Ecological site R025XY021OR CLAYPAN SOUTH SLOPES 11-13 PZ

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General information

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

MLRA notes

Major Land Resource Area (MLRA): 025X–Owyhee High Plateau

The Owyhee High Plateau, MLRA 25, lies within the Intermontane Plateaus physiographic province. The southern half is found in the Great Basin while the northern half is located in the Columbia Plateaus. The southern section of the Owyhee High Plateau is characterized by isolated, uplifted fault-block mountain ranges separated by narrow, aggraded desert plains. This geologically older terrain has been dissected by numerous streams draining to the Humboldt River. The northern section forms the southern boundary of the extensive Columbia Plateau basalt flows. Deep, narrow canyons drain to the Snake River across the broad volcanic plain. This MLRA is characteristically cooler and wetter than the neighboring MLRAs of the Great Basin. Elevation ranges from 3,000 to 7,550 feet on rolling plateaus and in gently sloping basins. It is more than 9,840 feet on some steep mountains. The average annual precipitation in most of this area is typically 11 to 22 inches. It increases to as much as 49 inches at the higher elevations. Precipitation occurs mainly as snow in winter. The supply of water from precipitation and streamflow is small and unreliable, except along major rivers. Streamflow depends largely on accumulated snow in the mountains. The dominant soil orders in this MLRA are Aridisols and Mollisols. The soils in the area dominantly have a mesic or frigid temperature regime and an aridic, arid bordering on xeric, or xeric moisture regime. Most of the soils formed in mixed parent material. Volcanic ash and loess mantle the landscape. Surface soil textures are loam and silt loam, and have ashy texture modifiers in some cases. Argillic horizons occur on the more stable landforms.

Ecological site concept

This ecological site is on south facing slopes of mountain plateaus and canyon side slopes. Slopes range from 15 to 40 percent. Elevations range from 4,500 – 5,700 ft. The soils associated with this site are shallow or moderately deep and have an abrupt boundary in the top 10 inches resulting in wet non-satiated conditions. The soil climate is frigid to mesic near frigid (soil temperature regime) and aridic boarding xeric (soil moisture regime). Since this site occurs on south aspects, it receives more solar insolation and thus is slightly drier and warmer than its non-aspect counterpart, resulting in reduced resistance and resilience and annual production. The reference plant community is characterized by dominance of low sagebrush and bluebunch wheatgrass. Thurber’s needlegrass and Sandburg bluegrass are also common in the understory.

Associated sites

R025XY020OR	**SOUTH SLOPES 11-13 PZ**
R025XY030OR	**DROUGHTY NORTH SLOPES 11-13 PZ**
R025XY032OR	**NORTH SLOPES 11-13 PZ**
R025XY038OR	**CLAYPAN NORTH SLOPES 11-13 PZ**

Similar sites

R025XY026OR	**CLAYPAN SOUTH SLOPES 13-16 PZ** Higher precipitation (xeric); higher production

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia arbuscula*
Herbaceous	(1) *Pseudoroegneria spicata subsp. spicata*

Physiographic features

This site is on south exposures of plateaus and south facing canyon side slopes. Slopes range from 15 to 40 percent. Elevation varies from 4,500 to 5,700 feet.

Table 2. Representative physiographic features

Landforms	(1) Lava plateau > Mountain slope (2) Canyon
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	1,370 – 1,740 m
Slope	20 – 40 %
Water table depth	250 cm
Aspect	SE, S, SW

Climatic features

The annual precipitation ranges from 11 to 13 inches, most of which occurs in the form of snow during the months of December through March. Localized convection storms occasionally occur during the summer. The soil temperature regime is frigid to mesic to near frigid with a mean air temperature of 50 degrees F. Temperature extremes range from 10 to 100 degrees F. The frost free period ranges from 45 to 110 days. The optimum growth period for native plants is from April through June.

Table 3 Representative climatic features

Frost-free period (characteristic range)	50-110 days
Freeze-free period (characteristic range)	110-130 days
Precipitation total (characteristic range)	280-330 mm
Frost-free period (average)	100 days
Freeze-free period (average)	120 days
Precipitation total (average)	330 mm

- (1) ROCKVILLE 5 N [USC00357277], Adrian, OR

Influencing water features

Site is not influenced by water features.
Site is not connected to a water table.

Soil features

The soils of this site are shallow to moderately deep over bedrock. Typically the surface layer is a gravelly ashy loam or silt loam. The subsoil is a clay to clay loam. An abrupt boundary occurs at the interface of the surface and subsoil, resulting in wet non-satiated conditions in the spring. Depth to bedrock or an indurated pan ranges from 10 to 30 inches. Permeability is moderate to moderately slow in the surface and slow in the subsoil. The soil is well drained. The available water holding capacity is about 2 to 3 inches for the profile.

(wet non-saturated conditions - Schoeneberger, P.J., 2012, pg 1-15)

The soil series correlated with this site is: Boost.

Table 4. Representative soil features

Parent material	(1) Colluvium (2) Volcanic ash (3) Loess (4) Residuum
Surface texture	(1) Gravelly, ashy loam (2) Gravelly, ashy silt loam
Family particle size	(1) Clayey-skeletal (2) Fine

Drainage class	Well drained
Permeability class	Slow to moderate
Depth to restrictive layer	30 – 100 cm
Soil depth	30 – 100 cm
Surface fragment cover <=3"	0 – 20 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-101.6cm)	5.08 – 7.62 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	10
Subsurface fragment volume <=3" (0-101.6cm)	0 – 30 %
Subsurface fragment volume >3" (0-101.6cm)	0 – 30 %

Ecological dynamics

The reference plant community is dominated by low sagebrush (little sagebrush) with an understory of bluebunch wheatagrass. Thurber's needlegrass and Sandberg bluegrass are also common in the stand. The site has low resilience to disturbance and resistance to invasion. Resilience is a system's capacity to regain its structure, processes, and function following stressors or disturbance (e.g. drought or fire). Resistance is the capacity of the system to retain its structure, processes, and function despite stressors or disturbances (including pressure from invasive species) (Chambers 2014a). Increased resilience increases with elevation, aspect, increased precipitation and increased nutrient availability (Stringham et al. 2015); where greater resource availability and more favorable environmental conditions exist for plant growth and reproduction (Chambers 2014a).

This ecological site's lower effective precipitation (aridic soil moisture regime and southern aspect) and restrictive soil features limit site productivity resulting in more open space for establishment of invasive annual grasses. Timing of precipitation also favors invasive annual grasses that are particularly well adapted to cool wet winters and warm dry summers; beginning growth and utilizing resources prior to native species breaking dormancy. The site's cooler soil temperature regime (frigid to mesic near frigid) does provide some resistance compared to warmer sites but is not cold enough to inhibit invasive annual grasses (Chambers 2014b). Furthermore, the increased solar insolation received by the site due to its southerly aspect makes this site warmer than its non-aspect counterpart and reduces overall site resistance.

Production and composition are affected by soil depth and texture. Bluebunch wheatgrass and production will increase as the soil depth increases. Sandberg bluegrass will increase as the surface becomes thinner. Thurber needlegrass will increase as the percent of gravels on the surface increases.

This ecological site is dominated by deep-rooted cool season, perennial bunchgrasses and long-lived shrubs (50+ years) with high root to shoot ratios. Community types with low sagebrush as the dominant shrub were found to have soil depths and thus available rooting depths of 71 to 81 centimeters in a study in northeast Nevada (Jensen 1990). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Comstock and Ehleringer 1992).

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).

Low sagebrush is fairly drought tolerant but also tolerates periodic wetness during some portion of the growing season. Low sagebrush is also susceptible to the sagebrush defoliator Aroga moth. Aroga moth can partially or entirely kill individual plants or entire stands of big sagebrush (Furniss and Barr 1975), but the research is inconclusive of the damage sustained by low sagebrush populations.

The low 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. It can also 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).

Bluebunch wheatgrass is the dominant perennial bunchgrass on this ecological site. Perennial bunchgrasses generally have 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 of the soil profile. General differences in root depth distributions between grasses and shrubs results in resource partitioning in these shrub/grass systems.

As ecological condition declines, the sagebrush and rabbitbrush become dominant with increases of Sandberg's bluegrass and mat forming forbs in the understory. The potential invasive/noxious weeds are cheatgrass, rabbitbrush, and annual mustards.

Four possible alternative stable states have been identified for this ecological site.

Fire Ecology:
Prior to 1897, mean fire return intervals for low sagebrush communities have been estimated to be from 35 to over 100 years. Fire most often occurs during wet years with high forage production.

Low sagebrush is killed by fire and does not sprout (Tisdale and Hironaka 1984). Establishment after fire is from seed, generally blown in and not from the seed bank (Bradley et al. 1992). Fire risk is greatest following a wet, productive year when there is greater production of fine fuels (Beardall and Sylvester 1976). Fire return intervals have been estimated at 100-200 years in black sagebrush-dominated sites (Kitchen and McArthur 2007) and likely is similar in the low sagebrush ecosystem. Historically, however, fires were probably patchy due to the low productivity of these sites. Recovery time of little sagebrush following fire is variable (Young 1983). After fire, if regeneration conditions are favorable, low sagebrush recovers in 2 to 5 years; on harsh sites where cover is low to begin with and/or erosion occurs after fire, recovery may require more than 10 years (Young 1983). Slow regeneration may subsequently worsen erosion (Blaisdell et al. 1982).

The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses within the site along with seasonality and intensity of the fire all factor into the individual species response. The growing points for most forbs and grasses are located at or below the soil surface, providing relative protection from disturbances which decrease above ground biomass, such as grazing or fire. Thus, fire mortality is more correlated to duration and intensity of heat which is related to culm density, culm-leaf morphology, size of plant and abundance of old growth (Wright 1971, Young 1983). However, season and severity of the fire and post-fire soil moisture availability will influence plant response.

Bluebunch wheatgrass has coarse stems with little leafy material, therefore the tops aboveground biomass burns rapidly and little heat is transferred downward into the crowns (Young 1983). Bluebunch wheatgrass was described as fairly tolerant of burning, other than in May in eastern Oregon (Britton et al. 1990). Uresk et al. (1976) reported burning increased vegetative and reproductive vigor of bluebunch wheatgrass. Thus, bluebunch wheatgrass is considered to experience slight damage to fire but is more susceptible in drought years (Young 1983). Most authors classify the plant as undamaged by fire (Kuntz 1982).

Thurber’s needlegrass is very susceptible to fire-caused mortality. Burning has been found to decrease the vegetative and reproductive vigor of Thurber’s needlegrass (Uresk et al. 1976). Fire can also reduce basal area and yield of Thurber’s needlegrass (Britton et al. 1990). The fine leaves and densely tufted growth form make this grass susceptible to subsurface charring of the crowns (Wright and Klemmedson 1965). Although timing of fire highly influences the response and mortality of Thurber’s needlegrass, smaller bunch sizes are less likely to be damaged by fire (Wright and Klemmedson 1965). Thurber’s needlegrass can and often survives fire and will continue growth when conditions are favorable (Koniak 1985).

Sandberg bluegrass has been found to increase following fire, likely due to its low stature and productivity (Daubenmire 1975) and may retard reestablishment of deeper rooted bunchgrasses.

Adapted from: Stringham, T.K., P. Novak-Echenique, P. Blackburn, D. Snyder, and A. Wartgow. 2015. Final Report for USDA Ecological Site Description State-and-Transition Models by Disturbance Response Groups, Major Land Resource Area 25 Nevada. University of Nevada Reno, Nevada Agricultural Experiment Station Research Report 2015-02. p. 569

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	**Dominant, perennial, deep rooted grasses**			538-628	
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	538-628	–
2	**Sub-dominant, perennial, deep rooted grasses**			27-72	
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	18-45	–
	squirreltail	ELEL5	*Elymus elymoides*	9-27	–
3	**Sub-dominant, shallow rooted perennial grass**			18-45	
	Sandberg bluegrass	POSE	*Poa secunda*	18-45	–
4	**All other perennial grasses**			9-36	
	prairie Junegrass	KOMA	*Koeleria macrantha*	4-18	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	4-18	–
Forb					
5	**Dominant, perennial forbs**			54-126	
	balsamroot	BALSA	*Balsamorhiza*	18-45	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	18-45	–
	phlox	PHLOX	*Phlox*	9-18	–
	milkvetch	ASTRA	*Astragalus*	9-18	–
6	**All other perennial forbs**			17-40	
	desertparsley	LOMAT	*Lomatium*	4-9	–
	fleabane	ERIGE2	*Erigeron*	4-9	–
	buckwheat	ERIOG	*Eriogonum*	4-9	–
	woodland-star	LITHO2	*Lithophragma*	1-4	–
	stoneseed	LITHO3	*Lithospermum*	1-4	–

	common yarrow	ACMI2	*Achillea millefolium*	1-4	–
Shrub/Vine					
8	**Dominant, perennial, evergreen shrubs**			45-90	
	little sagebrush	ARAR8	*Artemisia arbuscula*	45-90	–
9	**Other perennial shrubs**			13-36	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4-9	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	4-9	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0-4	–

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 2.4 plant community composition

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

Table 12. Community 3.1 plant community composition

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

Table 13. Community 3.2 plant community composition

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

Table 14. Community 4.1 plant community composition

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

Table 15. Community 5.1 plant community composition

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

Animal community

This site offers food and cover for antelope, mule deer, rodents and a variety of birds. It is an important spring, summer and fall use area for antelope and mule deer. This site is suitable for livestock grazing. Grazing management considerations include timing, intensity and duration of grazing. Domestic sheep and, to a much lesser degree, cattle consume low sagebrush, particularly during the spring, fall, and winter (Sheehy and Winward 1981). Heavy dormant season grazing by sheep will reduce sagebrush cover and increase grass production (Laycock 1967). Severe trampling damage to supersaturated soils could occur if sites are used in early spring when there is abundant snowmelt. Trampling damage, particularly from cattle or horses, in low sagebrush habitat types is greatest when high clay content soils are wet. Bunchgrasses, in general, best tolerate light grazing after seed formation. Britton et al. (1990) observed the effects of clipping date on basal area of 5 bunchgrasses in eastern Oregon and found grazing from August to October (after seed set) has the least impact. Heavy grazing during the growing season will reduce perennial bunchgrasses and increase sagebrush (Laycock 1967). Abusive grazing by cattle or horses will likely increase low sagebrush, rabbitbrush and some forbs such as arrowleaf balsamroot. Annual non-native weedy species such as cheatgrass and mustards, and potentially medusahead, may invade. Bluebunch wheatgrass is moderately grazing tolerant and is very sensitive to defoliation during the active growth period (Blaisdell and Pechanec 1949, Laycock 1967, Anderson and Scherzinger 1975, Britton et al. 1990). Herbage and flower stalk production was reduced with clipping at all times during the growing season; however, clipping was most harmful during the boot stage (Blaisdell and Pechanec 1949). Tiller production and growth of bluebunch was greatly reduced when clipping was coupled with drought (Busso and Richards 1995). Mueggler (1975) estimated that low vigor bluebunch wheatgrass may need up to 8 years rest to recover. Although an important forage species, it is not always the preferred species by livestock and wildlife. Thurber's needlegrass is an important forage source for livestock and wildlife in the arid regions of the West (Ganskopp 1988). Although the seeds are apparently not injurious, grazing animals avoid them when they begin to mature. Sheep, however, have been observed to graze the leaves closely, leaving stems untouched (Eckert and Spencer 1987). Heavy grazing during the growing season has been shown to reduce the basal area of Thurber's needlegrass (Eckert and Spencer 1987), suggesting that both seasonality and utilization are important factors in management of this plant. A single defoliation, particularly during the boot stage, was found to reduce herbage production and root mass thus potentially lowering the competitive ability of this needlegrass (Ganskopp 1988). Reduced bunchgrass vigor or density provides an opportunity for Sandberg bluegrass expansion and/or cheatgrass and other invasive species to occupy interspaces. Sandberg bluegrass increases under grazing pressure (Tisdale and Hironaka 1981) and is capable of co-existing with cheatgrass or other weedy species. Excessive sheep grazing favors Sandberg bluegrass; however, where cattle are the dominant grazers, cheatgrass often dominates (Daubenmire 1970). Thus, depending on the season of use, the grazer and site conditions, either Sandberg bluegrass or cheatgrass may become the dominant understory with inappropriate grazing management. (Adapted from Stringham, T.K. et al., 2015)

Inventory data references

Vale District BLM Ecological Site Inventory NASIS component and pedon data Range Site Descriptions Field knowledge of range-trained personnel

Type locality

Location 1: Malheur County, OR	
Township/Range/Section	T31 S R46 E S9
General legal description	NW¼ of Sec. 9

Other references

Anderson, E. W. and R. J. Scherzinger. 1975. Improving quality of winter forage for elk by cattle grazing. Journal of Range Management 28:120-125.

Barrington, M., S. Bunting, and G. Wright. 1988. A fire management plan for Craters of the Moon National Monument. Cooperative Agreement CA-9000-8-0005. Moscow, ID: University of Idaho, Range Resources Department. 52 p. Draft.

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.

Beardall, L. E. and V. E. Sylvester. 1976. Spring burning of removal of sagebrush competition in Nevada. In: Tall Timbers fire ecology conference and proceedings. Tall Timbers Research Station. 14: 539-547

Blaisdell, J. P. and J. F. Pechanec. 1949. Effects of Herbage Removal at Various Dates on Vigor of Bluebunch Wheatgrass and Arrowleaf Balsamroot. Ecology 30:298-305.

Blaisdell, J. P., R. B. Murray, and E. D. McArthur. 1982. Managing intermountain rangelands-sagebrushgrass ranges. Gen. Tech. Rep. INT-134. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. p. 41.

Britton, C. M., G. R. McPherson, and F. A. Sneva. 1990. Effects of burning and clipping on five bunchgrasses in eastern Oregon. Great Basin Naturalist 50:115-120.

Busso, C. A. and J. H. Richards. 1995. Drought and clipping effects on tiller demography and growth of two tussock grasses in Utah. Journal of Arid Environments 29:239-251.

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

Chambers J.C., Miller R.F., Board D.I., Pyke D.A., Roundy B.A., Grace J.B., Schupp E.W., Tausch R.J. 2014. Resilience and Resistance of Sagebrush Ecosystems: Implications for State and Transition Models and Management Treatments. Rangeland Ecology and Management, 67 (5) , pp. 440-454.

Chambers, Jeanne C.; Pyke, David A.; Maestas, Jeremy D.; Pellant, Mike; Boyd, Chad S.; Campbell, Steven B.; Espinosa, Shawn; Havlina, Douglas W.; Mayer, Kenneth E.; Wuenschel, Amarina. 2014. Using resistance and resilience concepts to reduce impacts of invasive annual grasses and altered fire regimes on the sagebrush ecosystem and greater sage-grouse: A strategic multi-scale approach. Gen. Tech. Rep. RMRS-GTR-326. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 73 p.

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.

Cole, D.N. 1987. Effects of three seasons of experimental trampling on five montane forest communities and a grassland in western Montana, USA. Biological Conservation 40:219-244.

Conrad, C. E. and C. E. Poulton. 1966. Effect of a wildfire on Idaho fescue and bluebunch wheatgrass. Journal of Range Management 19:138-141.

Daubenmire, R. 1970. Steppe vegetation of Washington. Technical bulletin. Washington Agriculture Experiment Station. 131 pp.

Daubenmire, R. 1975. Plant succession on abandoned fields, and fire influences in a steppe area in southeastern Washington. Northwest Science 49:36-48.

Eckert, R. E., Jr. and J. S. Spencer. 1987. Growth and reproduction of grasses heavily grazed under restoration management. Journal of Range Management 40:156-159.

Furniss, M. M. and W. F. Barr. 1975. Insects affecting important native shrubs of the northwestern United States General Technical Report INT-19. Intermountain Forest and Range Experiment Station, U.S. Department of Agriculture, Forest Service. Ogden, UT. p. 68

Ganskopp, D. 1988. Defoliation of Thurber Needlegrass: Herbage and Root Responses. Journal of Range Management 41:472-476.

Jensen, M.E. 1990 Interpretation of environmental gradients which influence sagebrush community distribution in northeastern Nevada. J. of Range Management 43:161-166.

Johnson, C.G., Jr., R.R. Clausnitzer, P.J. Mehringer, and C. Oliver. 1994. Biotic and abiotic processes of Eastside ecosystems: the effects of management on plant and community ecology and on stand and landscape vegetation dynamics. Gen. Tech. Rep. PNW-GTR-322. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 66 p.

Kitchen, S. G. and E. D. McArthur. 2007. Big and black sagebrush landscapes. In: S. Hood, M. Miller [eds.]. Fire ecology and mangement of the major ecosystems of southern Utah. Gen. Tech. Rep. RMRMS-GTR-202. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. P. 73-95.

Koniak, S. 1985. Succession in pinyon-juniper woodlands following wildfire in the Great Basin. The Great Basin Naturalist 45:556-566.

Laycock, W. A. 1967. How heavy grazing and protection affect sagebrush-grass ranges. Journal of Range Management 20:206-213.

Mueggler, W. F. 1975. Rate and Pattern of Vigor Recovery in Idaho Fescue and Bluebunch Wheatgrass. Journal of Range Management 28:198-204.

Mueggler, W.F. 1984. Diversity of western rangelands. In: Natural diversity in forest ecosystems: Proceedings; 1982; Athens, GA. Athens, GA: University of Georgia, Institute of Ecology: Pgs 211-217.

Robberecht, R. and G. Defossé. 1995. The relative sensitivity of two bunchgrass species to fire. International Journal of Wildland Fire 5:127-134.

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

Sheehy, D. P. and A. H. Winward. 1981. Relative Palatability of Seven Artemisia Taxa to Mule Deer and Sheep. Journal of Range Management 34:397-399.

Stringham, T.K., P. Novak-Echenique, P. Blackburn, D. Snyder, and A. Wartgow. 2015. Final Report for USDA Ecological Site Description State-and-Transition Models by Disturbance Response Groups, Major Land Resource Area 25 Nevada. University of Nevada Reno, Nevada Agricultural Experiment Station Research Report 2015-02. p. 569

Tisdale, E. W. and M. Hironaka. 1981. The sagebrush-grass region: A review of the ecological literature. University of Idaho, Forest, Wildlife and Range Experiment Station. Moscow, ID. P. 31

Uresk, D. W., J. F. Cline, and W. H. Rickard. 1976. Impact of wildfire on three perennial grasses in southcentral Washington. Journal of Range Management 29:309-310.

Young, R. P. 1983. Fire as a vegetation management tool in rangelands of the intermountain region. In: S. Monsen, N. Shaw [eds.] Managing intermountain rangelands - improvement of range and wildlife habitats. USDA, Forest Service. P. 18-31

Wright, H. A. and J. O. Klemmedson. 1965. Effect of Fire on Bunchgrasses of the Sagebrush-Grass Region in Southern Idaho. Ecology 46:680-688.

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.

Wright, H. A. 1971. Why Squirreltail Is More Tolerant to Burning than Needle-and-Thread. Journal of Range Management 24:277-284.

Contributors

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Approval

Kendra Moseley, 4/25/2024

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	08/08/2026
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:**