
Formation:	Mediterranean Grassland and Forb Meadow
Division:	California Grassland and Meadow

Related Links

» Feedback

» How to read alliance descriptions

» Full bibliography

Macro Group:	California Annual and Perennial Grassland
Group:	Mediterranean California naturalized annual and perennial grassland

Remarks (hide)

DiTomaso and Healy (2007) considered 24 species in the mustard family (Brassicaceae) as weedy in California. Many are associated with agricultural lands, but some form large stands in wildland settings. The following are open-branched, tall (1-3 m), aromatic, fast-growing, annuals or short-lived perennials from Europe. All create seed banks. Many have allelopathic properties.

We have included these five mustards as a singular type based on their ecological similarities, and we also have updated the alliance to include other non-native invasive forbs, *Cynara cardunculus* and *Euphorbia terracina.* As a whole, they form dense colonies that overtop other plants whether they are native or non-native. All respond positively to regular frequent disturbance, whether it be fire, disking, intermittent flooding, or heavy grazing. *Brassica nigra* was one of the early invaders and has been a part of the California landscape for over 200 years (D'Antonio et al. 2007). The species, however, tend to segregate by moisture and temperature tolerance. Local and regional studies can recognize stand types characterized by a single mustard.

In order of Cal-IPC status, *Brassica nigra*, has a Cal-IPC rank of Moderate; *B. rapa* is ranked as Limited; *B. napus* is unranked. The mustards are winter annuals with yellow flowers that can grow to 3 m in height. *B. nigra,* black mustard, forms dense stands in coastal to inland grasslands with mild winter climates, especially in areas that have been plowed or left fallow. *B. rapa,* field mustard, grows in more cold-winter inland areas; *B. napus,* rapeseed, is tied more to roadsides and disturbed waste places. These mustards' broad basal rosettes of leaves tend to crowd out surrounding native plants, and the tall dead stems tend to persist for several years following good rainfall, increasing the fuel loading and probability of fires.

Hirschfeldia incana, shortpod mustard, has a Cal-IPC rank of Moderate. This summer blooming, short-lived perennial mustard has distinctively beaked, indehiscent pods. It ranges throughout cismontane California at low elevations and the western Mojave Desert, but it is most invasive in grasslands, coastal scrub, and riparian areas in southern California.

Isatis tinctoria, dyer's woad, has a Cal-IPC rank of Moderate and a CDFA list of B. Its bright yellow, dense-flowered panicles give way to distinctive black, flat, single-seeded, indehiscent pod as the plants mature. This short-lived mustard forms extensive, showy patches in rangelands, agricultural lands, and meadows in the state's northern mountain ranges, especially in the Klamath Mountains and on the Modoc Plateau. *I. tinctoria* has been used as a purple dye, ink, and medicines. It is a troublesome weed in grain fields and has invaded roadsides and open *Artemisia tridentata* stands in the Great Basin.

Raphanus sativus, cultivated radish, has a Cal-IPC rank of Moderate; *R. raphanistrum,* wild radish, is unranked. Both radishes are winter or summer annuals that grow to 1 m in height. *R. sativus* has purple to white petals with dark veins, and *R. raphanistrum* has yellow to white petals with dark veins. Their beaked, jointed pods are indehiscent. They grow throughout cismontane California at lower elevations and on the Modoc Plateau in grasslands, meadows, coastal scrubs, and disturbed waste places.

*Carduus carduncul*us and *Euphorbia terracina* have a Cal-IPC rank of Moderate. The former has spiny leaves and flowering heads with pink-purple flowers, and the latter has small yellowish umbels of flowers that are surrounded by yellow-green bracts. They are summer-flowering perennial herbs that can grow to 1 m or more in height. They dominate in fields, fire clearance areas, grasslands, and roadsides along the immediate coast. They appear to be expanding rapidly in extent, displacing native vegetation (DiTomaso et al. 2013).

Life History Traits of the Principal Species (hide)

	Brassica nigra	Brassica rapa	Cynara cardunculus	Euphorbia terracina	Hirschfeldia incana	Isatis tinctoria	Raphar sativu
Life forms	Annual; herb	Annual; herb	Perennial; herb	Perennial; herb	Perennial; herb	Monocarpic perennial; herb	Annual/bie herb
Seed storage	Soil	Soil	Soil stored	Soil stored	Soil stored	Soil stored	Soil stored

	Brassica nigra	Brassica rapa	Cynara cardunculus	Euphorbia terracina	Hirschfeldia incana	Isatis tinctoria	Raphar sativu
Seed longevity	50+ years (if deeply burried)	50+ years (if burried)	Medium	Medium	Medium	Medium	Medium
Mode of dispersal	Gravity	null	Gravity; wind	Expulsion from capsule; animal; water	Gravity	Gravity; water; wind	Gravity
Germination agents	Heat (fire)	null	null	Stratification-winter	null	Scarification; winter stratification	null
Mode of sprouting	Underground structures (root)	null	null	Underground structures	null	Underground structures	Undergrou structures
Survivability after fire/disturbance	Fire hardy	Fire hardy	null	Fire-hardy; high sprouter	null	null	null
Disturbance-stimulated	null	null	null	No	null	null	null

	Brassica nigra	Brassica rapa	Cynara cardunculus	Euphorbia terracina	Hirschfeldia incana	Isatis tinctoria	Raphar sativu
flowering							
Reproductive range	null	null	1-? Years	null	null	null	null
Recruitment	null	null	High?	null	null	null	null
Regional variation	null	null	null	null	null	null	null

Fire Characteristics (hide)

These tall mustards increase fire fuel loads and fire intensity, especially in areas already altered by non-native grasses with which they commonly grow. The cover of *Brassica nigra* increased to 100% following fires in the Santa Monica Mountains (DiTomaso and Johnson 2006).

Fire return interval: –

Seasonality: –

Size/extent: –

Complexity: –

Intensity: –

Severity: –

Type: –

Regional knowledge: –

Regional Status (hide)

The range of *Brassica, Hirschfeldia, Isatis,* and *Raphanus* species includes all sections across California.

- **Central California Coast** (261Aa-l). No description available
- **Central California Coast Ranges** (M262Aa-k). No description available
- **Great Valley** (262Aa-z). Keeler-Wolf and Vaghti (2000) recognized sufficient areas of *Brassica nigra* and *Raphanus sativus* to map at Suisun Marsh. *R. sativus* tends to occur in slightly more moist and lowland settings than *B. nigra*. Neither species changed appreciably over a 4-year period. Stands of *Hirschfeldia incana* occur adjacent to agricultural fields in wildlands and in grazing lands.
- **Northern California Coast** (263Aa-m). No description available
- **Northern California Coast Ranges** (M261Ba-f). No description available
- **Sierra Nevada** (M261Ea-n, Ep-u). No description available
- **Sierra Nevada Foothills** (M261Fa-e). No description available
- **Southern California Coast** (261Ba-f, Bh-j). Keeler-Wolf and Evens (2006) recognized *Brassica nigra* types in the Santa Monica Mountains with *Bromus diandrus, Centaurea melitensis, Hirschfeldia incana,* and *Leymus condensatus*. Stands of *H. incana* were large enough to map along the Santa

Clara River (Stillwater Sciences and URS 2007).

- **Southern California Mountains and Valleys** (M262Bk-l). No description available

Management Considerations (hide)

People have planted mustard species as cover crops to reduce runoff and preserve nitrogen, as well as to suppress other weeds, nematodes, and soil-borne pathogens (Bryant 2003). However, mustard species have become invasive in fallow areas and in adjacent wildlands. See DiTomaso and Healy (2007) and DiTomaso et al. (2013) for ecology and management of the different species.

Associations (hide)

- Brassica nigra [1], [2], [6], [7], [8]
- Brassica nigra - Bromus diandrus [2], [4], [5]
- Cynara cardunculus [5]
- Euphorbia terracina [2], [4]
- Hirschfeldia incana [6]
- Raphanus sativus [1], [3], [9]

References (hide)

- [1] Klein, A.;Keeler-Wolf, T.;Evens, J. 2015
- [2] Keeler-Wolf, T.;Evens, J. 2006

- [3] Keeler-Wolf, T.;Vaghti, M. 2000
- [4] Verdone, L.;Evens, J. 2010
- [5] AECOM, 2013
- [6] Buck-Diaz, J.;Batiuk, S.;Evens, J.M. 2012
- [7] Sproul, F.;Keeler-Wolf, T.;Gordon-Reedy, P.;Dunn, J.;Klein, A.;Harper, K. 2011
- [8] Rodriguez, D.;Sikes, K.;Keeler-Wolf, T.;Kittel, G.;Curtis, J.;Curley, C.;Evens, J. 2017
- [9] Keeler-Wolf, T.;Schirokauer, D.;Meinke, J.;van derLeeden, P. 2003a
- DiTomaso, J.M.;Healy, E.A. 2007
- DiTomaso, J.M.;Kyser, G.B, Oneto, S.R.;Wilson, R.G.;Orloff, S.B.;Anderson, L.W.;et al., 2013
- Menke, J.;Reyes, E.;Hepburn, A.;Johnson, D.;Reyes, J. 2013
- VegCAMP (Vegetation Classification and Mapping Program),;AIS, 2013

California Native Plant Society

A Manual of California Vegetation Online

Artemisia californica Shrubland Alliance

California sagebrush scrub

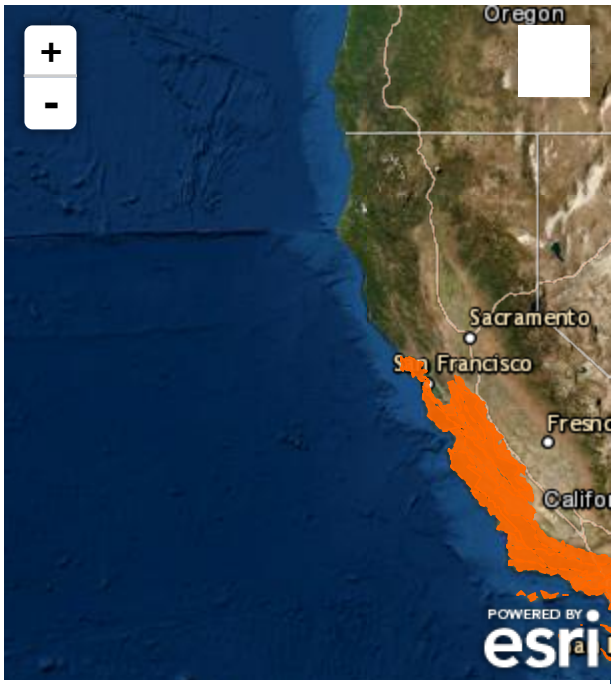
Characteristic Species

Artemisia californica is dominant or co-dominant in the shrub canopy with *Adenostoma fasciculatum*, *Baccharis pilularis*, *Cleome isomeris*, *Diplacus aurantiacus*, *Encelia californica*, *Encelia farinosa*, *Eriogonum fasciculatum*, *Hesperoyucca whipplei*, *Isocoma menziesii*, *Keckiella cordifolia*, *Lotus scoparius*, *Opuntia littoralis*, *Rhus integrifolia*, *Salvia apiana*, *Salvia leucophylla*, *Salvia mellifera*, *Sambucus nigra* and *Toxicodendron diversilobum*. Emergent trees or tall shrubs may be present at low cover.

Vegetation Layers

Shrub < 2 m, or in two tiers with a second at < 5 m tall; canopy is intermittent to continuous. Herbaceous layer is variable

USDA Ecological Section Map



Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

both seasonally and annually.

Membership Rules

- *Artemisia californica* › 3 times cover of *Baccharis pilularis* and other shrub species (Keeler-Wolf et al. 2003a).
- *Artemisia californica* › 60% relative cover in the shrub canopy (Gordon and White 1994, Borchert et al. 2004).
- *Artemisia californica* › 60% relative cover in the shrub canopy, or *Malosma laurina* or *Diplacus aurantiacus* sometimes › 30% relative cover (Keeler-Wolf and Evens 2006).

Habitats

Slopes that are usually steep and rarely flooded, low-gradient deposits along streams. Soils are alluvial or colluvial derived and shallow.

Other Habitat, Alliance and Community Groupings

Summary Information

- **Primary Life Form:** Shrub
- **Elevation:** 0-1200 m
- **State Rarity:** S5
- **Global Rarity:** G5
- **Distribution:** USA: CA. Baja California, Mexico (TJM2)
- **Endemic to California:** No
- **Endemic to California Floristic Province and Deserts:** Yes
- **Date Added:** 1995/11/01

MCV (1995):	California sagebrush series
NVCS (2009):	Artemisia californica shrubland alliance
Calveg:	California sagebrush
Holland:	Northern coastal bluff scrub, Southern coastal bluff scrub, Central (Lucian) coastal scrub, Venturan coastal sage scrub, Diablan sage scrub, Riversidian upland sage scrub
Munz:	Coastal sage scrub
WHR:	Coastal scrub
CDFW CA Code:	32.010.00

Related Links

» Feedback

» How to read alliance descriptions

» Full bibliography

National Vegetation Classification Hierarchy

Formation Class:	Mesomorphic Shrub and Herb Vegetation (Shrubland and Grassland)
Formation Subclass:	Mediterranean Scrub and Grassland
Formation:	Mediterranean Scrub
Division:	California Scrub
Macro Group:	California Coastal Scrub

Group: Central and South Coastal Californian coastal sage scrub

Remarks (hide)

Artemisia californica is a much-branched shrub up to 2 m tall with shallow roots. Leaves have a strong aroma and are gray green, soft, and entire to divided into narrow, linear segments. Leaves are drought deciduous and seasonally dimorphic. Leaves, shrub litter, and soil below the shrubs contain chemicals that inhibit germination or growth of some plants. Herbivores and seed eaters may contribute to conspicuous bare zones seen at the edge of shrub crowns. Seeds of these fall-blooming plants are dispersed in the winter and spring. They germinate best under lighted conditions and when fresh. Seeds germinate in canopy openings, and seedlings suffer high mortality from herbivory (Montalvo 2002a).

Stands of this alliance occur in modal settings of coastal scrub throughout the central and southern California Coast Ranges. It is found particularly on steep slopes and in high abundance on protected, north-facing hillsides. Closer to the coast in the northern portion of its range, *A. californica* commonly mixes with *Baccharis pilularis* and transitions into the *Baccharis pilularis* alliance when that species becomes co-dominant. Farther inland and in drier portions of the southern coastal area, *A. californica* mixes with *Eriogonum fasciculatum* and transitions to the *Artemisia californica-Eriogonum fasciculatum* alliance where both co-dominate (Rundel 2007).

Life History Traits of the Principal Species (hide)

	Artemisia californica
Life forms	Shrub; drought deciduous
Seed storage	Soil
Seed longevity	Medium to long
Mode of dispersal	Wind
Germination agents	Chemical (for some); none (photoperiod)
Mode of sprouting	Underground structures
Survivability after fire/disturbance	Fire-sensitive; canopy architecture susceptible; no/low sprouter
Disturbance-stimulated flowering	No
Reproductive range	5-25+ years
Recruitment	Low to medium
Regional variation	Moderate

Fire Characteristics (hide)

Artemisia californica sprouts moderately well after fire, though sprouting ability is reduced for older larger plants and after high-intensity fires (Keeley 1998b, 2006, Mooney 1977). Sprouting also is variable geographically, with shrubs in coastal sites sprouting more readily than in inland sites. In addition, seedling emergence is low after fire, but variable (Keeley and Keeley 1984, Malanson and O'Leary 1982,

Westman 1991). Buried seed may require some exposure to fire in order to break seed dormancy (Keeley 1991), but lighted conditions provide greater stimulation for germination than fire (Montalvo 2002a). Short fire return intervals can deplete the species's seed bank, and high-intensity fire or high frequency makes stands vulnerable to local extinction because most regeneration is from seed (Montalvo 2002a).

Fire return interval:	Medium (20-100+ years)
Seasonality:	Late summer-fall
Size/extent:	Medium to large—up to and beyond stand
Complexity:	Low
Intensity:	Moderate to high
Severity:	High to very high
Type:	Active-independent crown fire
Regional knowledge:	Both coastal and inland

Regional Status (hide)

- **Central California Coast** (261Ae-l). Stands are described for Cone Peak Gradient RNA (Cheng 2004) and generally within the section (Borchert et al. 2004).
- **Central California Coast Ranges** (M262Aa-f, Ah, Aj). Stands are described on serpentine at the Coyote Ridge area (Evens and San 2004), on sedimentary rock in the San Benito Mountain area (Evens et al. 2006a) of the Diablo Range, and on volcanics at Pinnacles National Monument (Kittel

et al. 2012) in the Gabilan Range. Other stands are described generally in the section (Borchert et al. 2004).

- **Northern California Coast** (263Ak-l). Stands are described for Point Reyes National Seashore and associated parks (Keeler-Wolf et al. 2003a).
- **Southern California Coast** (261Ba-j). Stands occur throughout the section. They are described for the Santa Monica Mountains (Keeler-Wolf and Evens 2006), Santa Ynez Mountains, western Transverse Ranges (Borchert et al. 2004), and coastal San Diego Co. (Evens and San 2005). Junak et al. (2007) recognize several associations on the Channel Islands.
- **Southern California Mountains and Valleys** (M262Ba-d, Bf, Bj-k, Bn). Stands are described for Antonia Canyon (Hanes et al. 1989), Gavilan Hills (Boyd 1983), Purissima Hills (Cole 1980), central San Diego Co. (Evens and San 2005), western Riverside Co. (White and Padley 1997, Klein and Evens 2005), and generally within the section (DeSimone and Burk 1992, Gordon and White 1994, Kirkpatrick and Hutchinson 1977).

Management Considerations (hide)

Artemisia californica is decreasing in wildlands with increased fire frequency, a presence of non-native grasses, and air pollution. Successful restoration requires conditions where shrubs can establish, mature, and develop seed banks (Montalvo 2002a).

Associations (hide)

Mixed Stands with Other Shrubs Usually Sub-Dominant

- Artemisia californica - Baccharis pilularis / Leymus condensatus [8]
- Artemisia californica - Ceanothus ferrisiae [2]
- Artemisia californica - Cleome isomeris [12]
- Artemisia californica - Diplacus aurantiacus [7], [11], [15], [18]
- Artemisia californica - Eriogonum cinereum [7], [13]
- Artemisia californica - Keckiella cordifolia [5]
- Artemisia californica - Lepidospartum squamatum [4]
- Artemisia californica - Lotus scoparius [1]
- Artemisia californica - Opuntia littoralis [13], [19]
- Artemisia californica - Salvia brandegeei [12]
- Artemisia californica - Salvia leucophylla [5], [20]
- Artemisia californica - (Salvia leucophylla) / Leymus condensatus [7], [13], [20]

Pure Stands of *Artemisia californica*

- Artemisia californica [3], [4], [5], [6], [7], [8], [10], [11], [12], [13], [14], [15], [16], [17], [19], [20]
- Artemisia californica / Amsinckia menziesii [9]
- Artemisia californica / Eschscholzia californica [2]
- Artemisia californica / Nassella (pulchra) [12], [19], [20]

References (hide)

- [1] DeSimone, S.A.;Burk, J.H. 1992
- [2] Evens, J.;San, S. 2004
- [3] Evens, J.;San, S. 2005
- [4] Evens, J.M.;Klein, A.;Taylor, J.;Hickson, D.;Keeler-Wolf, T. 2006
- [5] Gordon, H.J.;White, T.C. 1994
- [6] Keeler-Wolf, T.;Schirokauer, D.;Meinke, J.;van derLeeden, P. 2003a
- [7] Keeler-Wolf, T.;Evens, J. 2006
- [8] Kirkpatrick, J.B.;Hutchinson, C.F. 1977
- [9] Klein, A.;Evens, J. 2005
- [10] Kittel, G.;Reyes, E.;Evens, J.;Buck, J.;Johnson, D. 2012
- [11] Sproul, F.;Keeler-Wolf, T.;Gordon-Reedy, P.;Dunn, J.;Klein, A.;Harper, K. 2011
- [12] Rodriguez, D.;Sikes, K.;Keeler-Wolf, T.;Kittel, G.;Curtis, J.;Curley, C.;Evens, J. 2017
- [13] Verdone, L.;Evens, J. 2010
- [14] Buck-Diaz, J.;Evens, J. 2011b
- [15] AECOM, 2013
- [16] CNPS Vegetation Program, 2015
- [17] HDR, 2014b
- [18] Buck, J.;Evens, J. 2010
- [19] Dixon, P. 2019
- [20] Reyes, E.;Glass, A.;Johnson, D.;Sikes, K. 2020
- Axelrod, D.I. 1978

- Barbour, M.G. 1994b
- Barry, W.J. 1989a
- Barry, W.J. 1989b
- DeSimone, S.A.;Zedler, P.H. 1999
- Eliason, S.A.;Allen, E.B. 1997
- Gray, J.T. 1982
- Gray, J.T. 1983a
- Halligan, J.P. 1973
- Jones and Stokes Associates, 1993
- Keeley, J.E.;Keeley, S.C. 1988
- Malanson, G.P. 1984
- Malanson, G.P.;O'Leary, J.F. 1995
- Malanson, G.P.;Westman, W.E. 1991
- Montalvo, A.M. 2002a
- Mooney, H.A. 1977
- O'Leary, J.F. 1990
- O'Leary, J.F. 1995
- Pase, C.P.;Brown, D.E. 1982
- Paysen, T.E.;Derby, J.A.;Black, H.;Bleich, V.C.;Mincks, J.W. 1980
- Shiflet, T.N. 1994
- Stillwater Sciences and URS, 2007

- Thorne, R.F. 1976
- Westman, W.E. 1981a

Artemisia californica - Eriogonum fasciculatum Shrubland Alliance

California sagebrush - California buckwheat scrub

Characteristic Species

Artemisia californica and *Eriogonum fasciculatum* are co-dominant in the shrub canopy with *Adenostoma fasciculatum*, *Diplacus aurantiacus*, *Ephedra californica*, *Ericameria linearifolia*, *Hesperoyucca whipplei*, *Lotus scoparius*, *Malosma laurina*, *Rhus integrifolia*, *Rhus ovata* and *Salvia apiana*.

Vegetation Layers

Most shrubs < 2 m, some < 5 m tall; canopy is two tiered, and intermittent to continuous. Herbaceous layer is seasonally present.

USDA Ecological Section Map

Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Membership Rules

- Both *Artemisia californica* and *Eriogonum fasciculatum* have 30%-60% relative cover in the shrub canopy (Gordon and White 1994).

Habitats

Slopes that are steep and south facing. Soils are colluvial derived.

Other Habitat, Alliance and Community Groupings

MCV (1995):	California sagebrush-California buckwheat series
NVCS (2009):	Artemisia californica-Eriogonum fasciculatum shrubland alliance
Calveg:	Riversidean alluvial scrub, California buckwheat, California sagebrush
Holland:	Diegan coastal sage scrub, Riversidian upland sage scrub

Summary Information

- **Primary Life Form:** Shrub
- **Elevation:** 250-950 m
- **State Rarity:** S4
- **Global Rarity:** G4
- **Distribution:** USA: CA. Baja California, Mexico (TJM2)
- **Endemic to California:** No
- **Endemic to California Floristic Province and Deserts:** Yes
- **Date Added:** 1995/11/01

Munz:	Coastal sage scrub
WHR:	Coastal scrub
CDFW CA Code:	32.110.00

National Vegetation Classification Hierarchy

Formation Class:	Mesomorphic Shrub and Herb Vegetation (Shrubland and Grassland)
Formation Subclass:	Mediterranean Scrub and Grassland
Formation:	Mediterranean Scrub
Division:	California Scrub
Macro Group:	California Coastal Scrub
Group:	Central and South Coastal Californian coastal sage scrub

Related Links

» Feedback

» How to read alliance descriptions

» Full bibliography

Remarks (hide)

Artemisia californica is a much-branched shrub up to 2.5 m tall with shallow roots. Leaves have a strong aroma and are gray green, soft, and entire to divided into narrow linear segments. Leaves are drought

deciduous and seasonally dimorphic; they may contain chemicals that inhibit germination or growth of some plants. Herbivores and seed eaters may contribute to conspicuous bare zones seen at the edge of shrub crowns. Seeds of these fall-blooming plants disperse in the winter and spring. They germinate best under lighted conditions and when fresh. Seeds germinate in canopy openings, and seedlings suffer high mortality from herbivory. Exposure to fire heat/charate yields lower numbers than under light alone (Montalvo 2002a).

Eriogonum fasciculatum is a semiwoody, muchbranched shrub with woody, many-branched roots that penetrate 1.5 m in depth. Plants often occur on coarse-textured soils that may be moderately saline. Plants lose some leaves in the dry season and most leaves during severe drought. Plants flower from early spring through summer. Ants, wind, and water disperse seeds. Seedling success is high in wet years. Seed germination requires light (Montalvo 2002b).

This alliance reflects relatively hot, drought conditions of the Coast, Peninsular, and Transverse ranges. It occurs commonly well inland of the fog belt and usually occurs on fine-textured soils developed from granitic or sedimentary rocks. It often interfaces with annual grasslands or *Quercus agrifolia* woodlands on slopes with deeper soils, and it transitions to xeric chaparral such as the *Adenostoma fasciculatum* alliance on rockier, higher slopes. In more mesic settings on rockier soil, often closer to the coast, *Salvia mellifera* increases in importance, and this shifts stands to the *Artemisia californica- Salvia mellifera* alliance (Mooney 1977, Rundel 2007).

Life History Traits of the Principal Species (hide)

	Artemisia californica	Eriogonum fasciculatum
Life forms	Shrub; drought deciduous	Shrub; evergreen, (semi-) drought deciduous
Seed storage	Soil	Soil
Seed longevity	Medium to long	Medium
Mode of dispersal	Wind	Animal; water/hydrological; wind
Germination agents	Chemical (for some); none (photoperiod)	None
Mode of sprouting	Underground structures	Underground structures (weak)
Survivability after fire/disturbance	Fire-sensitive; canopy architecture susceptible; no/low sprouter	Fire-sensitive; thin epidermis; no/low sprouter; canopy architecture susceptible
Disturbance-stimulated flowering	No	No
Reproductive range	5-25+ years	5-50+ years
Recruitment	Low to medium	Low to medium
Regional variation	Moderate	Low

Fire Characteristics (hide)

Artemisia californica sprouts moderately well after fire; sprouting appears to be lower for older, larger plants or after higher-intensity fires (Keeley 1998b, Keeley 2006). Sprouting also is variable geographically, with shrubs in coastal sites sprouting more readily than those in inland sites (Westman 1991, Malanson and O'Leary 1982, Keeley and Keeley 1984). Similarly, *Eriogonum fasciculatum* sprouts after light fires; however, sprouting is low after hot fires (Keeley 1998b). Fires can deplete the seed banks of both species. The species and their mixed stands are vulnerable to local extinction under high-intensity or high-frequency fires because most regeneration is typically from seed (Keeley 1998b, Montalvo 2002a, 2002b). Post-fire recovery of some stands involves a stage with the *Lotus scoparius* or *Malacothamnus fasciculatus* alliances before transitioning to the *Artemisia californica- Eriogonum fasciculatum* alliance.

Fire return interval:	Medium (20-50+ years)
Seasonality:	Late summer-fall
Size/extent:	Medium to large—up to and beyond stand
Complexity:	Low to moderate
Intensity:	Moderate to high
Severity:	High to very high
Type:	Active-independent crown fire
Regional knowledge:	Southern California

Regional Status (hide)

- **Central California Coast** (261Aa, Aj-l). Stands occur in the Santa Lucia Mountains, such as at Cone Peak Gradient RNA (Cheng 2004), and others have been observed in the southern subsections.
- **Central California Coast Ranges** (M262Ab-f, Ah, Aj). Stands sampled include those from the San Benito Mountain area (Evens et al. 2006) and those from Pinnacles National Monument (Kittel et al. 2012). We know of stands farther south into western Kern Co. and north into Alameda Co. Most are inland and not strongly influenced by the summer maritime temperatures.
- **Southern California Coast** (261Ba-b, Bd-g, Bi-j). Stands occur across most of the section. Described stands include those from Santa Monica Mountains in Los Angeles and Ventura Cos. (Keeler-Wolf and Evens 2006) and coastal San Diego Co. (Evens and San 2005).
- **Southern California Mountains and Valleys** (M262Ba-d, Bf, Bj-l, Bn). Described stands include western Riverside Co. (White and Padley 1997, Klein and Evens 2005), central San Diego Co. (Evens and San 2005), and generally within the section (DeSimone and Burk 1992, Gordon and White 1994).

Management Considerations (hide)

Artemisia californica and *Eriogonum fasciculatum* decrease with increased fire frequency, presence of non-native grasses, and air pollution (Minnich and Dezzani 1998, Westman 1979a, 1983). Successful restoration requires conditions where shrubs can establish, mature, and develop seed banks (Montalvo 2002a, 2002b).

Associations (hide)

- Artemisia californica - Eriogonum fasciculatum [3], [5], [7], [8], [11], [12], [13]
- Artemisia californica - Eriogonum fasciculatum - Ephedra californica [2]
- Artemisia californica - Eriogonum fasciculatum - Opuntia littoralis / Dudleya (edulis) [9], [10]
- Artemisia californica - Eriogonum fasciculatum - Rhus ovata [4]
- Artemisia californica - Eriogonum fasciculatum - Salvia apiana [1], [6], [7]
- Artemisia californica - Eriogonum fasciculatum - Salvia leucophylla [5]
- Artemisia californica - Eriogonum fasciculatum - Salvia mellifera [5]
- Artemisia californica - Eriogonum fasciculatum - Viguiera laciniata [9]

References (hide)

- [1] DeSimone, S.A.;Burk, J.H. 1992
- [2] Evens, J.M.;Klein, A.;Taylor, J.;Hickson, D.;Keeler-Wolf, T. 2006
- [3] Evens, J.;San, S. 2005
- [4] Gordon, H.J.;White, T.C. 1994
- [5] Keeler-Wolf, T.;Evens, J. 2006
- [6] Kirkpatrick, J.B.;Hutchinson, C.F. 1977
- [7] Klein, A.;Evens, J. 2005
- [8] Kittel, G.;Reyes, E.;Evens, J.;Buck, J.;Johnson, D. 2012
- [9] Sproul, F.;Keeler-Wolf, T.;Gordon-Reedy, P.;Dunn, J.;Klein, A.;Harper, K. 2011

- [10] AECOM, 2013
- [11] Buck-Diaz, J.;Evens, J. 2011b
- [12] CNPS Vegetation Program, 2015
- [13] Reyes, E.;Glass, A.;Johnson, D.;Sikes, K. 2020
- Malanson, G.P. 1984
- Minnich, R.A.;Dezzani, R.J. 1998
- Montalvo, A.M. 2002a
- Montalvo, A.M. 2002b
- Mooney, H.A. 1977
- O'Leary, J.F. 1990
- O'Leary, J.F. 1995
- Pase, C.P.;Brown, D.E. 1982
- Shiflet, T.N. 1994
- Stillwater Sciences and URS, 2007
- Thorne, R.F. 1976
- Westman, W.E. 1979a
- Westman, W.E. 1983
- White, S.D. 1995
- White, S.D.;Padley, W.D. 1997

Conium maculatum - *Foeniculum vulgare* Herbaceous Semi-Natural Alliance

Poison hemlock or fennel patches

Characteristic Species

Conium maculatum, *Foeniculum vulgare* or another non-native invasive plant of the *Apiaceae* is dominant or co-dominant with other non-native plants in the herbaceous layer. Emergent trees and shrubs may be present at low cover, including trees *Quercus* spp. and shrubs: *Baccharis pilularis*.

Vegetation Layers

Herbs < 2 m; cover is open to continuous.

Membership Rules

- *Conium maculatum* > 50% relative cover in the

USDA Ecological Section Map

Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

herbaceous layer (Keeler-Wolf and Vaghti 2000).

- *Foeniculum vulgare* > 50% relative cover in the herbaceous layer (Keeler-Wolf and Evens 2006).

Habitats

All topography including wetlands. The USFWS Wetland Inventory (1996 national list) recognizes *Conium maculatum* and *Foeniculum vulgare* as FAC and FACU- plants, respectively.

Other Habitat, Alliance and Community Groupings

MCV (1995):	Not treated
NVCS (2009):	Not treated
Calveg:	Non-native/invasive forb, Non-native/ornamental grass
Holland:	Non-native grassland
Munz:	Valley grassland
WHR:	Pasture, Perennial grassland

Summary Information

- **Primary Life Form:** Herb
- **Elevation:** 0-1000 m
- **State Rarity:** SNA
- **Global Rarity:** GNA
- **Distribution:** USA: CA, OR?
- **Endemic to California:** No
- **Invasive species rank:** See remarks
- **Endemic to California Floristic Province and Deserts:** No
- **Date Added:** 2009/09/01

CDFW CA Code: 45.556.00

National Vegetation Classification Hierarchy

Formation Class:	Mesomorphic Shrub and Herb Vegetation (Shrubland and Grassland)
Formation Subclass:	Mediterranean Scrub and Grassland
Formation:	Mediterranean Grassland and Forb Meadow
Division:	California Grassland and Meadow
Macro Group:	California Annual and Perennial Grassland
Group:	Mediterranean California naturalized annual and perennial grassland

Related Links

» Feedback

» How to read alliance descriptions

» Full bibliography

Remarks (hide)

DiTomaso and Healy (2007) considered many members of the *Umbelliferae* in California as weeds, and

Cal-IPC lists *Conium maculatum* and *Foeniculum vulgare* as invasive in wildland settings in the state. Both are short-lived perennial herbs. The first-year plants produce ground-level rosettes and deep taproots. Plants in the second growing season send up tall stems, called canes, which flower, fruit, and die. In *F. vulgare*, some canes continue growing for an additional year. *C. maculatum* is usually a biennial as well. Old canes take several years to decay. Plants produce abundant seed that establishes a short- or long-lived seed bank in the soil (Bean and Russo 2001, DiTomaso and Healy 2007, Drewitz 2000, Klinger 2000). Both species are from Europe, are ecologically similar, and may coexist in the same stand, but *C. maculatum* tends to occur in relatively more moist locations and is tolerant of semi-shade, such as bottomlands and swales, whereas *F. vulgare* tends to occur in sunny uplands such as steep eroded banks, levee tops, or hills.

Conium maculatum, poison hemlock, has a Cal-IPC rank of Moderate. Plants grow to 3 m tall during the second year with ferny leaves and stems with distinctive purplish streaks or splotches. Its seed bank is short-lived. All plant parts are toxic to humans, especially seeds and young leaves, and some people develop dermatitis from touching plants. The ancient Greeks used poison hemlock to carry out judicial executions, including that of Socrates (DiTomaso and Healy 2007).

Foeniculum vulgare, fennel, has a Cal-IPC rank of High. It grows to 2 m tall with finely dissected leaves with a strong anise-like odor, and the stems are green. Its seed bank is short-lived. People have used this plant for medicinal and culinary purposes since ancient times (DiTomaso and Healy 2007).

Daucus carota, wild carrot, is an unlisted weed that can dominate roadsides, pastures, and grasslands, especially in coastal parts of California. It is an annual or short-lived perennial with a life history like that of *C. maculatum* and *F. vulgare,* but its seed bank is long-lived (DiTomaso and Healy 2007).

Life History Traits of the Principal Species (hide)

	Conium maculatum	Foeniculum vulgare
Life forms	Monocarpic perrenial; herb	Monocarpic perennial; herb
Seed storage	Transient; soil stored	Soil stored
Seed longevity	Medium	Medium
Mode of dispersal	Gravity	Water; animal
Germination agents	Stratification- winter; stratification-summer	Stratification- winter
Mode of sprouting	Underground structures	Underground structures
Survivability after fire/disturbance	null	Higher sprouter
Disturbance-stimulated flowering	null	No

	Conium maculatum	Foeniculum vulgare
Reproductive range	2 years	null
Recruitment	null	null
Regional variation	null	null

Fire Characteristics (more)

Regional Status (hide)

- **Central California Coast** (261Ad, Ah, Ak). Stands of *Conium maculatum* appear commonly along road cuts and steep unstable coastal slopes associated with coastal scrub.
- **Great Valley** (262Aa-z). Stands of *C. maculatum* and *Foeniculum vulgare* occur in disturbed sites. Over 100 ha of *C. maculatum* were mapped at Suisun Marsh (Keeler-Wolf and Vaghti 2000).
- **Mono** (341Da-f, Dh-l). No description available
- **Northern California Coast** (263Ak). Stands of all three non-natives are abundant in the section. Stands of *C. maculatum* exist at Point Reyes National Seashore (Keeler-Wolf et al. 2003a) with or without high grass cover. *C. maculatum* and *F. vulgare* are two of the invasive plants targeted at Humboldt Bay National Wildlife Refuge (Clifford and Walter 2005).
- **Southern California Coast** (261Ba-j). Some 76 ha of *F. vulgare* were mapped at Santa Monica Mountains (AIS and ESRI 2007, Keeler-Wolf and Evens 2006) and included *Brassica nigra, Bromus diandrus, Carduus pycnocephalus, Leymus condensatus, Malacothrix saxatilis, Raphanus sativus,*

and *Urtica dioica.* On Santa Cruz Island, AIS (2007) mapped 110 ha of *F. vulgare* using a > 50% dominance rule. Shrubs, particularly, *Baccharis pilularis,* are common and have increased in cover during the past decade (C. Cory, pers. comm. 2006). However, many native shrubs such as *Eriogonum arborescens* have only shown significant increases in restoration plots where fennel was treated with herbicide and native shrubs were seeded or planted, suggesting that the areas invaded by fennel lack a seed bank of native shrubs to re-establish (James et al. 2014, Power et al. 2014).

Management Considerations (hide)

Stands often have plants of conservation value. Enhancing native plant qualities requires several years of treatment, including cutting, fire, plant removal, and/or herbicides. The European palearctic moth (*Agonopterix alstroemeriana*) can control *Conium maculatum* infestations. Some *Daucus carota* plants form a tolerance to herbicides (DiTomaso and Healy 2007). As on Santa Cruz Island, R. Klinger (pers. comm. 1998) reports that removing these non-natives often leads to other invasive non-natives dominating mainland stands.

Associations (hide)

- Conium maculatum [2], [3], [6]
- Foeniculum vulgare [1], [4], [5]

References (hide)

- [1] Keeler-Wolf, T.;Evens, J. 2006
- [2] Keeler-Wolf, T.;Vaghti, M. 2000
- [3] Sproul, F.;Keeler-Wolf, T.;Gordon-Reedy, P.;Dunn, J.;Klein, A.;Harper, K. 2011
- [4] Rodriguez, D.;Sikes, K.;Keeler-Wolf, T.;Kittel, G.;Curtis, J.;Curley, C.;Evens, J. 2017
- [5] Verdone, L.;Evens, J. 2010
- [6] Buck-Diaz, J.;Batiuk, S.;Evens, J.M. 2012
- Bean, C.;Russo, M.J. 2001
- DiTomaso, J.M.;Healy, E.A. 2007
- Drewitz, J. 2000
- James, M.L.;Hubbard,D.M.;Cory, C. 2014
- Klinger, R. 2000
- Power, P.J.;Stanley, T.;Cowan,C.;Roberts, J.R. 2014