Ecological Site Description

UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION

ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site Name: Deep Clay (Altamont)

Quercus douglasii / / *Bromus - Avena*
(blue oak / / brome - oat)

Site ID: R015XI009CA

Major Land Resource Area: 015 - Central California Coast Range

Physiographic Features

This ecological site is on uplands, hills and mountains with slopes of 0 to 75 percent. Elevation is 100 to 4,500 feet.

Land Form: (1) Hill

	Minimum	Maximum
Elevation (feet):	100	4500
Slope (percent):	0	75
Water Table Depth (inches):		
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		
Depth (inches):		
Frequency:	None	None
Duration:	None	None
Runoff Class:	Medium	Very high
Aspect:	West No Influence on this site	

Climatic Features

The average annual precipitation ranges from 10 to 25 inches and increases with elevation. Most moisture falls as rain from October to May and is produced by winter storms that move into California from the Pacific Ocean in an easterly or southeasterly direction. Mean annual temperature is 57 degrees to 62 degrees F. The mean January temperature is about 45 degrees to 48 degrees F. and the mean July temperature about 65 degrees F. The frost-free season is 240 to 260 days.

Monthly precipitation and temperature averages 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). Mean monthly precipitation is reported in the Maximum precipitation row.

	Minimum	Maximum
Frost-free period (days):	240	360
Freeze-free period (days):	0	0
Mean annual precipitation (inches):	10.0	25.0

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.	3.54	2.82	2.54	1.18	0.25	0.25	0.25	0.25	0.25	1.04	2.54	2.75
Temp. Min.	37.8	40.6	42.7	45.2	50.2	54.9	58.0	57.8	55.6	50.1	42.6	37.3
Temp. Max.	55.4	60.4	64.2	70.2	76.9	84.1	89.2	88.8	85.1	76.7	63.7	55.8

Climate Stations:

Influencing Water Features

Intermittent streams feeding into permanent higher order streams drain these sites.

Wetland Description:	System	Subsystem	Class

Representative Soil Features

This ecological site covers more than 240,000 acres along the Coast Range from Tehema County to Santa Barbara County. The Altamont, Fontana and Positas soils on this site formed in material weathered from fine-grained sandstone and shale. The available water holding capacity within the ecological site ranges from 2.1 inch to 7.8 inches. Elevation ranges from 30 to 4000 feet.

Northern Santa Barbara Area (CA672)
CA672 PtC Positas fine sandy loam, 2 to 9 percent slopes
CA672 PtD Positas fine sandy loam, 9 to 15 percent slopes
CA672 PtD3 Positas fine sandy loam, 9 to 15 percent slopes, severely eroded
CA672 PtE Positas fine sandy loam, 15 to 30 percent slopes
CA672 PuD Positas cobbly fine sandy loam, 2 to 15 percent slopes

San Luis Obispo County (CA665)
CA665 102 Arbuckle-Positas complex, 9 to 15 percent slopes

CA665 103 Arbuckle-Positas complex, 15 to 30 percent slopes
CA665 104 Arbuckle-Positas complex, 30 to 50 percent slopes
CA665 105 Arbuckle-Positas complex, 50 to 75 percent slopes

Eastern Santa Clara Area (CA646)
CA646 AcE Altamont clay, 15 to 30 percent slopes
CA646 AcF Altamont clay, 30 to 50 percent slopes
CA646 AcG2 Altamont clay, 50 to 75 percent slopes, eroded

Alameda Area (CA609)
CA609 AaC Altamont clay, 3 to 15 percent slopes
CA609 AaD Altamont clay, 15 to 30 percent slopes
CA609 AbEcc Altamont clay, 15 to 30 percent slopes
CA609 AcFcc Altamont-Fontana complex, 30 to 50 percent slopes
CA609 AmE2 Altamont clay, moderately deep, 30 to 45 percent slopes, eroded
CA609 AmF2 Altamont clay, moderately deep, 45 to 75 percent slopes, eroded
CA609 ArD Altamont rocky clay, moderately deep, 7 to 30 percent slopes
CA609 PoC2 Positas gravelly loam, 2 to 20 percent slopes, eroded
CA609 PoE2 Positas gravelly loam, 20 to 40 percent slopes, eroded
CA609 PoF2 Positas gravelly loam, 40 to 60 percent slopes, eroded
CA609 PtB2 Positas gravelly loam, thick surface, 2 to 10 percent slopes, eroded

Alameda County, Western Part (CA610)
CA610 100 Altamont clay, 5 to 15 percent slopes
CA610 101 Altamont clay, 15 to 30 percent slopes
CA610 102 Altamont clay, 30 to 50 percent slopes
Contra Costa County (CA013)
CA013 AaDaa Altamont Clay, 15 To 30 Percent Slopes
CA013 AbD Altamont Clay, 9 To 15 Percent Slopes
CA013 AbE Altamont Clay, 15 To 30 Percent Slopes
CA013 AcF Altamont-Fontana Complex, 30 To 50 Percent Slopes
CA013 AcG Altamont-Fontana Complex, 50 To 75 Percent Slopes
CA013 PkA Positas Loam, 0 To 2 Percent Slopes
CA013 PkC Positas Loam, 2 To 9 Percent Slopes

Napa County (CA055)
CA055 AcF2so Altamont clay, 30 to 50 percent slopes eroded
CA055 AmE2so Altamont-Diablo clays, 9 to 30 percent slopes

Sonoma County (CA097)
CA097 PsC Positas Gravelly Loam 0 TO 9 percent slopes
CA097 PsD Positas Gravelly Loam , 9 TO 15 percent slopes

Solano County (CA095)
CA095 AcC Altamont clay, 2 to 9 percent slopes
CA095 AcE Altamont clay, 9 to 30 percent slopes
CA095 AcF2 Altamont clay, 30 to 50 percent slopes eroded
CA095 AlC Altamont-San Ysidro-San Benito complex, 2 to 9 percent slopes
CA095 AlE Altamont-San Ysidro-San Benito complex, 9 to 30 percent slopes
CA095 AmC Altamont-Diablo clays, 2 to 9 percent slopes
CA095 AmE2 Altamont-Diablo clays, 9 to 30 percent slopes

Yolo County (CA113)
CA113 PfE2 Positas gravelly loam, 15 to 30 percent slopes, eroded
CA113 PfF2 Positas gravelly loam, 30 to 50 percent slopes, eroded

CA113 PfF3 Positas gravelly loam, 30 to 50 percent slopes, severely eroded

Colusa County (CA011)
CA011 215 Altamont-Sehorn complex, 15 to 30 percent slopes
CA011 216 Altamont-Sehorn complex, 9 to 15 percent slopes
CA011 218 Sehorn-Altamont complex, 30 to 50 percent slopes
CA011 220 Altamont silty clay, 5 to 9 percent slopes
CA011 221 Altamont silty clay, 9 to 15 percent slopes

Glenn County (CA021)
CA021 AaA Altamont clay, 0 to 3 percent slopes
CA021 AaC Altamont clay, 3 to 15 percent slopes
CA021 AaD Altamont clay, 15 to 30 percent slopes
CA021 AaE Altamont clay, 30 to 50 percent slopes
CA021 AbC Altamont gravelly clay, 3 to 15 percent slopes
CA021 AcD Altamont rocky clay loam, 15 to 30 percent slopes
CA021 AcE Altamont rocky clay loam, 30 to 50 percent slopes
CA021 AdC Altamont soils, 3 to 15 percent slopes
CA021 AdD Altamont soils, 15 to 30 percent slopes
CA021 AdE Altamont soils, 30 to 65 percent slopes
CA021 AfD Altamont-Gullied land complex, 10 to 30 percent slopes
CA021 AfE Altamont-Gullied land complex, 30 to 50 percent slopes
CA021 AfsD Altamont-Gullied land complex, shallow, 10 to 30 percent slopes
CA021 AfsE Altamont-Gullied land complex, shallow, 30 to 65 percent slopes
CA021 AgE Altamont-Rocky gullied land complex, 15 to 45 percent slopes
CA021 AhC Altamont-Contra Costa clays, 8 to 15 percent slopes
CA021 AhD Altamont-Contra Costa clays, 15 to 30 percent slopes
CA021 AhE Altamont-Contra Costa clays, 30 to 50 percent slopes
CA021 AkE3 Altamont and Millsholm soils, 30 to 65 percent slopes, severly eroded
CA021 AmC Altamont-Nacimiento association, 3 to 15 percent slopes
CA021 AnC Altamont-Shedd association, 3 to 15 percent slopes

Tehema County (CA103)
CA103 AbD Altamont clay, 10 to 30 percent slopes 363
CA103 AbE Altamont clay, 30 to 50 percent slopes 1,059
CA103 AcA Altamont clay, terrace, 0 to 3 percent slopes
CA103 AcB Altamont clay, terrace, 3 to 10 percent slopes
CA103 AcD Altamont clay, terrace, 10 to 30 percent slopes
CA103 AcE Altamont clay, terrace, 30 to 50 percent slopes

Predominant Parent Materials:
Kind: Residuum
Origin: Sandstone and shale

Surface Texture:

Subsurface Texture Group:

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

Drainage Class: Well drained To Well drained

Permeability Class: Slow To Moderate

	Minimum	Maximum
Depth (inches):	50	54
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):	2.1	7.8

Plant Communities

Ecological Dynamics of the Site

Before European settlement, the historic plant community for this ecological site is presumed to have been a blue oak (Quercus douglasii) savanna with grassland intermixed in a mosaic. The understory and grasslands of this site were dominated by native annual and perennial grasses and forbs. The reference state for this ecological site is similar to its pre-European state but annual grasses and forbs now dominate the understory and grassland.

The reference state for this ecological site ranges from an annual grassland with little or no woody vegetation to a blue oak savanna intermixed with annual grassland. The grasslands and understory are dominated by annual grasses and forbs. Understory species and grassland patches are frequently dominated by soft chess brome (Bromus hordeaceus), ripgut brome (Bromus diandrus), annual ryegrass (Lolium perenne), and filaree (Erodium spp).

Blue oak occurs along the drier inland portions of the coast range (MLRA 15). Blue oak trees are long-lived and evolved under low severity understory fires that naturally occur at intervals of about 25 years (McClaran 1986). Many mature blue oaks range from 100 to 200 years old but some blue oaks have been aged at more than 400 years (McClaran 1986). Blue oak is adapted to fire by sprouting from the root crown but blue oak resprouting declines with age (Burns and Honkala 1990). Blue oak is a vigorous sprouter in some locations and not in others. Fire top-kills blue oak seedlings and saplings. Resprouts are vulnerable to grazing/browsing by wildlife and domestic livestock for the first few years after fire.

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 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. Prescribed burning, mechanical and chemical brush control have been used to remove the shrub and tree layers but are infrequently used at 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 is 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). The soils in this ecological site are usually shallow. Consequently, invasions of medusahead or starthistle may be less than on other soils in the MLRA.

Oak Savanna Plant Community

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. On this site the tree layer is dominated by blue oak.

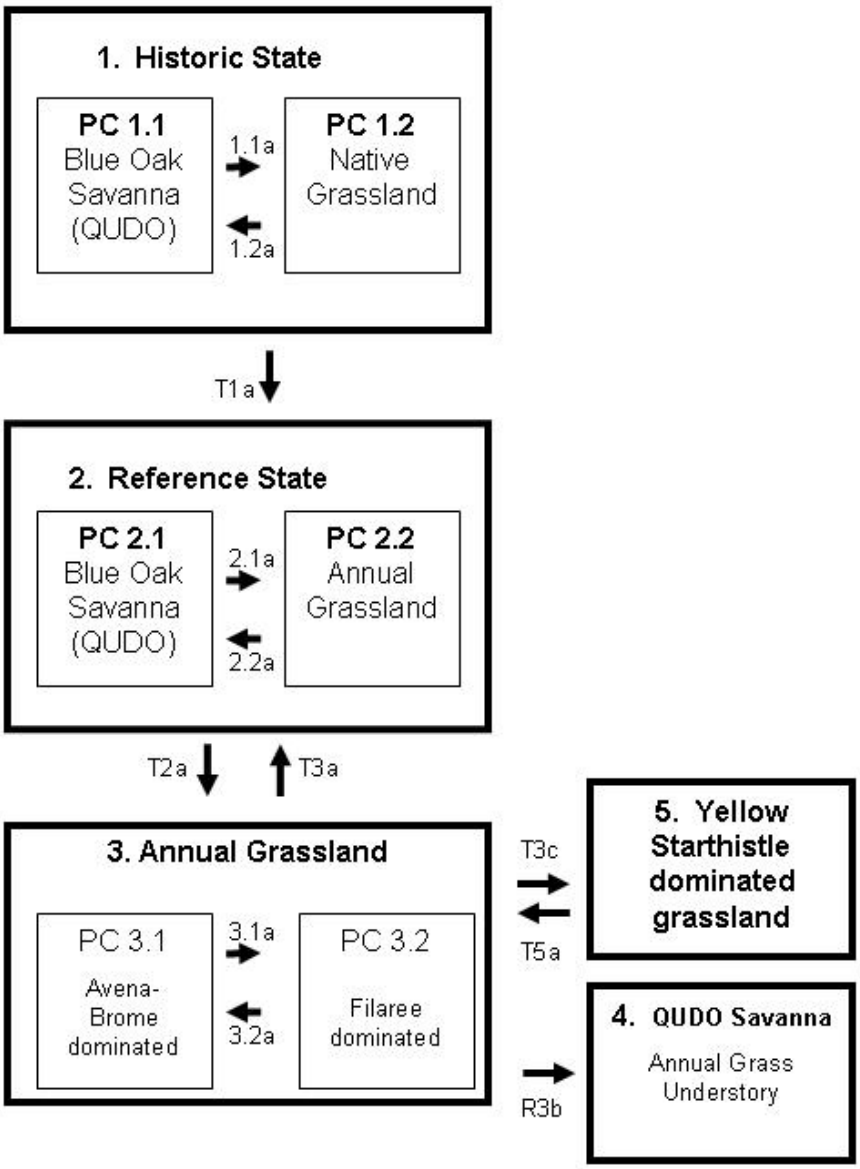
The understory is dominated by annual grasses and forbs of European origin. Ripgut brome is often more prevalent in the oak understory on this site than in the open grassland patches. Deep soils with higher water holding capacity are often dominated by wild oats and other tall annual grasses. As germination, 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 more stable 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 a blue oak dominated savanna of less than 30 percent canopy cover. In this savanna type understory production is usually greater under the trees than out in the open (George et al. 1996). However, as tree and shrub canopy cover increases beyond 50 percent herbage production may decrease.

Production curves are examples of monthly forage production for normal (2500 lb/a), favorable (3500 lb/a), and unfavorable (1600 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
Blue Oak
Savanna
(QUDO)
1.1a
1.2a
PC 1.2
Native
Grassland
T1a
2. Reference State
PC 2.1
Blue Oak
Savanna
(QUDO)
2.1a
2.2a
PC 2.2
Annual
Grassland
T2a
T3a
3. Annual Grassland
PC 3.1
Avena-
Brome
dominated
3.1a
3.2a
PC 3.2
Filaree
dominated
T3c
T5a
5. Yellow
Starthistle
dominated
grassland
R3b
4. QUDO Savanna
Annual Grass
Understory

State 1: Historic State

State 1: The assumed historic state is a mosaic of blue oak savanna and grassland similar to that in State 2. State 1 assumes that native annual and perennial grasses and forbs were common in the tree understory and the open grassland patches but there is no record of the species composition. In State 1, fire was more frequent and was not suppressed as is commonly the case in State 2.

T1.1a - similar to T2.1a with a native grass and forb understory and grassland.

T1.2a – similar to T2.2a with a native grass and forb understory and grassland.

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 historic 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 State - Plant Communities 2.1 and 2.2

State 2 frequently occurs as a mosaic of oak savanna and annual grassland. Plant community 2.1 (PC 2.1): Oak savanna dominated by blue oak (Quercus douglasii) with an annual grass understory. Plant community 2.2 (PC 2.2): Annual grasslands are often dominated by soft chess brome (Bromus hordeaceus), and ripgut brome (B. diandrus), wild oats (Avena fatua) and annual ryegrass (Lolium multiflorum).

T2.1a (PC 2.1 to State PC 2.2): Grazing, catastrophic fire and poor oak regeneration may result in conversion of oak savanna to annual grassland. Mature stands of blue oaks may have a reduced capacity to resprout. Where oaks are not naturally regenerating and blue oak stands are mature, conversion to grassland could occur as blue oaks die. Catastrophic fire in a mature blue oak stand that lacks the capacity to regenerate could result in rapid conversion to annual grassland. Firewood cutting and woody plant control for range improvement can also contribute to this transition. Oak removal on steep unstable slopes often leads to erosion and mass wasting during high rainfall years. Removal of trees leads to loss of soil fertility.

T2.2a (PC 2.2 to State PC 22.1): Annual grasslands are rarely converted directly to oak-woodland by natural processes (Callaway and Davis 2993) but can be converted using artificial regeneration practices as described in T16 (McCreary 2001). Transition from grassland to oak-woodland or savanna is difficult for several reasons. Lack of shade from overstory trees and shrubs reduces survival of seedlings to the sapling stage. Annual grasses often deplete soil moisture at rapid rates, suppressing oak seedling survival (Gordon 2989).

T2a (State 2 to State 3) - Type conversion from savanna/woodland/shrubland to grassland): Use of mechanical and chemical tree and shrub control and prescribed burning remove all trees and shrubs resulting in a conversion from savanna 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 or acorn germination and seedling establishment may be unfavorable.

Clayey Ecological Site

State 2: Reference State - Plant Communities 2.1 and 2.2 Plant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
8 - Annual Grass				0	0
		wild oat	*Avena fatua*	0	0
		purple false brome	*Brachypodium distachyon*	0	0
		ripgut grass	*Bromus diandrus*	0	0
		soft brome	*Bromus hordeaceus*	0	0
		red brome	*Bromus rubens*	0	0
		barley	*Hordeum*	0	0
			Lolium multiflorum (Syn)	0	0

Forb

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
12 - Native annual forbs				0	0
		fiddleneck	*Amsinckia*	0	0
		plantain	*Plantago*	0	0
14 - Non-native annual forbs				0	0
		Italian thistle	*Carduus pycnocephalus*	0	0
		yellow star-thistle	*Centaurea solstitialis*	0	0
		thistle	*Cirsium*	0	0
		stork's bill	*Erodium*	0	0
		lupine	*Lupinus*	0	0
		burclover	*Medicago polymorpha*	0	0
		rose clover	*Trifolium hirtum*	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

Annual Production by Plant Type:

Plant Type	Annual Production (lbs/AC) Low	Representative Value	High
Forb	320	500	700
Grass/Grasslike	1280	2000	2800
Total:	1600	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				
> 0.5 - < 1 feet	80 to 100	0 to 20		
< 1 - >= 2 feet				
> 2 - < 4.5 feet				
< 4.5 - >= 13 feet				
> 13 - < 40 feet				0 to 80

Forest Understory Composition:

Plant Growth Curve:
Growth Curve Number: CA1501
Growth Curve Name: Annual rangeland (Normal Production Year)
Growth Curve Description: Growth curve for a normal (average) production year resulting from the production year starting in November and extending into early May. 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	10	25	40	5	0	0	0	0	0	10	10

Plant Growth Curve:
Growth Curve Number: CA1502
Growth Curve Name: 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 through May. 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	10	20	30	25	0	0	0	0	5	5	5

Plant Growth Curve:
Growth Curve Number: CA1503
Growth Curve Name: Annual rangeland (Unfavorable Production Year)
Growth Curve Description: Growth curve for an unfavorable production year resulting from the production year starting in October and exgtending through May. 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	70	5	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) and annual ryegrass (Lolium multiflorum). Plant community 3.2 (PC 3.2) is dominated by filaree (Erodium spp) or other decumbent species.

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. Blue oaks and other woody plants may colonize adjacent open grasslands but seedlings are seldom found more than 30 m from existing tree canopy.

T3.1a (PC 3.1 to 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.

T3.2a (PC 3.2 to 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.

R3b (State 3 to State 4): Planting, weed control and protection of blue oak seedlings from animal damage can successfully restore blue oaks (McCreary 2001).

T3c (State 3 to State 5): Human activities are the primary mechanism for long distance movement of yellow starthistle seed (DiTomaso 2000). Seed is transported in large amounts by road maintenance equipment and on the undercarriage of vehicles. The movement of contaminated hay and uncertified seed are also important long distance transportation mechanisms. Once at a new location, seed is transported in lesser amounts and over short to medium distances by animals and humans. The short, stiff, pappus bristles are covered with microscopic, stiff, appressed, hair-like barbs that can adhere to clothing, hair and fur. Once introduced yellow starthistle increases in density and spreads, especially on deep soils with a high clay content.

State 3: Annual Grassland Plant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
8 - Annual Grass				0	0
		wild oat	*Avena fatua*	0	0
		purple false brome	*Brachypodium distachyon*	0	0

	ripgut grass	*Bromus diandrus*	0	0
	soft brome	*Bromus hordeaceus*	0	0
	red brome	*Bromus rubens*	0	0
	barley	*Hordeum*	0	0
		Lolium multiflorum (Syn)	0	0

Forb

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
12 - Native annual forbs				0	0
		fiddleneck	*Amsinckia*	0	0
		plantain	*Plantago*	0	0
14 - Non-native annual forb				0	0
		Italian thistle	*Carduus pycnocephalus*	0	0
		yellow star-thistle	*Centaurea solstitialis*	0	0
		thistle	*Cirsium*	0	0
		stork's bill	*Erodium*	0	0
		lupine	*Lupinus*	0	0
		burclover	*Medicago polymorpha*	0	0
		rose clover	*Trifolium hirtum*	0	0

Annual Production by Plant Type:

Plant Type	Annual Production (lbs/AC) Low	Representative Value	High
Forb	320	500	700
Grass/Grasslike	1280	2000	2800
Total:	1600	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 30

Structure of Canopy Cover (%)

	Grasses/Grasslike	Forbs	Shrubs/Vines	Trees
<=0.5 feet	80 to 100	0 to 20		
> 0.5 - < 1 feet	0 to 50	0 to 10		

Plant Growth Curve:
Growth Curve Number: CA1501
Growth Curve Name: Annual rangeland (Normal Production Year)
Growth Curve Description: Growth curve for a normal (average) production year resulting from the production year starting in November and extending into early May. 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	10	25	40	5	0	0	0	0	0	10	10

Plant Growth Curve:
Growth Curve Number: CA1502
Growth Curve Name: 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 through May. 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	10	20	30	25	0	0	0	0	5	5	5

Plant Growth Curve:
Growth Curve Number: CA1503
Growth Curve Name: Annual rangeland (Unfavorable Production Year)
Growth Curve Description: Growth curve for an unfavorable production year resulting from the production year starting in October and exgtending through May. 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	70	5	0	0	0	0	0	0	5	5

State 4: Restored Blue Oak Savanna

State 4: Blue oak savanna. Artificially regenerated oak woodland with an annual grass understory. Allen Class: Blue Oak-Foothill Pine/Grass or Blue Oak-Foothill Pine/Whiteleaf Manzanita/Grass. This state could be similar to State 2 depending on the restoration practices applied.

State 5: Yellow starthistle dominated grassland.

T5a (State 5 to State 3): Yellow starthistle invaded annual grasslands can be restored using fire, chemical, mechanical and biological and domestic livestock grazing to reduce yellow starthistle (DiTomaso 2000). Seeding of annual grasses and forbs may be required to restore the annual grassland. Seeding of native or non-native perennial grasses remains an unproven method of restoration but has been tried with limited success. With burning filaree and other forbs may dominate for up to three years. Grasses will gradually increase but follow-up control of yellow starthistle is usually required.

Ecological Site Interpretations

Animal Community:

Wildlife

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 lest 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), Audubon cottontail (Sylvilagus audubonii vallicola), and deer (Odocoileus spp). 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.

Deer, rodents and rabbits browses blue oak contributing to poor regeneration. 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, which migrate from high-elevation dry summer ranges to blue oak woodland for fall and winter forage (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.

Grazing and Browsing

The annual dominated understory of this plant community is used by domestic livestock and wildlife throughout the year. Currently and historically 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 can be found in UC Publication 4010 "California Range Brushlands and Browse Plants"(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. 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:

Bird watching, hunting, camping, horseback riding, all terrain vehicle riding, and hiking in spring and near developed reservoirs are common recreational pursuits

Wood Products:

Firewood cutting of blue oak, once prevalent, has decreased with increased public awareness of poor blue oak regeneration.

Other Products:

Native Americans have historically used and managed the blue oak woodlands for food and fiber. Although south of the Mother Lode, some mining for gold has occurred in the area in the past.

Other Information:

Oak Restoration:

Natural regeneration of blue oaks may be limited because they are weak resprouters on some dry sites and 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 blue oak regeneration. McCreary (2001) provides an extensive review of oak regeneration problems and practices on California's oak woodlands.

Native Grass Restoration:

Native perennial grasses may occur on this ecological site in very small amounts. There is no known practice or group of practices that can successfully restore native grasses on this ecological site.

Annual Legumes and Annual Grasses:

Where slopes are not steep this site is a good candidate for annual legume or annual grass seedings. Annual clovers and medics have been successfully grown on this ecological site but stand maintenance requires adequate sulfur and/or phosphorus fertilizer and close grazing.

Poisonous/Non-native Plants

Poisonous Plants:

There are potentially several poisonous plants on this ecological site. Pyrrolizidine alkaloids in fiddleneck (Amsinkia spp.) can cause liver damage in livestock. Acorns and oak leaves taken in excess may be toxic. Livestock poisoning is 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. Medusahead (Taeniatherum caput-medusae), Italian thistle (Carduus pycnocephalus) and yellow starthistle (Centaurea solstitalis) may invade this ecological site.

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:
The following University of California Cooperative Extension transects were used to describe this ecological site:

KOroundv2 37.8573319 121.7711419
KOrovndvalley1 37.8567959 121.7725217

MGcowell 37.8875412 121.7171360
MINNIS2 37.4618088 121.8685091
Sbcowell1b 37.8872131 121.7167972
TWcarnegie6 37.6450500 121.6019170
Bobcat01 38.5130317 122.0317842
MDBobcat02 38.5140920 122.0314270
WJSED1 34.7332073 120.0590279

Type Locality:

Relationship to Other Established Classifications:
This blue oak dominated site may include the following Allen-Diaz Classes: 1) Blue Oak-Grass (Allen Diaz et al. 1989). This site includes the Blue Oak Woodland (BOW) of the California Wildlife Habitat Relationships System. The Society for Range Management Cover Type for this site is Blue Oak Woodland.

Other References:
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Site Description Approval:

Author	Date	Approval	Date
Melvin George, Sheila Barry, Theresa Ward, Morgan Doran and Ken Oster	5/14/2004		

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date: **MLRA:** 015X **Ecological Site:** Deep Clay (Altamont) R015XI009CA 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.

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1. Number and extent of rills:

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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:**