Ecological Site Description

UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION

ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site Name: Clayey Hills

Quercus douglasii - Pinus sabiniana / *Arctostaphylos* / *Bromus - Avena fatua*
(blue oak - California foothill pine / manzanita / brome - wild oat)

Site ID: R015XI001CA

Major Land Resource Area: 015 - Central California Coast Range

Physiographic Features

This ecological site extends from Colusa County to Yolo County covering 117,966 acres of gently sloping to steep foothills of the Coast Ranges. Intermittent streams drain these sites following adequate rainfall. South facing slopes tend to dry sooner than north facing slopes.

Land Form: (1) Hill

	Minimum	Maximum
Elevation (feet):	100	2000
Slope (percent):	2	75
Water Table Depth (inches):	0	0
Flooding:		
Frequency:		
Duration:	None	None
Ponding:		
Depth (inches):		
Frequency:		
Duration:	None	None
Runoff Class:	Medium	High
Aspect:	North	

South

Climatic Features

The average annual precipitation ranges from 15 to 35 inches and increases with elevation. Most moisture falls as rain from October – May and is produced by winter storms that move into California from the Pacific Ocean in an easterly or southeasterly direction. Mean temperatures range from 46 F in January to 76 F in July. Freezing temperatures may occur in winter and summer temperatures can exceed 100 F.

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). Mean monthly precipitation is in the maximum precipitation row.

	Minimum	Maximum
Frost-free period (days):	200	340
Freeze-free period (days):	0	0
Mean annual precipitation (inches):	0.0	0.0

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.	4.67	3.75	3.25	1.33	0.25	0.25	0.25	0.25	0.33	1.33	3.25	3.67
Temp. Min.	36.0	39.0	42.0	45.0	50.0	56.0	58.0	57.0	54.0	48.0	41.0	36.0
Temp. Max.	55.0	61.0	65.0	72.0	81.0	89.0	94.0	94.0	89.0	79.0	64.0	56.0

Climate Stations:

Influencing Water Features

Intermittent streams feeding into permanent higher order streams drain these sites. Small springs are common.

Wetland Description: System Subsystem Class

Representative Soil Features

This site is characterized by clay or clay-loam soils weathered from sandstone and shale (Balcom, Dibble, and Millsholm) or calcareous residuum weathered from sedimentary rock (Sehorn). The depth to bedrock is about 20 to 40 inches. These soils are well drained. Available water holding capacity is low to moderate at about 4.5-7.0 inches. Elevation ranges from 100 to 2000 feet. In some places these parent materials occur as outcrops surrounded by the Altamont or Ayar Series.

CA011 215, 216, 218, 329, 331 Altamont-Sehorn complexes, Sehorn-Altamont complex, Sehorn-Millsholm complex, Sehorn-Millsholm-Rock Outcrop complex

CA011 270, 271 Balcom-Ayar complexes

CA113 SkD, SkE2, SkF2, SlD, SmD, SmE2. SmF2 Sehorn clay; Sehorn clay, eroded; Sehorn cobbly clay; Sehorn-Balcom complex; Sehorn-Balcom complexes, eroded

CA113 BaD3, BaE2, BaF2, BaG3, BdF2 Balcom silty clay loams, severely eroded; Balcom silty clay loams, eroded; Balcom-Dibble complex

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

Surface Texture: (1) Clay
(2) Clay loam

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: Moderate To Moderately rapid

	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):	4.5	7.0

Plant Communities

Ecological Dynamics of the Site

Ecological Dynamics

Before European settlement, the natural plant community for this ecological site is presumed to have been a blue oak (Quercus douglasii) savanna with patches of manzanita (Arctostaphylos manzanita) and grassland intermixed. 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; however, density of shrubs and foothill pine (Pinus sabiniana) may be different due to fire suppression and 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. This blue oak savanna includes foothill pine and patches of manzanita or possibly other shrubs intermixed with annual grassland. The grasslands and understory are dominated by annual grasses and forbs. Other woody species that can be found throughout this ecological site include; wedgeleaf ceanothus (Ceanothus cuneatus) and poison oak (Toxicodendron diversiloba). Understory species and grassland patches are frequently dominated by soft chess brome (Bromus hordeaceus), ripgut brome (Bromus diandrus), annual ryegrass (Lolium multiflorum), and rose clover (Trifolium hirtum). Filaree (Erodium spp) may occur on shallow soils or following close grazing or fire.

Competition between 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. South slopes tend to be grasslands mixed with an open savanna while the blue oak savanna is usually

denser on the north slopes. Frequent fire tends to result in vegetation states dominated by an oak-annual grass community. Protection from fire and grazing results in a gradual increase in shrubs and foothill pine (Pinus sabiniana) contributing to increased fuel loads. If the shrub canopy reaches into the tree canopy the potential for crown fires increases. Protection from browsing reduces hedging allowing the oak canopy to reach the ground layer increasing the chances for ground fires to become crown fires. Crown fires can top-kill oak trees. Grazing and browsing may slow recovery of woody plants following fire (Johnson and Fitzhugh 1990).

Blue oak and foothill pine occur 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. Protection from fire has decreased fire frequency allowing shrubs to extend into the oak canopy providing a ladder for fire. Resprouts are vulnerable to grazing/browsing by wildlife and domestic livestock for the first few years after fire. Foothill pine is increasing in blue oak-foothill pine communities due to fire suppression and lack of blue oak regeneration (Borchart et al. 1991).

The shrub layer is dominated by Manzanita (Manzanita spp) but other species may occur on this ecological site such as wedgeleaf ceanothus (Ceanothus cuneatus) and poison oak (Toxicodendron diversiloba). Following fire some of these shrubs resprout from the roots and crown and others are stimulated to germinate by fire. Ceanothus and manzanita are prolific seed producers. 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 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). Due to the clayey nature of the soils on this ecological site invasion of medusahead and yellow starthistle are probable. Some experts have suggested that medusahead and other invasive species may gradually adapt to new sites (Rice et al 2006).

Oak Woodland 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.

The tree layer is dominated by blue oak and foothill pine. The shrub layer, when present, is dominated by manzanita. At the lower elevations this site tends to be an oak savanna. With increasing elevation and slope the tree and shrub density increases.

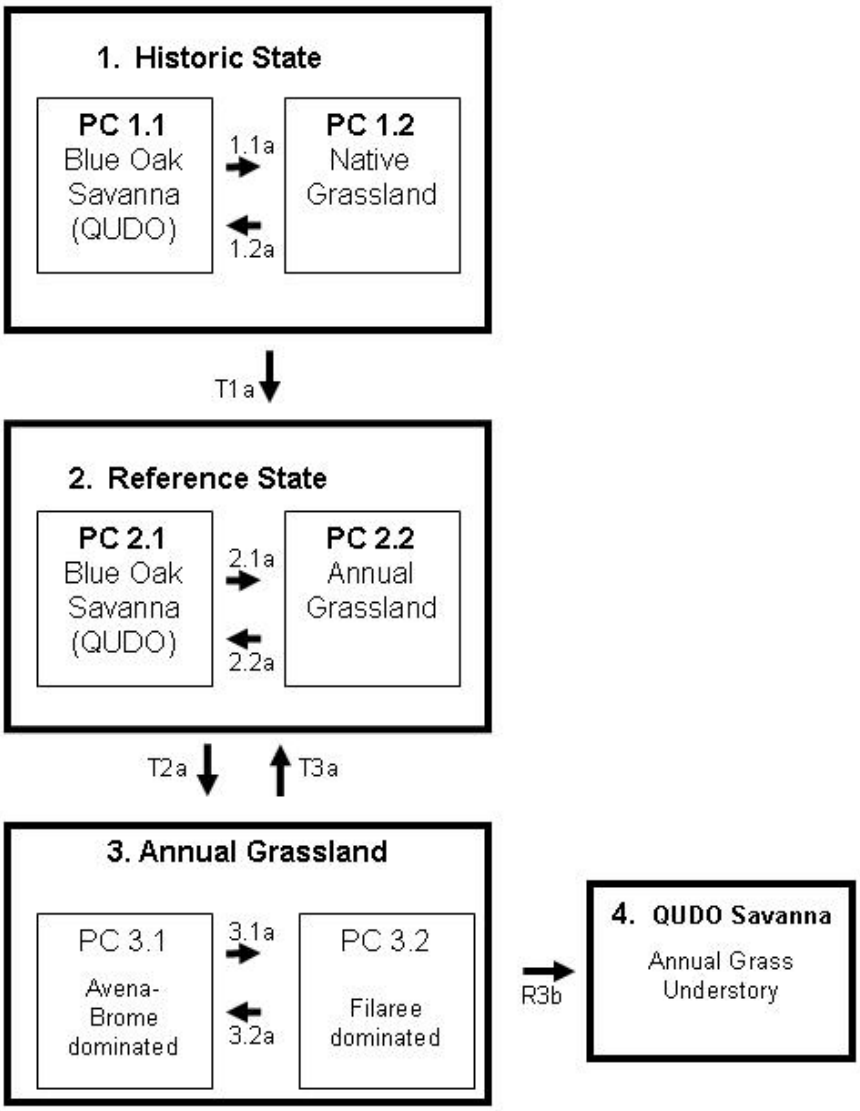
The understory is dominated by annual grasses and forbs of European origin. Ripgut brome is often more prevalent in the oak understory on this site than in the open grassland patches. Deep soils with higher water holding capacity are often dominated by wild oats and other tall annual grasses. As germination, 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 (2000 lb/a), favorable (2500 lb/a), and unfavorable (1300 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.

The Altamont, Ayar, Millsholm & Dibble series make up a portion of this site. Altamont productivity is the same as Sehorn (2000); Millsholm is lower with favorable, normal & unfavorable productivities of 1000, 800 & 400 lbs/a respectively; Ayar is higher, with productivities of 3500, 2500 & 1400; and Dibble is also higher, with productivities of 3900, 2900 & 1800 lbs/a.



Clayey Hills State and Transition Model

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. There is a tendency for the blue oaks to be denser on north facing slopes while the south slopes are grassland and savanna with lower blue oak densities. 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. Under a more frequent fire regime, the shrub community may have been reduced compared to State 2. Additionally, foothill pine was probably less prevalent in State 1.

Transitions: Protection from fire and grazing tends to support transition from grassland to shrubland or woodland. Grazing tends to slow these transitions. Fire tends to eliminate or mask vegetation patterns associated with topography.

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, 2.2 and 2.3

State 2: The reference state is a mosaic of blue oak savanna and annual grassland. There is a tendency for the blue oaks to be denser on north facing slopes. Less dense blue oak savanna and grassland are mixed on south facing slopes. 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 lightning as well, however the timing and frequency of the fire has probably changed from State 1 to State 2. Allen Class: Blue Oak-Foothill Pine/Grass or Blue Oak-Foothill Pine/Whiteleaf Manzanita/Grass

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-woodland 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 R3b (McCreary 2001). Transition from grassland to oak-woodland 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 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 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 or acorn germination and seedling establishment may be unfavorable.

Clayey Hills Ecological Site

State 2: Reference State - Plant communities 2.1, 2.2 and 2.3 Plant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
8 - Non-native cool season 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
			Lolium multiflorum (Syn)	0	0

Forb

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
12 - Native annual forb				0	0
		American wild carrot	*Daucus pusillus*	0	0

14 - Non-native annual forb			0	0
	smooth catsear	*Hypochaeris glabra*	0	0
	rose clover	*Trifolium hirtum*	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
23 - Native coniferous tree				0	0
		California foothill pine	*Pinus sabiniana*	0	0
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	200	400	500
Grass/Grasslike	800	1600	2000
Total:	1000	2000	2500

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			
< 1 - >= 2 feet				
> 2 - < 4.5 feet				
< 4.5 - >= 13 feet			0 to 10	
> 13 - < 40 feet				0 to 50

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

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 chess 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).

State 3: Annual Grassland State Plant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
8	Non-native cool season 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
		Lolium multiflorum (Syn)	0	0

Forb

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
12	Native annual forb			0	0
		American wild carrot	*Daucus pusillus*	0	0
14	Non-native annual forb			0	0
		smooth catsear	*Hypochaeris glabra*	0	0
		rose clover	*Trifolium hirtum*	0	0

Annual Production by Plant Type:

Plant Type	Annual Production (lbs/AC) Low	Representative Value	High
Forb	200	400	500
Grass/Grasslike	800	1600	2000
Total:	1000	2000	2500

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										

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: 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

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). 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 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. 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:
Revegetation/Restoration of Disturbed Areas

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:

Most of 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 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) 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
CLAYEY	R015XD001CA	
STEEP CLAYEY	R015XD010CA	
Fine Loamy 9-13" p.z.	R015XE020CA	
STEEP CLAYEY SLOPES	R015XD138CA	

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

Inventory Data References:
CTcolusaBVR.10 39.1188889 122.4488889
CTcolusaBVR.11 39.1186111 122.4508333
CTcolusaBVR.12 39.1166667 122.4490389
CTcolusaBVR.13 39.0598778 122.3985500
CTcolusaBVR.14 39.0546917 122.4008000
CTcolusaER.6 39.0102000 122.3447083

Type Locality:

Relationship to Other Established Classifications:
This blue oak dominated site may include the following Allen-Diaz Classes: 1) Blue Oak-Foothill Pine/Grass or 2)Blue Oak-Foothill Pine/Whiteleaf Manzanita/Grass (Allen Diaz et al. 1989). This site includes Blue Oak Woodland (BOW) and Blue Oak-Foothill Pine (BOP) of the California Wildlife Habitat Relationships System. The Society for Range Management Cover Type for this site is Blue Oak Woodland.

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Site Description Approval:

Author	Date	Approval	Date
Melvin George, Morgan Doran, and Craig Schriefer	5/16/2004		

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date: **MLRA:** 015X **Ecological Site:** Clayey Hills R015XI001CA 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:**