Ecological site R024XY023NV NORTH SLOPE 14+ P.Z.

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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): 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.

Ecological site concept

This ecological site is on smooth to convex mountain side slopes with a northerly aspect. The soils are very deep, well drained, and formed in residuum derived from volcanic parent material. The soil profile is characterized by a pachic epipedon and greater than 35 percent rock fragments in the particle size control section. Important abiotic factors contributing to the present of this ecological site include the north aspect and the thick mollic epipedon reflecting the increased vegetative production due to increased available soil moisture.

Associated sites

R024XY016NV	**Mountain Ridge** This site is on convex-convex landform positions, such as mountain ridges, summits and shoulders. Soils associated with this site are shallow, well drained, and formed in colluvium or residuum derived from igneous and/or sedimentary rocks. Important abiotic factors associated with this ecological site include low water holding capacity and reduced effective moisture due to high runoff, reduced snow accumulation, shallow depth and high amounts of rock fragments throughout the profile.
R024XY021NV	**Loamy Slope 12-14 P.Z.** Soils are moderately deep, well drained, and formed in residuum/colluvium derived from volcanic parent material. The soil profile is characterized by a dark surface horizon (mollic epipedon), a horizon of clay accumulation (argillic horizon) within 30 centimeters, and 18-35 percent clay in the particle size control section.

R024XY032NV	**LOAMY SLOPE 14+ P.Z.** The soil profile is characterized by a mollic (pachic) epipedon and greater than 35 percent rock fragments by volume.
R024XY046NV	**GRAVELLY NORTH SLOPE** This site occurs on mountain side slopes with northern aspects. Soils are very deep, well drained and formed in colluvium derived from mixed rocks. The soil profile is characterized by a mollic epipedon and greater than 35 percent rock fragments distributed throughout the profile.

Similar sites

R024XY021NV	**Loamy Slope 12-14 P.Z.** Idaho fescue (FEID)- Bluebunch wheatgrass (PSSPS) codominant grasses
R024XY033NV	**STEEP NORTH SLOPE 10-12 P.Z.** Less productive site Wyoming big sagebrush (ARTRW8) and Idaho Fescue (FEID)
R024XY046NV	**GRAVELLY NORTH SLOPE** Basin big sagebrush (ARTR4) dominant shrub

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata subsp. tridentata*
Herbaceous	(1) *Festuca idahoensis*

Physiographic features

This site is on smooth to convex mountain side slopes having a northerly aspect. Slopes range from 15 to 75 percent, but slope gradients of 30 to 50 percent are typical. Elevations are 5500 to 10000 feet (1676 to 3048m).

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Runoff class	Medium to high
Elevation	1,680 – 3,050 m
Slope	20 – 80 %

Water table depth	180 cm
Aspect	N

Climatic features

The climate associated with this site is semiarid and characterized by cold, moist winters and cool, dry summers. Average annual precipitation is 14 to over 20 inches (36 to over 51 cm). Mean annual air temperature is 35 to 45 degrees F. The average growing season is about 40 to 90 days. There is no climate station available for this site.

Table 3 Representative climatic features

Frost-free period (average)	90 days
Freeze-free period (average)	
Precipitation total (average)	510 mm

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are very deep, well drained and formed in residuum derived from mixed volcanic parent material.
The soil profile is characterized by a pachic epipedon and greater than 35 percent rock fragments throughout the profile.
Available water capacity is moderate to high. Snow accumulation persists on this site late into spring when the soil is not frozen. Snow melt, at this time, adds to the soil moisture supply. Soil temperatures and evapotranspiration potentials are limited due to reduced insolation on the northerly aspects where this site occurs.
Soil series associated with this site include: Glean and Iver.
Where this site is correlated to Hapgood or Tusel components should be field checked for re-correlation to Loamy Slope 14+"PZ (R024XY032NV).

Table 4. Representative soil features

Parent material	(1) Residuum
Surface texture	(1) Gravelly loam (2) Gravelly sandy loam (3) Gravelly silt loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid

Soil depth	100 – 180 cm
Surface fragment cover <=3"	10 – 40 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-101.6cm)	7.87 – 16.26 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)	6.1 – 7.3
Subsurface fragment volume <=3" (Depth not specified)	10 – 50 %
Subsurface fragment volume >3" (Depth not specified)	0 – 30 %

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 et al. 2013). Biotic factors that that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).

This ecological site is dominated by deep-rooted cool season, perennial bunchgrasses and long-lived shrubs (50+ years) with high root to shoot ratios. The dominant shrubs usually root to the full depth of the winter-spring soil moisture recharge, which ranges from 1.0 to over 3.0 m (Dobrowolski et al. 1990). Root length of mature sagebrush plants was measured to a depth of 2 meters in alluvial soils in Utah (Richards and Caldwell 1987). 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 within the soil profile (Bates et al. 2006). Mountain big sagebrush is generally long-lived; therefore it is not necessary for new individuals to recruit every year for perpetuation of the stand. Infrequent large recruitment events and simultaneous low, continuous recruitment is the foundation of population maintenance (Noy-Meir 1973). Survival of the seedlings is dependent on adequate moisture conditions.

Native insect outbreaks are also important drivers of ecosystem dynamics in sagebrush communities. Climate is generally believed to influence the timing of insect outbreaks especially a sagebrush defoliator, Aroga moth (Aroga websteri). Aroga moth infestations have occurred in the Great Basin in the 1960s, early 1970s, and have been ongoing in Nevada since 2004 (Bentz et al 2008). Thousands of acres of big sagebrush have been impacted, with partial to complete die-off observed. Aroga moth can partially or entirely kill individual plants or entire stands of big sagebrush (Furniss and Barr 1975).

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).

Production will be higher on sites with deeper soils. Overgrazing by livestock and horses will cause a decrease in deep-rooted perennial bunchgrasses, mainly Idaho fescue and bluebunch wheatgrass. As grass cover declines, the potential for invasion by annual non-native species likely cheatgrass increase. Continued inappropriate grazing management may result in an increase in Sandberg bluegrass (Poa secunda), balsamroot (Balsamorhiza spp.), lupine (Lupinus spp.), sagebrush, and rabbitbrush (Chrysothamnus viscidiflorus).

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

Fire Ecology:

Pre-settlement fire return intervals in mountain big sagebrush communities varied from 15 to 25 years (Burkhardt and Tisdale 1969, Houston 1973, and Miller et al. 2000). Mountain big sagebrush is killed by fire (Neunschwander 1980, Blaisdell et al. 1982) and does not resprout (Blaisdell 1953). Post fire regeneration occurs from seed and will vary depending on site characteristics, seed source, and fire characteristics. Mountain big sagebrush seedlings can grow rapidly and may reach reproductive maturity within 3 to 5 years (Bunting et al. 1987). Mountain big sagebrush may return to pre-burn density and cover within 15-20 years following fire, but establishment after severe fires may proceed more slowly (Bunting et al. 1987). The introduction of annual weedy species, like cheatgrass, may cause an increase in fire frequency and eventually lead to an annual dominated community. Conversely, as fire frequency decreases, sagebrush will increase.

Depending on fire severity, rabbitbrush, Utah serviceberry (Amelanchier utahensis), and mountain snowberry (Symphoricarpos orbiculatus) may increase after fire due to their ability to sprout. Douglas' rabbitbrush is top-killed by fire, but sprouts vigorously after fire (Kuntz 1982, Akinsoji 1988). Mountain snowberry is also top-killed by fire, but resprouts after fire from rhizomes (Leege and Hickey 1971, Noste and Bushey 1987). Snowberry has been noted to regenerate well and exceed pre-burn biomass in the third season after a fire (Merrill et al. 1982). Utah serviceberry resprouts from the root crown. If balsamroot is common before fire, they will increase after fire or with heavy grazing (Wright 1985).

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. For most forbs and grasses the growing points 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)

Idaho fescue response to fire varies with condition and size of the plant, season and severity of fire, and ecological conditions. Mature Idaho fescue plants are commonly reported to be severely damaged by fire in all seasons (Wright et al. 1979). Initial mortality may be high (in excess of 75%) on severe burns, but usually varies from 20 to 50 percent (Barrington et al 1988). Rapid burns have been found to leave little damage to root crowns, and new tillers are produced with onset of fall moisture (Johnson et al. 1994). However, Wright and others (1979) found the dense, fine leaves of Idaho fescue provided enough fuel to burn for hours after a fire had passed, thereby killing or seriously injuring the plant regardless of the intensity of the fire (Wright et al. 1979). Idaho fescue is commonly reported to be more sensitive to fire than the other prominent grass on this site, bluebunch wheatgrass (Conrad and Poulton 1966). However, Robberecht and Defosse (1995) suggested the latter was more sensitive. They observed culm and biomass reduction with moderate fire severity in bluebunch wheatgrass, whereas a high fire severity was required for this reduction in Idaho fescue. Also, given the same fire severity treatment, post-fire culm production was initiated earlier and more rapidly in Idaho fescue (Robberecht and Defosse 1995).

Bluebunch wheatgrass has coarse stems with little leafy material, therefore the 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 early spring 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).

Basin wildrye is a minor component of this site, is relatively resistant to fire, particularly dormant season fires, as plants sprout from surviving root crowns and rhizomes (Zschaechner 1985).

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 (%)

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 (%)

Animal community

Livestock Interpretations: This site has limited value for livestock grazing, due to steep slopes. Grazing management should be keyed to perennial grass production. Idaho fescue provides important forage for many types of domestic livestock. The foliage cures well and is preferred by livestock in late fall and winter. Cusick's bluegrass makes up only a small proportion of the biomass of the sagebrush communities in which it lives, but it is often taken preferentially by cattle, especially early in the season. Bluebunch wheatgrass is considered one of the most important forage grass species on western rangelands for livestock. Although bluebunch wheatgrass can be a crucial source of forage, it is not necessarily the most highly preferred species. Mountain big sagebrush is eaten by domestic livestock but has long been considered to be of low palatability, and a competitor to more desirable species. 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: Idaho fescue provides important forage for several wildlife species. It is reported to be good forage for pronghorn, and deer in ranges of northern Nevada. Deer, elk, and mountain goat also use Cusick's bluegrass early in the season. The value of Cusick's bluegrass as cover for small animals has been rated as poor to fair. Bluebunch wheatgrass is considered one of the most important forage grass species on western rangelands for wildlife. Bluebunch wheatgrass does not generally provide sufficient cover for ungulates, however, mule deer are frequently found in bluebunch-dominated grasslands. Mountain big sagebrush is highly preferred and nutritious winter forage for mule deer and elk. Sagebrush-grassland communities provide critical sage-grouse breeding and nesting habitats. Meadows surrounded by sagebrush may be used as feeding and strutting grounds. Sagebrush is a crucial component of their diet year-round, and sage-grouse select sagebrush almost exclusively for cover. Sage-grouse prefer mountain big sagebrush and Wyoming big sagebrush communities to basin big sagebrush communities.

Hydrological functions

Runoff is medium to rapid. The potential for sheet and rill erosion is moderate to severe depending upon slope. Hydrologic soil group is B. Rills are none to rare. Rock fragments armor the soil surface. Water flow patterns are none to rare. 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. Perennial herbaceous plants (i.e., Idaho fescue) slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

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 big sagebrush leaves and branches for medicinal teas, and the leaves as a fumigant. Bark was woven into mats, bags and clothing.

Inventory data references

NRCS-RANGE-417 - 4 records NV-ECS-1 - 1 record

Type locality

Location 1: Humboldt County, NV	
Township/Range/Section	T35N R36E S15
UTM zone	N
UTM northing	4529058
UTM easting	422722
Latitude	40° 54′32″
Longitude	117° 55′3″
General legal description	NE¼ Approximately 4½ miles southeast of Winnemucca, Sonoma Range, Humboldt County, Nevada. This site occurs also occurs in Eureka, Lander and Pershing counties, Nevada.

Other references

Akinsoji, A. 1988. Postfire vegetation dynamics in a sagebrush steppe in southeastern Idaho, USA. Vegetatio 78:151-155.
Anderson, E.W. and R.J. Scherzinger. 1975. Improving quality of winter forage for elk by cattle grazing. Journal of Range Management 28(2):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.
Beetle, Alan A. 1962. Range survey in Teton County, Wyoming: Part 2. Utilization and condition classes. Bull. 400. Laramie, WY: University of Wyoming, Agricultural Experiment Station. 38 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
Blaisdell, J.P. 1953. Ecological effects of planned burning of sagebrush-grass range on the Upper Snake River Plains. Tech. Bull. 1975.

Washington, DC: U.S. Department of Agriculture. 39 p.
Blaisdell, J.P. R.B. Murray, and E.D. McArthur. 1982. Managing Intermountain rangelands--sagebrush-grass ranges. Gen. Tech. Rep. INT-134. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 41 p.
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(3):298-305.
Britton, C.M., G.R. McPherson and F.A. Sneva. 1990. Effects of burning and clipping on five bunchgrasses in eastern Oregon. The Great Basin Naturalist 50(2):115-120.
Brunner, James R. 1972. Observations on Artemisia in Nevada. Journal of Range Management. 25: 205-298.
Bunting, S.C., B.M. Kilgore, and C.L. Bushey. 1987. Guidelines for prescribed burning sagebrush-grass rangelands in the northern Great Basin. Gen. Tech. Rep. INT-231. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 33 p.
Burkhardt, J.W. and E.W. Tisdale. 1969. Nature and successional status of western juniper vegetation in Idaho. Journal of Range Management 22(4):264-270.
Busso, C. A. and J. H. Richards. 1995. Drought and clipping effects on tiller demography andgrowth of two tussock grasses in Utah. Journal of Arid Environments 29:239-251.
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.
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.
Clark, D.L., T.W. Weaver, and D.G. Despain. 1994. Seedbanks under climax Rocky Mountain vegetation and the effects of fire on them. In: Despain, D.G. (ed.). Plants and their environments: proceedings of the 1st biennial scientific conference on the Greater Yellowstone Ecosystem; 1991 September 16-17; Yellowstone National Park. Tech. Rep. NPS/NRYELL/NRTR-93/XX. Denver, CO: U.S. Department of the Interior, National Park Service, Rocky Mountain Region, Yellowstone National Park: Pgs 315-316.
Comstock, J. P. and J. R. Ehleringer. 1992. Plant adaptation in the Great Basin and Colorado plateau. Western North American Naturalist 52:195-215.
Conrad, C.E. and C.E. Poulton. 1966. Effect of a wildfire on Idaho fescue and bluebunch wheatgrass. Journal of Range Management 19(3):138-141.
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., and J.S. Spencer. 1986. Vegetation response on allotments grazed under rest-rotation management. Journal of Range Management 39(2):166-174.
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.
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.
Gaffney, W.S. 1941. The effects of winter elk browsing, south fork of the Flathead River, Montana. Journal of Wildlife Management 5(4):427-453.
Ganskopp, D. 1988. Defoliation of Thurber needlegrass: herbage and root responses. Journal of Range Management 41(6):472-476.
Ganskopp, D., L. Aguilera, and M. Vavra. 2007. Livestock forage conditioning among six northern Great Basin grasses. Rangeland Ecology and Management 60:71-78.
Houston, D.B. 1973. Wildfires in northern Yellowstone National Park. Ecology 54(5):1111-1117.
Hurd, R.M. 1961. Grassland vegetation in the Big Horn Mountains, Wyoming. Ecology 42(3):459-467.
Johnson, C.G., Jr., R.R. Clausnitzer, P.J. Mehringer, and C.D. 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.
Koniak, S. 1985. Succession in pinyon-juniper woodlands following wildfire in the Great Basin. The Great Basin Naturalist 45(3):556-566.
Krall, J.L., J.R. Stroh, C.S. Cooper, and S.R. Chapman. 1971. Effect of time and extent of harvesting basin wildrye. Journal of Range Management 24(6):414-418.
Kuntz, D.E. 1982. Plant response following spring burning in an Artemisia tridentata subsp. vaseyana/Festuca idahoensis habitat type. Moscow, ID: University of Idaho. 73 p. Thesis.
Laycock, W.A. 1967. How heavy grazing and protection affect sagebrush-grass ranges. Journal of Range Management 20:206-213.
Leege, T. A. and W. O. Hickey. 1971. Sprouting of northern Idaho shrubs after prescribed burning. The Journal of Wildlife Management:508-515.
McArthur, E. Durant; Stevens, Richard 2004. Chapter 21. Composite shrubs. In: Monsen, Stephen B.; Stevens, Richard; Shaw, Nancy L., comps. Restoring western ranges and wildlands, vol. 2. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 493-538
Miller, R.F., T.J. Svejcar, and J.A. Rose. 2000. Impacts of western juniper on plant community composition and structure. Journal of Range Management 53(6):574-585.
Merrill, E. H., H. Mayland, and J. Peek. 1982. Shrub responses after fire in an idaho ponderosa pine community. The Journal of Wildlife Management 46:496-502.
Mueggler, W. F. 1975. Rate and Pattern of Vigor Recovery in Idaho Fescue and Bluebunch Wheatgrass. Journal of Range Management 28:198-204.
Neuenschwander, L.F. 1980. Broadcast burning of sagebrush in the winter. Journal of Range Management (33)3:233-236.

Noste, N.V. and C.L. Bushey. 1987. Fire response of shrubs of dry forest habitat types in Montana and Idaho. Gen. Tech. Rep. INT-239. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 22 p.
Noy-Meir, I. 1973. Desert ecosystems: environment and producers. Annual Review of Ecology and Systematics 4:25-51.
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.
Robberecht, R. and G.E. Defosse. 1995. The relative sensitivity of two bunchgrass species to fire. International Journal of Wildland Fire 5(3):127-134.
Smith, M.A. and F. Busby. 1981. Prescribed burning: effective control of sagebrush in Wyoming. RJ-165. Laramie, WY: University of Wyoming, Agricultural Experiment Station. 12 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 29:309-310.
Whisenant, S. G. 1990. Changing fire frequencies on Idaho's Snake River Plains: ecological and management implications. McArthur, E. Durant; Romney, Evan M.; Smith, Stanley D:5-7.
Wright, H. A. 1971. Why Squirreltail Is More Tolerant to Burning than Needle-and-Thread. Journal of Range Management 24:277-284.
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 Universtory 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.
Young, R.P. 1983. Fire as a vegetation management tool in rangelands of the Intermountain Region. In: Monsen, S.B. and N. Shaw (compilers). Managing Intermountain rangelands--improvement of range and wildlife habitats: Proceedings; 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.
Zschaechner, G.A. 1985. Studying rangeland fire effects: a case study in Nevada. In: Sanders, K. and J. Durham (eds). Rangeland fire effects. Proceedings of the symposium. 1984 November 27-29; Boise, ID. Boise, ID. U.S. Department of the Interior, Bureau of Land Management, Idaho State Office. Pgs 66-84.

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Approval

Kendra Moseley, 3/07/2025

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.

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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.**

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 is ± 10-20%.**

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

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 medium platy or very fine to medium granular. Soil surface colors are very dark and soils are typified by a mollic epipedon. Organic matter of the surface 2 to 3 inches is typically less than 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 (i.e., Idaho fescue) slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.**

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 or massive sub-surface horizons or subsoil argillic horizons are not to be interpreted as compacted layers.**

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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: Deep-rooted, cool season, perennial bunchgrasses

Sub-dominant: Tall shrubs (i.e., mountain big sagebrush) > shallow-rooted, cool season, perennial bunchgrasses > associated shrubs > deep-rooted, cool season, perennial forbs = fibrous, shallow-rooted, cool season, perennial and annual forbs

Other:

Additional:

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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.**

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

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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) ± 1200 lbs/ac; Spring moisture significantly affects total production.**

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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 mountain big sagebrush, Invaders include halogeton, Russian thistle, bassia, annual mustards, and cheatgrass.**

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