Ecological site R022AX103CA Cryic E Meadow System

Accessed: 08/26/2026

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 “X” represents ecological sites driven by abiotic features that override the typical soils or climatic features that drive most of the other LRU zones. In the Sierra Nevada these sites are typically driven by water features associated with lotic or lentic riparian systems. Other features maybe shallow bedrock, or unique chemical development which affects the growth of typical vegetation.

Ecological site concept

This riparian complex is associated with alluvial valley types (VIII) at elevations typically between 7,500 and 8,800 feet, with a reference E channel type (Rosgen 1996). The dominant soils are cryic, with deep rich A horizons. Histic soils are limited to the wettest areas along the streams, or associated with adjacent discharge slopes. These are typically first or second order streams associated with small alpine meadows. Dominant species are mountain willow (Salix eastwoodiae), Sierra willow (Salix orestera), mountain sedge (Carex scopulorum), and tufted hairgrass (Deschampsia cespitosa).

Associated sites

F022AX101CA	**Moist Colluvial Headwater System** This ecological site occurs on lacustrine fringe, or lake deltas with a Da type channel.
R022AX102CA	**Frigid E-C Meadow System** This ecological site occurs at lower elevations, with a frigid temperature regime, and typically larger stream systems. It has an E-C type reference channel.
R022AX104CA	**Sphagnum Fen** This ecological site occurs in depressional basins associated with sphagnum fens. Stream channels typically do not develop in the reference state.

Similar sites

R022AX007CA	**Subalpine, low to mid gradient E-channel riverine** This ecological site has an E type reference channel, and occurs at higher elevations than this site. It occurs in the southern sierras, and may extend above treeline.
R022AX102CA	**Frigid E-C Meadow System** This ecological site has similar stream succession dynamics, but different plant communities, due to the lower elevation of this site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Salix eastwoodiae* (2) *Salix orestera*
Herbaceous	(1) *Carex scopulorum* (2) *Deschampsia cespitosa*

Physiographic features

This ecological site is found on flood plain or fens in higher elevation mountain valleys. Elevations may range from 6,990 feet and 9,300 feet, but are typically between 7,500 and 8,800 feet. Slopes range from 0 to 2 percent. It is found on all aspects.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Fen
Flooding duration	Very long (more than 30 days)
Flooding frequency	None to frequent
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	2,130 – 2,840 m
Slope	0 %
Ponding depth	0 – 30 cm

Water table depth	0 – 50 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 33 to 65 inches, mostly in the form of snow in the winter months from November through April. The average annual air temperature is 37 to 41 degrees Fahrenheit, and the frost-free (>32F) season is 20 to 60 days. The freeze-free (>28F) season is 30 to 90 days.

The monthly data below is from the Echo Summit climate station listed below. This station is the closest to this ecological site in elevation and distance. However, this climate station is on a hillslope, and this ecological site is associated with meadows and valley floors where temperatures tend to be cooler. The monthly precipitation data below represent the average total monthly precipitation.

Table 3 Representative climatic features

Frost-free period (average)	40 days
Freeze-free period (average)	60 days
Precipitation total (average)	1,220 mm

Influencing water features

This site is a low gradient riparian system, associated with E type channels.

Soil features

The Bidart, Bidart wet phase, and Hellhole soils are associated with this ecological site. These soils are associated with different fluvial surfaces, and vary in wetness and organic matter accumulation. These soils are all very deep, and formed in alluvium from mixed parent material or deep mossy organic matter. These soils are very poorly drained with moderate to rapid (Hellhole) permeability. The soil moisture regime is aquic and the soil temperature regime is cryic or frigid (Hellhole). Surface and subsurface rock fragments are typically absent.

Soils by fluvial surface:

Discharge slopes and depressional basins:
The Hellhole soil occurs in areas with permanent high water tables, which allows deep organic soils to develop from moss fibers. The hellhole soils are Euic, frigid Typic Sphagnofibrists. They are rarely flooded for brief durations, but are frequently ponded (saturated) for long durations. Available water capacity is 21.7 to 25.6 inches in the upper 40 inches of soil (ESIS does not allow AWC greater than 15.99 to be entered). CC1 and CC2 are associated with this component.

Floodplain, Frequently Flooded:

The Bidart, wet phase occurs on the active floodplains. The Bidart soils have a mucky silt loam surface texture, with silt loam, extremely gravelly coarse sand, fine sandy loam, and sandy loam subsurface textures. These soils exhibit episodic depositional layers. Mottling from water saturation is evident at 3 inches, with gleyed conditions starting at 17 inches. The Bidart soils are coarse-loamy, mixed, superactive, acid Fluvaquentic Cryaquepts. The Bidart wet phase is frequently flooded and ponded for long durations. CC3 is associated with this component.

Floodplains, Occasionally Flooded

The Bidart silt loam component has the same features as describe for the Bidart wet phase, but it is occasionally flooded and ponded, due to its higher topographic position on the floodplain. CC4 is associated with this component.

This ecological site occurs in following mapunits and components in the Lake Tahoe Basin:

Mapunit;Mapunit name;Component;Phase;Percent
7021;Hellhole peat, 0 to 2 percent slopes;Bidart;wet;10
7071;Watah peat, 0 to 2 percent slopes;Bidart;wet;2
9001;Bidart complex, 0 to 2 percent slopes;Bidart;wet;30
9001;Bidart complex, 0 to 2 percent slopes;Bidart;mucky silt loam;50
9001;Bidart complex, 0 to 2 percent slopes;Hellhole;;2

Table 4. Representative soil features

Parent material	(1) Alluvium – granite (2) Mossy organic material – volcanic breccia
Surface texture	(1) Mucky silt loam
Family particle size	(1) Loamy
Drainage class	Poorly drained
Permeability class	Moderate to rapid
Soil depth	150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	13.97 – 40.61 cm
Soil reaction (1:1 water) (0-101.6cm)	4.5 – 10
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

Abiotic Features:

This riparian complex is associated with alluvial valley types (VIII), with a reference E channel type (Rosgen 1996). The dominant soils are cryic, with deep rich A horizons. Histic soils are limited to the wettest areas along the streams, or associated with adjacent discharge slopes. These are typically first or second order streams associated with small alpine meadows. Dominant species are mountain willow (Salix eastwoodiae), Sierra willow (Salix orestera), mountain sedge (Carex scopulorum), and tufted hairgrass (Deschampsia cespitosa).

Hydrologic factors:

These small, low gradient streams meander through alpine meadows with narrow and deep E type channels. E type channels typically have thick mats of sedge roots which stabilize channel banks and help maintain a low channel width-to-depth ratio and high stream sinuosity. These small channels frequently flood onto the floodplain leaving fine deposits on the surface. The floodplains have a shallow water table that supports rhizomatous sedges and many obligate wetland species.

E type channels are often considered stable systems, but they respond quickly to disturbances, which may cause channel incision or bank erosion. This can shift an E type channel towards a G type channel. E type channels can become unstable due to disturbances that impact the stream bank vegetation, change the flow regime, or alter the channel morphology. Overgrazing and excessive trampling by livestock can reduce streambank stability by reducing vegetative cover or physically trampling the banks. Continued disturbance can cause the stream to erode and incise deeper into the alluvial sediments, containing high flows within the channel, and reducing or eliminating overbank flows onto the floodplain. The incision and stream confinement creates a deep, narrow, eroded G type channel. Overtime, the G type channel is widened by bank erosion, and a wide, entrenched F type channel develops. These channels (“G” and “F”) generally lose wetland obligate species because the water table is lower and flow is disconnected from the floodplain. Floodplains associated with G and F type channels become dominated by upland grass, shrub and/or forest plant communities. The banks are often bare due to active erosion. As the F channel obtains sufficient width, erosive scour is reduced, and vegetation can establish on the banks and along the greenline. Channel meander and point bar development occurs in the entrenched channel, allowing a new entrenched C type channel to develop. The entrenched C channel supports wetland plant communities but it is confined to the lower floodplain by the incised banks. The abandoned floodplain remains with a lower water table and supports a greater proportion of upland plants. E channels may develop within the floodplain of the C channel, as sedges continue to capture fine sediments and stabilize banks.

Disturbance Factors:

These upper elevation meadows are generally less disturbed than the lower elevation meadows around Lake Tahoe. The main disturbance in higher elevation meadows is from historic grazing. Grazing has altered the composition and cover of the native vegetation, and caused changes in channel morphology in some areas. More remote meadows are less impacted.

During the mid-1800’s approximately 80 percent of the forests in Tahoe were clear-cut during the Comstock era (Elliott-Fisk et al. 1996). Tree removal increased erosion on adjacent mountain slopes and increased sediment supply to these river systems. Removal of trees would also have reduced water loss to evapotranspiration and increased water flow into the streams. The side effects of the logging era on the stream morphology are unknown, but likely increased sediment supply and stream volume in these systems. Davis (, 1996) report increased erosion between 1850 and 1900 based on analysis of cores from Lake Tahoe. The erosion was attributed to logging, grazing and road development during this period. During the same period, there was an increase in the algae Pediastrum, and an increase in sedge (Carex spp.) pollen, possibly due to increased nutrient loading into the lake and tributaries.

The meadows in the Lake Tahoe Basin were grazed in the past by cattle and sheep. Over 13 dairy farms were active in the basin, and most meadows were fenced for cattle grazing. Sheep roamed the mountains, and denuded much of the forbs and grasses (Elliott-Fisk et al. 1996). Cattle concentrate in riparian habitats because of access to water and forage, shade and gentle landscapes (Kie and Boroski 1996). Cattle may have affected the present composition of vegetation by selectively grazing species such as grasses, and trampling susceptible species. Grazing can affect channel morphology by removing bank stabilizing vegetation such as willows, and by trampling stream banks when accessing the stream.

Beavers were once thought to be non-native to the Sierra Nevada, but carbon dating of old beaver dams has shown that beavers were in the Sierra Nevada since AD 580 (James and Lanman 2012, Landman et al. 2012). Beaver trapping and extirpation efforts eliminated beavers from the higher Sierra Nevada by mid-1800s. Beavers were reintroduced into the Lake Tahoe Basin from 1939 to 1949 (Beier and Barrett 1987) after 100 years or more of absence. Nine beavers were introduced from the Snake River in Idaho to the Truckee River. Since then populations have expanded to many watersheds around Lake Tahoe. In 1987 there were 0.72 colonies (3.5 beavers) per km of stream along the Truckee River (Beier and Barrett 1987).

Beavers develop dams to create deeper water for mobility, safety, and den building (Beier and Barrett 1987). Dam building raises the water table above the dam, causing pond development and flooding across the floodplain. Below the beaver dam, or after dams are removed, the channel may become unstable and scour or widen depending upon the site. The historic impact of beaver on this site is unknown, but they likely influenced the development of these streams and meadows.

Ecological sites associated with lotic stream systems are developed using channel evolution models. Stream systems are dynamic and continually evolve to reach a stable equilibrium. Streams develop identifiable stages of development based on channel morphology (Rosgen 1997). These stages are identified using a state and transition model based on stream evolution models.

The reference state is typically the pre-settlement, most successionally advanced and hydrologically stable community phase (numbered 1.1), and the community phases that result from natural and human disturbances. Community phase 1.1 is deemed the phase representative of the most successionally advanced pre-European plant/animal community including beaver activity and hydrologic conditions that influence its composition and production. Because this phase is partly determined from reconstruction and/or historic literature, some speculation is necessarily involved in describing it.

All tabular data listed for a specific community component within this ecological site description represent a summary of one or more field data collection plots taken in modal communities within the community component. Although such data are valuable in understanding the community component (kinds and amounts of ground and surface materials, canopy characteristics, community phase overstory and understory species, production and composition, and growth), they do not represent the absolute range of characteristics or an exhaustive listing of all species that may occur in that phase over the geographic range of the ecological site.

State and transition model

Figure 5. R022AX103CA STM

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Shrub/Vine					
1	**Discharge slope**			73-118	
	mountain willow	SAEA	*Salix eastwoodiae*	0-56	0-5
	western moss heather	CAME7	*Cassiope mertensiana*	0-45	0-5
	Sierra willow	SAOR	*Salix orestera*	0-17	0-1
2	**Floodplain**			135-1233	
	Sierra willow	SAOR	*Salix orestera*	22-1009	1-10
	willow	SALIX	*Salix*	0-101	0-3
	mountain willow	SAEA	*Salix eastwoodiae*	45-90	2-3
	rose meadowsweet	SPSPS	*Spiraea splendens var. splendens*	0-22	0-1
	western moss heather	CAME7	*Cassiope mertensiana*	0-11	0-1
	purple mountainheath	PHBR4	*Phyllodoce breweri*	0-11	0-1
3	**Floodplain step**			0-168	
	mountain willow	SAEA	*Salix eastwoodiae*	0-168	0-5
Grass/Grasslike					
1	**Discharge slope**			785-2018	
	Northwest Territory sedge	CAUT	*Carex utriculata*	11-1749	2-60
	mountain sedge	CASC12	*Carex scopulorum*	168-790	10-70
	spikerush	ELEOC	*Eleocharis*	22-146	1-3
	blister sedge	CAVE6	*Carex vesicaria*	0-22	0-1
	water sedge	CAAQ	*Carex aquatilis*	0-22	0-1
	lakeshore sedge	CALE8	*Carex lenticularis*	0-22	0-1
	sedge	CAREX	*Carex*	0-22	0-1
	tufted hairgrass	DECE	*Deschampsia cespitosa*	0-11	0-1
	bentgrass	AGROS2	*Agrostis*	0-11	0-1
2	**Floodplain**			560-1345	
	mountain sedge	CASC12	*Carex scopulorum*	56-796	2-70
	tufted hairgrass	DECE	*Deschampsia cespitosa*	0-785	0-25
	Donner woodrush	LUSU7	*Luzula subcongesta*	0-504	0-30
	Northwest Territory sedge	CAUT	*Carex utriculata*	0-135	0-8
	slender hairgrass	DEEL	*Deschampsia elongata*	0-73	0-5

	pullup muhly	MUFI2	*Muhlenbergia filiformis*	0-22	0-2
	bentgrass	AGROS2	*Agrostis*	0-22	0-1
	lakeshore sedge	CALE8	*Carex lenticularis*	0-22	0-1
3	**Floodplain step**			448-1065	
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	280-897	40-70
	bluegrass	POA	*Poa*	0-146	0-9
	tufted hairgrass	DECE	*Deschampsia cespitosa*	0-90	0-5
	mountain sedge	CASC12	*Carex scopulorum*	22-50	150-650
	meadow barley	HOBR2	*Hordeum brachyantherum*	0-11	0-1
	alpine timothy	PHAL2	*Phleum alpinum*	0-11	0-1
	pullup muhly	MUFI2	*Muhlenbergia filiformis*	0-6	0-1
Forb					
1	**Discharge slope**			6-135	
	Parish's yampah	PEPA21	*Perideridia parishii*	1-123	1-20
	primrose monkeyflower	MIPR	*Mimulus primuloides*	0-11	0-3
	tundra aster	ORALA2	*Oreostemma alpigenum var. alpigenum*	0-6	0-1
	longleaf starwort	STLO	*Stellaria longifolia*	1-6	0-1
	western aster	SYAS3	*Symphyotrichum ascendens*	0-6	0-1
	hairy arnica	ARMO4	*Arnica mollis*	0-6	0-1
	alpine shootingstar	DOAL	*Dodecatheon alpinum*	0-6	0-1
	Sierra shootingstar	DOJE	*Dodecatheon jeffreyi*	0-6	0-1
	willowherb	EPILO	*Epilobium*	0-6	0-1
	alpine gentian	GENE	*Gentiana newberryi*	0-6	0-1
	tinker's penny	HYAN2	*Hypericum anagalloides*	0-6	0-1
2	**Floodplain**			11-112	
	Pacific onion	ALVA	*Allium validum*	0-168	0-5
	Parish's yampah	PEPA21	*Perideridia parishii*	0-39	0-3
	tundra aster	ORALA2	*Oreostemma alpigenum var. alpigenum*	0-22	0-1
	bigleaf lupine	LUPO2	*Lupinus polyphyllus*	0-22	0-1
	woollyhead parsnip	SPCA5	*Sphenosciadium capitellatum*	0-22	0-1
	western aster	SYAS3	*Symphyotrichum ascendens*	0-6	0-1
	primrose monkeyflower	MIPR	*Mimulus primuloides*	0-6	0-1
	little elephantshead	PEAT	*Pedicularis attollens*	0-6	0-1
	Sierra bog orchid	PLDIL	*Platanthera dilatata var. leucostachys*	0-6	0-1
	plantainleaf buttercup	RAAL	*Ranunculus alismifolius*	0-6	0-1
	alpine gentian	GENE	*Gentiana newberryi*	0-6	0-1
	tinker's penny	HYAN2	*Hypericum anagalloides*	0-6	0-1
3	**Floodplain step**			73-347	
	slender cinquefoil	POGR9	*Potentilla gracilis*	6-202	1-15
	California false hellebore	VECA2	*Veratrum californicum*	1-185	0-5
	common yarrow	ACMI2	*Achillea millefolium*	0-73	0-5
	Parish's yampah	PEPA21	*Perideridia parishii*	6-62	1-10
	tundra aster	ORALA2	*Oreostemma alpigenum var. alpigenum*	0-50	0-4
	meadow bistort	POBI5	*Polygonum bistorta*	1-11	0-1
	western mountain aster	SYSPS	*Symphyotrichum spathulatum var. spathulatum*	0-6	0-1
	tinker's penny	HYAN2	*Hypericum anagalloides*	0-6	0-1

Table 6. Community 2.1 plant community composition

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

Table 7. Community 2.2 plant community composition

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

Table 8. Community 3.1 plant community composition

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

Table 9. Community 3.2 plant community composition

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

Animal community

This site provides critical habitat for several species of birds. This site provides prime habitat for beaver. Deer, bear, and coyotes, use this area as well. This site can provide high quality habitat for fish and aquatic insects.

Hydrological functions

The hydrology of this site influenced primarily by the spring snowmelt. This ecological site provides for water catchment, sediment and nutrient storage when in good condition (State 1). It is a source for sediment and nutrients, when in poor condition (State 2).

Recreational uses

Some trails exist through these sites, however care should be taken to avoid compaction and water diversion.

Wood products

Not applicable

Inventory data references

The following NRCS plots were used to describe this ecological site. State 1 056 100 Lo02H42A lo02h51b MH03H190 Slf03249 057 (Reference Condition) 098 054 lo03031 rx03056 h42b Lo02h31 State 2 02CA693-213a GR02H7 (Type location) Gr02h6 02CA693-213b LoM04044 State 3 059a 058 059c 059b

Type locality

Location 1: El Dorado County, CA	
UTM zone	N
UTM northing	4289641
UTM easting	760298
General legal description	The type location is in upper portion of Meiss Meadow. To the east of the trail.

Other references

Allen-Diaz, Barbara H. 1991. Water Table and Plant Species Relationships in Sierra Nevada Meadows. American Midland Naturalist, Vol. 126, No. 1 (Jul., 1991), pp. 30-43. Currently published by University of Notre Dame.

AECOM, and C. ENTRIX. 2013. Upper Truckee River and Marsh Restoration Project (EIR).in C. T. Conservancy, editor.

Beier, P., and R. H. Barrett. 1987. Beaver habitat use and impact in Truckee River Basin, California. Journal of Wildlife Management 51:794-799.

Castelli, Regine M.; Chambers, Jeanne C.; and Tausch, Robin J. 2000. Soil-Plant Relations Along a Soil-Water Gradient in Great Basin Riparian Meadows. Wetlands, Vol. 20, No. 2, June 2000, pp. 251-266. The Society of Wetland Scientist.

Cowardin, L.M.; Carter, V.; Golet, F.C.; LaRoe, E.T. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service Report No. FWS/OBS/-79/31.Washington, D.C.

Davis, O. K. 1996. Pollen Analysis of a Mid-Lake Core from Lake Tahoe, California: Historic Vegetation Change. Sierra Nevada Ecosystem Project: Final report to Congress, Addendum.

Dwire, Kathleen A.; Kaufmann, Boone J.; and Baham, John E. 2006. Plant Species Distribution in relation to Water-Table Depth and Soil Redox Potential in Montane Riparian Meadows. Wetlands, Vol 26, No.1, March 2006, pp. 131-146. The Society of Wetland Scientist.

Elliott-Fisk, D. L., T. A. Cahill, O. K. Davis, L. Duan, C. R. Goldman, G. E. Gruell, R. Harris, R. Kattelmann, R. Lacey, D. Leisz, S. Lindstrom, D. Machida, R. A. Rowntree, P. Rucks, D. A. Sharkey, S. L. Stephens, and D. S. Ziegler. 1996. Tahoe Case Study. Sierra Nevada Ecosystem Project: Final Report to Congress.

James, C. D., and R. B. Lanman. 2012. Novel physical evidence that beaver historically were native to the Sierra Nevada. California Fish and Game 98:129-132.

Kie, J. G., and B. B. Boroski. 1996. Cattle distribution, habitats, and diets in the Sierra Nevada of California. Journal of Range Management 49:482-488.

Lahontan Water Board, and Nevada Division of Environmental Protection. 2008. Charting the Course to Clarity.

Landman, R., H. Perryman, D. Brock, and C. D. James. 2012. The historical range of beaver in the Sierra Nevada: a review of the evidence. California Fish and Game 98:65 to 80.

Martin, David, W. and Chambers, Jeanne C. 2001. Effects of Water Table, Clipping, and Species Interactions on Carex nebrascensis and Poa pratensis in Riparian Meadows. Wetlands, Vol. 21, N0. 3, September 2001, pp. 422-430. The Society of Wetland Scientist.

Muskopf, S. 2007. The effect of beaver (Castor canadensis) dam removal on total phosphorus
concentration in Taylor Creek and Wetland, South Lake Tahoe, California. . Natural Resources M.S.:35.

Rosgen, D. L. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO

Rosgen, D. L. 1997. A Geomorphological Approach to Restoration of Incised Rivers in Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision.

Uchytil, Ronald J. 1989. Salix lemmonii. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, January 26].

Weixelman, Dave A.; Zamudio, Desiderio C.; and Tausch,Robin J. 1997. Classifying Ecological Types and Evaluating Site Degradation. Journal of Range Management. 50(3).

Weixelman, Dave A.; Zamudio, Desiderio C.; and Zamudio, Karen A., 1999. Eastern Sierra Nevada Riparian Field Guide. USDA, Forest Service, Intermountain Region, R4-ECOL-99-01.

Contributors

Marchel M. Munnecke
Marchel Munnecke

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:**