Ecological site R024XY057NV
CHANNERY HILL

Last updated: 3/06/2025
Accessed: 05/30/2026

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): 024X–Humboldt Basin and Range Area

Major land resource area (MLRA) 24, the Humboldt Area, covers an area of approximately 8,115,200 acres (12,680 sq. mi.). It is found in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. Elevations range from 3,950 to 5,900 feet (1,205 to 1,800 meters) in most of the area, some mountain peaks are more than 8,850 feet (2,700 meters). A series of widely spaced north-south trending mountain ranges are separated by broad valleys filled with alluvium washed in from adjacent mountain ranges. Most valleys are drained by tributaries to the Humboldt River. However, playas occur in lower elevation valleys with closed drainage systems. Isolated ranges are dissected, uplifted fault-block mountains. Geology is comprised of Mesozoic and Paleozoic volcanic rock and marine and continental sediments. Occasional young andesite and basalt flows (6 to 17 million years old) occur at the margins of the mountains. Dominant soil orders include Aridisols, Entisols, Inceptisols and Mollisols. Soils of the area are generally characterized by a mesic soil temperature regime, an aridic soil moisture regime and mixed geology. They are generally well drained, loamy and very deep. Approximately 75 percent of MLRA 24 is federally owned, the remainder is primarily used for farming, ranching and mining. Irrigated land makes up about 3 percent of the area; the majority of irrigation water is from surface water sources, such as the Humboldt River and Rye Patch Reservoir. Annual precipitation ranges from 6 to 12 inches (15 to 30 cm) for most of the area, but can be as much as 40 inches (101 cm) in the mountain ranges. The majority of annual precipitation occurs as snow in the winter. Rainfall occurs as high-intensity, convective thunderstorms in the spring and fall. 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 ascends the western slopes of the Sierra Range, the air cools, condensation takes place 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.

Ecological site concept

This Channery Hill site is on summits and side slopes of mountains, hills and rock pediments. Soils are very shallow to bedrock, well drained and formed in residuum/colluvium derived from shale, rhyolite, siltstone and phyllite. The soil profile is characterized by an ochric epipedon, an argillic horizon and greater than 50 percent rock fragments by volume.

Associated sites

R024XY026NV	**STONY SLOPE 8-10 P.Z.** This site is on summits and side slopes of lower mountains, hills, and upper piedmont slopes. The soil profile is characterized by an ochric epipedon and an argillic horizon.
R024XY002NV	**LOAMY 5-8 P.Z.** This site is on fan remnants. The soils associated with this site are very deep, well drained and formed in alluvium derived from mixed parent material. Less than 25 percent rock fragments throughout the profile, a gravely surface and a horizon of salt accumulation (natric).

R024XY020NV	**DROUGHTY LOAM 8-10 P.Z.** The soils associated with this ecological site are deep, well drained, and formed in alluvium derived from mixed parent material. The soil profile is characterized by an ochric epipedon and high amounts of sand and gravel below 16 inches (40cm). Soil temperature regime is mesic. This site includes limited available soil moisture due to texture and precipitation zone. Plant available water is influenced by soil texture, presence and abundance of rock fragments, soil depth, aspect, elevation and landscape position.
R024XY025NV	**LOAMY SLOPE 5-8 P.Z.** Site found on hills and low mountains. Soils are shallow to bedrock, well drained and formed in residuum/colluvium derived from volcanics. The plant community is dominated by shadscale ATCO), bud sagebrush (ARSP5) and squireltail (ELEL5). Shallow depth and coarse fragments in the profile occupy plant growing space and reduce the available water capacity.

Similar sites

R024XY018NV	**Claypan 10-12 P.Z.** Low sagebrush (ARAR8) dominant shrub; Bluebunch wheatgrass (PSSPS)- Thurber's needlegrass (ACTH7) codominant grasses.
R024XY030NV	**SHALLOW CALCAREOUS LOAM 8-10 P.Z.** Black sagebrush (ARNO4) dominant shrub; Indian ricegrass (ACHY)- Thurber's needlegrass (ACTH7) codominant grasses.
R024XY031NV	**SHALLOW CALCAREOUS LOAM 10-14 P.Z.** Low sagebrush (ARAR8) dominant shrub; Bluebunch wheatgrass (PSSPS)- Thurber's needlegrass (ACTH7) codominant grasses.
R024XY016NV	**Mountain Ridge** Idaho fescue (FEID) dominant grass; Low sagebrush (ARAR8) and/or Black sagebrush (ARNO4) dominant shrubs; less productive site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia arbuscula subsp. longicaulis*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

The Channery Hill site occurs on summits and side slopes of mountains, hills, and rock pediments. Slopes range from 15 to 50 percent. Elevations are 4,500 to 6,500 feet (1,372 to 1,981 m).

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Hill (3) Rock pediment
Runoff class	Very high
Flooding frequency	None
Ponding frequency	None
Elevation	1,370 – 1,980 m
Slope	20 – 50 %
Water table depth	180 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate associated is semiarid and characterized by cool, moist winters and warm, dry summers. Average annual precipitation is 8 to 10 inches (20 to 25cm). Mean annual air temperature is 47 to 53 degrees F. The average growing season is about 100 to 130 days.

Table 3 Representative climatic features

Frost-free period (average)	130 days
Freeze-free period (average)	
Precipitation total (average)	250 mm

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils have a shallow effective rooting zone with depth to bedrock ranging from 4 to 14 inches (10 to 36 cm). The soil profile is characterized by an ochric epipedon, argillic horizon and greater than 50 percent channers and rock fragments throughout the profile. The available water capacity is very low. Runoff is very high. Surface soil rock fragments provide a stabilizing effect on surface erosion conditions. The soil series associated with this site include: Rocconda.

Table 4. Representative soil features

Parent material	(1) Colluvium – shale and siltstone (2) Residuum
Surface texture	(1) Very channery loam (2) Very cobbly loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow
Soil depth	10 – 40 cm
Surface fragment cover <=3"	20 – 40 %
Surface fragment cover >3"	0 – 20 %
Available water capacity (0-101.6cm)	1.02 – 1.27 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.4 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	20 – 40 %

Subsurface fragment volume >3" (Depth not specified)	0 – 20 %

Ecological dynamics

An ecological site is the product of all the environmental factors responsible for its development and it has a set of key characteristics that influence a site's resilience to disturbance and resistance to invasives. Key characteristics include 1) climate (precipitation, temperature), 2) topography (aspect, slope, elevation, and landform), 3) hydrology (infiltration, runoff), 4) soils (depth, texture, structure, organic matter), 5) plant communities (functional groups, productivity), and 6) natural disturbance regime (fire, herbivory, etc.) (Caudle 2013). Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).

Periodic drought regularly influences sagebrush ecosystems and drought duration and severity has increased throughout the 20th century in much of the Intermountain West. Major shifts away from historical precipitation patterns have the greatest potential to alter ecosystem function and productivity. Species composition and productivity can be altered by the timing of precipitation and water availability with the soil profile (Bates et al. 2006).

The perennial bunchgrasses that are dominant on this site include Indian ricegrass and squirreltail. These species generally have somewhat shallower root systems than the shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m but taper off more rapidly than shrubs. Differences in root depth distributions between grasses and shrubs result in resource partitioning in these shrub/grass systems.

The Great Basin sagebrush communities have high spatial and temporal variability in precipitation both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance. The invasion of sagebrush communities by cheatgrass (Bromus tectorum) has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Chambers et al. 2007). The introduction of annual weedy species, like cheatgrass, may cause an increase in fire frequency and eventually lead to an annual state. Conversely, as fire frequency decreases, sagebrush will increase and with inappropriate grazing management the perennial bunchgrasses and forbs may be reduced.

The ecological site has low to moderate resilience to disturbance and resistance to invasion. Increased resilience increases with elevation, aspect, increased precipitation and increased nutrient availability. Three possible alternative stable states have been identified for this site.

Fire Ecology:
Fire is not a major ecological component of these community types (Winward 2001), and would be infrequent. Fire return intervals have been estimated at 100 to 200 years (Kitchen and McArthur 2007); however, fires were probably patchy due to the low productivity of these sites. Black sagebrush plants have no morphological adaptations for surviving fire and must reestablish from seed following fire (Wright et al. 1979). In lower precipitation zones shadscale (Atriplex confertifolia), spiny hopsage (Grayia spinosa) and rabbitbrush (Chrysothamnus viscidiflorus or Ericameria nauseosa) may become the dominant shrub species following fire, often with an understory of Sandberg bluegrass and/or cheatgrass and other weedy species. Sandberg bluegrass has been found to increase following fire likely due to its low stature and productivity (Daubenmire 1975).

Indian ricegrass is the dominant perennial bunchgrass and is fairly fire tolerant (Wright 1985), which is likely due to its low culm density and below ground plant crowns. Indian ricegrass has been found to reestablish on burned sites through seed dispersed from adjacent unburned areas (Young 1983, West 1994). Thus the presence of surviving, seed producing plants is necessary for reestablishment of Indian ricegrass. Grazing management following fire to promote seed production and establishment of seedlings is important.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			48-139	

	Indian ricegrass	ACHY	*Achnatherum hymenoides*	20-59	–
	squirreltail	ELEL5	*Elymus elymoides*	20-59	–
	Sandberg bluegrass	POSE	*Poa secunda*	8-20	–
2	**Secondary Perennial Grasses**			8-20	
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	2-12	–
Forb					
3	**Perennial Forbs**			8-31	
	aster	ASTER	*Aster*	2-12	–
	milkvetch	ASTRA	*Astragalus*	2-12	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	2-12	–
	buckwheat	ERIOG	*Eriogonum*	2-12	–
	lupine	LUPIN	*Lupinus*	2-12	–
	phlox	PHLOX	*Phlox*	2-12	–
Shrub/Vine					
4	**Primary Shrubs**			164-268	
	little sagebrush	ARARL3	*Artemisia arbuscula ssp. longicaulis*	140-196	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	8-31	–
	spiny hopsage	GRSP	*Grayia spinosa*	8-20	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	8-20	–
5	**Secondary Shrubs**			8-39	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4-12	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	4-12	–
	horsebrush	TETRA3	*Tetradymia*	4-12	–

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 (%)

Table 8. Community 2.1 plant community composition

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

Table 9. Community 2.2 plant community composition

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

Table 10. Community 2.3 plant community composition

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

Table 11. Community 3.1 plant community composition

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

Table 12. Community 3.2 plant community composition

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

Table 13. Community 4.1 plant community composition

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

Table 14. Community 4.2 plant community composition

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

Animal community

Livestock Interpretations: This site has limited value for livestock grazing, due to the low forage production and steep slopes. Grazing management should be keyed to dominant grasses and palatable shrubs production. Lahontan sagebrush is considered a valuable browse plant during the spring, fall and winter months. In some areas it is of little value in winter due to heavy snow. Nevada ephedra is important winter range browse for domestic cattle, sheep and goats. Shadscale is a valuable browse species, providing a source of palatable, nutritious forage for a wide variety of livestock. Shadscale provides good browse for domestic sheep. Shadscale leaves and seeds are an important component of domestic sheep and cattle winter diets. Spiny hopsage provides a palatable and nutritious food source for livestock, particularly during late winter through spring. Domestic sheep browse the succulent new growth of spiny hopsage in late winter and early spring. Indian ricegrass is highly palatable to all classes of livestock in both green and cured condition. It supplies a source of green feed before most other native grasses have produced much new growth. 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. 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. Sandberg 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. 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: Lahontan sagebrush is considered a valuable browse plant during the spring, fall and winter months. In some areas it is of little value in winter due to heavy snow. Mule deer utilize and sometimes prefer Lahontan sagebrush, particularly in winter and early spring. Mule deer, bighorn sheep, and pronghorn browse Nevada ephedra, especially in spring and late summer when new growth is available. Shadscale is a valuable browse species, providing a source of palatable, nutritious forage for a wide variety of wildlife particularly during spring and summer before the hardening of spiny twigs. It supplies browse, seed, and cover for birds, small mammals, rabbits, deer, and pronghorn antelope. Spiny hopsage provides a palatable and nutritious food source for big game animals. Spiny hopsage is used as forage to at least some extent by domestic goats, deer, pronghorn, and rabbits. Indian ricegrass is eaten by pronghorn in moderate amounts whenever available. In Nevada it is consumed by desert bighorns. A number of heteromyid rodents inhabiting desert rangelands show preference for seed of Indian ricegrass. Indian ricegrass is an important component of jackrabbit diets in spring and summer. In Nevada, Indian ricegrass may even dominate jackrabbit diets during the spring through early summer months. Indian ricegrass seed provides food for many species of birds. Doves, for example, eat large amounts of shattered Indian ricegrass seed lying on the ground. Bottlebrush squirreltail is a dietary component of several wildlife species. Bottlebrush squirreltail may provide forage for mule deer and pronghorn. Sagebrush-grassland communities provide critical sage-grouse breeding and nesting habitats. Sagebrush is a crucial component of their diet year-round, and sage-grouse select sagebrush almost exclusively for cover.

Hydrological functions

Runoff is very high. Permeability is slow. Hydrologic soil group is D. Rills are none to rare. Rock fragments armor the soil surface. Water flow patterns are none to few. Rock fragments armor the soil surface. Pedestals are none to rare. Occurrence is usually limited to areas of water flow patterns. Frost heaving of shallow rooted plants should not be considered a "normal" condition. Gullies are none to rare. Perennial herbaceous plants (especially deep-rooted bunchgrasses [i.e., Indian ricegrass] slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact.

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 Nevada ephedra as a tea to treat stomach and kidney ailments. Seeds of shadscale were used by Native Americans for bread and mush. Some Native American peoples traditionally ground parched seeds of spiny hopsage to make pinole flour. Indian ricegrass was traditionally eaten by some Native Americans. The Paiutes used seed as a reserve food source.

Other information

Nevada ephedra is useful for erosion control, and seedlings have been successfully planted onto reclaimed strip mines. Atrazine may be effective in controlling Nevada ephedra, though some plants can survive through crown sprouting. Irrigation may increase control by atrazine. Spiny hopsage has moderate potential for erosion control and low to high potential for long-term revegetation projects. It can improve forage, control wind erosion, and increase soil stability on gentle to moderate slopes. Spiny hopsage is suitable for highway plantings on dry sites in Nevada. Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation.

Inventory data references

NASIS soil component data.

Type locality

Location 1: Humboldt County, NV	
Township/Range/Section	T36N R41E S31
UTM zone	N
UTM northing	4533543
UTM easting	466334
Latitude	40° 57′8″
Longitude	117° 24′0″
General legal description	NE¼ Edna Mountains south of Emigrant Canyon near Golonda, Humboldt County, Nevada. This site also occurs in Pershing County, Nevada.

Other references

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

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

Barney, M. A. and N. C. Frischknecht. 1974. Vegetation Changes following Fire in the Pinyon-Juniper Type of West-Central Utah. Journal of Range Management 27:91-96.

Bates, J. D., T. Svejcar, R. F. Miller, and R. A. Angell. 2006. The effects of precipitation timing on sagebrush steppe vegetation. Journal of Arid Environments 64:670-697.

Beale, D.M. and A.D. Smith. 1970. Forage use, water consumption, and productivity of pronghorn antelope in western Utah. Journal of Wildlife Management 34(3):570-582

Beetle, A.A. 1960. A study of sagebrush: The section Tridentatae of Artemisia. Bulletin 368. Laramie, WY: University of Wyoming, Agricultural Experiment Station. 83 p.

Bentz, B., D. Alston, and T. Evans. 2008. Great Basin Insect Outbreaks. In: J. Chambers, N. Devoe, A. Evenden [eds]. Collaborative Management and Research in the Great Basin -- Examining the issues and developing a framework for action Gen. Tech. Rep. RMRS-GTR-204. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. p. 45-48

Boltz, M. 1994. Factors influencing postfire sagebrush regeneration in south-central Idaho. In: Monsen, S.B. and S.G. Kitchen (compilers). Proceedings--ecology and management of annual rangelands; 1992 May 18-22; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: Pgs 281-290.

Booth, D. T., C. G. Howard, and C. E. Mowry. 2006. 'Nezpar' Indian ricegrass: description, justification for release, and recommendations for use. Rangelands Archives 2:53-54.

Bradley, A.F., N.V. Noste, and W.C. Fischer. 1992. Fire ecology of forests and woodlands in Utah. Gen. Tech. Rep. INT-287. Ogden, UT. U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 128 p.

Caudle, D., J. DiBenedetto, M. Karl, H. Sanchez, and C. Talbot. 2013. Interagency ecological site handbook for rangelands. Available at: http://jornada.nmsu.edu/sites/jornada.nmsu.edu/files/InteragencyEcolSiteHandbook.pdf. Accessed 4 October 2013.

Comstock, J. P. and J. R. Ehleringer. 1992. Plant adaptation in the Great Basin and Colorado plateau. Western North American Naturalist

52:195-215.
Cook, C.W. and R.D. Child. 1971. Recovery of desert plants in various states of vigor. Journal of Range Management 24(5):339-343.
Cook, C. W. 1962. An Evaluation of Some Common Factors Affecting Utilization of Desert Range Species. Journal of Range Management 15:333-338.
Chambers, J., B. Bradley, C. Brown, C. D'Antonio, M. Germino, J. Grace, S. Hardegree, R. Miller, and D. Pyke. 2013. Resilience to Stress and Disturbance, and Resistance to Bromus tectorum L. Invasion in Cold Desert Shrublands of Western North America. Ecosystems 17:1-16.
Chambers, J. C., B. A. Roundy, R. R. Blank, S. E. Meyer, and A. Whittaker. 2007. What makes great basin sagebrush ecosystems invasible by Bromus tectorum? Ecological Monographs 77:117-145.
Daubenmire, R.F. 1970. Steppe vegetation of Washington. Technical Bulletin 62. Pullman, WA: Washington State University, College of Agriculture, Washington Agricultural Experiment Station. 131 p.
Daubenmire, R.F. 1975. Plant succession on abandoned fields, and fire influences, in a steppe area in southeastern Washington. Northwest Science 49(1):36-48.
Dobrowolski, J. P., M. M. Caldwell, and J. H. Richards. 1990. Basin hydrology and plant root systems. In: C. B. Osmand, L. F. Pitelka, G. M. Hildy [eds]. Plant biology of the Basin and range. Ecological Studies. 80: 243-292
Eckert, R.E., Jr., A.D. Bruner and G.J. Klomp. 1972. Response of understory species following herbicidal control of low sagebrush. Journal of Range Management 25:280-285.
Eckert, R.E., Jr. and J.S. Spencer. 1987. Growth and reproduction of grasses heavily grazed under rest-rotation management. Journal of Range Management 40(2):156-159.
Evans, R.A. and J.A. Young. 1978. Effectiveness of rehabilitation practices following wildfire in a degraded big sagebrush-downy brome community. Journal of Range Management 31(3):185-188.
Furniss, M.M. and W.F. Barr. 1975. Insects affecting important native shrubs of the northwestern United States. US Intermountain Forest and Range Experiment Station. USDA Forest Service General Technical Report INT INT-19.
Ganskopp, D. 1988. Defoliation of Thurber needlegrass: herbage and root responses. Journal of Range Management 41(6):472-476.
Hironaka, M., M.A. Fosberg, and A.H. Winward. 1983. Sagebrush-grass habitat types of southern Idaho. Bulletin Number 35. Moscow, ID: University of Idaho, Forest, Wildlife and Range Experiment Station. 44 p.
Horton, H. 1989. Interagency forage and conservation planting guide for Utah. Extension Circular 433. Logan, UT: Utah State University, Cooperative Extension Service. 67 p.
Jensen, M.E. 1990 Interpretation of environmental gradients which influence sagebrush community distribution in northeastern Nevada. J. of Range Management 43:161-166.
Kitchen, S.G. and E.D. McArthur. 2007. Big and black sagebrush landscapes. In: Hood, S.M. and M. Miller (eds.). Fire ecology and management of the major ecosystems of southern Utah. Gen. Tech. Rep. RMRS-GTR-202. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Pgs 73-95.
Martens, E., D. Palmquist, and J.A. Young. 1994. Temperature profiles for germination of cheatgrass versus native perennial bunchgrasses. In: Monsen, S.B. and S.G. Kitchen (compilers). Proceedings--ecology and management of annual rangelands; 1992 May 18-22; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: Pgs 238-243.
McArthur, E.D., A.C. Blauer, A.P. Plummer, and R. Stevens. 1979. Characteristics and hybridization of important Intermountain shrubs. III. Sunflower family. Res. Pap. INT-220. Ogden, UT. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 82 p.
Meyer, S.E. 2008. Artemisia L.--sagebrush. In: Bonner, F.T. and R.P. Karrfalt (eds.). The woody plant seed manual. Agriculture Handbook 727. Washington, DC: U.S. Department of Agriculture, Forest Service: Pgs 274-280.
Miller, R. F. and R. J. Tausch. 2000. The role of fire in pinyon and juniper woodlands: a descriptive analysis. In Proceedings of the invasive species workshop: the role of fire in the control and spread of invasive species. Fire conference. P. 15-30
Miller, R.F., F.A. Branson, I.S. McQueen, and C.T. Snyder. 1982. Water relations in soils as related to plant communities in Ruby Valley, Nevada. Journal of Range Management 35(4): 462-468.
Mozingo, H.N. 1987. Shrubs of the Great Basin: A natural history. Reno, NV: University of Nevada Press. 342 p.
Noy-Meir, I. 1973. Desert ecosystems: environment and producers. Annual Review of Ecology and Systematics 4:25-51.
Pearson, L.C. 1965. Primary production in grazed and ungrazed desert communities of eastern Idaho. Ecology 46(3):278-285.
Richards, J. H. and M. M. Caldwell. 1987. Hydraulic lift: Substantial nocturnal water transport between soil layers by Artemisia tridentata roots. Oecologia 73:486-489.
Sampson, A.W. and B.S. Jespersen. 1963. California range brushlands and browse plants. Berkeley, CA: University of California, Division of Agricultural Sciences; California Agricultural Experiment Station, Extension Service. 162 p.
Schultz, B. and K. McAdoo. 2002. Common sagebrush in Nevada. Special Publication SP-02-02. Reno, NV. University of Nevada, Cooperative Extension. 9 p.
Stevens, R., K.R. Jorgensen, and J.N. Davis. 1981. Viability of seed from thirty-two shrub and forb species through fifteen years of warehouse storage. The Great Basin Naturalist 41(3):274-277.
Stubbendieck, J. L. 1985. Nebraska Range and Pasture Grasses: (including Grass-like Plants). University of Nebraska, Department of Agriculture, Cooperative Extension Service, Lincoln, NE.
Tausch, R. J. and N. E. West. 1988. Differential Establishment of Pinyon and Juniper Following Fire. American Midland Naturalist 119:174-184.
Tisdale, E.W. and M. Hironaka. 1981. The sagebrush-grass region: a review of the ecological literature. Bull. 33. Moscow, ID: University of Idaho, Forest, Wildlife and Range Experiment Station. 31 p.
Uresk, D.W., J.F. Cline, and W.H. Rickard. 1976. Impact of wildfire on three perennial grasses in south-central Washington. Journal of Range Management 29(4):309-310.

Van Vuren, D. 1984. Summer diets of bison and cattle in southern Utah. Journal of Range Management 37(3): 260-261.
West, N. E. 1994. Effects of fire on salt-desert shrub rangelands.in Proceedings--Ecology and Management of Annual Rangelands, General Technical Report INT-313. USDA Forest Service, Intermountain Research Station, Boise, ID.
Winward, A.H. 2001. Sagebrush taxonomy and ecology workshop--October 5-6, 1999. In: Vegetation, wildlife and fish ecology and rare species management--Wasatch-Cache National Forest. Logan, UT: U.S. Department of Agriculture, Forest Service, Intermountain Region, Uinta-Wasatch-Cache National Forest.
Wright, H. A. 1985. Effects of fire on grasses and forbs in sagebrush-grass communities. In: K.E. Sanders [ed.] Rangeland Fire Effects; A Symposium: proceedings of a symposium sponsored by Bureau of Land Management and University of Idaho at Boise Idaho. Boise, ID, USDI-BLM. P. 12-21
Wright, H.A., L.F. Neuenschwander, and C.M. Britton. 1979. The role and use of fire in sagebrush-grass and pinyon-juniper plant communities: A state-of-the-art review. Gen. Tech. Rep. INT-58. Ogden, UT. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 48 p.
Wambolt, C.L. 1996. Mule deer and elk foraging preference for 4 sagebrush taxa. Journal of Range Management 49(6):499-503.
Young, J. A., R. A. Evans, and P. T. Tueller. 1976. Great Basin plant communities--pristine and grazed. In: Elston, Robert, ed. Holocene environmental change in the Great Basin. Res. Pap. No. 6. Reno, NV: University of Nevada, Nevada Archeological Society: 187-216.
Young, R.P. 1983. Fire as a vegetation management tool in rangelands of the Intermountain region. In: Monsen, S.B. and N. Shaw (eds). Managing Intermountain rangelands—improvement of range and wildlife habitats: Proceedings of symposia; 1981 September 15-17; Twin Falls, ID; 1982 June 22-24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. Pgs 18-31.

Contributors

CP
TK Stringham

Approval

Kendra Moseley, 3/06/2025

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)	Patti Novak-Echenique
Contact for lead author	State Rangeland Management Specialist
Date	03/19/2010
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none to rare. Rock fragments armor the soil surface.

2. **Presence of water flow patterns:** Water flow patterns are none to rare. Rock fragments armor the soil surface.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare. Occurrence is usually limited to areas of water flow patterns. Frost heaving of shallow rooted plants should not be considered a "normal" condition.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground 30-50%.

5. **Number of gullies and erosion associated with gullies:** Gullies are none to rare.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage from grasses and annual & perennial forbs) expected to move distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during catastrophic events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values should be 3 to 6 on most soil textures found on this site. Areas of this site occurring on soils that have a physical crust will probably have stability values less than 3. (To be field tested.)

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface structure is typically fine platy. Soil surface colors are light and soils are typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is typically 1 to 1.5 percent dropping off quickly below. Organic matter content can be more or less depending on micro-topography.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial herbaceous plants (especially deep-rooted bunchgrasses [i.e., Indian ricegrass] slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Compacted layers are not typical. Subangular blocky sub-surface horizons or subsoil argillic horizons are not to be interpreted as compacted layers.

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: Reference Plant Community: Low shrubs (Lahontan sagebrush)

    Sub-dominant: Deep-rooted, cool season, perennial bunchgrasses > associated shrubs > shallow-rooted, cool season, grasses > deep-rooted, cool season, perennial forbs = fibrous, shallow-rooted, cool season, perennial and annual forbs

    Other:

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** **Dead branches within individual shrubs common and standing dead shrub canopy material may be as much as 25% of total woody canopy; some of the mature bunchgrasses (<20%) have dead centers.**

---

14. **Average percent litter cover (%) and depth (in):** **Within plant interspaces (± 10-20%) and depth of litter is <½ inch.**

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** **For normal or average growing season (end of May) ± 350 lbs/ac; Spring moisture significantly affects total 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:** **Increasers include Douglas rabbitbrush and snakeweed. Invaders include halogeton, Russian thistle, annual mustards, and cheatgrass.**

---

17. **Perennial plant reproductive capability:** **All functional groups should reproduce in average (or normal) and above average growing season years.**
