United States Department of Agriculture
NRCS Natural Resources Conservation Service

Ecological Site Description

UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION

ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site Name: Loamy Upland (Laughlin, Suther)

Quercus / *Arctostaphylos* / *Bromus* - *Avena*
(oak / manzanita / brome - oat)

Site ID: R015XI015CA

Major Land Resource Area: 015 - Central California Coast Range

Physiographic Features

This site occurs on more than 100,000 acres, primarily in Sonoma County, on strongly sloping to very steep footslopes and mountain slopes at elevations of 125 to 3,500 feet. This site occurs on hills and mountains with slopes are 2 to 75 percent.

Land Form: (1) Hill

	Minimum	Maximum
Elevation (feet):	125	3500
Slope (percent):	2	75
Water Table Depth (inches):		
Flooding:		
Frequency:		
Duration:	None	None
Ponding:		
Depth (inches):		
Frequency:		
Duration:	None	None
Runoff Class:	Low	Very high
Aspect:	No Influence on this site	

Climatic Features

The climate on this site is humid mesothermal with warm dry summers and cool moist winters. Mean annual precipitation is 35 to 70 inches with very little snow. Average January temperature is 46 degrees F., average July temperature is about 69 degrees F., and the mean annual temperature is about 53 degrees to 58 degrees F. The average freeze-free season is 240 to 280 days. Average monthly precipitation is presented in the maximum monthly precipitation row in the table below.

Precipitation and temperature are 1971-2000 means from the PRISM Group, Oregon Climate Service, Oregon State University, Corvallis, Oregon (Daly 2006). Frost free period obtained from map unit descriptions (Soil Data Mart).

	Minimum	Maximum
Frost-free period (days):	240	280
Freeze-free period (days):	0	0
Mean annual precipitation (inches):	35.0	70.0

Monthly precipitation (inches) and temperature (°F):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precip. Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Precip. Max.	9.25	7.25	6.0	2.75	0.75	0.25	0.25	0.25	0.75	3.0	7.25	7.75
Temp. Min.	37.4	38.7	40.4	43.0	47.0	51.8	57.2	56.2	54.4	49.0	41.5	36.9
Temp. Max.	53.7	56.3	60.7	66.7	73.5	81.2	89.0	88.8	84.8	74.7	60.9	53.8

Climate Stations:

Influencing Water Features

Intermittent and permanent streams drain these sites.

Wetland
Description: System Subsystem Class

Representative Soil Features

This site is characterized by moderately steep to steep uplands formed in residuum weathered from sandstones and shale (Laughlin and Suther Series) or weathered from basic igneous and metamorphic rocks, mainly amphibolite schist, diabase, andesite, or basalt (Sobrante).

Fertility of these soils is generally low due to low nutrient content of the parent material or low organic matter build up. Nutrient concentration is often higher under oak trees.

Sonoma County (CA097), California

CA097 Lge Laughlin Loam, 2 To 30 Percent Slopes
CA097 Lgf Laughlin Loam, 30 To 50 Percent Slopes

CA097 Lgg Laughlin Loam, 50 To 75 Percent Slopes
CA097 Lgg2 Laughlin Loam, 50 To 75 Percent Slopes, Eroded
CA097 Lhg Laughlin-Yorkville Complex, 30 To 75 Percent Slopes
CA097 She Sobrante Loam, 15 To 30 Percent Slopes
CA097 Shf Sobrante Loam, 30 To 50 Percent Slopes
CA097 Shg Sobrante Loam, 50 To 75 Percent Slopes
CA097 Ste Suther Loam, 15 To 30 Percent Slopes
CA097 Ste2 Suther Loam, 15 To 30 Percent Slopes, Eroded 173 *
CA097 Stf Suther Loam, 30 To 50 Percent Slopes
CA097 Suf Suther-Laughlin Loams, 15 To 50 Percent Slopes
CA097 Sug Suther-Laughlin Loams, 50 To 75 Percent Slopes

Predominant Parent Materials:
Kind: Residuum
Origin: Sandstone

Surface Texture: (1) Loam

Subsurface Texture Group:

	Minimum	Maximum
Surface Fragments <=3" (% Cover):		
Surface Fragments > 3" (% Cover):		
Subsurface Fragments <=3" (% Volume):		
Subsurface Fragments > 3" (% Volume):		

Drainage Class: Moderately well drained To Well drained

Permeability Class: Slow To Moderate

	Minimum	Maximum
Depth (inches):	20	40
Electrical Conductivity (mmhos/cm):		
Sodium Absorption Ratio:		
Calcium Carbonate Equivalent (percent):		
Soil Reaction (1:1 Water):		
Soil Reaction (0.01M CaCl2):		
Available Water Capacity (inches):	0.0	0.0

Plant Communities

Ecological Dynamics of the Site

Before European settlement, the natural plant community for this ecological site is assumed to have been a coast live oak dominated mixed oak woodland or savanna with a grass understory. A shrub layer may have been present depending on fire frequency. On this site, the woodland or savanna is frequently intermixed in a mosaic with open grasslands. The grassland and understory of this site was dominated by native annual and perennial grasses and forbs. The reference state for this ecological site is similar to its pre-European state; however, density of shrubs may be different due to fire suppression and annual grasses and forbs now dominate the understory.

The reference state for this ecological site is a coast live oak (Quercus agrifolia) dominated mixed oak woodland with an annual dominated understory. In addition to coast live oak the woodland may also include blue oak (Q. douglasii), black oak (Q. kelloggii), valley oak (Q. lobata), canyon live oak (Q.chrysolepsis), and Oregon white oak (Q. garryana). Annual grass dominated patches (non-woody) are interspersed in a mosaic with woodland or savanna patches. Manzanita (Arctostaphylos spp.) is common in the shrub layer. Understory species and grassland patches are frequently dominated by bromes (Bromus spp), wild oats (Avena spp), filaree (Erodium spp), and annual legumes (Trifolium spp and Vicia spp). The native perennial, blue wildrye (Elymus

glaucus), may be present in small amounts.

Competition between the species that germinate or resprout following fire or other disturbances, mediated by weather and soil moisture conditions, greatly influence the vegetation states present in the oak-woodlands. On some soils, geological substrates, and aspects; tree, shrub and grass patches are all possible vegetations states. Shallow soils, coarse and rocky soils and southern aspects sometimes limit vegetation to shrub dominated states. Frequent fire tends to result in vegetation states dominated by an annual grass or oak-annual grass community. Protection from fire and grazing results in a gradual increase in shrubs contributing to increased fuel loads. As the shrub canopy reaches into the tree canopy the potential for crown fires increases. Crown fires can top-kill oak trees.

Coast live oak is exceptionally fire resistant (Plumb 1979, Muick and Bartolome 1987). Coast live oak trees are long-lived species that evolved under low severity understory fires that are estimated to have naturally occurred at intervals of 10 to 30 years (Greenlee and Langenheim 1990). Beginning in the mid-1900s fire return intervals are estimated to have increased to as much as 50 to 75 years. Coast live oak is adapted to fire by having a thick bark and by sprouting from the root crown following fire. Blue oak is a vigorous sprouter in some locations and not in others. Fire top-kills blue oak seedlings and saplings. Black oak is a vigorous resprouter following fire. Valley oak trees are fire resistant, while top-killed seedlings and saplings sprout from the root crown. Canyon live oak typically sprouts prolifically from the stump or rootcrown after the trunk or crown is marginally damaged by fire. The shrub layer on this ecological site is dominated by manzanita. These long-lived seeds accumulate in the soil and litter until they are stimulated to germinate by the heat of a fire. Frequent burning can remove these species from the site.

The historic herbaceous understory layer of this ecological site is unknown, having been replaced by annual grasses and forbs of European origin during the European settlement of California (Burcham 1957, Bartolome 1987, Baker 1989). The tree and shrub layers remain intact and fire is a normal component of these plant communities that were maintained by the Native American population to provide food and fiber (Blackburn and Anderson 1993). Prior to European settlement fire frequency was approximately every 25 years (McClaran 1986). Fires were more frequent (5 to 15 years) following settlement before and after the gold rush (Pavlik 1991, Mensing 1992, Stephens 1997). The intentional use of fire by ranchers and others to reduce brush from 1850 to the 1950s contributed to this frequent fire return interval. While prescribed burning continues today, foothill subdivision, urbanization and air quality concerns have reduced the use of fire as a management tool. Today fire frequency is more likely to be on the order of 25 to 50 years or more. Prescribed burning, mechanical and chemical brush control have been used to remove the shrub and tree layers but have been used infrequently since the beginning of the 21st century (Murphy and Crampton 1964, Murphy and Berry 1973).

Species composition and productivity of the annual dominated understory grasses and forbs vary greatly within and between years and are greatly influenced by the timing and amount of precipitation and the amount of residual dry matter (George et al. 2001a). Grass dominated years occur when rainfall is well-distributed or greater than normal. Filaree years occur in low rainfall years or when residual dry matter (Bartolome et al. 2002) is low. Drought, heavy grazing and fire result in filaree dominated understory. Following a fire filaree may dominate the site for up to three years (Parsons and Stohlgren 1989, McDougald et al 1991). Medusahead (Taeniatherum caput-medusa), goatgrass (Aegilops triuncialis) and yellow starthistle (Centaurea solstitialis) are potential invaders on this site because of it’s higher clay content and higher precipitation than more southern sites in this MLRA. Some experts have suggested that medusahead and other invasive species may gradually adapt to new sites (Rice et al 2006).

Oak Woodland Plant Community

This ecological site is dominated by oak woodland, savanna and open grassland patches. The oak woodlands of California are a multi-layered mosaic of trees, shrubs and grass patches. In some locations these mosaics have been correlated with geological substrate (Cole 1980) and soil characteristics (Harrison et al. 1971). However, other researches have found each of these vegetation types on most soil depths, slopes, aspects and all geological substrates suggesting that disturbance (fire) and/or biological factors (competition, grazing and browsing) are important determinants of the patchy distribution of these vegetation types (Wells 1962,

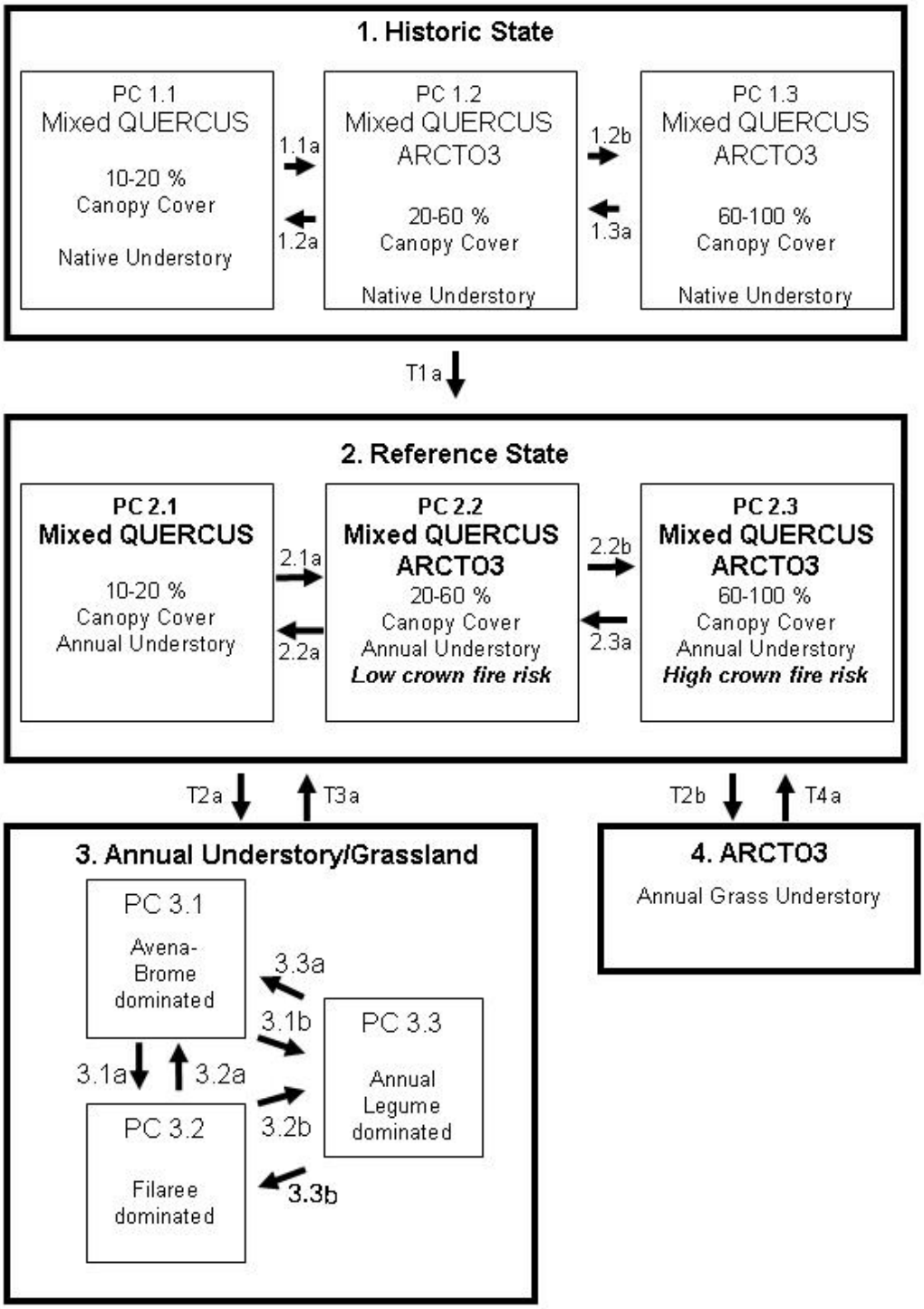
Callaway and Davis 1991) at a scale smaller than an ecological site or even a soil mapping unit. Given this mosaic of multi-layered vegetation types there is wide amplitude in expected species composition and amounts on the same soil series or association within an ecological site. Therefore, these sites were delineated more on the basis of soil characteristics and long-term understory production than on species composition.

The understory and open grassland patches are dominated by annual grasses and forbs of European origin. As germination, seedling establishment and plant growth progress during the growing season, species composition changes depending primarily on the timing and amount of precipitation and temperature (George et al. 2001a). Consequently, understory and open grassland species composition varies seasonally and annually. Unlike many perennial dominated grasslands, kinds and amounts (weight or cover) of herbaceous species are not stable and annually predictable. Therefore, exact percentages by weight or ground cover are not reported as is done in perennial dominated ecosystems. Instead several species are listed, several of which can be expected to dominate the composition in some years and be present in most years.

Total Annual Production and Growth Curve

Forage production and species composition is largely controlled by four factors: precipitation, temperature, soil characteristics and plant residue (George et al. 2001a). Precipitation and temperature control the timing and characteristics of four distinct phases of forage growth: break of season (germination and onset of growth), winter growth, rapid spring growth, and peak forage production. March and April are usually the months when 50 to 75 percent of the annual production occurs. The cold months of December and January often produce only 0 to 5 percent of the annual production. During cold weather seasonal and annual variation in production during each of these seasons contributes to the variable total annual production in the annual dominated understory and open grass patches. This ecological site commonly supports an open annual grassland intermixed with a blue oak dominated woodland of less than 50 percent canopy cover. In this woodland type understory production decreases as canopy cover increases above 25 percent.

Production curves are provided as examples of monthly forage production for normal (2500 lb/a), favorable (3500 lb/a), and unfavorable (1500 lb/a) years. Annual plant growth begins with germination following the first fall rains (George et al. 2001a). Germination commonly begins within 1 week of receiving 0.5 to 1.0 inch of rainfall. This normally occurs late in October or early November. Temperatures commonly turn cold in mid-November. The longer the period between germination and the onset of cold temperatures the greater is fall herbage production. Early rains followed by an extended dry period can result in loss of most of the initial wave of germination. This is known as a “false break” and will be followed by a second germination wave when adequate rainfall resumes. The onset of rapid spring growth coincides with warming spring temperatures commonly in mid-February. The rapid spring growth period continues until soil moisture is depleted following the end of the rainy season. The longer the period from mid-February to soil moisture depletion, the greater is spring production.


1. Historic State
PC 1.1
Mixed QUERCUS
10-20 %
Canopy Cover
Native Understory
1.1a
1.2a
PC 1.2
Mixed QUERCUS
ARCTO3
20-60 %
Canopy Cover
Native Understory
1.2b
1.3a
PC 1.3
Mixed QUERCUS
ARCTO3
60-100 %
Canopy Cover
Native Understory
T1a
2. Reference State
PC 2.1
Mixed QUERCUS
10-20 %
Canopy Cover
Annual Understory
2.1a
2.2a
PC 2.2
Mixed QUERCUS
ARCTO3
20-60 %
Canopy Cover
Annual Understory
Low crown fire risk
2.2b
2.3a
PC 2.3
Mixed QUERCUS
ARCTO3
60-100 %
Canopy Cover
Annual Understory
High crown fire risk
T2a
T3a
T2b
T4a
3. Annual Understory/Grassland
PC 3.1
Avena-
Brome
dominated
3.3a
3.1b
3.1a
3.2a
PC 3.3
Annual
Legume
dominated
PC 3.2
Filaree
dominated
3.2b
3.3b
4. ARCTO3
Annual Grass Understory

State 1: Historic State

State 1: This is the assumed historic plant state consisting of long-lived tree and shrub species similar to those in State 2. State 1 assumes that native annual and perennial grasses and forbs were common in the understory of the tree and shrub layer of these former mixed oak-woodland ecosystems but there is no record of the species composition. As in State 2 a continuum of plant communities (PC 1.1, 1.2, and 1.3) resulted from increasing canopy cover following fire. In State 1, fire was more frequent and was not suppressed as is commonly the case in State 2. Under a more frequent fire regime, this community may never have reached the higher canopy covers that occur in State 2.

1.1a (PC 1.1 to PC1.2): Under natural fire frequencies shrub and tree canopy cover increases toward State PC 1.2 following fire.

1.2a (PC 1.2 to PC 1.1): Natural fire frequencies estimated to be every 25 years maintains an oak savanna with few shrubs and an herbaceous understory.

1.2b (PC 1.2 to PC 1.3): Prolonged periods without fire result in increased shrub and tree canopy cover to the point where the savanna is classified as woodland. Increasing ladder fuels increase the chances of a high intensity crown fire. Under a 25 year fire interval this state may not have been reached in the pre-European plant community.

1.3a (PC 1.3 to PC 1.1 or 1.2): Burning woodlands with dense shrub and tree layers results in removal of most shrub and understory tree canopy. In extreme cases this transition could return from PC 1.3 to PC 1.1.

T1a (State 1 to State 2): Invasion by exotic annual species, yearlong continuous grazing, drought, fire suppression and cultivation reduced or destroyed the native perennial grass and forb component of the assumed climax plant community (Burcham 1957, Bartolome 1987, Baker 1989). Apparently this is an irreversible transition in a time frame relevant to management. Restoration of native perennial herbaceous vegetation is a recurring management objective that has been largely unsuccessful. Researchers, managers and citizens groups have been unsuccessful at reversing the loss of native perennial grasses. Competition from invasive annuals and long dry summers apparently are insurmountable. Annual grasses and forbs are more competitive for soil moisture than native perennials reducing oak seedling survival (Gordon et al. 1989, Corbin and D'Antonio 2004).

State 2: Reference Plant Communities 2.1, 2.2 & 2.3

State 2: This reference state is characterized by a continuum of plant communities that can be sparse in canopy cover to dense canopy cover depending on the frequency of fire. Fire suppression has resulted in longer intervals between fires resulting in fewer ground fires and more intense crown fires. Natural fires in State 1 would have been ignited by lightening, whereas anthropogenic fires were ignited most commonly by Native Americans. Fire in State 2 is often man-caused, but can be started by lightening as well, however the timing and frequency of the fire has probably changed from State 1 to State 2.

Plant community 2.1 (PC 2.1) is a mixed oak (coast live oak dominated) savanna community of 10 to 20 percent canopy cover with an annual grass dominated understory and few or no shrubs. The dominant coast live oaks are fire-resistant and evolved under low-severity grassland fires. Blue oak, black oak, valley oak canyon live oak and coast live oak resprout vigorously following most fires. Manzanita reestablishes from seed following fire.

Plant community 2.2 (PC 2.2) ranges from 20 – 60 percent canopy cover resulting from an increase in manzanita, and other shrubs, and increased oak canopy.

Plant community 2.3 (PC 2.3) is a mixed oak woodland community resulting from continued increases in canopy cover (60 – 100 %) due to infrequent fire. Fire hazard is usually high in this plant community because of the high fuel loads that can lead to high crown fire risk. The understory of these plant communities is generally

dominated by annual grasses and forbs of Eurasian origin. Understory productivity decreases as canopy cover increases above 50%. The understory species composition and dynamics in this state is similar to that for State 3 with ripgut brome and foxtail barley often prevalent under the oak canopy and soft brome and filaree more common in the open patches.

2.1a (PC 2.1 to PC 2.2): Under natural fire frequencies shrub and tree canopy cover increases toward PC 2.2 following fire.

2.2a (PC 2.2 to PC 2.1): Natural fire frequencies estimated to be 25 years maintains an oak savanna with a few shrubs and an herbaceous understory. More frequent burning can result in a savanna free of shrubs and understory trees. Application of mechanical and/or chemical brush control practices can result in a similar transition.

2.2b (PC 2.2 to PC 2.3): Prolonged periods without fire result in increased shrub and tree canopy cover to the point where the savanna is classified as woodland. Increasing ladder fuels increase the chances of a high intensity crown fire.

2.3a (PC 2.3 to PC 2.1 or 2.2): Burning woodlands with dense shrub layers results in removal of most shrub and understory tree canopy. In extreme cases this transition could return from PC 2.3 to PC 2.1. Implementation of mechanical or chemical brush control practices can result in a similar transition.

T2a (State 2 to State 3 - Type conversion from woodland to grassland): Use of mechanical and chemical tree and shrub control and prescribed burning remove all trees and shrubs resulting in a conversion from woodland to annual grassland. In some cases this transition may be irreversible without artificial regeneration of native woody species, especially if frequent fires and grazing suppress seedlings of woody species. Seeding and fertilization often accompanied tree and shrub control. At low canopy covers fire or natural mortality could remove woody species and conditions for resprouting and/or acorn germination and seedling establishment may be unfavorable.

T2b (State 2 to State 4): Intense fire, wood cutting or vegetation management kills all trees and they do not resprout. Sudden oak death kills coast live oak. With fire protection shrubs gradually increase.

State 2: Reference Plant Communities 2.1, 2.2 & 2.3 Plant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
2 - Native perennial grasslike				0	0
		blue wildrye	*Elymus glaucus*	0	0
		bluegrass	*Poa*	0	0
8 - Non-native cool season annual grass				0	0
		silver hairgrass	*Aira caryophyllea*	0	0
		oat	*Avena*	0	0
		ripgut grass	*Bromus diandrus*	0	0
		soft brome	*Bromus hordeaceus*	0	0
		red brome	*Bromus rubens*	0	0
		barley	*Hordeum*	0	0

Forb

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
11 - Native perennial forb				0	0
		California buttercup	*Ranunculus californicus*	0	0
12 - Native annual forb				0	0
		Indian paintbrush	*Castilleja*	0	0
			Lotus purshianus (Syn)	0	0
		California buttercup	*Ranunculus californicus*	0	0
14 - Non-native annual forb				0	0

	pimpernel	*Anagallis arvensis*	0	0
	Italian thistle	*Carduus pycnocephalus*	0	0
	thistle	*Cirsium*	0	0
	stork's bill	*Erodium*	0	0
	lupine	*Lupinus*	0	0
	wild mint	*Mentha arvensis*	0	0
	burclover	*Medicago polymorpha*	0	0
	forget-me-not	*Myosotis*	0	0
	dotseed plantain	*Plantago erecta*	0	0
	common chickweed	*Stellaria media*	0	0
	common dandelion	*Taraxacum officinale*	0	0
	clover	*Trifolium*	0	0
	garden vetch	*Vicia sativa*	0	0

Shrub/Vine

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
17 - Native shrub				0	0
		manzanita	*Arctostaphylos*	0	0

Tree

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
24 - Native Deciduous Tree				0	0
		blue oak	*Quercus douglasii*	0	0
		Oregon white oak	*Quercus garryana*	0	0
		California black oak	*Quercus kelloggii*	0	0
		valley oak	*Quercus lobata*	0	0
25 - Native non-deciduous tree				0	0
		California live oak	*Quercus agrifolia*	0	0
		canyon live oak	*Quercus chrysolepis*	0	0

Annual Production by Plant Type:

Plant Type	Annual Production (lbs/AC) Low	Representative Value	High
Forb	300	500	700
Grass/Grasslike	1200	2000	2800
Total:	1500	2500	3500

Structure and Cover:

Ground Cover (%)

Vegetative Cover						Non-Vegetative Cover					
Grass/ Grasslike	Forb	Shrub/ Vine	Tree	Non-Vascular Plants	Biological Crust	Litter	Surface Fragments > 1/4 & <= 3"	Surface Fragments > 3"	Bedrock	Water	Bare Ground
80 to 100	0 to 20	0 to 20	0 to 100			0 to 100					0 to 20

Structure of Canopy Cover (%)

	Grasses/Grasslike	Forbs	Shrubs/Vines	Trees
<=0.5 feet		0 to 20		
> 0.5 - < 1 feet	80 to 100			
< 1 - >= 2 feet				

> 2 - < 4.5 feet			0 to 20	
< 4.5 - >= 13 feet				0 to 100

Plant Growth Curve:
Growth Curve Number: CA1504
Growth Curve Name: North Coast annual rangeland (normal production year)
Growth Curve Description: Growth curve for a normal(average)production year resulting form the production year starting in October and extending through May. Growth curve is for oak-woodland and associated annual grasslands.

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	10	25	30	20	0	0	0	0	5	5	5

Plant Growth Curve:
Growth Curve Number: CA1505
Growth Curve Name: North Coast annual rangeland (favorable production year)
Growth Curve Description: Growth curve for a favorable production year resulting from the production year starting in October and extending into June. Growth curve is oak-woodlands and associated annual grasslands.

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	10	20	25	20	5	0	0	0	10	5	5

Plant Growth Curve:
Growth Curve Number: CA1506
Growth Curve Name: North Coast annual rangeland (unfavorable production year)
Growth Curve Description: Growth curve for an unfavorable production year resulting from the production year starting late and ending early. Growth curve is for oak-woodlands and associated annual grasslands.

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	15	30	45	0	0	0	0	0	0	5	5

State 3: Annual Grassland

State 3: Annual grassland with species composition fluctuating in response to weather, grazing, fire and fertility. Plant community 3.1 (PC 3.1) is dominated by wild oats (Avena spp), soft brome (Bromus hordeaceus) and ripgut brome (B. diandrus). Plant community 3.2 (PC 3.2) is dominated by filaree (Erodium spp) or other decumbent species. Plant community 3.3 (PC 3.3) is an annual grassland containing seeded annual legumes such as subterranean clover (Trifolium subterraneum) and vetch (Vicia spp.). Soil quality, especially fertility, declines following tree removal.

T3a (State 3 to State 2): Recovery from grassland conversions may take decades or may be irreversible depending on the intensity and type of brush control practices. Repeated fires and grazing help to maintain the grassland. Oaks and other woody plants may colonize adjacent open grasslands but seedlings are seldom found more than 30 m from existing tree or shrub canopy.

3.1a (PC 3.1 to PC 3.2): Filaree increases in response to low litter levels. Litter levels reduced by poor growing conditions, fire or heavy grazing. Long periods of inadequate rainfall within the growing season reduce grasses.

3.2a (PC 3.2 to PC 3.1): Annual grasses increase in filaree patches. Light to moderate grazing increases litter. Mulching effect of litter favors annual grass seedlings. Annual grasses shade filaree and other forb seedlings. Nitrogen fertilization favors increase in grasses.

3.1b (PC 3.1 to 3.3): Sulfur and/or phosphorus fertilization are required to maintain productive subterranean clover stands. Rose clover increases and spreads without fertilization. Close grazing helps to maintain legume composition.

3.2b (PC 3.2 to 3.3): Sulfur and/or phosphorus fertilization are required to maintain productive subterranean clover stands. Rose clover increases and spreads without fertilization. Close grazing helps to maintain legume composition.

3.3a (PC 3.3 to PC 3.1): Grasses increase with improved soil fertility and light grazing

3.3b (PC 3.3 to PC 3.2): With loss of fertility and close grazing annual legumes are replaced by filaree.

State 3: Annual Grassland Plant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
2	Native perennial grass/grasslike			0	0
		blue wildrye	*Elymus glaucus*	0	0
		bluegrass	*Poa*	0	0
8	Non-native cool season annual grass			0	0
		silver hairgrass	*Aira caryophyllea*	0	0
		oat	*Avena*	0	0
		ripgut grass	*Bromus diandrus*	0	0
		soft brome	*Bromus hordeaceus*	0	0
		red brome	*Bromus rubens*	0	0
		barley	*Hordeum*	0	0

Forb

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
11	Native perennial forb			0	0
		California buttercup	*Ranunculus californicus*	0	0
12	Native annual forb			0	0
		Indian paintbrush	*Castilleja*	0	0
			Lotus purshianus (Syn)	0	0
		dotseed plantain	*Plantago erecta*	0	0
14	Non-native annual forb			0	0
		pimpernel	*Anagallis arvensis*	0	0
		Italian thistle	*Carduus pycnocephalus*	0	0
		thistle	*Cirsium*	0	0
		stork's bill	*Erodium*	0	0
		lupine	*Lupinus*	0	0
		wild mint	*Mentha arvensis*	0	0
		burclover	*Medicago polymorpha*	0	0
		forget-me-not	*Myosotis*	0	0
		common chickweed	*Stellaria media*	0	0
		common dandelion	*Taraxacum officinale*	0	0
		clover	*Trifolium*	0	0
		garden vetch	*Vicia sativa*	0	0

Annual Production by Plant Type:

	Annual Production (lbs/AC)		
Plant Type	Low	Representative Value	High
Forb	300	500	700
Grass/Grasslike	1200	2000	2800
Total:	1500	2500	3500

Structure and Cover:

Ground Cover (%)

Vegetative Cover						Non-Vegetative Cover					
Grass/ Grasslike	Forb	Shrub/ Vine	Tree	Non-Vascular Plants	Biological Crust	Litter	Surface Fragments > 1/4 & <= 3"	Surface Fragments > 3"	Bedrock	Water	Bare Ground
80 to 100	0 to 20					0 to 100					0 to 20

Structure of Canopy Cover (%)

	Grasses/Grasslike	Forbs	Shrubs/Vines	Trees
<=0.5 feet		0 to 20		
> 0.5 - < 1 feet	80 to 100			

Plant Growth Curve:
Growth Curve Number: CA1504
Growth Curve Name: North Coast annual rangeland (normal production year)
Growth Curve Description: Growth curve for a normal(average)production year resulting form the production year starting in October and extending through May. Growth curve is for oak-woodland and associated annual grasslands.

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	10	25	30	20	0	0	0	0	5	5	5

Plant Growth Curve:
Growth Curve Number: CA1505
Growth Curve Name: North Coast annual rangeland (favorable production year)
Growth Curve Description: Growth curve for a favorable production year resulting from the production year starting in October and extending into June. Growth curve is oak-woodlands and associated annual grasslands.

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	10	20	25	20	5	0	0	0	10	5	5

Plant Growth Curve:
Growth Curve Number: CA1506
Growth Curve Name: North Coast annual rangeland (unfavorable production year)
Growth Curve Description: Growth curve for an unfavorable production year resulting from the production year starting late and ending early. Growth curve is for oak-woodlands and associated annual grasslands.

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	15	30	45	0	0	0	0	0	0	5	5

State 4: Manzanita - Poison Oak Community

State 4: Manzanita patches mixed with annual grassland.

T4a (State 4 to 2): On deeper soils with better moisture holding capacity oaks regenerate from acorns that germinate under canopy of shrubs (Callaway and D'Antonio 1991, Muick 1997). This is a slow successional process.

Ecological Site Interpretations

Animal Community:

Wildlife

Deer and lagomorphs, browse oaks and rodents graze and browse in this community. Acorns are eaten by at least a dozen species of songbirds, several upland game birds, rodents, black-tailed deer, feral and domestic pig, and all other classes of livestock (Adams et al. 1992, Duncan and Clawson 1980, Sampson and Jespersen 1963). Acorns are a critical food source for deer (Burns and Honkala 1990). Studies in the central Sierra Nevada foothills showed that blue oak woodland is utilized by 92 species of birds, 60 of which nest there (Block and Morrison 1990). The California Wildlife Habitat Database (Mayer and Laudenslayer 1988), maintained by California Department of Fish and Game, can provide extensive information on wildlife species that may occur in the habitat type on this site.

Of the 632 terrestrial vertebrates (amphibians, reptiles, birds, and mammals) native to California, over 300 species use oak woodlands for food, cover and reproduction, including at least 120 species of mammals, 147 species of birds and approximately 60 species of amphibians and reptiles (Tietje et al. 2005). Common species on this site include California quail (Callipepla californicus), Beechey ground squirrels (Spermophilus beecheyi), Botta pocket gopher (Thomomys bottae mewa), Blacktailed jackrabbit (Lepus californicus), and mule deer (Odocoileus hemionus). The rich rodent and lagomorph population is an important food source for common predators including: bobcat (Lynx rufus californicus), coyote (Canis latrans) and the Pacific rattlesnake (Crotalus viridis oreganus). The value of this site for food or cover changes seasonally with the vegetation. In habitat planning each plant community and each species needs must be considered individually and collectively.

Grazing and Browsing

The annual dominated understory of this plant community is used by domestic livestock and wildlife throughout the year. Historically and currently use has been primarily by cow-calf operations but stocker cattle are also grass fed on these plant communities. While sheep use may have been greater in the past it is currently limited. The main problem for livestock production on this site is lack of natural water sources during most of the year.

The plant communities on this site are suitable for grazing by all classes of livestock at any season. However, forage quality declines below the nutritional needs of many kinds and classes of livestock during the 6 to 8 month dry season. Matching the nutrient demands of livestock with the nutrients supplied by range forage is a balancing act for a considerable portion of each year (George et al. 2001b). The quality of range forage varies with plant species, season, location, and range improvement practices. Range forage is optimal for livestock growth and production for only a short period of the year. Early in the growing season, forage may be of high nutrient content, but high water content in the forage may result in rapid passage through the rumen and incomplete nutrient extraction. The browse value of common oak woodland species is listed in Sampson and Jespersen (1963).

Plant Preference by Animal Kind:

Hydrology Functions:

The watersheds associated with these sites are drained by intermittent streams that only flow during the wet season and by perennial streams. In dry years these intermittent streams may not flow at all. Runoff on these soils is rapid and soil erosion hazard is high.

Recreational Uses:

Hunting, horseback riding, bird watching, off-road driving and hiking are common recreational pursuits.

Wood Products:

Firewood cutting of oak trees, once prevalent, has decreased as voluntary and county regulatory actions to protect native oaks.

Other Products:
Native Americans have historically used and managed the blue oak woodlands for food and fiber.

Other Information:

Revegetation/Restoration Of Disturbed Areas

Oak Restoration:

Natural regeneration of oaks may be limited because of a number of factors that limit seed germination, seedling establishment and survival to the tree stage. Competition for soil moisture from the understory annual plants, acorn and seedling damage by rodents, livestock grazing and changed fire regimes are important factors that can reduce oak regeneration. Blue oaks may be limited because they are weak resprouters on some dry sites. Valley oaks may occur on this site and have been reported to have regeneration problems in some areas. Black oak regeneration is generally not a problem because they are strong resprouters. McCreary (2001) provides an extensive review of oak regeneration problems and practices on California’s oak woodlands.

Native Grass Restoration:

While, the soils on this ecological site support remnant native perennial grasses, competition from non-native annuals have often prevented successful natural and artificial re-introduction of native grasses.

Annual Legumes and Non-native Perennial Grasses:

Subterranean clover seedings have been highly successful on these soils but require phosphorus and sulfur to maintain high productivity. The high cost of seeding and fertilization has reduced the use of this practice. Introductions of non-native perennial grasses such as harding grass (Phalaris tuberosa) and summer dormant orchard grass (Dactylis glomerata) can be successful on this site but this practice is infrequently used (George et al. 1983).

Poisonous/Non-native Plants

Poisonous Plants:

Poisonous plants that may occur on this ecological site include lupine (Lupinus spp), and fiddleneck (Amsinkia

spp), common groundsel (Senecio vulgaris), and hemlock (Cicuta spp). Yellow starthistle (Centaurea solstitialis) is poisonous to horses. Livestock poisoning is usually a result of hungry animals being concentrated on toxic plants.

Invasive Species:

The understory and open grassland vegetation on this site is dominated by non-native annuals that invaded during the colonization of California. The species composition of the pre-colonization community is unknown. Several species have invaded and spread in these annual dominated communities including: medusahead (Taeneantherum caput-medusa), goatgrass (Aegilops triuncialis), starthistle (Centaurea solstitialis), Italian thistle (Carduus pycnocephalus), and tansy ragwort (Senecio jacobaea).

Supporting Information

Associated Sites:

Site Name	Site ID	Site Narrative

Similar Sites:

Site Name	Site ID	Site Narrative

State Correlation:
This site has been correlated with the following states:
CA

Inventory Data References:
JHpineflat2 38.7396570 122.7664132
PineFlat2 38.7395890 122.7661011
SlLakeSonoma1 38.7760959 123.0640734
JMHSONPineflat4 38.7338578 122.7632976

Type Locality:

Relationship to Other Established Classifications:
This coast live oak dominated mixed oak site may include the following Oak Woodland Classes (Allen-Diaz et al. 1989): 1) Coast live oak/Grass, 2) Blue Oak-Coast Live Oak/Grass, 3) Mixed Oak/Grass, and 4) Mixed Oak-Black Oak/Grass. This site includes Coast Oak Woodland (COW) of the California Wildlife Habitat Relationships System.

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Site Description Approval:

Author	Date	Approval	Date
Melvin George, John Harper, Stephanie Larson, Michael Lennox	6/4/2004		

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date: **MLRA:** 015X **Ecological Site:** Loamy Upland (Laughlin, Suther) R015XI015CA
This *must* be verified based on soils and climate (see Ecological Site Description). Current plant community cannot be used to identify the ecological site.

Composition (indicators 10 and 12) based on: Annual Production, Foliar Cover, Biomass

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Indicators. For each indicator, describe the potential for the site. Where possible, (1) use numbers, (2) include expected range of values for above- and below-average years for **each** community and natural disturbance regimes within the reference state, when appropriate and (3) cite data. Continue descriptions on separate sheet.

1. **Number and extent of rills:**
2. **Presence of water flow patterns:**
3. **Number and height of erosional pedestals or terracettes:**
4. **Bare ground from Ecological Site Description or other studies (rock, litter, standing dead, lichen, moss, plant canopy are not bare ground):**
5. **Number of gullies and erosion associated with gullies:**
6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type and strength of structure, and A-horizon color and thickness):**

10. **Effect on plant community composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground weight using symbols: >>, >, = to indicate much greater than, greater than, and equal to) with dominants and sub-dominants and "others" on separate lines:**
    Dominant:
    Sub-dominant:
    Other:
    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (inches):**

15. **Expected annual production (this is TOTAL above-ground production, not just forage production:**

16. **Potential invasive (including noxious) species (native and non-native). List Species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicator, we are describing what in NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**