Ecological site R025XY004NV
LOAMY SLOPE 16+ 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): 025X–Owyhee High Plateau

MLRA Notes 25—Owyhee High Plateau
This area is in Nevada (56 percent), Idaho (30 percent), Oregon (12 percent), and Utah (2 percent). It makes up about 27,443 square miles. MLRA 25 is characteristically cooler and wetter than the neighboring MLRAs of the Great Basin. The western boundary is marked by a gradual transition to the lower and warmer basins of MLRA 24. The boundary to the south-southeast, with MLRA 28B, is marked by gradual changes in geology marked by an increased dominance of singleleaf pinyon and Utah juniper and a reduced presence of Idaho fescue. The boundary to the north, with MLRA 11, is a rapid transition from the lava plateau topography to the lower elevation Snake River Plain.
Physiography:
All of this area lies within the Intermontane Plateaus. The southern half is in the Great Basin section of the Basin and Range province. This part of the MLRA 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 half of the area lies within the Columbia Plateaus province. This part of the MLRA forms the southern boundary of the extensive Columbia Plateau basalt flows. Most of the northern half is in the Payette section, but the northeast corner is in the Snake River Plain section. Deep, narrow canyons draining into the Snake River have been incised into this broad basalt plain. 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 Humboldt River crosses the southern half of this area
Geology:
The dominant rock types in this MLRA are volcanic. They include andesite, basalt, tuff, and rhyolite. In the north and west parts of the area, Cretaceous granitic rocks are exposed among Miocene volcanic rocks in mountains. A Mesozoic igneous and metamorphic rock complex dominates the south and east parts of the area. Upper and Lower Paleozoic calcareous sediments, including oceanic deposits, are exposed with limited extent in the mountains. Alluvial fan and basin fill sediments occur in the valleys.
Climate:
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. Rainfall occurs in spring and sporadically in summer. Precipitation occurs mainly as snow in winter. The precipitation is distributed fairly evenly throughout fall, winter, and spring. The amount of precipitation is lowest from midsummer to early autumn. The average annual temperature is 33 to 51 degrees F. The freeze-free period averages 130 days and ranges from 65 to 190 days, decreasing in length with elevation. It is typically less than 70 days in the mountains.
Water:
The supply of water from precipitation and streamflow is small and unreliable, except along the Owyhee, Bruneau, and Humboldt Rivers. Streamflow depends largely on accumulated snow in the mountains. Surface water from mountain runoff is generally of excellent quality and suitable for all uses. The basin fill sediments in the narrow alluvial valleys between the mountain ranges provide some ground water for irrigation. The alluvial deposits along the large streams have the most ground water. Based on measurements of water quality in similar deposits in

adjacent areas, the basin fill deposits probably contain moderately hard water. The water is suitable for almost all uses. The carbonate rocks in this area are considered aquifers, but they are little used. Springs are common along the edges of the limestone outcrops.
Soils:
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, aridic bordering on xeric, or xeric moisture regime. Soils with aquic moisture regimes are limited to drainage or spring areas, where moisture originates or runs on and through. These soils are of a very limited extent throughout the MLRA. They generally are well drained, clayey or loamy, and shallow or moderately deep. Most of the soils formed in mixed parent material. Volcanic ash and loess mantle the landscape. Surface soil textures are loam and silt loam with ashy texture modifiers in some areas. Argillic horizons occur on the more stable landforms. They are exposed nearer the soil surface on convex landforms, where ash and loess deposits are more likely to erode. Soils that formed in carbonatic parent material in areas that receive less than 12 inches of precipitation are characterized by calcic horizons throughout the profile, while soils in areas that receive more than 12 inches of precipitation do not have calcic horizons in the upper part of the profile. Soils that formed on stable landforms at the lower elevations are dominated by ochric horizons. Soils that formed at the middle and upper elevations are characterized by mollic epipedons. Soils in drainage areas at all elevations that receive moisture running on or through them are characterized by thicker mollic epipedons.
Biological Resources:
This MLRA supports shrub-grass vegetation. Lower elevations are characterized by Wyoming big sagebrush associated with bluebunch wheatgrass, western wheatgrass, and Thurber's needlegrass. Other important plants include bluegrass, squirreltail, penstemon, phlox, milkvetch, lupine, Indian paintbrush, aster, and rabbitbrush. Black sagebrush occurs but is less extensive. Singleleaf pinyon and Utah juniper occur in limited areas. With increasing elevation and precipitation, vast areas characterized by mountain big sagebrush or low sagebrush/early sagebrush in association with Idaho fescue, bluebunch wheatgrass, needlegrasses, and bluegrass become common. Snowberry, curl-leaf mountain mahogany, ceanothus, and juniper also occur. Mountains at the highest elevations support whitebark pine, Douglas-fir, limber pine, Engelmann spruce, subalpine fir, aspen, and curl-leaf mountain mahogany.
Major wildlife species include mule deer, bighorn sheep, pronghorn, mountain lion, coyote, bobcat, badger, river otter, mink, weasel, golden eagle, red-tailed hawk, ferruginous hawk, Swainson's hawk, northern harrier, prairie falcon, kestrel, great horned owl, short-eared owl, long-eared owl, burrowing owl, pheasant, sage grouse, chukar, gray partridge, and California quail. Reptiles and amphibians include western racer, gopher snake, western rattlesnake, side-blotched lizard, western toad, and spotted frog. Fish species include bull, red band, and rainbow trout.

Ecological site concept

The Loamy Slope 16+ P.Z. site is on steep mountain slopes of northerly exposures. Slopes range from 4 to over 75 percent. Elevations range from 6,500 to 10,000 feet (1,981 to 3,048 meters).

The soils associated with this site are formed in residuum and colluvium from mixed rock sources. The soils of this site are deep or very deep and are well drained. Available water capacity is moderate to high. The surface layer is moderately coarse to medium textured and is 20 inches or more in thickness to the subsoil or underlying material. Subsoils are moderately coarse to moderately fine textured and may be slightly acidic. Some soils have high volumes of rock fragments through their profile. The soils typically have a mollic epipedon. This site provides a cool, moist environment for plant growth because of the elevations and/or steep northerly exposures where it occurs. Soil temperatures and evaporation potentials are limited during the growing season due to reduced insolation.

The representative plant community is dominated by mountain brome, slender wheatgrass and Idaho fescue, in association with a variety of mountain brush species. Potential vegetative composition is about 50 percent grasses, 15 percent forbs and 35 percent shrubs and trees. Approximate ground cover (basal and crown) is 40 to 55 percent. Bare ground is approximately 25 percent.

Associated sites

F025XY065NV	**Backslope Aspen**
R025XY002NV	**ASPEN THICKET**
R025XY010NV	**STEEP NORTH SLOPE**

R025XY016NV	**SOUTH SLOPE 14-18 P.Z.**
R025XY028NV	**SNOWPOCKET**

Similar sites

R025XY029NV	**DEEP LOAMY 14+ P.Z.** LECI4 dominant grass
R025XY056NV	**LOAMY 14-16 P.Z.** FEID dominant grass
R025XY012NV	**LOAMY SLOPE 12-16 P.Z.** FEID-PSSPS codominant grasses; less productive site

Table 1. Dominant plant species

Tree	(1) *Juniperus* (2) *Pinus*
Shrub	(1) *Artemisia tridentata subsp. vaseyana* (2) *Symphoricarpos oreophilus*
Herbaceous	(1) *Bromus marginatus* (2) *Elymus trachycaulus*

Physiographic features

The Loamy Slope 16+ P.Z. site is on steep mountain slopes of northerly exposures. Slopes range from 4 to over 75 percent, with slope gradients of 30 to 50 representing the majority of the site. Elevations are 6500 to 10000 feet (1981 to 3048 meters).

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	6,500–10,000 ft
Slope	4–75%
Ponding depth	84 in
Water table depth	84 in
Aspect	NW, N, NE

Climatic features

The climate associated with this ecological site is semiarid, characterized by cold, moist winters and hot, dry summers.

The average annual precipitation ranges from 14 to 17 inches (36 to 43cm). Average annual air temperature is around 44 Degrees F.

Frost free period for this site is 54 days while the freeze free period is 92 days.

Monthly mean precipitation in inches: January 1.3 (3cm); February 1.2 (3cm); March 1.9 (5cm); April 2.1 (5cm); May 2.0 (5cm); June 1.2 (3cm); July 0.6 (1.5cm); August 0.5 (1.2cm); September 0.9 (2.2cm); October 1.0 (2.5cm); November 1.45 (3.6cm); December 1.3 (3.3cm).

Monthly average high temperature in Degrees F: January 37; February 40; March 48; April 55; May 65; June 74; July 85; August 84; September 74; October 60; November 46; December 37.

Monthly average low temperature in Degrees F: January 16; February 18; March 24; April 29; May 35; June 42; July 48; August 47; September 39; October 30; November 23; December 16.

Average snowfall is 106 inches.

*The above data is averaged from the Jarbridge 4N and Lamoille PH WRCC climate stations.

Table 3. Representative climatic features

Frost-free period (characteristic range)	53-55 days
Freeze-free period (characteristic range)	80-93 days
Precipitation total (characteristic range)	14-16 in
Frost-free period (actual range)	52-56 days
Freeze-free period (actual range)	80-94 days
Precipitation total (actual range)	14-17 in
Frost-free period (average)	54 days
Freeze-free period (average)	92 days
Precipitation total (average)	15 in

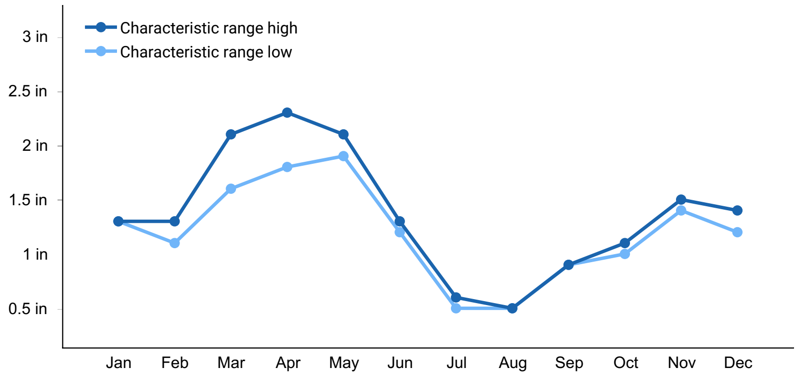

Figure 1. Monthly precipitation range

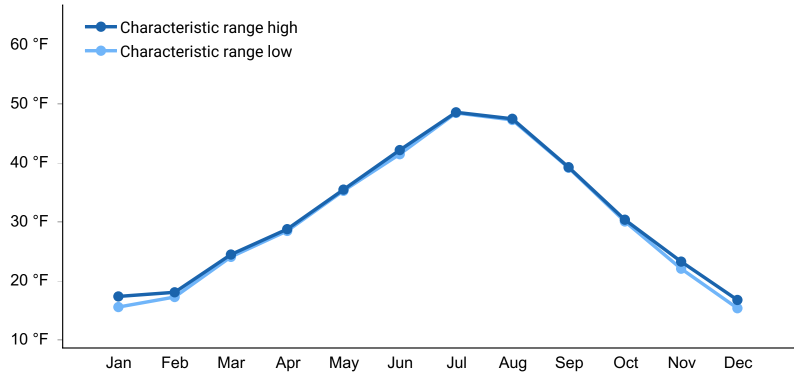

Figure 2. Monthly minimum temperature range

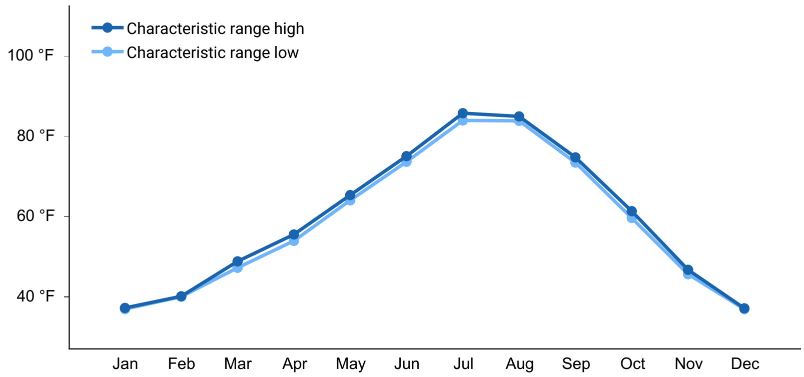

Figure 3. Monthly maximum temperature range

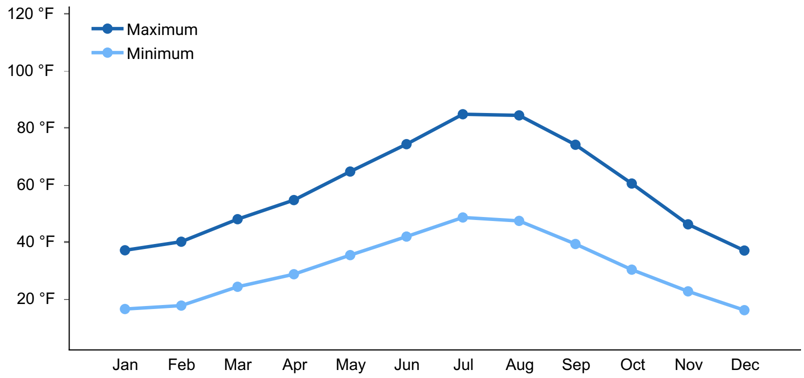

Figure 4. Monthly average minimum and maximum temperature

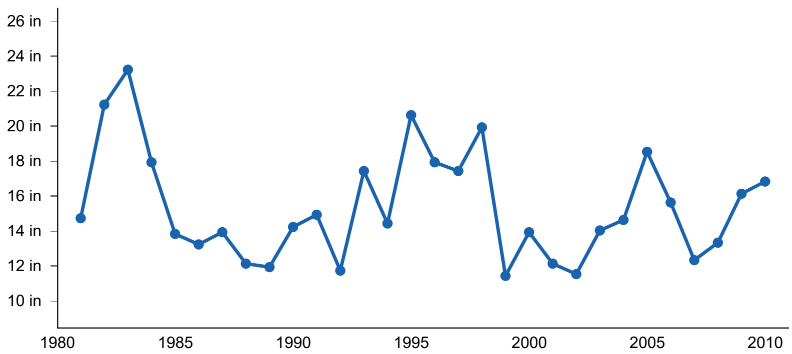

Figure 5. Annual precipitation pattern

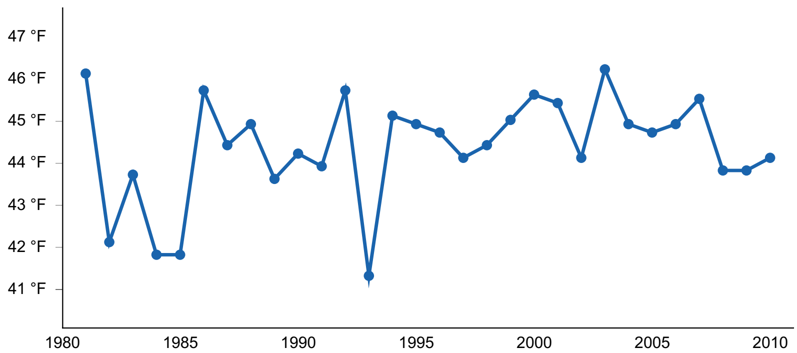

Figure 6. Annual average temperature pattern

Climate stations used

- (1) LAMOILLE YOST [USC00264394], Spring Creek, NV
- (2) JARBIDGE 7 N [USC00264039], Jackpot, NV

Influencing water features

There are no influencing water features for this site.

Soil features

The soils associated with this site are formed in residuum and colluvium from mixed rock sources. The soils of this site are deep or very deep and are well drained. Available water capacity is moderate to high. The surface layer is moderately coarse to medium textured and is 20 inches (51cm) or more in thickness to the subsoil or underlying material. Subsoils are moderately coarse to moderately fine textured and may be slightly acidic. Some soils have high volumes of rock fragments through their profile. The soils typically have a mollic epipedon. This site provides a cool, moist environment for plant growth because of the elevations and/or steep northerly exposures where it occurs. Soil temperatures and evaporation potentials are limited during the growing season due to reduced insolation. The potential for sheet and rill erosion is moderate to high. The soil series associated with this site are: Aycab, Belsac, Coffepot, Earcree, Fez, Foxvire, Gravier, Hapgood, Harcany, Krenka, McIvey, Snopoc and Tusel.

A representative soil series is Hapgood, classified as a loamy-skeletal, mixed, superactive Pachic Haplocryoll. This soil is a deep, well drained soil that formed mainly in colluvium and residuum derived from mixed rocks with a component of loess and volcanic ash. Reaction is slightly acid or neutral. Diagnostic horizons include a mollic epipedon that occurs from the soil surface to 36 inches (91cm). Clay content in the particle-size control section averages 18 to 27 percent. Rock fragments range from 35 to 50 percent, dominantly gravel. Lithology of fragments is mixed.

Table 4. Representative soil features

Parent material	(1) Residuum–quartzite
Surface texture	(1) Ashy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to moderately rapid
Depth to restrictive layer	60–84 in
Soil depth	60–84 in
Surface fragment cover <=3"	5–40%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	3–5.1 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–7
Subsurface fragment volume <=3" (Depth not specified)	5–55%
Subsurface fragment volume >3" (Depth not specified)	2–30%

Ecological dynamics

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

This ecological site is dominated by deep-rooted cool season, perennial bunchgrasses and long-lived shrubs (50+ years). The dominant shrubs usually root to the full depth of the winter-spring soil moisture, which ranges from 40 inches to over 120 inches (Dobrowolski et al. 1990). Root length of mature sagebrush plants was measured to a depth of 80 inches in Utah alluvial soils (Richards and Caldwell 1987). Sagebrush have a flexible, generalized root system with deep taproots and laterals near the surface (Comstock and Ehleringer 1992).

The perennial bunchgrasses that are co-dominant with the shrubs include mountain brome, slender wheatgrass, Idaho fescue, spike fescue and grass like plants such as sedges. 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 20 inches of the soil profile. The root systems of short lived perennial grasses such as Sandberg bluegrass and mountain brome penetrate only the upper 15 inches of the soil, whereas longer lived perennial bunchgrasses can reach depths up to 80 inches (Spence 1937). General differences in root depth distributions between grasses and shrubs results in resource partitioning in these shrub/grass systems.

Periodic drought influences sagebrush ecosystems throughout this ecological site. Shifts away from historical precipitation patterns have the greatest potential to alter ecosystem form and function. Species composition and productivity can be altered by the timing of precipitation and water availability within the soil profile (Bates et al. 2006).
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 susceptibility of invasive plant communities is often linked to resource availability. The invasion of sagebrush communities by cheatgrass (*Bromus tectorum*) has been linked to disturbances (fire, abusive grazing) that have resulted in resource fluctuation (Chambers et al. 2007).

Singleleaf pinyon (*Pinus monophylla*) may occur where these sites are adjacent to woodlands. An extended fire return interval and/or inappropriate grazing can facilitate pinyon invasion. Eventually, singleleaf pinyon will dominate the site and out-compete sagebrush for water and sunlight, severely reducing both the shrub and herbaceous understory (Lett and Knapp 2005, Miller and Tausch 2000). Bluegrasses may remain underneath trees on north-facing slopes.

As ecological conditions decline, mountain big sagebrush and snowberry become more prevalent. Nevada bluegrass, bottlebrush squirreltail, and arrowleaf balsamroot increase in the understory as conditions deteriorate. Potential invasive/noxious weeds are cheatgrass, rabbitbrush, annual mustards, knapweeds and Utah juniper.

This ecological site has moderate to high resilience to disturbance and resistance to invasion. Resilience increases with elevation, aspect, increased precipitation and nutrient availability. Two possible stable states have been identified for the Loamy Slope 16+P.Z. ecological site.

Fire Ecology:
Pre-settlement fire return intervals in mountain big sagebrush communities varies from 15 to 25 years (Burkhardt and Tisdale 1969, Houston 1973, Miller 2000). Mountain big sagebrush is killed by fire (Neuenschwander 1980, Blaisdell et al. 1982, 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 and can take up to 50 years (Bunting et al. 1987, Ziegenhagen 2003, Miller and Heyerdahl 2008, Ziegenhagen and Miller 2009). The introduction of annual weedy species such as cheatgrass may cause an increase in fire frequency and would eventually lead to an annual dominated community. Conversely, sagebrush will increase along with pinyon and juniper encroachment. The herbaceous understory will also be reduced; Idaho fescue may remain underneath trees on north facing slopes. The potential for soil erosion increases as the woodland matures and the understory plant community cover declines. Severe wildfire in tree dominated sites may lead to an annual weed dominated state.

Mountain snowberry is top-killed by fire and will sprout after fire from rhizomes (Leege and Hickey 1971, Noste and Bushey 1987). It has also been noted to regenerate well and exceed pre-burn biomass in the third season after fire (Merrill et al. 1982). Currant, a minor component of this site, is known as a weak reproducer from the root crown but usually regenerates from seeds that were stored in the soil before the burn. If mule-ears or balsamroot is common before fire, these plants will increase after fire or with heavy grazing disturbance (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).

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 species response. For most forbs and grasses, the growing points are located at or below the soil surface and provides relative protection from disturbances which decrease above ground biomass, such as grazing or fire. Thus, fire mortality is more correlated to the duration and intensity of heat produced during the burning period. (Wright 1971, Young 1983).

Mountain brome, the dominant grass found on this site, is a robust, coarse-stemmed, short lived perennial bunchgrass that can grow from 1 to 5 feet in height (Dayton 1937, Tilley et al. 2004). It is commonly seeded by land managers following wildfires because of its ability to quickly establish and reduce erosion (Tilley et al. 2004). Mountain brome density significantly decreases after burning (Nimir and Payne 1978).

Sandberg bluegrass (*Poa secunda*), a minor component of this ecological site, has been found to increase following fire likely due to its low stature and productivity (Daubenmire 1975). Sandberg bluegrass may retard reestablishment of deeper rooted bunchgrasses.

State and transition model

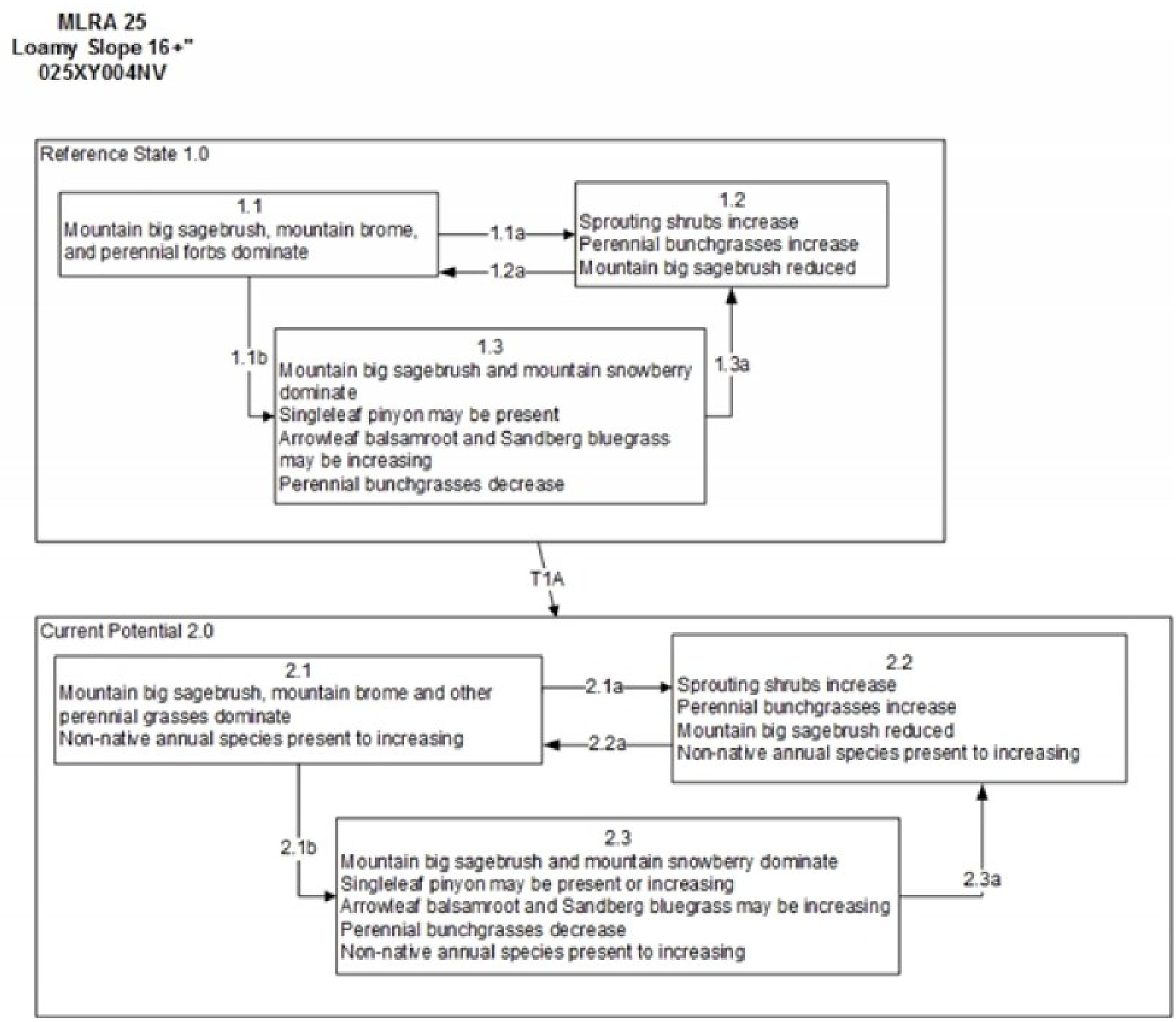

Figure 7. T Stringham 3/2015

MLRA 25
Loamy Slope 16+"
025XY004NV
Legend

Reference State 1.0 Community Pathways
1.1a: Low severity fire creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs.
1.1b: Time and lack of disturbance such as fire or drought. Excessive herbivory may also decrease perennial understory.
1.2a: Time and lack of disturbance allows for shrub regeneration.
1.3a: High severity fire significantly reduces sagebrush cover leading to early/mid-seral community.

Transition T1A: Introduction of annual non-native species.

Current Potential State 2.0 Community Pathways
2.1a: Low severity fire creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs; non-native annual species present.
2.1b: Time and lack of disturbance such as fire or drought. Inappropriate grazing management may also reduce perennial understory.
2.2a: Time and lack of disturbance allows for regeneration of sagebrush
2.3a: High severity fire and/or brush management with minimal soil disturbance would decrease big sagebrush and allow for perennial bunchgrasses to dominate the site.

Figure 8. Legend

State 1
Reference State

The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. The reference state has three general community phases: a shrub-grass dominant phase, a perennial grass-dominant phase and a shrub-dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic drought and/or insect or disease attack.

Community 1.1
Mountain big sagebrush/perennial bunchgrasses

The representative plant community is dominated by mountain brome, slender wheatgrass and Idaho fescue, in association with a variety of mountain brush species. Potential vegetative composition is about 50 percent grasses, 15 percent forbs and 35 percent shrubs and trees. Approximate ground cover (basal and crown) is 40 to 55 percent. Bare ground is approximately 25 percent. Dead branches within individual shrubs are common. Standing-dead shrub canopy material is approximately 10 percent of total woody canopy; some of the mature bunchgrasses (<10 percent) have dead centers. Litter cover (approximately 35 percent) occurs within plant interspaces at a depth of approximately 1 inch.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	600	900	1400
Shrub/Vine	420	630	980
Forb	180	270	420
Tree	9	18	54
Total	**1209**	**1818**	**2854**

Community 1.2
Perennial bunchgrasses/sprouting shrubs

This community phase is characteristic of a post-disturbance, early to mid-seral community phase. Perennial bunchgrasses, such as; mountain brome, slender wheatgrass and Idaho fescue dominate. Sagebrush is killed by fire and may be a minor component and present in unburned patches. Mountain snowberry, Utah serviceberry, black chokecherry, elderberry and rabbitbrush may be sprouting. Forbs may increase post-fire but will likely return to pre-burn levels within a few years. Bluegrass is stable within the community.

Community 1.3
Mountain big sagebrush

Figure 10. Loamy Slope 16+" (R025XY004NV) Phase 1.3 T. K. Stringham August 2012

Mountain big sagebrush and other woody shrubs increase in the absence of disturbance. Singleleaf pinyon may be present. Decadent sagebrush dominates the overstory and the deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs or from grazing management. Sandberg bluegrass will likely increase in the understory and may be the dominant grass on the site. Balsamroot and other perennial forbs may also increase on the site.

Pathway 1.1a
Community 1.1 to 1.2

Fire would decrease or eliminate the overstory of sagebrush and allow for the perennial bunchgrasses to dominate the site. Fires would typically be low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring may be more severe and reduce sagebrush cover to trace amounts.

Pathway 1.2b
Community 1.1 to 1.3

Time and lack of disturbance such as fire allows for sagebrush to increase and become decadent. Long-term drought, herbivory, or combinations of these would cause a decline in perennial bunchgrasses and fine fuels leading to a reduced fire frequency allowing big sagebrush to dominate the site.

Pathway 1.2a
Community 1.2 to 1.1

Time and lack of disturbance over time allows for the sagebrush and other woody shrubs to recover and increase in size and density.

Pathway 1.3a
Community 1.3 to 1.2

Fire would decrease or eliminate the overstory of sagebrush and allow for the perennial bunchgrasses to dominate the site. Fires would typically be small and patchy due to low fine fuel loads. A fire following an unusually wet spring or a change in management may be more severe and reduce sagebrush cover to trace amounts.

State 2
Current Potential

This state is similar to the Reference State 1.0 with three similar community phases. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this State. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate and adaptations for seed dispersal. Additionally, the presence of highly flammable, non-native species reduces State resilience because these species can promote fire where historically fire has been infrequent leading to positive feedbacks that further the degradation of the system.

Community 2.1
Mountain big sagebrush-perennial bunchgrasses/non-native species

This community phase is similar to the Reference State Community Phase 1.1, with the presence of non-native species in trace amounts. The plant community is dominated by mountain brome, slender wheatgrass and Idaho fescue, in association with a variety of mountain brush species such as mountain big sagebrush, Utah serviceberry, chokecherry and mountain snowberry. Perennial forbs are a minor component of this plant community. Leafy spurge and cheatgrass may occur in minor amounts.

Community 2.2
Perennial bunchgrasses/sprouting shrubs/non-native species

This community phase is characteristic of a post-disturbance, early seral community where annual non-native species are present. Perennial bunchgrasses are dominant along with sprouting shrubs. Depending on fire severity patches of intact big sagebrush may remain. Mountain snowberry, Utah serviceberry, chokecherry, elderberry and rabbitbrush may be sprouting. Forbs may increase post-fire but will likely return to pre-burn levels within a few years. Bluegrass is stable within the community.

Community 2.3
Mountain big sagebrush

Figure 11. Loamy Slope 16+" (R025XY004NV) Phase 2.3 T. K. Stringham August 2012

Figure 12. Loamy Slope 16+" (R025XY004NV) Phase 2.3 T. K. Stringham August 2012. Some singleleaf pinyon present.

Big Sagebrush dominates the overstory and perennial bunchgrasses in the understory are reduced, either from competition with shrubs or from inappropriate grazing, or from both. Singleleaf pinyon may be present and without management will likely increase. Annual non-natives species may be stable or increasing due to lack of competition with perennial bunchgrasses. This site is susceptible to further degradation from grazing, drought, and fire.

Pathway 2.1a
Community 2.1 to 2.2

Fire would reduce the shrub overstory and allow for perennial bunchgrasses to dominate the site. Fires would typically be low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring or a change in management may be more severe and reduce sagebrush cover to trace amounts. Annual non-native species are likely to increase after fire.

Pathway 2.1b
Community 2.1 to 2.3

Time and lack of disturbance allows for sagebrush to increase and become decadent. Long-term drought would reduce fine fuels and lead to a reduced fire frequency allowing big sagebrush to dominate the site. Inappropriate grazing management would reduce the perennial bunchgrass understory; conversely Sandberg bluegrass may increase in the understory depending on grazing management. Perennial forbs such as arrowleaf balsamroot may also increase in the understory.

Pathway 2.2a
Community 2.2 to 2.1

Time and lack of disturbance and/or grazing management that favors the establishment and growth of sagebrush allows the shrub component to recover. The establishment of big sagebrush can take many years.

Pathway 2.3a
Community 2.3 to 2.2

A change in grazing management that decreases shrubs would allow for the perennial bunchgrasses in the understory to increase. Heavy fall grazing may cause mechanical damage and subsequent death to sagebrush, facilitating an increase in the herbaceous understory. Brush treatments with minimal soil disturbance would also decrease sagebrush and release the perennial understory. Annual non-native species are present and may increase in the community.

Transition T1A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass, mustards and leafy spurge. Slow variables: Over time the annual and perennial non-native species will increase within the community, reducing organic matter inputs. Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual and perennial non-native species cannot be easily removed from the system and have the potential to significantly alter disturbance regimes from their historic range of variation.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			342–918	
	mountain brome	BRMA4	*Bromus marginatus*	180–360	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	90–270	–
	Idaho fescue	FEID	*Festuca idahoensis*	36–144	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	18–72	–
2	**Secondary Perennial Grasses**			90–270	
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	9–90	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	9–90	–
	western needlegrass	ACOC3	*Achnatherum occidentale*	9–90	–
	sedge	CAREX	*Carex*	9–90	–
	spike fescue	LEKI2	*Leucopoa kingii*	9–90	–
	melicgrass	MELIC	*Melica*	9–90	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	9–90	–
Forb					
3	**Perennial**			180–360	
	sedge	CAREX	*Carex*	9–90	–
	yarrow	ACHIL	*Achillea*	9–54	–
	nettleleaf giant hyssop	AGUR	*Agastache urticifolia*	9–54	–
	balsamroot	BALSA	*Balsamorhiza*	9–54	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	9–54	–
	geranium	GERAN	*Geranium*	9–54	

	geranium	GERAN	*Geranium*	9–54	–
	helianthella	HELIA	*Helianthella*	9–54	–
	carrotleaf biscuitroot	LODIM	*Lomatium dissectum var. multifidum*	9–54	–
	lupine	LUPIN	*Lupinus*	9–54	–
	ragwort	SENEC	*Senecio*	9–54	–
	clover	TRIFO	*Trifolium*	9–54	–
Shrub/Vine					
4	**Primary Shrubs**			162–774	
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	36–270	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	90–270	–
	Utah serviceberry	AMUT	*Amelanchier utahensis*	36–144	–
	black chokecherry	PRVIM	*Prunus virginiana var. melanocarpa*	0–90	–
	yarrow	ACHIL	*Achillea*	9–54	–
	nettleleaf giant hyssop	AGUR	*Agastache urticifolia*	9–54	–
	balsamroot	BALSA	*Balsamorhiza*	9–54	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	9–54	–
	geranium	GERAN	*Geranium*	9–54	–
	helianthella	HELIA	*Helianthella*	9–54	–
	carrotleaf biscuitroot	LODIM	*Lomatium dissectum var. multifidum*	9–54	–
	lupine	LUPIN	*Lupinus*	9–54	–
	ragwort	SENEC	*Senecio*	9–54	–
	clover	TRIFO	*Trifolium*	9–54	–
5	**Secondary Shrubs**			90–270	
	quaking aspen	POTR5	*Populus tremuloides*	9–54	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	9–54	–
	elderberry	SAMBU	*Sambucus*	9–54	–

Animal community

Livestock/Wildlife Grazing Interpretations:
This site is suited to grazing by domestic livestock. Sheep will make good use of the shrub component on this site. Livestock water is usually adequate as this site occurs in mountainous areas where flowing streams and springs are common. Considerations for grazing management include timing, intensity and duration of grazing. Grazing management should be keyed to mountain brome, slender wheatgrass and other annual grass production. Attentive grazing management is required on steeper slopes due to high erosion potential.

Mountain brome furnishes an abundance of herbage that remains palatable and nutritious through the growing season. New plants are established from seed and grazing practices should allow for ample seed production and establishment. This species is ranked as excellent forage for both cattle and horses and good for domestic sheep, though domestic animals will graze mountain brome only when it is fairly succulent. Mountain brome increases with grazing (Leege et al. 1981). A study by Mueggler (1967) found that with clipping, mountain brome increased in herbage production when clipped in June. When clipped in July, mountain brome increased due to reduced competition from forb species. The study also found that after three successive years of clipping, however, mountain brome started to exhibit adverse effects.

Slender wheatgrass is a perennial bunchgrass that tends to be short-lived, though it spreads well by natural reseeding. It is widely used in restoration seedings (Monsen et al. 2004). It is palatable and nutritious for livestock. Slender wheatgrass tends to persist longer than other perennial grasses when subjected to heavy grazing (Monsen et al. 1996, Monsen et al. 2004).

Idaho fescue provides important forage for many types of domestic livestock as well as pronghorn and deer in ranges of northern Nevada. The foliage cures well and is preferred by livestock in the late fall and winter. Idaho fescue tolerates light to moderate grazing (Ganskopp and Bedell 1980) and is moderately resistant to trampling (Cole 1987). Heavy grazing may lead to replacement of Idaho fescue with non-native species such as cheatgrass (Mueggler 1984).

Nevada 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. Nevada 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. Nevada bluegrass is preferred by both domestic livestock and wildlife during the spring and early summer, with reported crude protein levels of over 17% (Monson et al. 2004). Nevada bluegrass and Sandberg bluegrass are no longer differentiated taxonomically, however the grasses typically grow in different ecological niches; Nevada bluegrass prefers locations with greater soil moisture during the growing season. Nevada bluegrass exhibits the characteristic of early spring growth, however in locations with sufficient soil moisture the growing season may be extended allowing the plant to increase in stature.

Depending on soil moisture availability along with intensity, frequency and season of use, Nevada bluegrass may decrease under grazing pressure. Conversely, Sandberg bluegrass has been found to increase under grazing pressure due to its early dormancy and short stature (Tisdale and Hironaka 1981). Sandberg bluegrass increases under grazing pressure (Tisdale and Hironaka 1981) and is capable of co-existing with cheatgrass (*Bromus tectorum*). 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.

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.

Snowberry is readily eaten by all classes of livestock, particularly domestic sheep. It is frequently one of the first species to leaf out, making it a highly sought after food in the early spring.

Chokecherry is moderately palatable to all classes of livestock, although it is more heavily browsed by domestic sheep than by cattle. Because of its toxicity, poisoning sometimes occurs. Livestock normally do not eat fatal quantities except when other forage is scarce. Chokecherry provides important cover and habitat for livestock. Serviceberry branches and leaves are consumed by both domestic livestock and wildlife, particularly in late winter and early spring. Serviceberry can tolerate moderate to heaving browsing when adequate precipitation is received.

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.

Wildlife Interpretations:
Mountain big sagebrush is a highly preferred winter forage for mule deer: In a study by Personius et al. (1987), mountain big sagebrush was the most preferred sagebrush species. Fecal samples from ungulates in Montana showed that bighorn sheep, mule deer, and elk all consumed mountain big sagebrush in small amounts in winter, while cattle showed no sign of sagebrush use. Reliance on the big sagebrush ecosystem by many wild animals for both food and cover has been documented and reviewed extensively. 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.

Deer, elk, and mountain goat utilize both Nevada and 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.

Slender wheatgrass is grazed by sage grouse, deer, elk, moose, bighorn sheep, mountain goat, pronghorn, various rodents, and all classes of livestock. The seeds are eaten by various seed predators. Slender wheatgrass provides hiding and thermal cover for songbirds, upland game birds, waterfowl, and small mammals.

Serviceberry provides excellent forage for small animals and birds. Birds also utilize the shrub for nesting and cover.

Mountain brome seedheads and seeds also provide food for many birds and small mammals. Pronghorn antelope will consume mountain brome primarily in the spring. The palatability of mountain brome is excellent for deer, particularly during the late spring and early summer. Mountain brome is ranked as highly valuable as elk winter forage (Kufeld 1973).
Black chokecherry is preferred browse by game species such as mule deer, birds and small mammals which consume both fruits and leaves (Plummer et al. 1968) sometimes to the exclusion of other forages (Gullion 1964).

Hydrological functions

Rills and waterflow patterns are typically non-existent. Water flow patterns (of short length) may rarely be observed on steeper slopes in areas recently subjected to summer convection storms or rapid spring snowmelt. Gullies are non-existent in areas of this site that occur on stable landforms. Fine litter (foliage from grasses and annual and perennial forbs) is expected to move the 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. Perennial herbaceous plants (especially deep-rooted bunchgrasses) 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. Steeper slopes inhibit many forms of recreation. This site offers rewarding opportunities to photographers and for the nature study. There is potential for deer and upland game hunting.

Wood products

Although aspen is associated with this site, it is too sparse to furnish harvestable wood products.

Other products

Native peoples used big sagebrush leaves and branches for medicinal teas, and the leaves as a fumigant. Bark was woven into mats, bags and clothing. Utah serviceberry fruits were used by Native Americans and early European explorers in North America for food and medicine. Indigenous peoples gathered chokecherries and used them to make pemmican and treat cold sores. The Paiutes made a medicinal tea from the leaves and twigs to treat colds and rheumatism. Mountain brome is an excellent native bunchgrass for seeding alone or in mixtures in disturbed areas, including depleted rangelands, burned areas, roadways, mined lands, and degraded riparian zones.

Other information

Mountain snowberry is useful for establishing cover on bare sites and has done well when planted onto roadbanks. Mountain big sagebrush is easily propagated from seed under greenhouse, nursery, and common garden conditions and has been successfully seeded directly into field sites. Utah serviceberry has been used to revegetate big game winter range and for surface stabilization. It grows slowly from seed and therefore transplanting may be more successful than seeding for revegetation projects. Chokecherry has been selected as a revegetation species for wildlife habitat, shelterbelts, mine spoils and soil stabilization. Slender wheatgrass is widely used for revegetating disturbed lands. Slender wheatgrass is a short-lived perennial with good seedling vigor. It germinates and establishes quickly when seeded making it a good choice for quick cover on disturbed sites. It persists long enough for other, slower developing species to establish. It is especially valuable for use in saline soils. It has been used for rehabilitating mine spoils, livestock ranges, and wildlife habitat and watershed areas.

Inventory data references

Soils and Physiographic features were gathered from NASIS.

Type locality

Location 1: Elko County, NV	
Township/Range/Section	T37N R51E S17
General legal description	Approximately 2 miles north of Beaver Creek, Tuscarora Mountains, Elko County, Nevada. This site also occurs in Humboldt County, Nevada.

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Approval

Kendra Moseley, 4/24/2024

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)	GK BRACKLEY
Contact for lead author	State Rangeland Management Specialist
Date	06/22/2006
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are typically non-existent.

2. **Presence of water flow patterns:** Water flow patterns are typically non-existent. Water flow patterns (of short length) may rarely be observed on steeper slopes in areas recently subjected to summer convection storms or rapid spring snowmelt.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare. Occurrence is 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 ± 25%; surface rock fragments ±25%; shrub canopy 15 to 25%; foliar cover of perennial herbaceous plants ± 40%.

5. **Number of gullies and erosion associated with gullies:** 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) is expected to move the distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during large rainfall 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. (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 thin to thick platy, subangular blocky or massive. Soil surface colors are dark and the soils are typified by a thick mollic epipedon. Organic matter of the surface 2 to 4 inches is typically more than 3.5 percent.

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., Idaho fescue & bluebunch wheatgrass] 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. Platy or massive sub-surface horizons, subsoil argillic horizons or hardpans shallow to the surface are not to be interpreted as compacted.

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 = tall shrubs (mountain big sagebrush & mixed mountain browse species). (By above ground production)

Sub-dominant: Deep-rooted, cool season, perennial forbs > shallow-rooted, cool season, perennial grasses and grass-like plants = fibrous, shallow-rooted, cool season, perennial and annual forbs. (By above ground production)

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 are common. Standing-dead shrub canopy material ± 10% of total woody canopy; some of the mature bunchgrasses (<10%) have dead centers.

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14. **Average percent litter cover (%) and depth (in):** Between plant interspaces (± 35%) and litter depth 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 (through mid-June) ± 1800 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:** Potential invaders include cheatgrass, annual mustards, and knapweeds.

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