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

Quercus douglasii - Quercus wislizeni / *Cercocarpus betuloides - Toxicodendron diversilobum* / *Bromus diandrus - Avena fatua*
(blue oak - interior live oak / - Pacific poison oak / ripgut grass - wild oat)

Site ID: R018XI004CA

Major Land Resource Area: 018 - Sierra Nevada Foothills

Physiographic Features

This ecological site extends from Mariposa County to Tulare County covering 555,635 acres of gently sloping to steep foothills of the Sierra Nevada foothills. 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):	800	2400
Slope (percent):	0	50
Water Table Depth (inches):		
Flooding:		
Frequency:		
Duration:	None	None
Ponding:		
Depth (inches):		
Frequency:		
Duration:	None	None

Runoff Class:	Medium	High
Aspect:	No Influence on this site	

Climatic Features

The average annual precipitation ranges from 15 to 30 inches and increases with elevation. Most moisture falls as rain during from October – May and is produced by winter storm that move into California from the Pacific Ocean in an easterly or southeasterly direction. Mean temperatures range from 46 F in January to 79 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 reported in the maximum precipitation row of the table below.

	Minimum	Maximum
Frost-free period (days):	180	220
Freeze-free period (days):	0	0
Mean annual precipitation (inches):	15.0	30.0

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.	4.5	4.0	4.0	2.25	0.75	0.25	0.25	0.25	0.5	1.0	3.0	3.5
Temp. Min.	35.0	37.0	40.0	43.0	49.0	56.0	63.0	62.0	57.0	49.0	39.0	34.0
Temp. Max.	57.0	60.0	63.0	70.0	79.0	88.0	95.0	94.0	88.0	78.0	64.0	57.0

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 loamy soils developed from hard mica schist. This site includes soil mapping units in the Coarsegold, San Andreas and Trabuco Series. The depth to bedrock is about 20 to 40 inches. These soils are well drained. Available water holding capacity is low at about 5 inches. Elevation ranges from 800 to 2400 feet. In some places these parent materials occur as outcrops surrounded by the Ahwahnee Series.

Madera County (CA651)

CA651 ChD, ChF, CkD, CkF Coarsegold loam
CA651 The, Tkc, TkF Trabuco clay loam
Eastern Fresno (CA654)

CA654 CxC,CxD,CxE,CxF,CyF Coarsegold fine sandy loam

CA654 ToC,ToD,ToE,ToF,TpE,TpF Trabuco loam

Mariposa (CA649)

CA649 SaD, SaE, SaF, SbE San Andreas-Coarsegold complex
CA649 TaD2, TaE2, TbF2, Trabuco clay loam

Tulare County (CA660)

CA660 118, 119, 120 Coarsegold loam
CA649 161, 162, 163 Trabuco loam

Stanislaus NF (CA731)

CA731 TbFma Trabuco very rocky clay loam

Sierra NF (Ca750)

CA 750 29, 213 127, 128 Coarsegold-Auberry Family Association
CA731 ToCef Trabuco loam

Predominant Parent Materials:
Kind: Residuum
Origin: Mica schist

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: 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):	5.5	5.5

Plant Communities

Ecological Dynamics of the Site

Before European settlement, the natural plant community for this ecological site ranged from a blue oak (Quercus douglasii) savanna to a woodland with little or no shrub layer. The understory of this site was dominated by native annual and perennial grasses and forbs. On this site the savanna or woodland is frequently intermixed in a mosaic with open grasslands. 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.

The reference state for this ecological site ranges from a blue oak savanna at lower elevations to a blue oak-interior live oak-foothill pine woodland. A shrub layer of birchleaf mountain mahogany (Cercocarpus betuloides) and poison oak (Toxicodendron diversilobum) may occur on north facing slopes. Wedgeleaf ceanothus (Ceanothus cuneatus) is occasionally present. The understory is dominated by annual grasses and forbs. Annual grass patches (non woody) are interspersed in a mosaic with the savanna and woodland patches. Other woody species that may be found throughout this ecological site include; California buckeye and California ash. Understory species and grassland patches are dominated by soft chess brome (Bromus hordeaceus), ripgut brome (Bromus diandrus), annual fescue (Vulpia myuros), filaree (Erodium spp), and tarweed (Hemizonia spp).

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. Shrub canopy tends to occur on north and east aspects. 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 oak-annual grass community. Protection from fire and grazing results in a gradual increase in shrubs and foothill pine contributing to increased fuel loads. As 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. While interior live oak (Q. wislizeni) will resprout vigorously, blue oak may not resprout in some locations resulting in a post fire interior live oak dominated site. Grazing and browsing may slow recovery of woody plants following fire (Johnson and Fitzhugh 1990).

Blue oak and interior live oak trees are long-lived species that 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. Trunks and crowns of interior live oak are extremely sensitive to fire. However, it is a strong resprouting species that will usually survive even when the above ground vegetation is consumed by fire. Young trees are vulnerable to fire. Trunks of mature trees may receive minor damage from cool grass fires but are severely damaged by hotter fires. Frequent burning may kill interior live oaks. 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 (Pinus sabiniana) is increasing in blue oak-foothill pine communities due to fire suppression and lack of blue oak regeneration (Borchart et al. 1991). California ash may be present on north slopes. Mountain mahogany is the dominant shrub occurring on wetter north slopes. Poison oak may also be present. Both shrubs resprout from basal buds following fire.

The historic herbaceous understory layer of the plant community is not known, having been replaced by annual grasses and forbs of European origin during the colonization 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 managed by the Native American population to provide food and fiber (Blackburn and Anderson 1993). Prior to European settlement in the mid-1800s 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 is 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).

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 may include interior live oak, Foothill pine, California buckeye (Aesculus californica) and California ash (Fraxinus dipetala). Mountain mahogany (Cercocarpus betuloides) is the main shrub but is not always present. Poison oak (Toxicodendron diversilobum) and wedgeleaf ceanothus may also be present in small amounts. Both shrubs tend to occur on wetter north facing slopes. At the lower elevations this site tends to be an oak savanna. With increasing elevation and slope the interior live oak and shrub component 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. Patches on shallow soils are often dominated by filaree or other low growing forbs. Deep soils with higher water holding capacity are often dominated by wild oats and other tall annual grasses. The native forb, tarweed, occurs in patches and is more dense in years with late spring rains.

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.

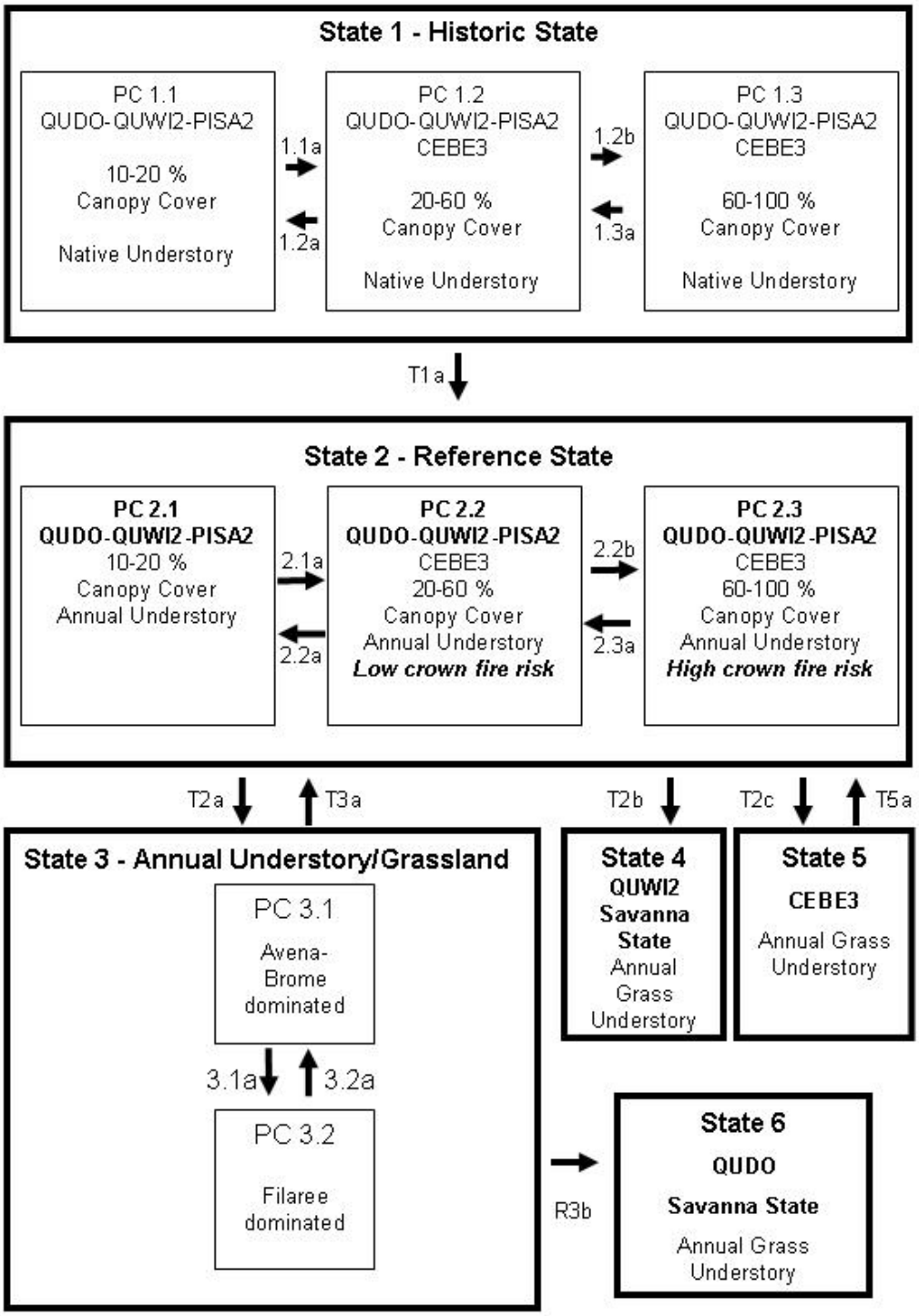
Total Annual Production and Growth Curve

Understory and open grassland production on this site is lower than more northerly ecological sites because average annual precipitation is lower and the growing season is often shorter. 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. Annual forage production for normal, favorable and unfavorable years is 2000-2400 lb/a, 3000-3500 lb/a, and 1000-1200 lb/a years, respectively.

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 (3000 lb/a), and unfavorable (1000 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 San Andreas makes up a small portion of this site and has a higher productivity than the other soils with a favorable, normal and unfavorable productivities of 5000, 4300, 3650 lb/a respectively.



Loamy State and Transition Model

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 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. Additionally, foothill pine was probably less prevalent in State 1.

T1.1a (PC 1.1 to PC1.2): Under natural fire frequencies shrub and tree canopy cover increases toward State PC 1.2 following fire.

T1.2a (PC 1.2 to PC 1.1): Natural fire frequencies estimated to be 25 years maintains an oak savanna with few shrubs and a herbaceous understory.

T1.2b (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.

T1.3a (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

State 2: Reference State - 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 in 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 savanna community (Allen Class: Blue Oak-Interior Live Oak/Grass) of 10 to 20 percent canopy cover of blue oak and interior live oak with an annual grass dominated understory and few or no shrubs. Blue oaks are fire resistant and evolved under low-severity grassland fires. Interior live oak is sensitive to fire but resprouts vigorously following most fires. Foothill pine is sensitive to moderate or intense fires but its overall cover is increasing throughout the site more than likely due to fire suppression. Ceanothus species and many manzanitas have seeds that require fire to germinate; therefore these species may dominate immediately following a fire.

Plant community 2.2 (PC 2.2) ranges from 20 – 60 percent canopy cover resulting from an increase in mountain mahogany and poison oak, foothill pine and increased oak canopy (Allen Class: Blue Oak/Wedgeleaf Ceanothus-Mountain Mahogany).

Plant community 2.3 (PC 2.3) is a woodland community(Allen Class: Blue Oak/Wedgeleaf Ceanothus-Mountain Mahogany)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 often prevalent under the oak canopy and soft brome and filaree more common in the open patches.

T2.1a (PC 2.1 to PC 2.2): Under natural fire frequencies shrub and tree canopy cover increases toward PC 1B following fire.

T2.2a (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.

T2.2b (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.

T2.3a (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 blue oaks and they do not resprout due to old age (Burns and Honkala 1990) or site conditions (DeLasaux and Pillsbury 1987, Haggerty 1991). Interior live oaks are top killed but resprout vigorously. With fire protection shrubs gradually increase producing a state similar to State 2 but without blue oak.

Loamy Ecological Site

State 2: Reference State - 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
8 - Non-native Annual Grass				0	0
		wild oat	*Avena fatua*	0	0
		ripgut grass	*Bromus diandrus*	0	0
		soft brome	*Bromus hordeaceus*	0	0
		fescue	*Vulpia*	0	0

Forb

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
12 - Native annual forb				0	0
		tarweed	*Hemizonia*	0	0
14 - Non-native Annual Forb				0	0
		stork's bill	*Erodium*	0	0

Shrub/Vine

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
17 - Native Shrub				0	0
			Cercocarpus betuloides (Syn)	0	0
		Pacific poison oak	*Toxicodendron diversilobum*	0	0

Tree

Annual Production in Pounds Per Acre

Group	Group Name	Common Name	Scientific Name	Low	High
23 - Native coniferous tree				0	0
		California foothill pine	*Pinus sabiniana*	0	0
24 - Native deciduous tree				0	0
		California buckeye	*Aesculus californica*	0	0
		California ash	*Fraxinus dipetala*	0	0
		blue oak	*Quercus douglasii*	0	0
25 - Native non-deciduous tree				0	0
		interior live oak	*Quercus wislizeni*	0	0

Annual Production by Plant Type:

	Annual Production (lbs/AC)		
Plant Type	Low	Representative Value	High
Forb	200	400	600
Grass/Grasslike	800	1600	2400
Total:	1000	2000	3000

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			0 to 50	
> 13 - < 40 feet				0 to 60

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). 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.

R3b (State 3 to State 6): Planting, weed control and protection of blue oak seedlings from animal damage can successfully restore blue oaks (McCreary 2001).

T3.1a (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.

T3.2a (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.

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	Non-native cool season annual grass			0	0
		wild oat	*Avena fatua*	0	0
		ripgut grass	*Bromus diandrus*	0	0
		soft brome	*Bromus hordeaceus*	0	0
		fescue	*Vulpia*	0	0

Forb

Annual Production in Pounds Per Acre

Group	Group Name	Common Name	Scientific Name	Low	High
12 - Native forbs				0	0
		tarweed	*Hemizonia*	0	0
14 - Non-native annual forb				0	0
		stork's bill	*Erodium*	0	0

Annual Production by Plant Type:

	Annual Production (lbs/AC)		
Plant Type	Low	Representative Value	High
Forb	200	400	600
Grass/Grasslike	800	1600	2400
Total:	1000	2000	3000

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: 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: Interior Live Oak Savanna

State 4: Live oak savanna. Live Oak dominated savanna. Allen Class: Live Oak/Grass

State 5: Cercocarpus betuloides

State 5: Cercocarpus Betuloides

T5a (State 5 to 2): On deeper soils with better moisture holding capacity interior live oak and/or blue oak regenerate from acorns that germinate under canopy of shrubs (Callaway and D'Antonio 1991, Muick 1997). This is a slow successional process.

State 6: Restored Blue Oak Savanna

State 6: Artificially revegetated blue oak woodland with an annual grass understory. This state is similar to State 2 without interior live oak and shrubs. Interior live oak and shrubs may naturally reestablish over a period of several decades. Allen Class: Blue Oak/Grass or Blue Oak-Understory Blue Oak/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). 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 are reported in Sampson and Jespersen (1963).

Plant Preference by Animal Kind:

Hydrology Functions:

The watersheds associated with these sites are predominantly drained by intermittent streams that only flow during the wet season. These intermittent streams feed into higher order permanent streams. It takes several inches of rainfall to saturate the watershed and cause intermittent streams to flow. Consequently, streamflow may not begin until January. In dry years these intermittent streams may not flow at all (George et al. 2002, 2004). Most of this site is steep resulting in moderate to rapid runoff.

Recreational Uses:

Bird watching, hunting, camping, horseback riding, all terrain vehicle riding, and hiking in spring and near developed reservoirs are common recreational pursuits. Stock ponds containing warm water fishes are used for recreational purposes.

Wood Products:

Firewood cutting of blue oak, once prevalent, has decreased with increased public awareness of poor blue oak regeneration. Cutting of interior live oak for fire wood is common.

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 past. Copper mines and quarries for granite and gravel currently operate on this site or have operated in the recent past.

Other Information:

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. Mexican whorled milkweed contains several glucosidic substances called cardenolides that are toxic to range animals. Klamath weed may occur on this site. Acorns and oak leaves taken

in excess may be toxic. Oleander, an ornamental frequently used in foothill landscapes is very toxic to humans and animals and should be kept away from pasture fence lines. Livestock poisoning is a result of hungry animals being concentrated on toxic plants.

Invasive Species:

The understory 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. Because of the poor water holding capacity of this site, it has not been subject to invasions by medusahead and yellow starthistle that have occurred on other ecological sites. However, limited invasions of medusahead have occurred on this sites in since the 1980s. Bull thistle and Italian thistle may also invade this 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:
NMmadera0510 37.3005000 119.7046944
DWtulare0518A 36.0040167 118.7802167
DWtulare0518B 36.0030667 118.7805167
NMmadera0510 37.1126667 119.6410556
NMmadera0510 37.1547222 119.5493056
NMmadera0510 37.1545833 119.5486389
DWtulare0528 36.0081833 118.7671333
NMmadera0510 37.1952222 119.5917500
NMmadera0510 37.1943333 119.5851111

Type Locality:

Relationship to Other Established Classifications:
This blue oak dominated site may include the following Allen-Diaz Classes: 1) Blue Oak-Interior Live Oak/Grass, 2) Blue Oak /Wedgeleaf Ceanothus-Mountain Mahogany, 3) Blue Oak/Grass or 4) Blue Oak-Understory Blue Oak/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, Neil McDougald, and Dennis Dudley	5/14/2004		

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date: **MLRA:** 018X **Ecological Site:** Loamy R018XI004CA 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:**

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: