Ecological site R022AE217CA
Frigid Volcanic Slopes

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 022A–Sierra Nevada and Tehachapi Mountains

Major Land Resource Area 22A, Sierra Nevada Mountains, is located predominantly in California and a small section of western Nevada. The area lies completely within the Sierra Nevada Section of the Cascade-Sierra Mountains Province. The Sierra Nevada range has a gentle western slope, and a very abrupt eastern slope. The Sierra Nevada consists of hilly to steep mountains and occasional flatter mountain valleys. Elevation ranges between 1,500 and 9,000 ft throughout most of the range, but peaks often exceed 12,000 ft. The highest point in the continental US occurs in this MLRA (Mount Whitney, 14,494 ft). Most of the Sierra Nevada is dominated by granitic rock of the Mesozoic age, known as the Sierra Nevada Batholith. The northern half is flanked on the west by a metamorphic belt, which consists of highly metamorphosed sedimentary and volcanic rocks. Additionally, glacial activity of the Pleistocene has played a major role in shaping Sierra Nevada features, including cirques, arêtes, and glacial deposits and moraines. Average annual precipitation ranges from 20 to 80 inches in most of the area, with increases along elevational and south-north gradients. Soil temperature regime ranges from mesic, frigid, and cryic. Due to the extreme elevational range found within this MLRA, Land Resource Units (LRUs) were designated to group the MLRA into similar land units. LRU "E" Northern Sierran Upper Montane: This LRU occurs at the mid elevations of the Sierra Nevada, from the Sonora Pass area to the higher mountains in the vicinity of Quincy. Elevations are typically between 5,500 feet to 8,500 feet, with the lower elevations typically on southern aspects, and the higher elevations on northern aspects. The frost-free season is 60 to 125 days, MAAT ranges from 40 to 50 F, and MAP ranges from 35 to 85 inches. The soil temperature regime is mostly frigid, with some cryic soil temperatures at the upper elevations and northern aspects. Soil moisture regimes are mostly xeric, but may be udic where snow persists through spring.

Ecological site concept

This ecological site is associated with shallow loamy soils that have developed over strongly cemented andesitic bedrock. Elevations range from 6,200 to 7,700 feet and slopes are typically between 30 and 70 percent. This site is typically found on undulating south facing slopes in patchy areas of shallow soil, with exposed bedrock within a forest matrix. Shallow, erosion prone soils and warm aspects support only sparse tree cover, and the dominant vegetation is open and diverse montane chaparral. Huckleberry oak (Quercus vaccinifolia) is the most frequent shrub, and greenleaf manzanita (Arctostaphylos patula) is also common. The loamy volcanic soils and undulating, dissected landscape support a higher diversity of shrubs and forbs than is found in montane chaparral communities associated with granitic substrates and more uniform slopes. Forbs are especially diverse on this site, with up to 27 different species occurring at a single location. Forbs tend to be distributed in more open patches of soil and around exposed bedrock.

Associated sites

F022AE008CA	**Frigid Loamy Moraine Slopes** Occurs on adjacent moraine slopes with very deep soils volcanic soils. The vegetation is red fir (Abies magnifica) - white fir (Abies concolor) forest.
F022AE013CA	**Frigid, Loamy, Volcanic Mountain Slopes** Occurs on adjacent mountain slopes with loamy, moderately deep to deep andesitic soils. The vegetation is a white fir (Abies concolor) mixed conifer forest. White fir, jeffrey pine (Pinus jeffreyi), sugar pine (Pinus lambertiana) and incense cedar (Calocedrus decurrens) are all important species.

R022AX104CA	**Sphagnum Fen** Occurs on sphagnum fens.
R022AX107CA	**Frigid C Channel System** Occurs along C type channels with gravelly to cobbly channel substrates. The vegetation is dominated by Lemmons willow (Salix lemmonii) with mixed forbs.

Similar sites

R022AE213CA	**Steep Rubbly Slope** This site is associated with very steep, rubbly slopes. It has a denser shrub cover and lower diversity of herbaceous species.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Quercus vacciniifolia* (2) *Arctostaphylos patula*
Herbaceous	(1) *Erigeron peregrinus* (2) *Penstemon deustus*

Physiographic features

This site is found on glacially scoured side slopes at elevations of 6,200 to 7,710 feet. This site is found on all aspects but more typically on south facing slopes. Slopes can range from 9 to 70 percent, but slopes of 30 to 50 percent are typical. Runoff class is very high.

Table 2. Representative physiographic features

Landforms	(1) U-shaped valley
Flooding frequency	None
Ponding frequency	None
Elevation	1,890 – 2,350 m
Slope	10 – 70 %
Aspect	SE, S, SW

Climatic features

The climate of this ecological site is characterized by cool temperatures, wet winters with most precipitation falling as snow in winters, and relatively dry summers. The average annual precipitation ranges from 23 to 63 inches. The average annual air temperature ranges from 40 to 46 degrees Fahrenheit. The frost-free (>32F) season is 40 to 90 days. The freeze-free (>28F) season is 70 to 110 days.

Table 3 Representative climatic features

Frost-free period (average)	90 days
Freeze-free period (average)	70 days
Precipitation total (average)	1,090 mm

Influencing water features

This ecological site is not influenced by wetland or riparian water features.

Soil features

The soils associated with this ecological site are shallow, and formed in colluvium derived from andesitic lahar or welded tuff. They are excessively drained with rapid permeability. The soil moisture regime is typic xeric and the soil temperature regime is frigid. Surface rock fragments smaller than 3 mm in diameter average 25 percent, and larger fragments average 6 percent. The surface texture is stony very fine sandy loam, and subsurface textures are very cobbly sandy loam and extremely gravelly fine sandy loam. Subsurface rock fragments smaller than 3 mm in diameter range from 15 to 50 percent by volume, and larger fragments range from 10 to 25 percent (for a depth of 0 to 12 inches). The soils correlated to this site include Ellispeak (loamy-skeletal, isotic, frigid Lithic Haploxerolls).

This ecological site has been correlated with the following mapunits and soil components in the Tahoe Basin soil survey area (CA693):

Area_sym ; Musym ; MUname ; Compname ; Local_phase ; Comp_pct
CA693 ; 7121 ; Ellispeak-Rock outcrop complex, 9 to 30 percent slopes ; Ellispeak ; ; 45
CA693 ; 7122 ; Ellispeak-Rock outcrop complex, 30 to 50 percent slopes ; Ellispeak ; ; 45
CA693 ; 7123 ; Ellispeak-Rock outcrop complex, 50 to 70 percent slopes ; Ellispeak ; ; 45
CA693 ; 7131 ; Ellispeak-Waca complex, 9 to 30 percent slopes ; Ellispeak ; ; 45
CA693 ; 7132 ; Ellispeak-Waca complex, 30 to 50 percent slopes ; Ellispeak ; ; 45
CA693 ; 7133 ; Ellispeak-Waca complex, 50 to 70 percent slopes ; Ellispeak ; ; 45
CA693 ; 7151 ; Jorge very cobbly fine sandy loam, 5 to 15 percent slopes, rubbly ; Ellispeak ; ; 2
CA693 ; 7152 ; Jorge very cobbly fine sandy loam, 15 to 30 percent slopes, rubbly ; Ellispeak ; ; 2
CA693 ; 7153 ; Jorge very cobbly fine sandy loam, 30 to 50 percent slopes, rubbly ; Ellispeak ; ; 2
CA693 ; 7154 ; Jorge very cobbly loam, 2 to 15 percent slopes, extremely stony ; Ellispeak ; ; 3
CA693 ; 7155 ; Jorge very cobbly loam, 15 to 50 percent slopes, extremely stony ; Ellispeak ; ; 3
CA693 ; 7156 ; Jorge-Tahoma complex, 15 to 30 percent slopes ; Ellispeak ; ; 1
CA693 ; 7157 ; Jorge-Tahoma complex, 30 to 50 percent slopes ; Ellispeak ; ; 1
CA693 ; 7221 ; Tahoma very cobbly sandy loam, 2 to 15 percent slopes, very stony ; Ellispeak ; ; 1
CA693 ; 7222 ; Tahoma-Jorge complex, 2 to 15 percent slopes ; Ellispeak ; ; 1
CA693 ; 7231 ; Waca very gravelly medial coarse sandy loam, 9 to 30 percent slopes ; Ellispeak ; ; 5
CA693 ; 7232 ; Waca very gravelly medial coarse sandy loam, 30 to 50 percent slopes ; Ellispeak ; ; 5
CA693 ; 7233 ; Waca very gravelly medial coarse sandy loam, 50 to 70 percent slopes ; Ellispeak ; ; 5
CA693 ; 9121 ; Watsonlake gravelly sandy loam, 5 to 15 percent slopes, rubbly ; Ellispeak ; ; 1
CA693 ; 9122 ; Watsonlake gravelly sandy loam, 15 to 30 percent slopes, rubbly ; Ellispeak ; ; 1
CA693 ; 9123 ; Watsonlake gravelly sandy loam, 30 to 50 percent slopes, rubbly ; Ellispeak ; ; 1

Table 4. Representative soil features

Parent material	(1) Colluvium – andesite

Surface texture	(1) Stony very fine sandy loam
Family particle size	(1) Loamy
Drainage class	Excessively drained
Permeability class	Rapid
Soil depth	30 – 50 cm
Surface fragment cover <=3"	30 %
Surface fragment cover >3"	10 %
Available water capacity (0-101.6cm)	2.03 – 2.29 cm
Subsurface fragment volume <=3" (Depth not specified)	20 – 50 %
Subsurface fragment volume >3" (Depth not specified)	10 – 30 %

Ecological dynamics

Abiotic factors
This ecological site is associated with shallow loamy soils that have developed over strongly cemented andesitic bedrock. Exposed volcanic outcrops are commonly present. This site is typically found on undulating south facing slopes in patchy areas of shallow soil within a forest matrix. Shallow, erosion prone soils and warm aspects support only sparse tree cover, and the dominant vegetation is open and diverse montane chaparral. Huckleberry oak is the most frequent shrub, with greenleaf manzanita also common. The loamy volcanic soils and undulating, dissected landscape support a higher diversity of shrubs and forbs than is found in montane chaparral communities associated with granitic substrates and more uniform slopes. Forbs are especially diverse on this site, with up to 27 different species occurring at a single location. Forbs tend to be distributed in more open patches of soil and around exposed bedrock. Scabland penstemon (Penstemon deustus), which is associated with open rocky volcanic habitats (Jepson 1993), is one of the most abundant forbs on this site.

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Disturbance factors
Fire is the primary disturbance impacting ecological dynamics of this site. The shrub community associated with this site is fire dependent, and forb richness benefits from relatively frequent burning (e.g. Wayman and North, 2007, Webster 2010). The fire return interval for montane chaparral ranged from 6 to 77 years prior to European settlement (Nagal and Taylor 2005). A high cover of bare ground and patchily distributed shrubs in this site mean that fire would not spread as rapidly or have the same severity as in chaparral dominated sites with more continuous shrub cover; nevertheless, fire is important in maintaining the reference community of this site.

For the past century, fires have been almost non-existent in this site due to fire suppression, which has allowed trees to increase (Nagal and Taylor 2005). In chaparral communities on the west shore of Lake Tahoe, where this site occurs, tree encroachment is estimated to have occurred in over 60% of chaparral stands (Nagal and Taylor 2005). The shallow, erosive soils of this site are quite resistant to forest encroachment, but undoubtedly tree cover has increased beyond historic ranges. With a lack of fire, shrubs increase in cove, causing forb cover and diversity to decline, and as trees increase in height and cover, shrub growth is suppressed, slowly resulting in forest encroachment into this site.

Livestock grazing may have impacted this ecological site. Exploitative grazing practices in the Sierra Nevada from the 1850s to approximately 1930 impacted many forest, shrub, meadow and riparian communities (Elliot-Fisk et al. 1996, Taylor 2004). Heavy and pervasive sheep grazing in the Lake Tahoe Basin removed all grasses and palatable shrubs in some areas by 1900 (Sudworth, 1900, quoted in Elliot-Fisk et al. 1996). Documentation of grazing impacts in this site is not available, so impacts of grazing are speculative only. Grass cover may have been more abundant prior to livestock grazing, and grazing may have increased erosion of the shallow steep soils of this site.

Invasive species are largely absent in this site; and the shallow soils and warm aspects confer some resilience against invasion. However, cheatgrass (Bromus tectorum) may be present in the site at low levels, and has only invaded in the last 10 years (NRCS plot data). Cheatgrass has the potential to become abundant after fire, outcompeting native species and reducing site diversity, and shortening the fire return interval by providing continuous flashy fuel cover (e.g. Holmgren, 1956; McIver et al. 2010).

State and transition model

Figure 5. R022AE217CA

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Tree					
1	**Trees**			28-101	
	Jeffrey pine	PIJE	*Pinus jeffreyi*	1-67	1-5
	western white pine	PIMO3	*Pinus monticola*	1-34	1-5
	white fir	ABCO	*Abies concolor*	1-34	1-5
Shrub/Vine					
2	**Shrubs**			785-2802	
	huckleberry oak	QUVA	*Quercus vacciniifolia*	112-1345	5-20
	greenleaf manzanita	ARPA6	*Arctostaphylos patula*	112-1009	1-15
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0-151	0-2
	prostrate ceanothus	CEPR	*Ceanothus prostratus*	0-140	0-6
	bitter cherry	PREM	*Prunus emarginata*	0-17	0-10
	pinemat manzanita	ARNE	*Arctostaphylos nevadensis*	1-17	1-10
	Sierra gooseberry	RIROR	*Ribes roezlii var. roezlii*	0-6	0-1
	creeping snowberry	SYMO	*Symphoricarpos mollis*	0-6	0-1
	roundleaf snowberry	SYRO	*Symphoricarpos rotundifolius*	0-6	0-1
Forb					
3	**Forbs**			45-146	
	subalpine fleabane	ERPE3	*Erigeron peregrinus*	0-34	0-5
	scabland penstemon	PEDE4	*Penstemon deustus*	0-22	0-2
	Ashland cinquefoil	POGLA2	*Potentilla glandulosa ssp. ashlandica*	0-7	0-1

	wavyleaf Indian paintbrush	CAAP4	*Castilleja applegatei*	0-7	0-1
	Torrey's blue eyed Mary	COTO	*Collinsia torreyi*	0-3	0-1
	dusky onion	ALCA2	*Allium campanulatum*	0-1	0-1
	spreading groundsmoke	GADI2	*Gayophytum diffusum*	0-1	0-1
	mountain monardella	MOOD	*Monardella odoratissima*	0-1	0-1
	lambstongue ragwort	SEIN2	*Senecio integerrimus*	0-1	0-1
	waxy checkerbloom	SIGL2	*Sidalcea glaucescens*	0-1	0-1
	woolly mule-ears	WYMO	*Wyethia mollis*	0-1	0-1
Grass/Grasslike					
4	**Grasses and Grasslike**			4-34	
	needlegrass	ACHNA	*Achnatherum*	0-11	0-2
	squirreltail	ELEL5	*Elymus elymoides*	0-11	0-2
	Sandberg bluegrass	POSE	*Poa secunda*	0-11	0-2

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

This shrubland community provides food from leaf tissue, fruits, seeds, and nuts for deer, bears, squirrels, birds, and other animals.

Recreational uses

This area is generally too steep and rocky to be used for recreation, but some trails do exist in this terrain.

Other information

The fruits of greenleaf manzanita can be eaten raw or made into tea (Hauser, 2007). The fruits of bitter cherry are used as a laxative, and the roots and inner bark were boiled to make a medicine to prevent heart trouble. The bark of bitter cherry is used to make baskets (Esser, 1995).

Inventory data references

The following NRCS TEUI and production plots were used to describe this ecological site: Mxf04117 (Type location) Elf04026 Ra03h173

Type locality

Location 1: Placer County, CA	
Township/Range/Section	T15N R16E S27
UTM zone	N
UTM northing	4333098
UTM easting	742828

General legal description	Take HW 89 along the west shore to Barker Pass Road. Plot is upslope on north side of road.

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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):**

   _____

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:**
