USDA Natural Resources Conservation Service

Ecological site R022AE213CA
Steep Rubbly Slope

Accessed: 05/17/2024

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.

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): 022A–Sierra Nevada and Tehachapi Mountains

MLRA 22A

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 found on steep, generally south-facing mountain slopes. Elevations are typically between 6,200 and 8,400 feet and slopes range from 30 to 90 percent. Soils developed on rocky talus fields, which have been deposited over dense glacial till or hard granitic bedrock. The dense till creates a root-restricting layer between 39 and 59 inches below the soil surface, while the bedrock occurs at depths of 7 to 20 inches. The reference plant community is montane chaparral, dominated by huckleberry oak (Quercus vaccinifolia), and greenleaf manzanita (Arctostaphylos patula) may be locally abundant. Trees, forbs and grasses are present at trace amounts. High solar radiation on warm south-facing slopes and the impermeable soil layer or shallow bedrock reduces the duration of moisture availability on this site, which restricts forest growth. Fire severity is high on these dry, south-facing slopes, and chaparral vegetation persists as a climax community due to a combination of poor abiotic suitability for forest growth and a positive feedback between flammable fire dependent vegetation and high severity fires.

Associated sites

F022AC003CA	**Frigid-Cryic Sandy Slopes** Occurs on higher elevation slopes with moderately to very deep sandy soils. Red fir (Abies magnifica) and western white pine (Pinus monticola) dominate the forest, with pinemat manzanita (Arctostaphylos nevadensis) dominant in canopy openings.
F022AC005CA	**Cryic Sheltered, Moist Sandy Mountain Slopes** Occurs on adjacent north-facing slopes with deep sandy soils. A mixed-subalpine forest is present, with Sierra lodgepole pine (Pinus contorta var. murrayana), mountain hemlock (Tsuga mertensiana), red fir (Abies magnifica) and western white pine (Pinus monticola) all present.
F022AC007CA	**North-Facing Cryic Loamy Mountain Slopes** Occurs on adjacent north-facing higher elevation slopes with moderately deep andic soils. A mixed conifer forest is present, with mountain hemlock (Tsuga mertensiana), red fir (Abies magnifica) and western white pine (Pinus monticola).
R022AC202CA	**Shallow Andesite Ridge** Occurs on adjacent loamy shallow soils over andesitic bedrock. The vegetation is a low productivity shrubland dominated by low sagebrush (Artemisia arbuscula).
R022AC204CA	**Cryic, Umbric Or Andic Slopes** Occurs on adjacent slopes with moderately to very deep, cryic with a thick umbric epipedon or andic properties. The vegetation is a productive shrubland dominated by mountain big sagebrush (Artemisia tridentata ssp. vaseyana) and antelope bitterbrush (Purshia tridentata).

Similar sites

R022AE217CA	**Frigid Volcanic Slopes** This site occurs on shallow soils with loamy textures, and rock surface cover is not as high. Loamy soils support a higher diversity of shrubs and forbs. Production and cover are lower.
F022AF004CA	**Frigid, Shallow To Deep, Sandy Mountain Slopes** This site occurs on shallow to moderately deep sandy soils on south-facing aspects, typically in a lower precipitation zone. Rock cover is not as high. This site supports and open Jeffrey pine (Pinus jeffreyi) forest, but disturbance phases have high shrub cover, and can resemble R022AE213CA.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Quercus vacciniifolia* (2) *Arctostaphylos patula*
Herbaceous	(1) *Eriogonum nudum*

Physiographic features

This site is found on glacially scoured valleys walls and mountain slopes at elevations between 6,220 and 9,280 feet, but typically below 8.400 feet. Talus and rock outcrop cover more than 50 percent of the area. This site is found on all aspects but generally on south to southeast facing slopes. Slopes range from 30 to 90 percent, but are typically above 50 percent. Runoff class is low.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) U-shaped valley
Flooding frequency	None
Ponding frequency	None
Elevation	1,896–2,829 m
Slope	30–90%
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 mean annual precipitation ranges from 33 to 61 inches. The mean annual temperature ranges from 41 to 46 degrees F. The frost-free (>32F) season is 40 to 90 days. The freeze-free (>28F) season is 80 to 140 days.

Table 3. Representative climatic features

Frost-free period (average)	110 days
Freeze-free period (average)	65 days
Precipitation total (average)	1,194 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 to deep, and formed in colluvium derived from volcanic, metamorphic, or granitic rock. They are excessively drained with rapid permeability. The soil moisture regime is xeric and the soil temperature regime is frigid. Surface rock fragments smaller than 3 inches in diameter range from 10 to 30 percent, and larger fragments range from 45 to 55 percent. Surface texture is very cobbly fine sandy loam and very gravelly coarse sand. Subsurface textures are very to extremely cobbly fine sandy loam, and very to extremely gravelly coarse sand. Subsurface rock fragments smaller than 3 inches in diameter range from 10 to 40 percent by volume, and larger fragments range from 5 to 50 percent (for a depth of 0 to 59 inches). The soils correlated to this site include Glenalpine (Loamy-skeletal, isotic, frigid Humic Dystroxerepts) and Rockbound (Sandy-skeletal, mixed, frigid Lithic Xerorthents). Glenalpine soils have a root restrictive layer from dense glacial till at 39 to 59 inches, and Rockbound soils have bedrock at 7 to 20 inches.

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 ; 7201 ; Rubble land-Glenalpine complex, 50 to 90 percent slopes ; Glenalpine ; ; 40; Rockbound ; very stony loam ; 5

CA693 ; 7502 ; Rock Outcrop-Rockbound complex, 30 to 70 percent slopes ; Rockbound ; very stony loam ; 25; Glenalpine ; ; 5
CA693 ; 9406 ; Dagget very gravelly loamy coarse sand, moist, 30 to 70 percent slopes, rubbly ; Rockbound ; very stony loam ; 5
CA693 ; 9101 ; Callat very gravelly coarse sandy loam, 9 to 30 percent slopes, very stony ; Glenalpine ; ; 5
CA693 ; 9102 ; Callat very gravelly coarse sandy loam, 30 to 50 percent slopes, very stony ; Glenalpine ; ; 5
CA693 ; 7489 ; Meeks gravelly loamy coarse sand, 30 to 70 percent slopes, rubbly ; Rockbound ; very stony loam ; 5
CA693 ; 7500 ; Rock outcrop, granitic ; Rockbound ; very stony loam ; 2
CA693 ; 7191 ; Rock outcrop, volcanic ; Glenalpine ; ; 2
CA693 ; 7523 ; Tallac gravelly coarse sandy loam, 30 to 70 percent slopes, very stony ; Rockbound ; very stony loam ; 1

Table 4. Representative soil features

Parent material	(1) Colluvium–volcanic breccia
Surface texture	(1) Very cobbly fine sandy loam (2) Very gravelly coarse sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid
Soil depth	18–150 cm
Surface fragment cover <=3"	10–30%
Surface fragment cover >3"	45–55%
Available water capacity (0-101.6cm)	0.51–7.37 cm
Soil reaction (1:1 water) (0-101.6cm)	5.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	10–40%
Subsurface fragment volume >3" (Depth not specified)	5–50%

Ecological dynamics

Abiotic Factors
This ecological site is found on steep, generally south-facing mountain slopes. Soils have developed on rocky talus fields, which have been deposited over dense glacial till or hard granitic bedrock. The dense till creates a root-restricting layer between 39 and 59 inches, while the bedrock occurs at 7 to 20 inch depths. The reference community for this site is montane chaparral, dominated by huckleberry oak, and greenleaf manzanita may be locally abundant. High solar radiation on warm south-facing slopes and the impermeable soil layer or shallow bedrock reduces the duration of moisture availability on this site, which restricts forest growth. Fire severity is greater on dry, south-facing slopes (Weatherspoon and Skinner 1995, Alexander et al. 2006), and chaparral vegetation persists as a climax community on this site due to a combination of poor abiotic suitability for forest growth and a positive feedback between flammable fire dependent vegetation and high severity fires (Nagal and Taylor 2005, Odion et al. 2009).

Disturbance Factors
Fire is the primary disturbance impacting ecological dynamics of this site. All of the shrubs associated with this community are either fire adapted or fire dependent. Lightning is common on these sites, and flammability of these shrubs is high, so fire spreads rapidly, and fire intensity is high. The fire return interval for montane chaparral in the ecological site area ranged from 6 to 77 years, with a mean fire return interval (FRI) of 28 years prior to European settlement (Nagal and Taylor 2005). Since 1871, fires have been almost non-existent due to fire suppression, which

has allowed trees to increase in areas that naturally support chaparral (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).

State and transition model

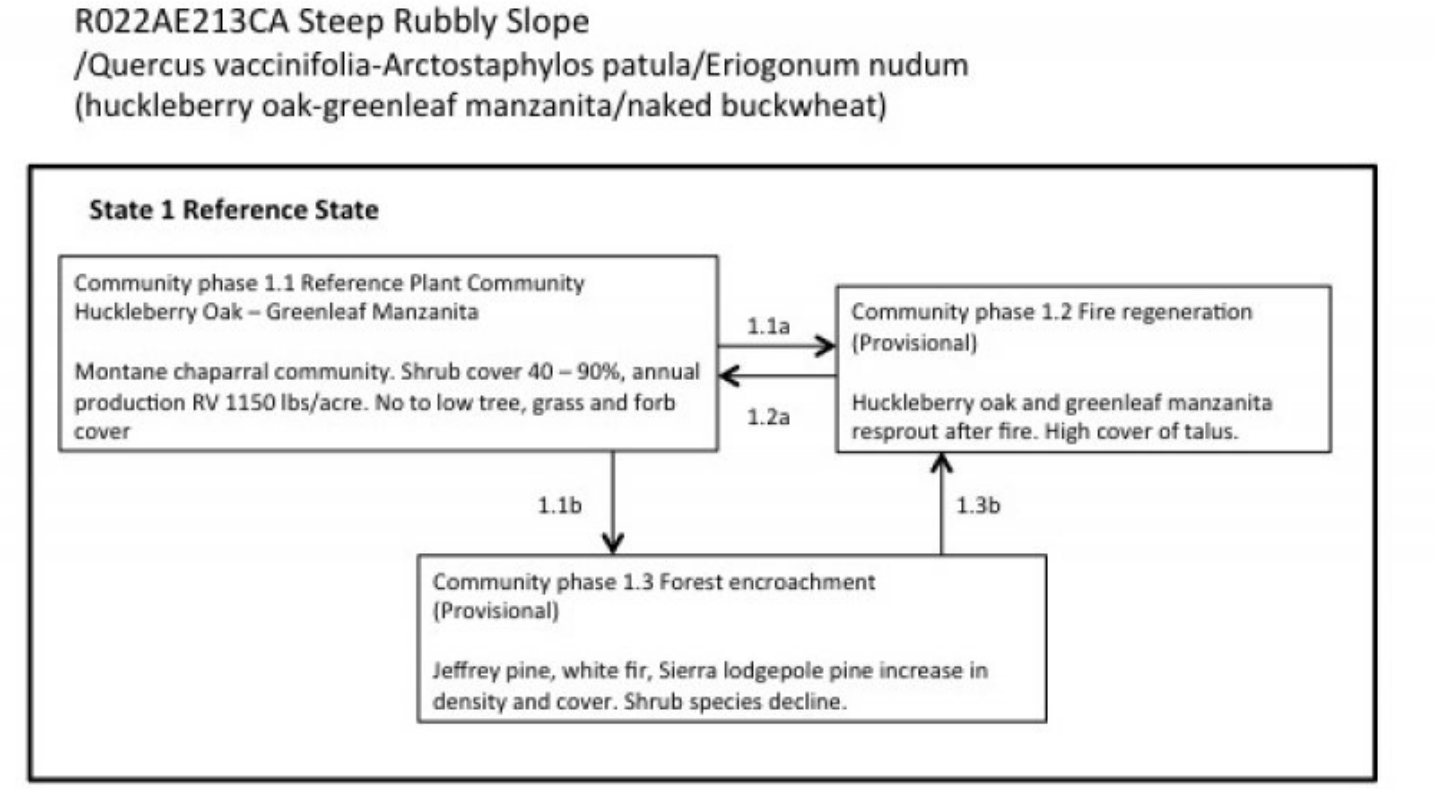

Figure 6. R020AE213CA

State 1
Reference State

The reference state is characterized by a montane chaparral community dominated by huckleberry oak and maintained by regular high severity fire, with a mean fire return interval of 28 years. Fire suppression over the last century has led to forest encroachment and a forested community phase. Fire in the forested phase should cause a return to the reference plant community, and it is not thought that forest encroachment has led to an altered state. This ecological site has high ecological resilience, with dry, rocky slopes limiting exotic species invasion, and suitability for livestock grazing.

Community 1.1
Reference plant community

Figure 7. Reference Plant Community

The reference community is montane chaparral dominated by huckleberry oak. Greenleaf manzanita may be locally abundant. Common secondary shrubs present at lower cover include whitethorn ceanothus (*Ceanothus cordulatus*), bitter cherry (*Prunus emarginata*), bastardsage (*Eriogonum wrightii*), roundleaf snowberry (Symphoricarpos rotundifolia), sulphur-flower buckwheat (*Eriogonum umbellatum*), Utah serviceberry (*Amelanchier utahensis*), and wax current (*Ribes cereum*). Tree, forb and grass cover is typically insignificant. Trees that may occur on the site include Jeffrey pine (*Pinus jeffreyi*), California red fir (*Abies magnifica*) and Sierra lodgepole pine (*Pinus contorta* ssp. murrayana).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	594	1289	2018
Tree	–	–	34
Forb	–	1	11
Grass/Grasslike	–	–	4
Total	**594**	**1290**	**2067**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-1%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	40-70%
Surface fragments >0.25" and <=3"	7-10%
Surface fragments >3"	13-20%
Bedrock	0-30%
Water	0%
Bare ground	1-8%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-1%	0-2%	0-10%
>0.15 <= 0.3	–	0-1%	0-4%	0-13%
>0.3 <= 0.6	–	0-40%	–	0-5%
>0.6 <= 1.4	–	0-75%	–	–
>1.4 <= 4	0-4%	–	–	–
>4 <= 12	0-4%	–	–	–
>12 <= 24	0-4%	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2
Fire Regeneration (Provisional)

The reference community is adapted to fire; with most shrubs associated with this site able to resprout after the aerial portion of the shrub has been killed or to regenerate from heat-activated seed that is long-lived in the soil seed bank. Huckleberry oak is a fire-adapted species that is highly flammable and vigorously resprouts from the root crown after fire (Howard 1992, Nagal and Taylor 2005, Odion et al. 2009). Greenleaf manzanita vigorously resprouts from underground lignotubers, and regerates from heat scarified seeds that may survive in the soil for more than 400 years (Nagal and Taylor 2005, Hauser 2007). Whitethorn ceanothus will resprout following light to moderate severity fire, and after severe intensity fire regenerates from heat activated seed that may survive in the soil for more than 200 years (Nagal and Taylor 2005, Reeves 2006). With rapid regeneration from root sprouts, and recruitment from on site seed stores, this shrubland can resemble preburn coverage in 7 to 9 years (Risser and Fry, 1988).

Community 1.3
Fire Suppression (Provisional)

A national policy of fire suppression over the last century has meant that many locations where this ecological site occurs have not burned for more than 120 years (Nagal and Taylor 2005). Prior to fire suppression, long periods of time between fires were possible, with a maximum range of 20 to 77 years (Nagal and Taylor 2005). Tree cover would have increased during long fire intervals, but not as systemically over as wide an area as the current time. Shrub and tree regeneration is most pronounced in the decade immediately following fire, but may continue for at least five decades and probably longer, resulting in mix-aged shrub stands (Nagal and Taylor 2005). However, as trees increase in height and cover they begin to suppress shrub growth, slowly resulting in forest encroachment into the chaparral. Data is not available for this community phase, but it is assumed that cover of Jeffrey pine, red fire, and Sierra lodgepole pine, which are characteristic of surrounding forests and already present at trace amounts in the reference community, would increase, while huckleberry oak, greenleaf manzanita and other shrubs would decrease.

Pathway 1.1a
Community 1.1 to 1.2

Occurs with fire.

Pathway 1.1b
Community 1.1 to 1.3

Occurs with long-term fire suppression.

Pathway 1.2a
Community 1.2 to 1.1

Occurs with time without fire.

Pathway 2.3a
Community 1.3 to 1.1

Occurs with fire.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			594–2018	
	huckleberry oak	QUVA	*Quercus vacciniifolia*	560–1681	35–55
	greenleaf manzanita	ARPA6	*Arctostaphylos patula*	0–336	0–8
	whitethorn ceanothus	CECO	*Ceanothus cordulatus*	0–34	0–1
	bitter cherry	PREM	*Prunus emarginata*	0–17	0–1
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–6	0–1
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–6	0–1
	bastardsage	ERWR	*Eriogonum wrightii*	0–6	0–1
	wax currant	RICE	*Ribes cereum*	0–6	0–1
	roundleaf snowberry	SYRO	*Symphoricarpos rotundifolius*	0–6	0–1
Tree					
2	**Trees**			0–34	
	California red fir	ABMA	*Abies magnifica*	0–22	0–4
	Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	0–11	0–1
	Jeffrey pine	PIJE	*Pinus jeffreyi*	0–6	0–1
Forb					
3	**Forbs**			0–11	
	naked buckwheat	ERNU3	*Eriogonum nudum*	0–3	0–5
	woolly mule-ears	WYMO	*Wyethia mollis*	0–2	0–1
	spreading phlox	PHDI3	*Phlox diffusa*	0–1	0–1
	broadleaf knotweed	POMI2	*Polygonum minimum*	0–1	0–1
	lambstongue ragwort	SEIN2	*Senecio integerrimus*	0–1	0–1
	Sierra stonecrop	SEOBO	*Sedum obtusatum ssp. obtusatum*	0–1	0–1
	dusky onion	ALCA2	*Allium campanulatum*	0–1	0–1
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–1	0–1
	sanddune wallflower	ERCA14	*Erysimum capitatum*	0–1	0–1
Grass/Grasslike					
4	**Grasses and Grasslike**			0–4	
	needlegrass	ACHNA	*Achnatherum*	0–1	0–1
	sedge	CAREX	*Carex*	0–1	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–1	0–1
	Parry's rush	JUPA	*Juncus parryi*	0–1	0–1

Animal community

This shrubland community provides food from leaf tissue, fruits, seeds, and nuts for deer, bears, squirrels, birds, and other animals. The dense shrubs provide good cover for small animals.

Recreational uses

This ecological site is generally too steep and rocky to be used for recreation, but trails accessing higher elevations 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 plots were used to describe this ecological site:

Community Phase 1.1:
RIF02013 (Type location)
ra02h23
Rlf030132013

Type locality

Location 1: El Dorado County, CA	
Township/Range/Section	T12N R17E S15
UTM zone	N
UTM northing	4307576
UTM easting	752413
General legal description	Take Highway 88 to Fallen Leaf Lake Road, then to the Glen Alpine Springs Trailhead. Head up talus trail to the north of parking lot, up the side flank-talus of Mount Tallac. Site is just above trail about half way up the slope.

Other references

Alexander, J. D., N. E. Seavy, C. J. Ralph, and B. Hogoboom. 2006. Vegetation and topographical correlates of fire severity from two fires in the Klamath-Siskiyou region of Oregon and California. International Journal of Wildland Fire 15:237-245.

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Nagal, T. A. and A. H. Taylor. 2005. Fire and persistence of montane chaparral in mixed conifer forest landscapes in the northern Sierra Nevada, Lake Tahoe Basin, California, USA. Journal of the Torrey Botanical Society 132:442-457.

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Risser, Roland J. and Fry, Michael E. 1988. Montane Chaparral. California Wildlife Habitat Relationships System. California Department of Fish and Game. California Interagency Wildlife Task Group. Available: http://www.dfg.ca.gov/bdb/cwhr/pdfs/MCP.pdf.

Weatherspoon, C. P. and C. N. Skinner. 1995. An assessment of factors associated with damage to tree crowns from the 1987 wildfires in Northern California. Forest Science 41:430-451.

Whitlock, C., C. N. Skinner, P. J. Bartlein, T. Minckley, and J. A. Mohr. 2004. Comparison of charcoal and tree-ring records of recent fires in the eastern Klamath Mountains, California, USA. Canadian Journal of Forest Research 34:2110-2121.

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):**

10. **Effect of community phase 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 annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    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 (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-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 indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**