

Ecological site R028AY069NV ALPINE RIDGE

Last updated: 6/12/2025

Accessed: 03/14/2026

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): 028A–Ancient Lake Bonneville

MLRA 28A occurs in Utah (82%), Nevada (16%), and Idaho (2%). It makes up about 36,775 square miles. A large area west and southwest of Great Salt Lake is a salty playa. This area is the farthest eastern extent of the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. It is an area of nearly level basins between widely separated mountain ranges trending north to south. The basins are bordered by long, gently sloping alluvial fans. The mountains are uplifted fault blocks with steep side slopes. They are not well dissected because of low rainfall in the MLRA. Most of the valleys are closed basins containing sinks or playa lakes. Elevation ranges from 3,950 to 6,560 ft. in the basins and from 6,560 to 11,150 ft. in the mountains. Most of this area has alluvial valley fill and playa lakebed deposits at the surface. Great Salt Lake is all that remains of glacial Lake Bonneville. A level line on some mountain slopes indicates the former extent of this glacial lake. Most of the mountains in the interior of this area consist of tilted blocks of marine sediments from Cambrian to Mississippian age. Scattered outcrops of Tertiary continental sediments and volcanic rocks are throughout the area. The average annual precipitation is 5 to 12 ins. in the valleys and is as much as 49 ins. in the mountains. Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The driest period is from midsummer to early autumn. Precipitation in winter typically occurs as snow. The average annual temperature is 39 to 53 °F. The freeze-free period averages 165 days and ranges from 110 to 215 days, decreasing in length with elevation. The dominant soil orders in this MLRA are Aridisols, Entisols, and Mollisols. The soils in the area dominantly have a mesic or frigid soil temperature regime, an aridic or xeric soil moisture regime, and mixed mineralogy. They generally are well drained, loamy or loamy-skeletal, and very deep.

Ecological site concept

This site occurs on sideslopes of high, wind- swept mountains. Slope gradients of 8 to 75 percent, but slopes of 15 to 75 percent are most typical. Elevations are over 9350 feet to over 13,000, above the upper boundaries of *Artemisia arbuscula* communities.

Average annual precipitation is over 20 inches. Mean annual air temperature is about 40 degrees F. The average growing season is about 40 days.

The soils associated with this site are shallow to very deep and well drained. The soils are formed in residuum and colluvium from quartzite. Intense winds over this site inhibit snow accumulation and thus lower the effective precipitation. Soils of the alpine zone are poorly developed. These soils have high amounts of gravels, cobbles, rock or stones on the surface. Lack of soil depth and high volumes of coarse fragments in the soil profile result in very low available water capacity.

The reference plant community is dominated by low-growing perennial grasses and forbs. Common grasses include alpine fescue, and Cusick's, Wheeler's, and timberline bluegrasses. Low-statured Engelmann's spruce trees line the lower margins of this plant community as a stunted krummholz shrub. Potential vegetative composition is about 35% grasses and grass-like plants, 55% forbs and 10% shrubs and low-statured trees. Approximate ground cover (basal and crown) is 10 to 25 percent.

Associated sites

F028AY081NV	PILO-PIFL2/RIBES-JUCO6/CARO5-POA
F028AY083NV	PIEN/RIMO2/BRMA4-ACHNA
R028AY071NV	ALPINE SLOPE

Similar sites

R028AY070NV	CALCAREOUS ALPINE RIDGE only occurs on soils from limestone PM
R028AY062NV	MOUNTAIN RIDGE lower elevations; ARAR8 dominant plant
R028AY071NV	ALPINE SLOPE more productive site

Table 1. Dominant plant species

Tree	(1) <i>Picea engelmannii</i>
Shrub	Not specified

Herbaceous	(1) <i>Poa</i> (2) <i>Carex</i>
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Physiographic features

This site occurs on sideslopes of high, wind-swept mountains. Slope gradients of 8 to 75 percent, but slopes of 15 to 75 percent are most typical. Elevations are over 9350 feet to over 13,000, above the upper boundaries of *Artemisia arbuscula* communities.

Table 2. Representative physiographic features

Landforms	(1) Mountain
Elevation	2,850–3,962 m
Slope	8–75%
Aspect	Aspect is not a significant factor

Climatic features

Nevada's climate is predominantly arid, with large daily ranges of temperature, infrequent severe storms, heavy snowfall in the higher mountains, and great location variations with elevation. Three basic geographical factors largely influence Nevada's climate: continentality, latitude, and elevation. Continentality is the most important factor. The strong continental effect is expressed in the form of both dryness and large temperature variations. Nevada lies on the eastern, lee side of the Sierra Nevada Range, a massive mountain barrier that markedly influences the climate of the State. The prevailing winds are from the west, and as the warm moist air from the Pacific Ocean ascend the western slopes of the Sierra Range, the air cools, condensation occurs and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed by compression, and very little precipitation occurs. The effects of this mountain barrier are felt not only in the West but throughout the state, with the result that the lowlands of Nevada are largely desert or steppes. The temperature regime is also affected by the blocking of the inland-moving maritime air. Nevada sheltered from maritime winds, has a continental climate with well-developed seasons and the terrain responds quickly to changes in solar heating. Nevada lies within the mid-latitude belt of prevailing westerly winds which occur most of the year. These winds bring frequent changes in weather during the late fall, winter and spring months, when most of the precipitation occurs. To the south of the mid-latitude westerlies, lies a zone of high pressure in subtropical latitudes, with a center over the Pacific Ocean. In the summer, this high-pressure belt shifts northward over the latitudes of Nevada, blocking storms from the ocean. The resulting weather is mostly clear and dry during the summer and early fall, with scattered thundershowers. The eastern portion of the state receives significant summer thunderstorms generated from monsoonal moisture pushed up from the Gulf of California, known as the North American monsoon. The monsoon system peaks in August and by October the monsoon high over the Western U.S. begins to weaken and the precipitation retreats southward towards the tropics (NOAA

2004).

Average annual precipitation is over 20 inches. Mean annual air temperature is about 40 degrees F. The average growing season is about 40 days.

The Mean annual precipitation at the Great Basin Natinal Park Climate Station (263340) is 13.33 inches.

Monthly mean precipitation is:

January 1.05; February 1.18; March 1.37; April 1.21; May 1.24; June .87; July .97; August 1.18; September 1.08; October .96; December .96

Table 3. Representative climatic features

Frost-free period (average)	
Freeze-free period (average)	30 days
Precipitation total (average)	533 mm

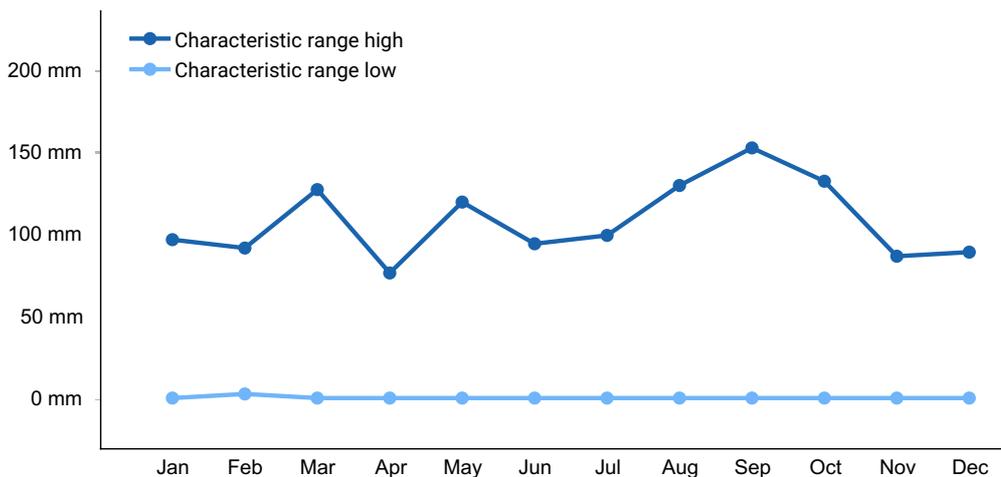


Figure 1. Monthly precipitation range

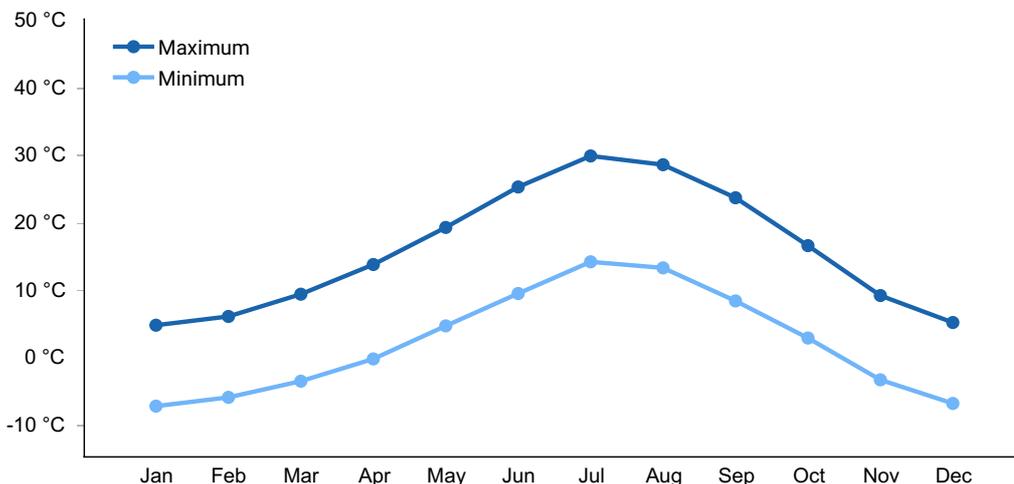


Figure 2. Monthly average minimum and maximum temperature

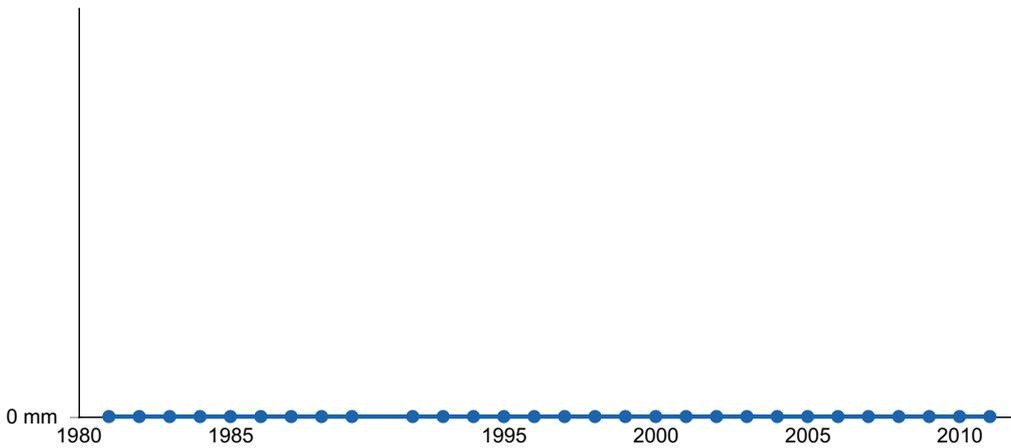


Figure 3. Annual precipitation pattern

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are shallow to very deep and well drained. The soils are formed in residuum and colluvium from quartzite. Intense winds over this site inhibit snow accumulation and thus lower the effective precipitation. Soils of the alpine zone are poorly developed. These soils have high amounts of gravels, cobbles, rock or stones on the surface. Lack of soil depth and high volumes of coarse fragments in the soil profile result in very low available water capacity. The surface cover of rock fragments helps to reduce evaporation and conserve soil moisture. The soil series associated with this site include: Cobblywheel and Wheelerpek.

The representative soil series is Cobblywheel, a Loamy-skeletal, mixed, active Xeric Haplocryolls. Diagnostic horizons include an Ochric epipedon from the soil surface to 18 cm, and a Cambic horizon from 37 to 152 cm. Clay content in the particle control section averages 12 to 18 percent. Rock fragments range from 50 to 85 percent, mainly gravel and cobbles. Reaction is neutral. Effervescence is none to violently effervescent on fine secondary calcium carbonate concretions on the bottom of rock fragments. Lithology consists of quartzite.

Table 4. Representative soil features

Parent material	(1) Colluvium–quartzite
Surface texture	(1) Extremely cobbly loam (2) Extremely gravelly loam (3) Extremely cobbly loam
Family particle size	(1) Loamy

Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	38–152 cm
Surface fragment cover ≤3"	35–50%
Surface fragment cover >3"	10–25%
Available water capacity (0-101.6cm)	2.29–7.87 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.2–7.3
Subsurface fragment volume ≤3" (Depth not specified)	35–50%
Subsurface fragment volume >3" (Depth not specified)	25–40%

Ecological dynamics

Plant community composition varies with differences in aspect, size and amount of rock fragments on the surface, and steepness of slope. Areas of snow accumulation, mostly on north facing slopes, tend to be dominated by herbaceous species. Alpine communities are sensitive to disturbance and the effects of human disturbances are more drastic and long-lasting than in other plant communities. Vegetation recovery is slow because of the cold and extreme temperatures, high winds, prolonged snow cover, and intense ultraviolet radiation. Cheatgrass has spread to high elevations in the western U.S. over the last 10 to 15 years. This range expansion may due to 1) local adaptation, 2) phenotypic plasticity of all-purpose genotypes, 3) changes in climate, 4) increased local disturbance, 5) nutrient enrichment and 6) seed dispersal, or some combination of one or more of these mechanisms.

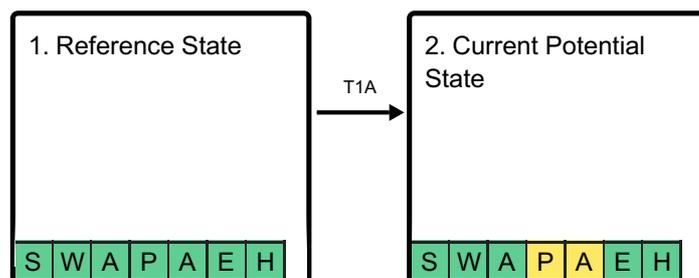
Fire Ecology:

Fire occurs very infrequently in alpine communities and fire size is small, sometimes limited to a single tree. Engelmann spruce is very fire sensitive and is generally killed even by low-intensity fires. Postfire reestablishment is via wind-dispersed seeds which readily germinate on fire-prepared seedbeds. The occasional mature tree which survives fire, those escaping fire in small, unburned pockets, and trees adjacent to burned areas provide seeds to colonize burned sites. Large trees occasionally survive light fires.

Bluegrass is generally unharmed by fire. It produces little litter, and its small bunch size and sparse litter reduces the amount of heat transferred to perennating buds in the soil. Its rapid maturation in the spring also reduces fire damage, since it is dormant when most fires occur. Sedge is top-killed by fire, with rhizomes protected by insulating soil. The rhizomes of sedge species may be killed by high-severity fires that remove most of the soil organic layer. Reestablishment after fire occurs by seed establishment and/or rhizomatous spread. Bottlebrush squirreltail's small size, coarse stems, and sparse leafy material aid in its tolerance of fire. Postfire regeneration occurs from surviving root crowns and from on- and off-site seed sources. Frequency of disturbance greatly influences postfire response of bottlebrush squirreltail. Undisturbed plants within a 6 to 9 year age class generally contain large amounts of dead material, increasing bottlebrush squirreltail's susceptibility to fire. Alpine fescue grows in a dense, fine-leaved tuft. Fires tend to burn within the accumulated fine leaves at the base of the plant and may produce temperatures sufficient to kill some of the root crown. Mature alpine fescue plants are commonly reported to be severely damaged by fire in all seasons.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 1 Reference State

The reference plant community is dominated by low-growing perennial grasses and forbs. Common grasses include alpine fescue, and Cusick's, Wheeler's, and timberline bluegrasses. Low-statured Engelmann's spruce trees line the lower margins of this plant community as a stunted krummholz shrub. Potential vegetative composition is about 35% grasses and grass-like plants, 55% forbs and 10% shrubs and low-statured trees. Approximate ground cover (basal and crown) is 10 to 25 percent.

Community 1.1 Krummholz trees/grasses

The plant community is dominated by low-growing perennial grasses and forbs. Common grasses include alpine fescue, and Cusick's, Wheeler's, and timberline bluegrasses. Low-statured Engelmann's spruce trees line the lower margins of this plant community as a stunted krummholz shrub. Potential vegetative composition is about 35% grasses and grass-like plants, 55% forbs and 10% shrubs and low-statured trees. Approximate ground cover (basal and crown) is 10 to 25 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Forb	46	62	92
Grass/Grasslike	29	39	59
Tree	6	7	10
Shrub/Vine	3	4	7
Total	84	112	168

State 2 Current Potential State

The Current Potential state is dominated by low-growing perennial grasses and forbs. Common grasses include alpine fescue, and Cusick's, Wheeler's, and timberline bluegrasses. Low-statured Engelmann's spruce trees line the lower margins of this plant community as a stunted krummholz shrub. Potential vegetative composition is about 35% grasses and grass-like plants, 55% forbs and 10% shrubs and low-statured trees. Approximate ground cover (basal and crown) is 10 to 25 percent. There are non-native species in the plant community, such as cheatgrass.

Community 2.1 Krummholz trees/grasses

This phase is similar to community phase 1.1, except community phase 2.1 has non-native plants in the plant community. The plant community is dominated by low-growing perennial

grasses and forbs. Common grasses include alpine fescue, and Cusick's, Wheeler's, and timberline bluegrasses. Low-statured Engelmann's spruce trees line the lower margins of this plant community as a stunted krummholz shrub. Potential vegetative composition is about 35% grasses and grass-like plants, 55% forbs and 10% shrubs and low-statured trees. Approximate ground cover (basal and crown) is 10 to 25 percent.

Transition T1A State 1 to 2

Establishment of non-native species in the plant community.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Primary Perennial Grasses			21–54	
	dunhead sedge	CAPH2	<i>Carex phaeocephala</i>	2–9	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	2–9	–
	Ross' sedge	CARO5	<i>Carex rossii</i>	3–8	–
	timberline bluegrass	POGLR2	<i>Poa glauca ssp. rupicola</i>	3–8	–
	Wheeler's bluegrass	POWH2	<i>Poa wheeleri</i>	3–7	–
	alpine fescue	FEBR	<i>Festuca brachyphylla</i>	2–6	–
2	Secondary Perennial Grasses			2–9	
	Letterman's needlegrass	ACLE9	<i>Achnatherum lettermanii</i>	1–3	–
	spike trisetum	TRSP2	<i>Trisetum spicatum</i>	1–3	–
Forb					
3	Perennial			33–80	
	alpine buttercup	RAADA	<i>Ranunculus adoneus var. alpinus</i>	6–17	–
	sticky polemonium	POVI	<i>Polemonium viscosum</i>	2–9	–
	Parry's primrose	PRPA	<i>Primula parryi</i>	2–9	–
	pussytoes	ANTEN	<i>Antennaria</i>	1–6	–
	draba	DRABA	<i>Draba</i>	1–6	–
	fleabane	ERIGE2	<i>Erigeron</i>	1–6	–
	buckwheat	ERIOG	<i>Eriogonum</i>	1–6	–

	Ross' avens	GERO2	<i>Geum rossii</i>	1-6	-
	clubmoss	LYCOP2	<i>Lycopodium</i>	1-6	-
	phlox	PHLOX	<i>Phlox</i>	1-6	-
Shrub/Vine					
4	Secondary Shrubs			2-11	
	whitestem goldenbush	ERDI14	<i>Ericameria discoidea</i>	1-6	-
	currant	RIBES	<i>Ribes</i>	1-6	-
Tree					
5	Evergreen			3-16	
	Engelmann spruce	PIEN	<i>Picea engelmannii</i>	1-11	-
	limber pine	PIFL2	<i>Pinus flexilis</i>	1-2	-
	Great Basin bristlecone pine	PILO	<i>Pinus longaeva</i>	1-2	-

Animal community

Livestock Interpretations:

This site has limited value for livestock grazing, due to the low forage production and steep slopes. Bluegrass is a widespread forage grass. It is one of the earliest grasses in the spring and is sought by domestic livestock and several wildlife species. Bluegrass is a palatable species, but its production is closely tied to weather conditions. It produces little forage in drought years, making it a less dependable food source than other perennial bunchgrasses. Sedges are an important forage species for domestic sheep, goats, and cattle. Bottlebrush squirreltail is very palatable winter forage for domestic sheep of Intermountain ranges. Domestic sheep relish the green foliage. Overall, bottlebrush squirreltail is considered moderately palatable to livestock. Alpine fescue provides important forage for many types of domestic livestock. The foliage cures well and is preferred by livestock in late fall and winter. Livestock generally do not browse Engelmann spruce.

Stocking rates vary over time depending upon season of use, climate variations, site, and previous and current management goals. A safe starting stocking rate is an estimated stocking rate that is fine tuned by the client by adaptive management through the year and from year to year.

Wildlife Interpretations:

Engelmann spruce-subalpine fir forests provide forage and habitat for a wide variety of small and large wildlife species. However, these properties are characteristic of where spruce grows and the understory species associated with it rather than to the species itself. Animals that inhabit Engelmann spruce stands include elk, mule deer, chipmunks,

and voles. The young growth of Engelmann spruce is occasionally browsed by ungulates, but it is not an important food item and is probably only taken as a last resort. Bluegrass is an important forage species for many wildlife species. Sedges have a high to moderate resource value for elk and a medium value for mule deer. Elk consume beaked sedge later in the growing season. Bottlebrush squirreltail is a dietary component of several wildlife species. Bottlebrush squirreltail may provide forage for mule deer and pronghorn. Alpine fescue provides important forage for several wildlife species. It is reported to be good forage for pronghorn, and deer in ranges of northern Nevada.

Hydrological functions

Permeability is very slow to moderately rapid. Runoff is high to very high. Hydrologic soil groups are B and D.

Recreational uses

Aesthetic value is derived from the diverse floral and faunal composition and the colorful flowering of wild flowers and shrubs during the spring and early summer. This site offers rewarding opportunities to photographers and for nature study. This site is used for hiking and has potential for upland and big game hunting.

Other products

Native Americans used Engelmann spruce for numerous purposes. The bark was often peeled into sheets and used for making canoes, baskets, and roofing. The fibrous roots were used to make rope, and the boughs and needles to make incense, body scents, and cleansing agents. Various teas and poultices were made from Engelmann spruce for medicinal purposes. Native Americans occasionally ate the inner bark.

Other information

Engelmann spruce is sometimes used as an ornamental landscape plant. It has been used for screenings, windbreaks, and as a specimen tree. Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T13N R68E S15
Latitude	38° 59' 26"
Longitude	114° 19' 40"
General legal description	Wheeler Peak Summit Trail, Great Basin National Park, Snake Range, White Pine County, Nevada

Other references

Fire Effects Information System (Online; <http://www.fs.fed.us/database/feis/plants/>).

Houghton, J.G., C.M. Sakamoto, and R.O. Gifford. 1975. Nevada's Weather and Climate, Special Publication 2. Nevada Bureau of Mines and Geology, Mackay School of Mines, University of Nevada, Reno, NV.

National Oceanic and Atmospheric Administration. 2004. The North American Monsoon. Reports to the Nation. National Weather Service, Climate Prediction Center. Available online: <http://www.weather.gov/>

USDA-NRCS Plants Database (Online; <http://www.plants.usda.gov>).

Contributors

DBP/GKB

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	03/14/2026
Approved by	Kendra Moseley
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:**
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17. **Perennial plant reproductive capability:**
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