USDA Natural Resources Conservation Service

Ecological site R018XI103CA
Thermic Ultramafic Foothills Moderately High Magnesium Content (Ca:Mg Ratio 0.5 To 2)

Accessed: 05/11/2025

General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

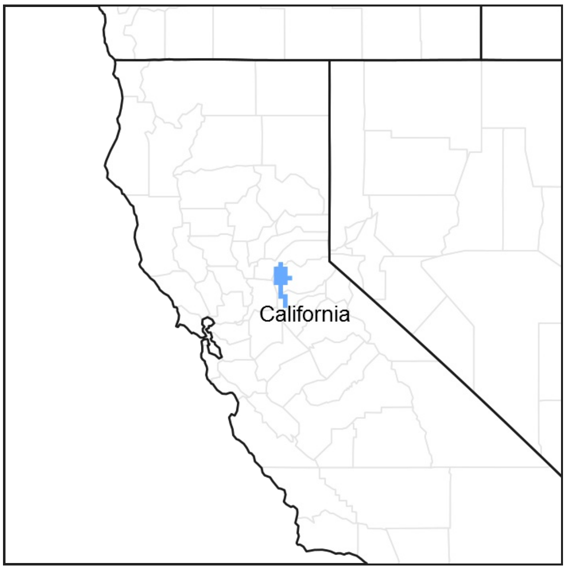

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 018X–Sierra Nevada Foothills

Major Land Resource Area (MLRA) 18, Sierra Nevada Foothills is located entirely in California and runs north to south adjacent to and down-slope of the Sierra Nevada Mountains (MLRA 22A). MLRA 18 includes rolling to steep dissected hills and low mountains, with several very steep river valleys. Climate is distinctively Mediterranean (xeric soil moisture regime) with hot, dry summers, and relatively cool, wet winters. Most of the precipitation comes as rain; average annual precipitation ranges from 18 to 40 inches in most of the area (precipitation generally increases with elevation and from south to north). Geology is rather complex in this region; there were several volcanic flow and ashfall events, as well as tectonic uplift, during the past 25 million years that contributed to the current landscape. Due to extreme latitudinal differences in MLRA 18, Land Resource Units (LRUs) were designated to group the MLRA into similar land units.

LRU Description:

This LRU (designated XI) is located on moderate to steep mountains and hills in the Sierra Nevada Foothills. It also includes mesa formations from volcanic flows, where vernal pool habitats occur. Various geologies occur in this region: metavolcanics, granodiorite, slate, marble, argillite, and quartzite, as well as ultramafic bands to a limited and localized extent. Soil temperature regime is thermic and soil moisture regime is xeric. Elevation ranges between 300 and 2000 ft above sea level. Precipitation ranges from 18 to 42 inches annually. Most precipitation falls between the months of November and March in the form of rain. Dominant vegetation includes annual grasslands, blue oak (Quercus douglasii), interior live oak (Quercus wislizeni), chamise (Adenostoma fasciculatum), buckbrush (*Ceanothus cuneatus*), and California foothill pine (Pinus sabiniana).

Classification relationships

This site is located within M261F, the Sierra Nevada Foothills Section, (McNab et al., 2007) of the National Hierarchical Framework of Ecological Units (Cleland et al., 1997), 261Ca, the Western Foothills Subsection.

Level III and Level IV ecoregions systems (Omernik, 1987, and EPA, 2011) are: Level III, Central California Foothills and Coastal Mountains and Level IV, Ecoregion 6b, Northern Sierran Foothills.

Nature Conservancy Biophysical Setting is the California Xeric Serpentine Chaparral (NaturServ, 2015).

Ecological site concept

Ultramafic bedrock is characterized by its low Ca:Mg ratios and high heavy metal accumulations and is thus toxic to many plants; it is usually associated with stunted growth or reduced productivity. The Ca:Mg ratio for this ecological site ranges from 0.5 to 2 in the subsurface horizons . The influence of soil chemistry is readily apparent by virtue of its influence on vegetation composition, production, and species distribution. The plant communities in this ecological site are strikingly different than the adjacent non-serpentinite derived soils, (shifting from blue oak woodland to chamise chaparral on serpentinite; see McGahan et al., 2009 and Kruckenburg, 1984). The parent material is easily identifiable as having minerals associated with serpentine vegetation (i.e. olivine, pyroxene, lizardite, peridotite, serpentinite).

This ecological site is constrained by parent material that is slightly less toxic to plant life than other ultramafic ecological sites within the Sierra Nevada Foothills, which have lower Ca:Mg ratios (less than 0.5). The shrub component is the dominant functional group in most of the community phases. In this ecological site, chamise (Adenostoma fasciculatum) form dense near monocultures, while buckbrush (*Ceanothus cuneatus*), California yerba santa (Eriodictyon californicum), buckthorn (Rhamnus spp.), and manzanita (Arctostaphylos spp.) are present in lower quantities. Forbs and grasses are usually sparse, except in the post-fire community phase. The production RV is about 615 lbs per acre and ranges between 436 and 1280 lbs per acre.

Associated sites

R018XI102CA	**Thermic Ultramafic Foothills Extremely High Magnesium Content (Ca:Mg Ratio Less Than 0.5)** This site occurs on hill slopes with lower Ca:Mg ratios (0.05 to 0.5), and have therefore more toxic effects to plant life (lower annual production and different species compositions). Buckbrush (Ceanothus cuneatus) and California foothill pine (Pinus sabiniana) are the most common species.
R018XI104CA	**Thermic Ultramafic North-Facing Steep Slopes** This site occurs on adjacent, steep (60-90%) north-facing hill slopes. Ca:Mg ratios are variable in this site. A diverse array of shrubs are present (toyon (Heteromeles arbutifolia), manzanita (Arctostaphylos spp.), buckbrush (Ceanothus cuneatus), and buckthorn (Rhamnus spp.)) often in the understory of dense California foothill pine.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Adenostoma fasciculatum* (2) *Eriodictyon californicum*
Herbaceous	Not specified

Physiographic features

This ecological site likely occurs in ultramafic bands extending among throughout the entire Sierra Nevada Foothill region. However, the ecological dynamics are specific to ultramafic bands in the northern foothills LRU and is most recognizable from Tuolumne to Placer Counties, CA. The ecological site occurs on loamy to loamy-skeletal soils on footslopes and backslopes of all aspects and slope gradient ranges between 3 and 60% (central tendency is between 15 and 35 % slope). Soils occur on elevations between 300 and 1,730 feet above sea level (central tendency is between 800 to 1150 feet).

Table 2. Representative physiographic features

Landforms	(1) Hill
Elevation	300–1,730 ft
Slope	3–60%

Climatic features

This ecological site is a found in a broad Mediterranean climatic region, with hot, dry summers and cool, wet winters. Mean annual precipitation is around 27.5 inches and ranges between 22 to 33 inches per year, mostly occurring between November and April in the form of rain. Mean annual air temperature ranges between 48 and 74 degrees F. The frost free period is 213 to 223 days and the freeze-free period is approximately 217 to 235 days. Maximum and minimum monthly climate data for this ESD were generated by the Climate Summarizer (http://www.nm.nrcs.usda.gov/technical/handbooks/nrph/Climate_Summarizer.xls) using data
from the following climate stations (equally weighted):

41428 Camp Pardee
(Period of record = 1959 to 2014)

46172 New Melones Dam
(Period of record = 1992 to 2014)

48713 Sutter Hill CDF
(Period of record = 1999 to 2014)

The data from multiple weather stations were combined to most accurately reflect the climatic conditions of this ecological site. The New Melones Dam weather station is in a nearby area, but is at slightly higher elevation, and precipitation was considerably higher. The selection of Camp Pardee and Sutter Hill CDF had lower precipitation but are located further north, where the central tendency of the site occurs.

Table 3. Representative climatic features

Frost-free period (average)	218 days
Freeze-free period (average)	226 days
Precipitation total (average)	28 in

Influencing water features

Soil features

The soils in this ecological site are formed from the colluvium and residuum of serpentinite and other ultramafic rock. Soils are shallow (17% of mapped area) to moderately deep (83 % of mapped area), and have loamy-skeletal textures. The bedrock is a restrictive layer found between 10 and 39 inches of depth. Gravels (< 3 inch diameter) range between 0 to 10 % cover, while larger fragments (>= 3 inch diameter) are 0 to 18 % cover. Subsurface gravels range between 2 to 22 % and larger fragments occupy 7 to 26 % by volume. The soils in this ecological site are well-drained to excessively well-drained and the permeability class ranges from slow to very slow.

The most commonly occurring soil component in the map units outlined below is Crimeahouse (loamy-skeletal, smectitic, thermic Mollic Haploxeralfs). This ecological site is also associated with major component of Hennekenot (loamy-skeletal, mixed, superactive, thermic Lithic Argixerolls) and Henneke (clayey-skeletal, magnesic, thermic Lithic Argixerolls. The primary difference between the Crimeahouse of soils and Hennekenot/Henneke suite of soils is the depth class (moderately deep and shallow, respectively) and the thickness of the mollic epipedon (the Hennekenot/Henneke soils having a thicker and possibly more organic input than the Crimeahouse soils). Henneke soils differ from Hennekenot by the magnesic mineralogy class and soils of a higher clay content.

The common characteristic shared by all soils in this ecological site is the high level of magnesium relative to calcium. The Ca:Mg ratio of subsurface soils often poses extreme limitations on plant communities due to soil chemistry. However, low Ca:Mg ratios may not always equate to magnesic mineralogy class, by definition. Magnesic soils are classified as soils with forty percent or more (by weight) magnesium silicate minerals such as serpentinite (antigorite, shrysotile, and lizardite) talc, olivines, Mg-rich pyroxenes, and/or Mg-rich amphiboles in the particle size control section. While Crimeahouse and Hennekenot do not have a magnesic mineralogy class, they still have very low Ca:Mg ratios in the subsurface horizons which poses a limitation on which plants may establish on the site.

This ecological site is correlated with the following national map units and soil components in MLRA 18:

2rx1g; Crimeahouse-Hennekenot complex, 3 to 15 percent slopes;;Crimeahouse;;65; Hennekenot;;35;

2rxlz; Crimeahouse-Hennekenot complex, 15 to 45 percent slopes;;Crimeahouse;;65;
Hennekenot;;35;

Hj3r; Henneke very rocky loam, 3 to 51 percent slopes;; Henneke;;65;

Figure 6. Typical Henneke soil profile in R018XI103CA; Photo

Table 4. Representative soil features

Parent material	(1) Colluvium–ultramafic rock
Surface texture	(1) Gravelly loam
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to slow
Soil depth	10–39 in
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–18%
Available water capacity (0-40in)	0.7–1.1 in

Subsurface fragment volume <=3" (Depth not specified)	2–22%
Subsurface fragment volume >3" (Depth not specified)	7–26%

Ecological dynamics

The main controlling factor in soils forming in ultramafic parent material is the chemical composition. The overwhelming abundance of extractable Mg at the cation exchange sites (at the expense of extractable Ca (Brooks, 1987)) prevents many plants from establishing. In addition to low Ca:Mg ratios, serpentinite, dunite, and perioditite contain elevated levels of heavy metals (Woodruff et al., 2009, Ni Mn, etc.). This site is often thought of as the most droughty of the ultramafic ecological sites within the Sierra Nevada foothills region because of the type of chaparral shrubs that dominate and the available water capacity (AWC) is lower than in R018XI102CA (AWC of 0.9 inches in this ecological site, and 2.65 inches in R018XI102CA). However, the annual production from this ecological site is about 50 % higher (mostly due to the chamise production) than ecological site R018XI102CA, a site with very low Ca:Mg ratios. There is some laboratory data to suggest that the ultramafic sites dominated by chamise tend to have Ca:Mg ratios around 1 +/- 0.5 in the subsurface horizons. The buckbrush dominated sites from R018XI102CA rarely exceed 0.5 in the subsurface horizons. Therefore, it can be argued that the Ca:Mg ratio is the main driver.

Chamise, the dominate shrub on this site, also forms near-monocultures on non-ultramafic soils, especially on steep, dry aspects in shallow, rocky soils with granitic or metasedimentary parent material. How would this ecological site compare with other chamise dominated systems that occur on soils with less restrictive chemical limitations (i.e. non-magnesic, Ca:Mg ratios within normal range for most plants)? For the casual observer, it may appear that this ecological site seems identical to chamise monocultures occurring in soils of metasedimentary or granitic origin. However, the chamise stands on non-ultramafic soils usually are much steeper (25 to 40 percent slope, while this site does not often exceed 30 percent slope), they tend to occur on convex landscape positions, and are highly skeletal and often south-facing. The soils in this ecological site can be skeletal, but they occur on all aspects. Additionally, the depth class between the two (3) ecological sites are not considerably different. Because of these extremely droughty conditions where the non-ultramafic chamise occurs, annual production should be low (or at least lower than this ecological site). However it is not; the shrub production in the metasedimentary (representative value) is around 2,100 lbs/acre. In the chaparral of the granitics it is 1,100 lbs/acre. This ecological site has an annual production of 540 for the shrubs (615 total annual production). One can argue that the metasedimentary and granite bands occur at higher elevations and receive more precipitation and consequently, produce greater amounts of vegetation. However, the granitic chaparral type is even higher than the metasedimentary band and yet has almost 50% less shrub production than its drier counterpart. Also, total production values around 600 lbs per acre (those observed in this ecological site) are very low, even at lower elevations. Annual grassland and blue oak savannahs adjacent to this ecological site produce greater than 2,000 lbs per acre and even up to 5,000 lbs per acre.

Disturbance dynamics

The two main historical disturbances in this ecological site are grazing practices and fire. Livestock grazing has occurred for at least 200 years and has likely contributed to the spread of Mediterranean annual grasses such as Bromus, Avena genus (Jackson, 1985). The convergence of several groups of Europeans (e.g. Spanish, Russians) in the late 18th Century brought both invasive annuals and domestic livestock animals in numbers that the California systems had never before encountered (J. Reioux, personal communication, 2015). Nevertheless, herbaceous vegetation is only ephemerally part of this ecological site. Therefore, most of our focus is on the woody vegetation component. This ecological site is less accessible due to the steep terrain and brushy conditions, so it is possible that domestic livestock would prefer adjacent sites on more even terrain. Native herbivores such as rabbits (Lepus spp.) and deer (Odocoileus spp.) utilize both the herbaceous and woody vegetation; yet, gophers (Scuiridae) have likely played a more definitive role in disturbance dynamics (esp. in soil formation) and probably overshadow the effects of rabbits.

In contrast, fire has likely been a shaping force over a much longer period with more readily apparent influences than grazing. Native indigenous groups among the entire length of the Sierra Nevada Foothills practiced setting fires millennia before European establishment. The diverse array of reasons for burning, included hunting purposes, to maintain vegetation (keeping land traversable, but also to maximize early growth vegetation most useful to indigenous needs; see Anderson, 1994), and to improve crop yield (Stewart, 2002). It is likely that the native inhabitants played some role in maintaining the fire regime of this ecological site. The effects of fire in serpentinite dominated vegetation communities have been studied more extensively on the Central California Coastal Range (MLRA 15). For example, Safford and Harrison (2004) noted that serpentine chaparral differs in post-fire response than other chaparral types. Their study area showed longer intervals between fires in serpentine, in part because of less fuel loading due to relatively lower site productivity.

The three main shrubs in this ecological site are chamise, yerba santa, and buckbrush. Chamise is highly adapted to fire. It reproduces both sexually and vegetatively (McMurray, 1990a). The seeds are highly unpalatable (Reid and Oechel, 1984) and thus accumulate in the seedbank until fire scarifies the seed (Keeley, 1987), promoting germination. Following fire, chamise will sprout from dormant buds on the lignotuber (Keeley and Soderstrom, 1986). Chamise rapidly reoccupies post-fire area and often can support subsequent intense fires in as early as 15 years (Anderson, 1982). Yerba santa is known to colonize post-fire and otherwise disturbed environments (Schultz et al., 1955; Lyon and Stickney, 1976). It can persist for several years, but is shade-intolerant and therefore steadily decreases after other chaparral shrubs obtain moderate heights. It both germinates from seed and can sprout from rhizomes in the first post-fire growing season (Hedrick, 1951). The life history of buckbrush (League, 2005) suggests that a longer fire return interval may be beneficial to some plant species. Buckbrush is an obligate seeder that germinates following fire scarification (Biswell, 1963), but can remain viable in the seed bank for several years in absence of fire. Buckbrush plants begin senescing beyond 50 years (Biswell, 1963), in which time substantial fuel buildup will have occurred, raising the potential for wildfires. Modeling showed that another long-lived obligate-seeder (*Ceanothus greggii*) responded most favorably to a 35 to 50 year fire return interval (Regan et al., 2010). This interval is up to twice as long as the fire interval recorded in blue oak grasslands (McClaran, 1986).

Other shrubs in this ecological site vary in their response to fire. For example, toyon is adapted to fire and can resprout from dormant buds located on its root crown following a stand-replacing fire (Sampson, 1944; Sampson and Jespersen, 1963; McMurray, 1990b). The numerous buds enable toyon to rapidly reoccupy the post-fire environments (McDonald, 1981). Additionally, toyon is able to resist low intensity fires and is less flammable than other chaparral shrubs (Van Dersal, 1938). On the other hand, manzanita is less resistant to fire and can be killed even in low-intensity fires (Abrahamson, 2014). However, manzanita species common in this ecological site (i.e. A. viscida, A. manzanita) are obligate seeders and can readily establish in post-burn sites (Eastwood, 1934, Wells, 1987).

State and transition model

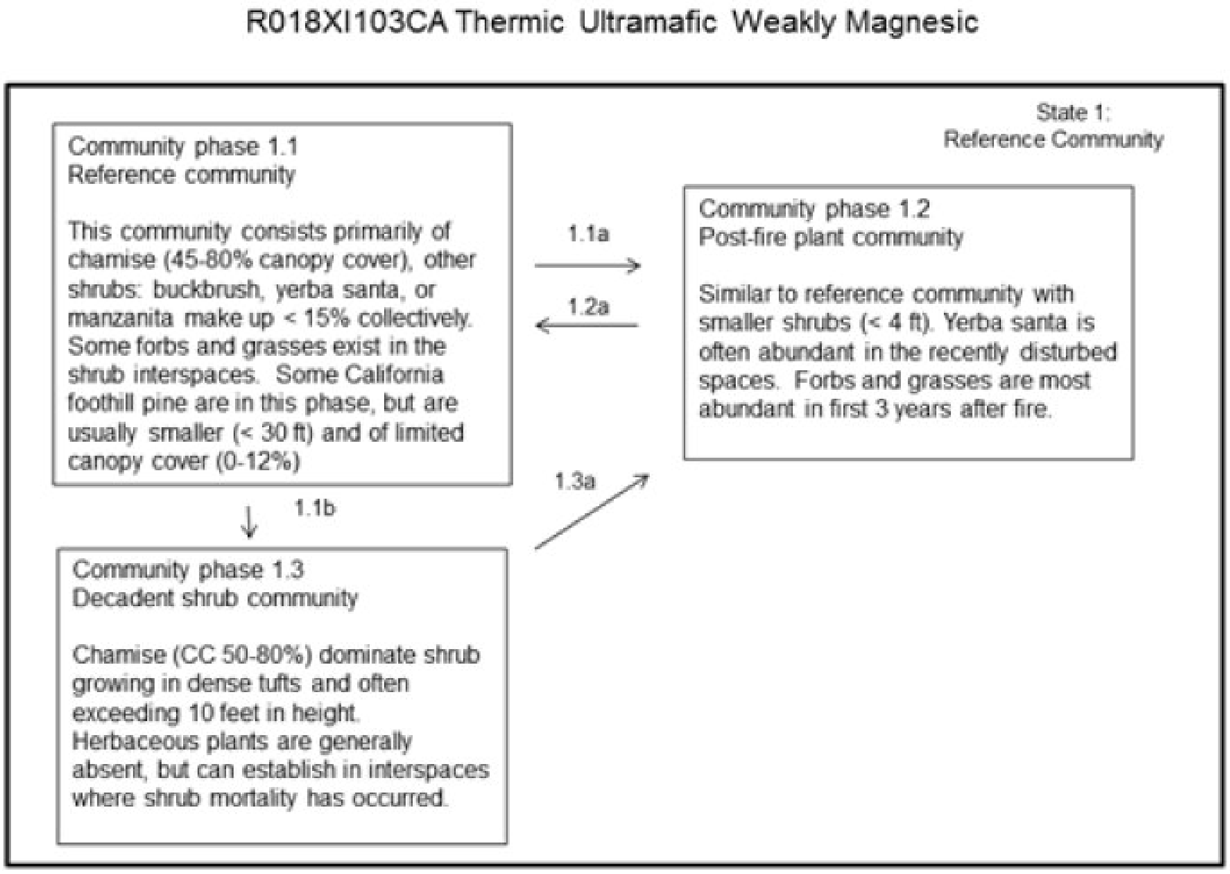

Figure 7. R018XI103CA STM

State 1
Reference State

State 1 represents the historic range of variability for this ecological site. Ultramafic soils often offer a refuge to many native endemic herbaceous species (e.g. red hills soap root plant (*Chlorogalum grandiflorum*; Calflora.org, 2016) because its unique soil chemistry is not amenable to the vast majority of plant species. Some of the endemic plants are still intact, despite the introduction of a number of annual grasses and forbs arriving after the discovery of the New World. However, most of the plants found in this ecological site can also be encountered in non-ultramafic soils. They are indifferent to the harsh soil conditions found in ultramafic areas and not great serpentinite indicators (See Bodenvag plants, Kruckeberg, 1984). The different community phases below differ slightly in hydrological function and nutrient dynamics. For example, the post-fire phase (community phase 1.2) is more vulnerable to erosion, especially when significant precipitation events occur in the months following the fire. Within 2-3 years, there is generally enough plant cover to retain the soil. Community phases 1.1 and 1.3 are generally more stable and are less prone to erosion. However, it must be recognized that many of these ultramafic bands occur on undulating and less steep soils (< 35%), and thus do not pose as great a threat as chaparral communities in other ecological sites with more relief.

Community 1.1
Reference Community Phase

Figure 8. Community Phase 1.1-chamise chaparral vegetation community in the foreground on a Hennekenot soil. Note the ultramafic band on the ridgetop in the background; Photo: D. Glass, 2011.

This community phase consists of a relatively stable chaparral shrub component, dominated primarily by chamise. Chamise has little livestock value for forage (Sampson and Jespersen, 1963), however chamise provides excellent cover and bedding material for mule deer (Nichols and Menke, 1984) and other mammals and birds. The successional status of this ecological site is under debate and there is a question about whether oak trees would appear if left undisturbed for a significant period of time. Hanes (1977) contended that this vegetation type is a fire-induced subclimax. However, given the sharp contrast of this site and lack of ecotone (J. Hansen, personal communication, 2015) there is some inclination that the site would not support woodland, nor other adjacent communities because of the toxicity. This does not necessarily mean that ecotonal areas between this site and the blue oak/savannah type do not exist. Anecdotally, we have found ecotones downhill from serpentinite bands. One particular location had soil forming influences from both alluvium and colluvium derived from sources other than serpentinite. Some of the blue oaks appeared stunted, but other trees (at a further distance from the serpentinitic hillslope) seemed to resume normal growth patterns. These dense stands of chamise also contain a variety of other chaparral shrubs sometimes in low densities, and rarely codominating the vegetation community. These include various species of manzanita (Arctostaphylos spp.), toyon (*Heteromeles arbutifolia*), and buckbrush (*Ceanothus cuneatus*). California yerba santa will often codominate, but this species is usually less prevalent in this community phase because it is a disturbance indicator and is more common in a recently cleared or burned community (see Community Phase 1.2). Most of the shrubs are between 5 and 10 feet tall. Forbs and grasses are generally very sparse under the dense canopies of chamise. If present, the annual herbaceous component will exist in clearings or shrub interspaces. Several brome species (Bromus spp.), fescues (Vulpia spp.) and purple false brome (*Brachypodium distachyon*) are the most common grasses. Forbs often have greater production, especially soap plant (Chlorogalum spp.) and paintbrush (Castilleja spp.), but also ferns such as goldenback fern (*Pentagramma triangularis*) may be locally abundant.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	102	540	1280
Forb	0	50	231
Grass/Grasslike	0	20	103
Tree	0	5	20
Total	**102**	**615**	**1634**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	2-4%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%

Non-vascular plants	4-25%
Biological crusts	0%
Litter	40-60%
Surface fragments >0.25" and <=3"	5-20%
Surface fragments >3"	10-35%
Bedrock	0-2%
Water	0%
Bare ground	2-10%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	0-1%	–	0-5%	1-5%
>0.5 <= 1	1-4%	–	0-2%	1-3%
>1 <= 2	0-1%	0-1%	–	0-1%
>2 <= 4.5	0-1%	0-2%	–	1-3%
>4.5 <= 13	0-4%	40-65%	–	–
>13 <= 40	0-8%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Post-fire Shrub Community

Figure 10. Community Phase 1.2, post-fire phase, nine years following Creek Fire. Soil is a Crimeahouse; Photo: K. Tierney, 2010.

This community phase is characterized by regenerating and resprouting chaparral shrubs such as chamise, yerba santa, buckbrush, and manzanita within 5 to 10 years post-fire. Shrub height is generally less than five feet, although yerba santa can be taller. Sites may contain openings dominated by annual herbaceous plants, but herbaceous cover is sparse underneath the shrubs. This community phase could be considered the most vulnerable to the loss of ecosystem function, as the exposed soil may be eroded by winter rains. Therefore, this community phase may have more rilling and other hydrological features than the other community phases with denser vegetation. Fire return interval may range between 15- 20 years because the resins from chamise litter are highly flammable (Phlilpot, 1977), but become more so on older plants (Rundel, 1982). In the early post-fire environment, chamise and other sprouting shrubs may initially have the advantage over shrubs that need to start from seed. The numerous dormant buds, coupled with prolific seed production enable chamise to rapidly reoccupy the post-fire environment (Keeley and Soderstrom, 1986). Obligate seeders such as buckbrush may also be able to recover after a few years, but in lower densities (5- 10 % canopy cover). Fuel densities for the first five years would unlikely support another stand replacing fire, but the occurrence of a second fire before the young shrubs start to produce seed would severely decrease the abundance of obligate seeders (e.g. buckbrush and manzanita) and may lead to a greater proportion of sprouting shrubs (e.g. chamise, yerba santa) on the site. Most manzanita species will die on exposure to fire, some even at low intensities (e.g. A. manzanita; Abrahamson, 2014). Like buckbrush they are obligate seeders and will come back as long as there is a seed source available. Some manzanita such as A. uva-ursi are able to sprout from burls following a burn (Stuart and Sawyer, 2001). The herbaceous plants on this site can be especially prolific in the first 1 to 3 years following the burn. The forb component usually includes bedstraw (Galium spp.), paintbrush (Castilleja spp.), Clarkia (Clarkia spp.), bluedics (Dichelostemma capitana), soap plant (Chlorogalum spp., sometimes to include the endemic *Chlorogalum grandiflorum*), and golden yarrow (Eriophyllum confertifolium). Annual grasses often include fescue (Vulpia spp.), soft brome (*Bromus hordeaceus*), purple false brome (*Brachypodium distachyon*) and nit grass (Gastridum pheloides). The main perennial bunchgrass melicgrass (Melica spp.)

Table 8. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	1-5%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%
Non-vascular plants	0-25%
Biological crusts	0%
Litter	10-40%
Surface fragments >0.25" and <=3"	1-25%
Surface fragments >3"	1-25%
Bedrock	0-1%
Water	0%
Bare ground	2-88%

Table 9. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	0-2%	0-1%
>0.5 <= 1	–	–	0-1%	0-1%
>1 <= 2	–	0-1%	0-1%	0-1%
>2 <= 4.5	–	65-85%	0-1%	0-5%
>4.5 <= 13	–	10-15%	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.3
Mature Shrub Community

Figure 11. Example of a mature community phase in Amador County; Photo: D. Evans, 2014.

This community phase results from several decades without fire and is composed of mature chamise shrubs exceeding 10 feet in height and often comprising 80 to 95% canopy cover. The occasional traces of other shrubs such as toyon and manzanita may be present. Many of the shrubs have considerable dieback and dead woody material. Chamise branches are often overloaded and grow in dense tufts all the way to the ground. Travel through this community phase is extremely difficult, therefore data therein are lacking. This community phase may also have a greater tree density of the California foothill pine (0-10 canopy cover %). Annual production of herbaceous plants is usually zero in this community phase. Apart from possible wildlife cover for some bird species, this community phase is not particularly useful neither to large mammals nor to domestic livestock because of decreased mobility within the dense stand (Kinucan, 1965; McMurray, 1990a), restricting access to new growth which deer are more likely to consume. This community phase may persist over 100 years (e.g. chamise chaparral in Sequoia National Park) without compromising sprouting ability (Keeley, 1986). However, older growth chaparral may be more likely to support very intense burns which may lead to high mortality rates for shrubs by damaging the lignotubers. Post-fire recovery period, therefore, may be prolonged after such fires and regeneration might be restricted to interspace areas where soils do not reach as high of a temperature (Davis et. al., 1989).

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	0%	0%	4-5%	0-3%
>0.5 <= 1	0%	0-1%	0-1%	0-1%
>1 <= 2	0%	0-1%	0-6%	1-5%
>2 <= 4.5	0-2%	0-1%	–	0-2%
>4.5 <= 13	0-1%	48-76%	–	–
>13 <= 40	0-4%	5-10%	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 1.1a
Community 1.1 to 1.2

Reference Community Phase

Post-fire Shrub Community

This pathway occurs after a stand replacing fire. The community phase represented in Community Phase 1.2

occurs after approximately 5 years of post-fire recovery.

Pathway 1.1b
Community 1.1 to 1.3

Reference Community Phase

Mature Shrub Community

This pathway occurs after a considerable amount of time (> 50 years) without fire.

Pathway 1.2a
Community 1.2 to 1.1

Post-fire Shrub Community

Reference Community Phase

This pathway occurs over time, pending the absence of fire for 15 to 20 years.

Pathway 1.3a
Community 1.3 to 1.2

Mature Shrub Community

Post-fire Shrub Community

This pathway occurs after a high severity, stand replacing fire. Alternatively, complete brush removal followed by slash burning will obtain the community phase changes.

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
1	**Chaparral Shrubs**			102–1280	
	chamise	ADFA	*Adenostoma fasciculatum*	95–952	40–80
	manzanita	ARCTO3	*Arctostaphylos*	7–167	1–5
	California yerba santa	ERCA6	*Eriodictyon californicum*	0–135	0–1
	toyon	HEAR5	*Heteromeles arbutifolia*	0–100	0–2
	buckbrush	CECU	*Ceanothus cuneatus*	10–65	1–5
Tree					
2	**Trees**			0–20	
	California foothill pine	PISA2	*Pinus sabiniana*	0–20	0–10
Grass/Grasslike					
3	**Annual Grasses**			0–100	
	purple false brome	BRDI2	*Brachypodium distachyon*	0–102	0–3
	poverty brome	BRST2	*Bromus sterilis*	0–20	0–5
	silver hairgrass	AICA	*Aira caryophyllea*	0–5	0–3
	soft brome	BRHO2	*Bromus hordeaceus*	0–4	0–1
	Pacific fescue	VUMIP	*Vulpia microstachys var. pauciflora*	0–2	0–4
	annual fescue	VUMY	*Vulpia myuros*	0–2	0–4
	red brome	BRRU2	*Bromus rubens*	0–1	0–1
Forb					
4	**Native Forbs**			0–231	
	Indian paintbrush	CASTI2	*Castilleja*	0–183	0–5
	wavyleaf soap plant	CHPO3	*Chlorogalum pomeridianum*	0–53	1–5
	agoseris	AGOSE	*Agoseris*	0–5	0–1
	bedstraw	GALIU	*Galium*	0–1	0–1

Animal community

Various wildlife species (esp. birds) have been observed in this site. This site provides excellent cover, material for nesting, etc. This area has close to 100 bird species during some time of the year. Common mammals include bobcat (Felis rufus), coyote, (Canis latrans), Western gray squirrel (Spermophilus beecheyi), and mule deer (Odocoileus hemionus); reptiles such as Western pond turtle (Clemnys marmorata), Sierra garter snake (Thamnophis couchi couchi), California king snake (Lampropeltis getulus californiae), and Northern Pacific rattlesnake (Crotalus virdis oreganus) have been spotted.

Hydrological functions

The soils ecological site functions largely as subsurface recharge although much of the moisture may be shed as surface runoff during higher precipitation events as a result of relatively low water permeability of the surface. Erosive rainfall events often occur during the fall with flow patterns being very common, terracettes being somewhat common, and patches of effective bare ground being many, small and generally interconnected.

Moisture may discharge over time to lower points of this landscape moving along bedrock features and through bedrock fractures and nearing or emerging from the soil surface along slope breaks where restrictive subsurface parent material redirects subsurface flow laterally rather than vertically.

Recreational uses

Where trails exist and are maintained, this site has excellent potential for activities such as horseback riding, bird viewing, recreational botany, and hiking.

Wood products

None, California foothill pine is the only species of tree. Although important for roost sites, this tree has little timber value.

Type locality

Location 1: Calaveras County, CA	
Township/Range/Section	T4N R11E S28
UTM zone	N
UTM northing	4227243
UTM easting	0695076
Latitude	38° 10′ 19″
Longitude	120° 46′ 25″
General legal description	Army Corps of Engineer Land on the south shore of approximately the middle of New Hogan Reservoir. About 100 m uphill from access road. North of the intersection of Hwys 12 and 26.

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Contributors

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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, 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):**

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

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

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

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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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 indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
