Ecological Site Description

UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION

ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site Name: Sandy Loam

Quercus douglasii - Quercus wislizeni / / *Bromus - Avena fatua*
(blue oak - interior live oak / / brome - wild oat)

Site ID: R018XI006CA

Major Land Resource Area: 018 - Sierra Nevada Foothills

Physiographic Features

This ecological site extends from Mariposa County to Tulare County covering more than 150,000 acres of gently sloping to steep foothills along the west slope of the Sierra Nevada Mountains. 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):	120	3500
Slope (percent):	0	50
Water Table Depth (inches):		
Flooding:		
Frequency:		
Duration:	None	None
Ponding:		
Depth (inches):		
Frequency:		
Duration:	None	None
Runoff Class:	Low	Medium
Aspect:	No Influence on this site	

Climatic Features

The average annual precipitation ranges from 9 to 25 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 77 F in July. Freezing temperatures may occur in winter and summer temperatures can exceed 100 F. Mean monthly precipitation is reported in the maximum precipitation row of the table below.

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).

	Minimum	Maximum
Frost-free period (days):	150	300
Freeze-free period (days):	0	0
Mean annual precipitation (inches):	15.0	50.0

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.	3.5	3.25	3.0	2.0	0.75	0.25	0.25	0.25	0.25	0.75	2.25	3.0
Temp. Min.	34.0	37.0	39.0	42.0	48.0	54.0	60.0	60.0	55.0	47.0	38.0	33.0
Temp. Max.	58.0	60.0	63.0	70.0	78.0	87.0	94.0	93.0	87.0	77.0	64.0	58.0

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

The soils for this ecological site formed on weathered intrusive and metamorphosed basic igneous rocks (Blasingame sandy loam) and residuum weathered from gabro (Las Posas loam). Soil depth is less than two feet to 3 1/2 feet deep with a low water holding capacity (about 4.5 inches). These soils are well drained and occur at 400 to 4500 feet elevation.

Eastern Fresno (CA654)

CA654 106tc, BcC, BcD,BcE, BcF, BdF,BgD,BgF, BkF,BlD,BlE,BmE Blasingame loam

Mariposa County (CA649)

CA649 BdD, BdE, BeD, BeF, BfG, BgD, BgE, BkE2, BlD, BlF, BmG2, Blasingame loam
CA649 LbE,LcF, Los Posas rocky clay loam

Tulare County (CA660)

CA660 105, 106, 107, 108 Blasingame sandy loam

Stanislaus NF (CA731)

CA731 BdDma, BdEma, BeFma Blasingame loam

Sierra NF (CA750)

CA750 BcFef, BgFef, Blasingame loam
CA750 BmGma Blasingame-Las Posas extremely rocky loams

Predominant Parent Materials:
Kind: Residuum
Origin: Schist

Surface Texture: (1) Very gravelly 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

Permeability Class: Moderate

	Minimum	Maximum
Depth (inches):	10	28
Electrical Conductivity (mmhos/cm):		
Sodium Absorption Ratio:		
Calcium Carbonate Equivalent (percent):	0	0
Soil Reaction (1:1 Water):		
Soil Reaction (0.01M CaCl2):		
Available Water Capacity (inches):	2.7	8.6

Plant Communities

Ecological Dynamics of the Site

The historic state for this ecological site is a blue oak (Quercus douglasii) dominated savanna with little or no shrub layer. Before European settlement the understory of this site was dominated by native annual and perennial grasses and forbs. At lower elevations it may have been a grassland with few trees. The reference state for this ecological site is similar to its pre-European state but the native understory has largely been replaced by annual grasses and forbs of European origin. Understory species are dominated by soft chess brome (Bromus hordeaceus), ripgut brome (Bromus diandrus), annual fescue (Vulpia myuros), filaree (Erodium spp), popcorn flower (Plagiobothyrus novofulvus), fiddleneck (Amsinkia spp) and tarweed (Hemizonia spp). Other woody species that can be found in the upper elevations of this site are interior live oak (Q. wislizenii) and California buckeye (Aesculus californica). Frequent fire in the past may have removed the shrub layer from this ecological site or it may be naturally devoid of shrubs. While interior live oak 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. Resprouts are vulnerable to grazing/browsing by wildlife and domestic livestock for the first few years after 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 layer remains 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 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 in this oak savanna is dominated by blue oak. Interior live oak and California buckeye may be present in small amounts. There is no shrub layer.

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.

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

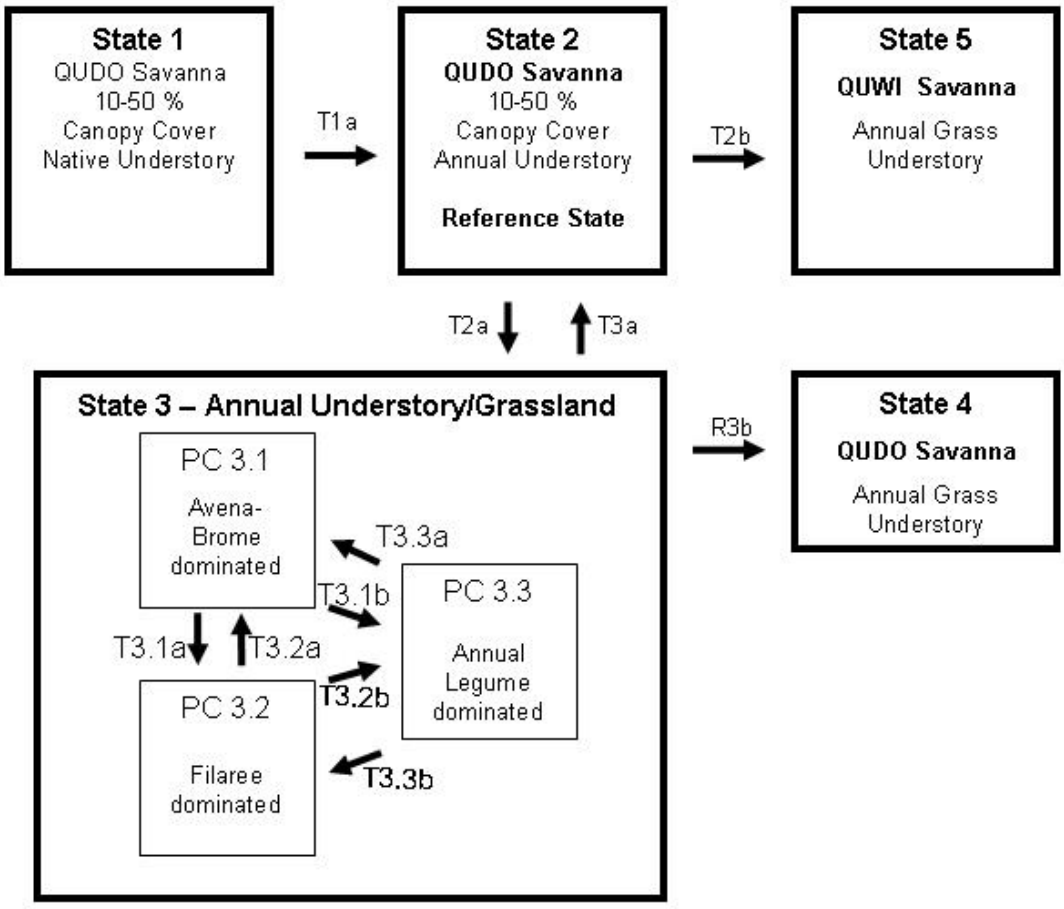
not stable and annually predictable. Therefore, exact percentages by weight or ground cover are not reported as is done in perennial dominated ecosystems. Instead several species are listed, several of which

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. Annual forage production for normal, favorable and unfavorable years is 1800 lb/a, 2500 lb/a, and 1300 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 canopy cover increases beyond 50 percent herbage production may decrease.

Production curves are examples of monthly forage production for normal (1800 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.


State 1
QUDO Savanna
10-50 %
Canopy Cover
Native Understory
T1a
State 2
QUDO Savanna
10-50 %
Canopy Cover
Annual Understory
Reference State
T2b
State 5
QUWI Savanna
Annual Grass
Understory
T2a
T3a
State 3 – Annual Understory/Grassland
PC 3.1
Avena-
Brome
dominated
T3.3a
T3.1b
PC 3.3
Annual
Legume
dominated
T3.1a
T3.2a
T3.2b
PC 3.2
Filaree
dominated
T3.3b
R3b
State 4
QUDO Savanna
Annual Grass
Understory

State 1: Historic State

State 1: This is the assumed historic 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.

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

State 2: Reference State

State 2: This reference community is a blue oak savanna (10 – 50 % canopy cover). Blue oaks are commonly scattered at densities less than 20 percent canopy cover but may occasionally occur as dense patches at higher elevations. At lower elevations this ecological site may be an annual grassland with few scattered blue oaks. Interior live oak and California buckeye may occur in the tree layer, especially at higher elevations. 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. Understory is generally dominated by annual grasses and forbs of Eurasian origin. Allen Class: Blue Oak /grass.

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 5): 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.

Sandy Loam Ecological Site

State 2: Reference State Plant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
2 - Native cool season perennial grass				0	0
		California brome	*Bromus carinatus*	0	0
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
		barley	*Hordeum*	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
		fiddleneck	*Amsinckia*	0	0
		tarweed	*Hemizonia*	0	0
		California licorice-root	*Ligusticum californicum*	0	0
		rusty popcornflower	*Plagiobothrys nothofulvus*	0	0
14 - Non-native annual forb				0	0
		stork's bill	*Erodium*	0	0

Annual Production

Tree

Group	Group Name	Common Name	Scientific Name	in Pounds Per Acre Low	High
24 - Native deciduous tree				0	0
		California buckeye	*Aesculus californica*	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:

Plant Type	Annual Production (lbs/AC) 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 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 3: Annual Grassland

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

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.

T3.1b (PC 3.1 to 3.3): Sulfur and/or phosphorus fertilization are required to maintain productive subterranean clover stands. Rose clover increases and spreads without fertilization. Close grazing helps to maintain legume composition.

T3.2b (PC 3.2 to 3.3): Sulfur and/or phosphorus fertilization are required to maintain productive subterranean clover stands. Rose clover increases and spreads without fertilization. Close grazing helps to maintain legume composition.

T3.3a (PC 3.3 to PC 3.1): Grasses increase with improved soil fertility and light grazing

T3.3b (PC 3.3 to PC 3.2): With loss of fertility and close grazing annual legumes are replaced by filaree.

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

State 3: Annual Grassland Plant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
2 - Native cool season perennial grass				0	0
		California brome	*Bromus carinatus*	0	0
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
		barley	*Hordeum*	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
		fiddleneck	*Amsinckia*	0	0
		tarweed	*Hemizonia*	0	0
		California licorice-root	*Ligusticum californicum*	0	0
		rusty popcornflower	*Plagiobothrys nothofulvus*	0	0
14 - Non-native annual forb				0	0
		stork's bill	*Erodium*	0	0

Annual Production by Plant Type:

Plant Type	Annual Production (lbs/AC) 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

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: Blue oak savanna

State 4: 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.

State 5: Interior live oak savanna

State 5: Live oak savanna. Live Oak dominated savanna. Allen Class: Live 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 can be found 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).

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. 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.

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. Interior live oak regeneration is generally not a problem because it is a strong resprouter. McCreary (2001) provides an extensive review of oak regeneration problems and practices on California's oak woodlands.

Native Grass Restoration:

The soils on sandy loam range sites generally have insufficient depth and water holding capacity to be good candidates for native grass restoration. Perennial grasses native to this site tend to be sensitive to grazing, further reducing the potential for restoration.

Annual Legumes and Annual Grasses:

Seeding of annual legumes(annual medics, rose clover and subterranean clover) can improve forage production and quality if accompanied by fertilizer application. These soils may be sulfur and/or phosphorus deficient. Legume seedings are very responsive to addition of S and/or P fertilizer. Non-legumes respond to application of nitrogen with sulfur and/or P. The high cost of seeding and fertilization has reduced the use of these practices.

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. Yellow starthistle (Centaurea solstitialis) is poisonous to horses. Acorns and oak leaves taken in excess may be toxic. Milkweed (Asclepias fasicularis), Klamath weed (Hypericum perforatum), and common grounsel (Senecio vulgaris) are known to be present on this ecological site. Livestock poisoning is often 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 in the area 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:

NMAckersRanch 36.0040167 118.7802167
DWtule108.1 36.0412167 118.8032167
VerSteeg1 35.8908333 118.7011111
VerSteeg2 35.8800000 118.6952778
DWtule108.2 36.0187667 118.7630333

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/Grass, 3) Blue Oak-Understory Blue Oak/Grass, 4) Blue Oak-Foothill Pine/Wedgeleaf Ceanothus/Grass, or 5) 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.

Other References:
References

Adams, Theodore E., Peter B. Sands, William H. Weitkamp, and Neil K. McDougald. 1992. Oak seedling establishment on California rangelands. J. Range Manage. 45: 93-98.

Allen Diaz, Barbara, Rand R. Evett, Barbara A. Holzman, and Ayan J. Martin. 1989. Report on Rangeland Cover Type Descriptions for California Hardwood Rangelands. Forest and Rangeland Resources Assessment Program, Calif. Dep. of Forestry and Fire Protection, Sacramento, Calif. 318 pgs.

Baker, H.G. Sources of the naturalized grasses and herbs in California. In: Huenneke, L.F. and H.A. Mooney (ed.). 1989. Grassland Structure and Function: California Annual Grassland. Kluwer Academic Publishers, Dordrecht, Netherlands. Pg 29-38.

Bartolome, J. W. 1987. California grassland and oak savannah. Rangelands 9. 122- 125.

Bartolome, J.W., W.F. Frost, N.K. McDougald and M. Connor. 2002. California guidelines for residual dry matter (RDM) management on coastal and foothill annual rangelands. Rangeland Monitoring Series. Publ. 8092, Div. of Agr. and Nat Res., Univ. of Calif. 8pp.

Blackburn, T.C. and K. Anderson. 1993. Before The Wilderness: Environmental Management By Native Californians. Ballena Press, Menlo Park, CA.

Block, William M. and Michael L Morrison. 1990. Wildlife diversity of the Central Sierra foothills. Calif. Agric. 44:19-22.

Borchert, Mark, Frank W. Davis and Barbara Allen-Diaz. 1991. Environmental relationships of herbs in blue oak (Quercus douglasii) woodlands of central coastal California. Madrono. 38: 249-266.

Burcham, L. T. 1957. California Rangeland. Div. Forestry, Sacramento, Calif. 261 pgs.

Burns, Russell M. and Barbara H. Honkala. 1990. Silvics of North America (Vol 2): Hardwoods. Agric. Handbook 654. USDA Forest. Service, Washington D.C. 877 p.

Callaway, R.M. and C.M. D'Antonio. 1991. Shrub facilitation of coast live oak establishment in central California. Madrono 38:158-169.

Callaway, R.M. and F.W. Davis. 1991. Vegetation dynamics, fire, and physical environment in coastal central California. Ecology 74:1567-1578.

Cole, K. 1980. Geological control of vegetation in the Purisima Hills, California. Madrono 27:79-89.

Corbin, Jeffrey D. and Carla M D'Antonio. 2004. Competition between native perennial and exotic annual grasses: Implications for an historical invasion. Ecology 85:1273-1283.

Dahlgren R.A. and M.J. Singer. 1994. Nutrient cycling in managed and non-managed oak woodland-grass ecosystems. Final Report: Integrated Hardwood Range Management Program. Land, Air andWater Resources Paper – 100028. University of California, Davis, CA

Dahlgren, R.A., M.J. Singer and X. Huang. 1997. Oak tree and grazing impacts on soil properties and nutrients in a California oak woodland. Biogeochemistry 39: 45–64

Daly, Christopher. 2006. Guidelines for assessing the suitability of spatial climate data sets. International. Journal of Climatology 26: 707–721.

DeLasaux, M.J. and N. H. Pillsbury. 1987. Site index and yield equations for blue oak and coast live oak. In: Plumb, Timothy R. and N.H. Pillsbury (technical coordinators). Proceedings of the symposium on Multiple-Use Management of California's Hardwood Resources. USDA Forest Service Gen. Tech. Rep. PSW-44., Pacific Southwest Forest and Range Exp. Sta., Berkeley, CA. Pgs. 325-334.

Duncan, D. A. and W.J. Clawson. 1980. Livestock utilization of California's oak woodlands. In: Plumb, Timothy R., (technical coordinator). Proceedings of the symposium on the ecology, management, and utilization of California oaks. Gen. Tech. Rep. PSW-44. U.S. Dep. of Agr., For. Serv. Pacific Southwest Forest and Range Exp. Sta., Berkeley, CA. Pgs. 306-313.

George, Mel, William Frost, Neil McDougald, J. Michael Connor, James Bartolome, Richard Standiford, John Maas, and Robert Timm. Livestock and grazing management. In: Standiford, Richard (tech. coord.) 1996. Guidelines for Managing California's Hardwood Rangelands. ANR Publ 3368, Div. of Agric. And Nat. Res., Univ. of Calif., Oakland, Calif. pp. 51-67.

George, Mel, Jim Bartolome, Neil McDougald, Mike Connor, Charles Vaughn and Gary Markegard. 2001a. Annual Range Forage Production. ANR Publ. 8018, Div. of Agric. And Nat. Res., Univ. of Calif., Oakland, Calif. 9 pgs.

George, Melvin, Glenn Nader, Neil McDougald, Mike Connor, and Bill Frost. 2001b. Annual Rangeland Forage Quality. ANR Publ. 8022, Div. of Agric. And Nat. Res., Univ. of Calif., Oakland, Calif. 13 pgs.

Gordon, D.P., J.M. Whelker, J.M. Menke, and K.J. Rice. 1989. Neighborhood competition between annual plants and blue oak (Quercus douglasii) seedlings. Oecologia 79:533-51.

Haggerty, Patricia K. 1991. Fire effects in blue oak woodland. In: Standiford, R. (technical coordinators). Proceedings of the Symposium on Oak Woodlands and Hardwood Rangeland Management. USDA Forest Service Gen. Tech. Rep. PSW-126., Pacific Southwest Forest and Range Exp. Sta., Berkeley, CA. Pgs. 342-344

.
Harrison, A., E. Small, and H. Mooney. 1971. Drought relationships and distribution of two Mediterranean-climate California plant communities. Ecology 52: 869-875.

Johnson, W.H. and E.L. Fitzhugh. 1990. Grazing helps maintain brush growth on cleared land. Calif. Agric. 44:31-32.

Kay B.L. 1987. The effect of blue oak removal on herbaceous production on a foothill site in the northern Sierra Nevada. In: Plumb T.R. and H.R. Pillsbury (Eds). Multiple Use Management of California's Oak Hardwood Resources. USDA General Technical Report PSW-100, Berkeley, CA. pp 343–350.

Lewis, D., M.J. Singer, R.A. Dahlgren and K.W. Tate. 2000. Hydrology in a California oak woodland watershed: a 17-year study. Journal of Hydrology 240-106-117.

Mayer K. E., W. F. Laudenslayer. (Eds.) 1988. A guide to wildlife habitats of California. California Dept. of Forestry and Fire Protection, Sacramento.

McCreary, Douglas D. 2001. Regenerating rangeland oaks in California. ANR Publ. 21601, Div. of Agric. And Nat. Res., Univ. of Calif., Oakland, Calif. 62 pgs.

McClaran, M.P. 1986. Age structure of Quercus douglasii in relation to livestock grazing and fire. Ph.D. Dissertation. Univ. of Calif., Berkeley. 119 pp.

McDougald, N.K. W.E. Frost, and W.J. Clawson. 1991. Estimating the cost of replacing forage losses on annual rangeland. Leaflet 21494. Division of Agric. and Nat. Res., Univ. of Calif., Oakland, Calif.

Mensing, Scott A. 1992. The impact of European settlement on blue oak (Quercus douglasii) regeneration and recruitment in the Tehachapi Mountains, California. Madrono. 39: 36-46.

Muick, Pamela C. Effects of shade and clipping on coast live and blue oak seedling mortality and growth in California annual grasslands. In: Pillsbury, N.H., Jared Verner, and W.D. Tietje (tech ed). 1997. Proceedings, Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues. USDA Forest Service GTR-PSW GTR-160.

Murphy, A.L. and B. Crampton. 1964. Quality and yield of forage as affected by chemical removal of blue oak (Quercus douglasii). J. Range Manage. 17:142-144.

Murphy, A.L. and L.J. Berry. 1973. Range pasture benefits through tree removal. Calif. Agric. 27:8-10.

Parsons, D.J and T.K. Stohlgren. 1989. Effects of varying fire regimes on annual grasslands in the southern Sierra Nevada of California. Madroño, 36:154-168.

Pavlik, B.M., P.C. Muick, S. Johnson, and M. Popper. 1991. Oaks of California. Cachuma Press, Inc. Los Olivos, Calif. 184 pgs.

Rice, Kevin J. and Erin K. Espeland. 2006. Genes on the Range: Population Genetics (in press).

Sampson, Arthur W. and Beryl S. Jespersen. 1963. California range brushlands and browse plants. Univ. of Calif. Div. of Agr. Sci., Berkeley, CA. 162 pgs.

Stephens, S.L. Fire history of mixed oak-pine forest in the foothills of the Sierra Nevada, El Dorado County, Calif. In: Pillsbury, N.H., Jared Verner, and W.D. Tietje (ed). 1997. Proceedings, Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues. USDA Forest Service GTR-PSW GTR-160

Tietje, William, Kathryn Purcell, and Sabrina Drill. Oak woodlands as wildlife habitat. In: Giusti, Gregory A., Douglas D. McCreary, and Richard B. Standiford (ed). 2005. A Planner's Guide for Oak Woodlands, 2nd Ed. ANR Publ. 3491, Div. of Agric. and Nat. Res., Univ. of Calif., Oakland, Calif. pp 15-31.

Wells, P.V. 1962. Vegetation in relation to geological substratum and fire in the San Luis Obispo Quadrangle, California. Ecol. Monog. 32:79-103.

Site Description Approval:

Author	Date	Approval	Date
Melvin George, Neil McDougald, Dennis Dudley, and Jim Sullins	5/25/2004		

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date: **MLRA:** 018X **Ecological Site:** Sandy Loam R018XI006CA 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

---

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:
