USDA Natural Resources
Conservation Service

Ecological site R025XY045NV
ASHY LOAM 8-10 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

This site occurs on hills and rock pediments on all exposures. Slopes range from 2 to 15 percent, but slope gradients of 4 to 15 percent are most typical. Elevations range from 5,199 to 5,399 feet.

The soils associated with this site are shallow to moderately deep and well drained. Permeability is moderately rapid and runoff is medium. These soils are coarse textured throughout and are high in volcanic ash. The available water capacity is low to moderate depending on soil depth. The potential for sheet and rill erosion is moderate to high, depending on slope.

The reference plant community is dominated by needle and thread, Indian ricegrass and big sagebrush. Commonly associated plants are Nevada bluegrass, thickspike wheatgrass and Thurber's needlegrass.

Associated sites

F025XY059NV	**Gravelly Juniper**
R025XY066NV	**ASHY LOAM 10-12 P.Z.**

Similar sites

R025XY066NV	**ASHY LOAM 10-12 P.Z.** PSSPS-ACTH7 codominant grasses; more productive site

R025XY019NV	**LOAMY 8-10 P.Z.** Dominant species are ARTRW8/ACTH7.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata subsp. tridentata*
Herbaceous	(1) *Hesperostipa comata* (2) *Achnatherum hymenoides*

Physiographic features

This site occurs on hills and rock pediments on all exposures. Slopes range from 2 to 15 percent, but slope gradients of 4 to 15 percent are most typical. Elevations are 5199 to 5399 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	5,200–5,800 ft
Slope	2–15%
Water table depth	60 in
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The climate associated with this site is semiarid, characterized by cold, moist winters and warm, dry summers. The average annual precipitation ranges from 8 to 10 inches. Mean annual air temperature is about 45 to 50 degrees F.

Mean annual precipitation across the range in which this ES occurs is 9.85".

Monthly mean precipitation: January 1.00”; February 0.72”; March 0.87”; April 0.79”; May 1.32”; June 1.06”; July 0.47”; August 0.53”; September 0.59”; October 0.70”; November 0.84”; December 0.96”.

*The above data is averaged from the Elko AP and Contact WRCC climate stations.
Frost free days (>32): 89.5
Freeze free days (>28): 120.5

Table 3. Representative climatic features

Frost-free period (average)	74 days
Freeze-free period (average)	105 days
Precipitation total (average)	11 in

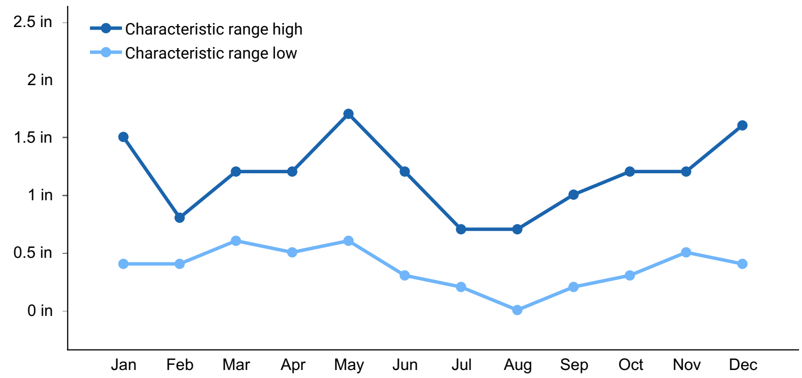

Figure 1. Monthly precipitation range

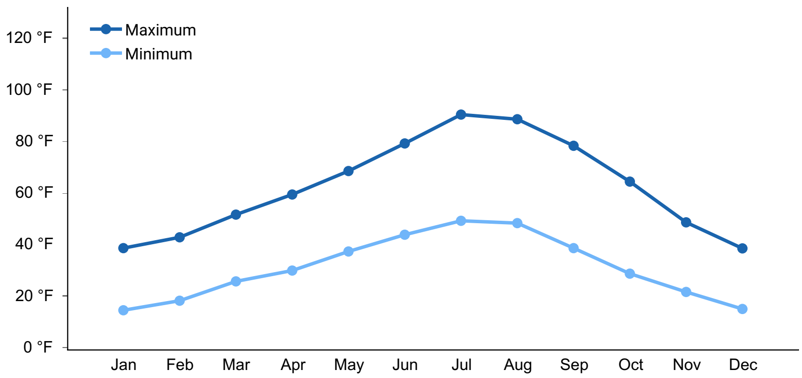

Figure 2. Monthly average minimum and maximum temperature

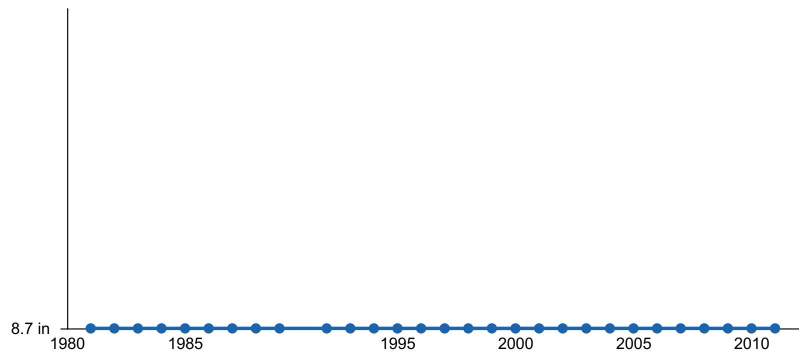

Figure 3. Annual precipitation pattern

Climate stations used

- (1) CONTACT [USC00261905], Jackpot, NV
- (2) ELKO RGNL AP [USW00024121], Elko, NV

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are typically moderately deep and well drained and a formed in residuum and colluvium derived from tuff. The soils have a mollic epipedon, are coarse-textured throughout and are high in volcanic ash. Permeability is high and runoff is medium to very high. The available water capacity is high. The soil temperature regime is mesic and the soil moisture regime is aridic bordering on xeric. The potential for sheet and rill erosion is moderate to high, depending on slope.

The soil series correlated with this site are: Zark and Tuffo.

Zark is classified as an ashy, glassy, mesic Vitritorrandic Haploxeroll. Depth to bedrock is 50 to 100 cm to paralithic contact. Volcanic glass content is 30 to 95 percent in the coarse silt through fine sand fractions. Reaction is neutral to slightly alkaline. Diagnostic features include a mollic epipedon that occurs from the soil surface to 16 inches. Durinodes are present from 16 inches to 29 inches. Duric features and identifiable secondary carbonates occur from 29 inches to 35 inches. Clay content is 5 to 15 percent. Rock fragments average 0 to 15 percent gravel. Lithology of fragments is tuff.

Table 4. Representative soil features

Parent material	(1) Colluvium–tuff (2) Residuum
Surface texture	(1) Loamy fine sand
Family particle size	(1) Ashy
Drainage class	Well drained
Permeability class	Rapid to very rapid
Depth to restrictive layer	20–40 in
Soil depth	20–40 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	8.4–17.1 in
Calcium carbonate equivalent (0-40in)	0–1%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	7.1–8.2
Subsurface fragment volume <=3" (Depth not specified)	5–20%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

An ecological site is the product of all the environmental factors responsible for its development and has a set of key characteristics that influence a site’s resilience to disturbance and resistance to invasives. 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 et al. 2013). Biotic factors 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 meters. (Comstock and Ehleringer 1992). 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).

In the Great Basin, the majority of annual precipitation is received during winter and early spring. This continental semiarid climate regime favors growth and development of deep-rooted shrubs and herbaceous cool season plants using the C3 photosynthetic pathway (Comstock and Ehleringer 1992). Winter precipitation and slow melting of snow results in deeper percolation of moisture into the soil profile. Herbaceous plants, more shallow-rooted than shrubs, grow earlier in the growing season and thrive on spring rains, while the deeper rooted shrubs lag in phenological development because they draw from deeply infiltrating moisture from snowmelt the previous winter.

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).

Wyoming big sagebrush, the most drought-tolerant of the big sagebrushes, is generally long-lived; therefore it is unnecessary for new individuals to recruit every year for perpetuation of the stand. Infrequent large recruitment events and simultaneous low, continuous recruitment comprise 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 with regard to Aroga moth (Aroga websteri), a sagebrush defoliator. 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 of individual plants or entire stands observed (Furniss and Barr 1975).

Perennial bunchgrasses generally have shallower root systems than shrubs in these systems, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m but taper off more rapidly than shrubs. General differences in root depth distributions between grasses and shrubs result in resource partitioning in these shrub/grass systems.

The Great Basin sagebrush communities have high spatial and temporal variability in precipitation both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The moisture resource supporting the greatest amount of plant growth is usually the water stored in the soil profile during winter. 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 via the decomposition of dead plant material following disturbance. The invasion of sagebrush communities by cheatgrass has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Chambers et al 2007).

The introduction of annual weedy species, like cheatgrass (*Bromus tectorum*), may cause an increase in fire frequency and eventually lead to an annual state. Conversely, as fire frequency decreases, sagebrush will increase and with inappropriate grazing management, perennial bunchgrasses and forbs may be reduced.

Infilling by Utah juniper may also occur with an extended fire return interval. Eventually, Utah juniper 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 et al. 2000). Bluegrasses may remain underneath trees on north-facing slopes. The potential for soil erosion increases as the Utah juniper woodland matures and the understory plant community cover declines (Pierson et al. 2010).

As ecological condition declines, big sagebrush and rabbitbrush increase in density as Indian ricegrass and needle and thread decrease. Cheatgrass and Utah juniper are species likely to invade this site. Utah juniper invades this site where it occurs adjacent to these woodlands. When Utah juniper occupies this site it competes with other species for available light, moisture and nutrients. If Utah juniper canopies are to close, they can eliminate all understory vegetation.

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

Fire Ecology:

Fire return intervals in basin big sagebrush are intermediate between mountain big sagebrush (5 to 15 years) and Wyoming big sagebrush (10 to 70 years). A naturally wide variation in fire frequency in this system is expected.

Fire is the principal means of renewal of decadent stands of Wyoming big sagebrush. It is is killed by fire and only regenerates from seed. Recovery time for Wyoming big sagebrush may require 50 to 120 or more years (Baker 2006). Post-fire hydrologic recovery and resilience is primarily influenced by pre-fire site conditions, fire severity, and post-fire weather and land use that relate to vegetation recovery. Sites with low abundances of native perennial grasses and forbs typically have reduced resiliency following disturbance and are less resistant to invasion or increases in cheatgrass (Miller et al 2013). The introduction and expansion of cheatgrass has dramatically altered the fire regime (Balch et al. 2013) and restoration potential of Wyoming big sagebrush communities.

Basin big sagebrush may occur in more productive areas within this site concept. Basin big sagebrush does not sprout after fire. Because of the time needed to produce seed, it is eliminated by frequent fires (Bunting et al. 1987). Basin big sagebrush reinvades a site primarily by off-site seed or seed from plants that survive in unburned patches. Approximately 90% of big sagebrush seed is dispersed within 30 feet (9 m) of the parent shrub (Goodrich et al. 1985) with maximum seed dispersal at approximately 108 feet (33 m) from the parent shrub (Shumar and Anderson 1986). Therefore, regeneration of basin big sagebrush after stand-replacing fires is difficult and dependent upon proximity of residual mature plants and favorable moisture conditions (Johnson and Payne 1968, Humphrey 1984).

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).

Needleandthread is a fine-leaf grass and is considered sensitive to fire (Akinsoji 1988, Bradley et al. 1992, Miller et al. 2013). Needleandthread is top-killed by fire but is likely to resprout if fire does not consume above ground stems (Akinsoji 1988, Bradley et al. 1992). In a study by Wright and Klemmedson (1965), season of burn rather than fire intensity seemed to be the crucial factor in mortality for needleandthread. Early spring season burning killed the plants, while August burning had no effect. As such, needleandthread is often present in the post-burn community but should be managered carefully following fire due to its grazing intolerance.

Indian ricegrass is fairly fire tolerant (Wright 1985), which is likely due to its low culm density and below ground plant crowns. Vallentine (1989) cites several studies in the sagebrush zone that classified Indian ricegrass as being slightly damaged from late summer burning. Indian ricegrass has been found to reestablish on burned sites through seed dispersed from adjacent unburned areas (Young 1983, West 1994), therefore the presence of surviving, seed-producing plants facilitates the reestablishment of Indian ricegrass. Grazing management following fire to promote seed production and establishment of seedlings is important.

Thurber’s needlegrass, a minor component on this site, 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 also reduces 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 often survives fire, however, and will continue growth when conditions are favorable (Koniak 1985). Thus, the initial condition of the bunchgrasses within the site along with seasonality and intensity of the fire are important factors in individual species’ responses. Sandberg bluegrass, a minor component of this ecological site, has been found to increase following fire likely due to its low stature and productivity (Daubenmire 1975) and may retard reestablishment of more deeply-rooted bunchgrasses.

Sandberg bluegrass, a minor component of this ecological site, has been found to increase following fire likely due to its low stature and productivity (Daubenmire 1975). Reduced bunchgrass vigor or density provides an opportunity for Sandberg bluegrass expansion and/or cheatgrass and other invasive species to occupy interspaces, leading to increased fire frequency and potentially an annual plant community. Repeated frequent fire in this community will eliminate big sagebrush and severely decrease or eliminate the deep rooted perennial bunchgrasses from the site and facilitate the establishment of an annual weed community with varying amounts of Sandberg bluegrass and Douglas' rabbitbrush (Chrysothamnus visicidiflorus).

Depending on fire severity, rabbitbrush may increase after fire. Douglas' rabbitbrush is top-killed by fire, but sprouts vigorously after fire (Kuntz 1982, Akinsoji 1988). Shortened fire intervals within this ecological site favor an annual invasive herbaceous understory with varying amounts of Sandberg bluegrass and an overstory of rabbitbrush.

State and transition model

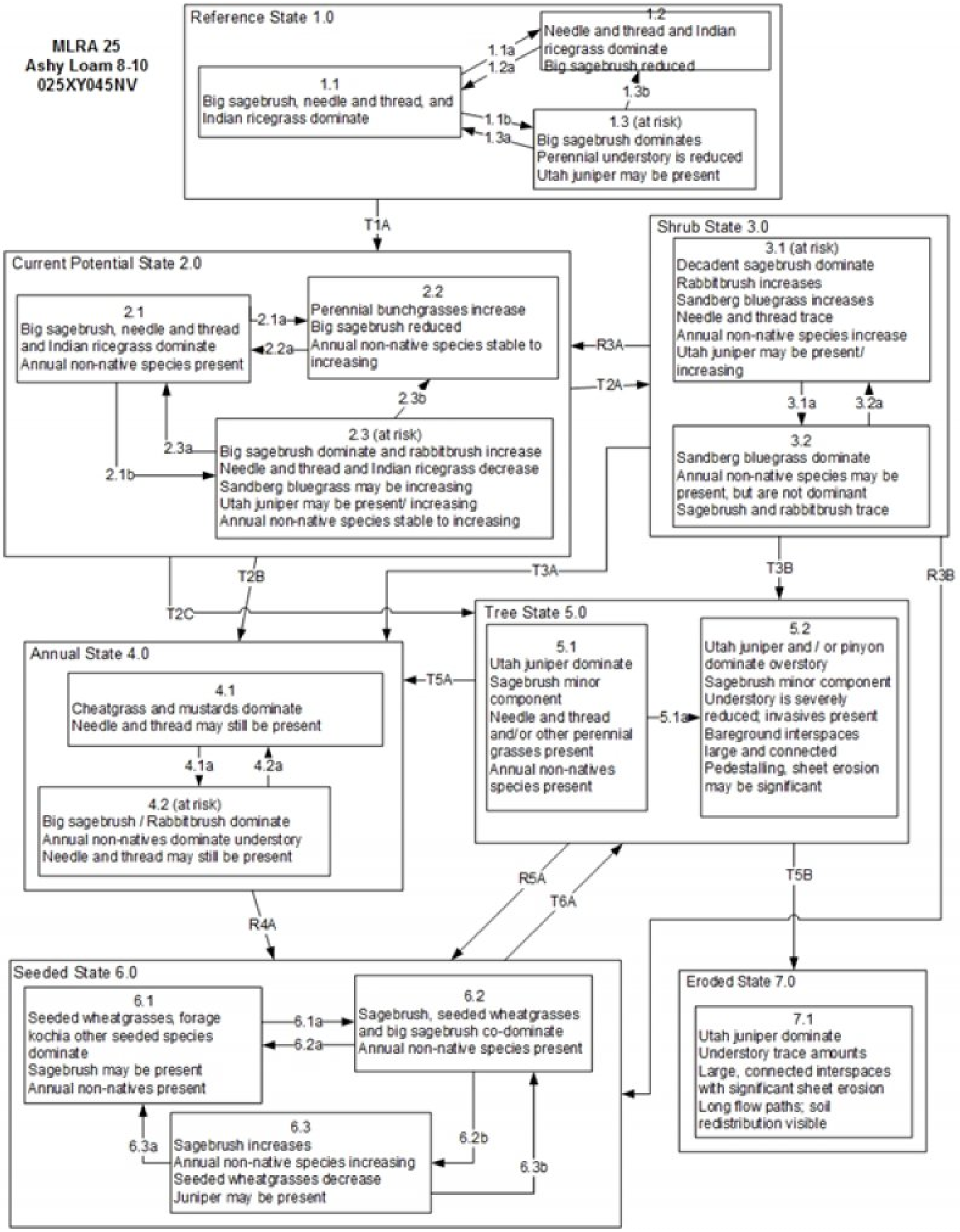

Figure 5. T. Stringham July 2015

MLRA 25
Ashy Loam 8-10
025XY045NV

Reference State 1.0 Community Phase 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 reduce perennial understory.
1.2a: Time and lack of disturbance allows for shrub regeneration
1.3a: Low severity fire or Aroga moth infestation creates sagebrush/grass mosaic
1.3b: High severity fire significantly reduces sagebrush cover leading to early/mid-seral community

Transition T1A: Introduction of non-native annual species

Current Potential State 2.0 Community Phase 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: Low severity fire or Aroga moth infestation creates sagebrush/grass mosaic. Brush treatment with minimal soil disturbance; late-fall/winter grazing causing mechanical damage to sagebrush.
2.3b: High severity fire significantly reduces sagebrush cover leading to early mid-seral community

Transition T2A: Time and lack of disturbance and/or inappropriate grazing management (3.1)
Transition T2B: Catastrophic fire (4.1). Inappropriate grazing management in the presence of non-native annual species (4.2)
Transition T2C: Time and lack of disturbance allows trees to dominate site resources; may be coupled with inappropriate grazing management (5.1)

Shrub State 3.0 Community Phase Pathways
3.1a: Fire or severe Aroga moth infestation; brush management with minimal soil disturbance
3.2a: Time and lack of disturbance allows for regeneration of sagebrush

Restoration R3A: Brush management with minimal soil disturbance (i.e. mowing) coupled with seeding of desired native species(probability of success low)
Restoration R3B: Brush management with minimal soil disturbance (i.e. mowing) coupled with seeding of desired introduced species

Transition T3A: Catastrophic fire and/or soil disturbing treatments such as drill seeding, roller chopper, Lawson aerator etc. (4.1). Inappropriate grazing management in the presence of annual non-native species (4.2)
Transition T3B: Time and a lack of disturbance allows for trees to dominate site resources; may be coupled with inappropriate grazing management that favors shrub and tree dominance (5.1)

Annual State 4.0 Community Phase Pathways
4.1a: Time and lack of disturbance (unlikely to occur).
4.2a: Fire

Restoration R4A: Seeding of desired introduced species; may be coupled with brush management with minimal soil disturbance (i.e. no till drill, mowing etc.) Probability of success low.

Tree State 5.0 Community Phase Pathways
5.1a: Time and lack of disturbance allows for tree maturation.

Restoration R5A: Tree removal with minimal soil disturbance and seeding of desired species (6.1)

Transition T5A: Catastrophic fire (4.1)
Transition T5B: Time and lack of disturbance allows for trees to dominate site resources.

Seeded State 6.0 Community Phase Pathways
6.1a: Time and lack of disturbance allows for regeneration of sagebrush
6.2a: Fire, Aroga moth infestation and/or brush management with minimal soil disturbance.
6.2b: Time and lack of disturbance and/or inappropriate grazing management
6.3a: High severity fire significantly reduces sagebrush cover leading to early mid-seral community
6.3b: Low severity fire or Aroga moth infestation creates sagebrush/grass mosaic. Brush treatment with minimal soil disturbance; late-fall/winter grazing causing mechanical damage to sagebrush.

Transition T6A: Time and lack of disturbance allows for trees to dominate site resources; may be coupled with inappropriate grazing management that favors shrub and tree dominance (4.1)

Eroded State 7.0

Figure 6. T. Stringham July 2015

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
Perennial bunchgrasses/big sagebrush

The reference plant community is dominated by needle and thread, Indian ricegrass and big sagebrush. Commonly associated plants are Nevada bluegrass, thickspike wheatgrass and Thurber’s needlegrass. Potential vegetative composition is about 60 percent grasses, 10 percent forbs and 30 percent shrubs and trees. Approximate ground cover (basal and crown) is 15 to 25 percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	240	360	480
Shrub/Vine	117	172	228
Forb	40	60	80
Tree	3	8	12
Total	**400**	**600**	**800**

Community 1.2
Herbaceous

This community phase is characteristic of a post-disturbance, early-seral community. Needleandthread grass, Indian ricegrass, and other perennial bunchgrasses dominate. Depending on fire severity or intensity of Aroga moth infestation, patches of intact sagebrush may remain.

Community 1.3
Big sagebrush/perennial bunchgrasses (at risk)

Big sagebrush increases in the absence of disturbance. Decadent sagebrush dominates the overstory and the deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs and/or from herbivory.

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 small and patchy 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. A severe infestation of Aroga moth could also cause a large decrease in sagebrush giving a competitive advantage to the perennial grasses and forbs.

Pathway 1.1b
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 and lead to a reduced fire frequency allowing big sagebrush to dominate the site.

Pathway 1.2a
Community 1.2 to 1.1

Absence of disturbance over time would allow for sagebrush to increase.

Pathway 1.3a
Community 1.3 to 1.1

A low severity fire, Aroga moth or combination would reduce the sagebrush overstory and create a sagebrush/grass mosaic with sagebrush and perennial bunchgrasses co-dominant.

Pathway 1.3b
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 low severity resulting in a mosaic pattern due to low fine fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels, may be more severe and reduce sagebrush cover to trace amounts. A severe infestation of Aroga moth could also cause a large decrease in sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs.

State 2
Current Potential State

This state is similar to the Reference State 1.0. This state has the same three general 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.

Community 2.1
Perennial bunchgrasses/big sagebrush/annual non-native species present

Figure 8. Ashy Loam 8-10" (R025XY045NV) Phase 2.1 T. K. Stringham, June 2011

This community phase is similar to the Reference State Community Phase 1.1, with the presence of non-native species in trace amounts. Big sagebrush, needle and thread and Indian ricegrass dominate the site. Forbs and other shrubs and grasses make up smaller components of this site. Non-native species are present.

Community 2.2
Herbaceous

Figure 9. Ashy Loam 8-10" (R025XY045NV) Phase 2.2 T. K. Stringham, July 2011

This community phase is characteristic of a post-disturbance, early seral community phase. Needleandthread grass, Indian ricegrass and other perennial bunchgrasses dominate the site. Sagebrush is present in trace amounts. Depending on fire severity or intensity of Aroga moth infestations, patches of intact sagebrush may remain. Rabbitbrush may be sprouting. Perennial forbs may be a significant component for a number of years. Annual non-native species generally respond well after fire and may be stable or increasing within the community.

Community 2.3
Big sagebrush (at risk)

Figure 10. Ashy Loam 8-10" (R025XY045NV) Phase 2.3 T. K. Stringham, August 2011

Figure 11. Ashy Loam 8-10" (R025XY045NV) Phase 2.3 T. K. Stringham, August 2011

This community is at risk of crossing a threshold to another state. Sagebrush dominates the overstory and perennial bunchgrasses in the understory are reduced, either from competition with shrubs or from inappropriate grazing management, or from both. Rabbitbrush may be a significant component. Sandberg bluegrass may increase and become co-dominate with deep rooted bunchgrasses. Utah juniper 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 inappropriate grazing management, drought, and fire.

Pathway 2.1a
Community 2.1 to 2.2

Perennial bunchgrasses/big sagebrush/annual non-native species present

Herbaceous

Fire reduces the shrub overstory and allows for perennial bunchgrasses to dominate the site. Fires are typically low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels, may be more severe and reduce sagebrush cover to trace amounts. A severe infestation of Aroga moth could also cause a large decrease in sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs. Annual non-native species are likely to increase after fire.

Pathway 2.1b
Community 2.1 to 2.3

Perennial bunchgrasses/big sagebrush/annual non-native species present

Big sagebrush (at risk)

Time and lack of disturbance such as fire, allows for sagebrush to increase and become decadent. Chronic drought reduces fine fuels and leads to a reduced fire frequency allowing big sagebrush to dominate the site. Inappropriate grazing management reduces the perennial bunchgrass understory; conversely Sandberg bluegrass may increase in the understory depending on grazing management. Excessive sheep grazing favors Sandberg bluegrass; however, where cattle and/or horses are the dominant grazers, cheatgrass often increases.

Pathway 2.2a
Community 2.2 to 2.1

Herbaceous

Perennial bunchgrasses/big sagebrush/annual non-native species present

Absence of disturbance over time and appropriate herbivory management

Pathway 2.3a
Community 2.3 to 2.1

Big sagebrush (at risk)

Perennial bunchgrasses/big sagebrush/annual non-native species present

A change in grazing management that decreases shrubs would allow for the perennial bunchgrasses in the understory to increase. Heavy late-fall/winter grazing may cause mechanical damage and subsequent death to sagebrush, facilitating an increase in the herbaceous understory. An infestation of Aroga moth or a low severity fire would reduce some sagebrush overstory and allow perennial grasses to increase in the community. 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.

Pathway 2.3b
Community 2.3 to 2.2

Big sagebrush (at risk)

Herbaceous

Fire eliminates/decreases the overstory of sagebrush and allows for the understory perennial grasses to increase. Fires would typically be small and patchy due to low fine fuel loads. A fire following an unusually wet spring or change in management favoring an increase in fine fuels, may be more severe and reduce the shrub component to trace amounts. A severe infestation of Aroga moth would also cause a large decrease in sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs. Annual non-native species respond well to fire and may increase post-burn.

State 3
Shrub State

This state has two community phases: a Wyoming big sagebrush-dominated phase and a rabbitbrush-dominated phase. This state is a product of many years of heavy grazing during time periods harmful to perennial bunchgrasses. Sandberg bluegrass will increase with a reduction in deep rooted perennial bunchgrass competition and become the dominate grass. Sagebrush dominates the overstory and rabbitbrush may be a significant component. Sagebrush canopy cover is high and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The shrub overstory and Sandberg bluegrass understory dominate site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed.

Community 3.1
Shrubs/Sandberg bluegrass/annual non-native species (at risk)

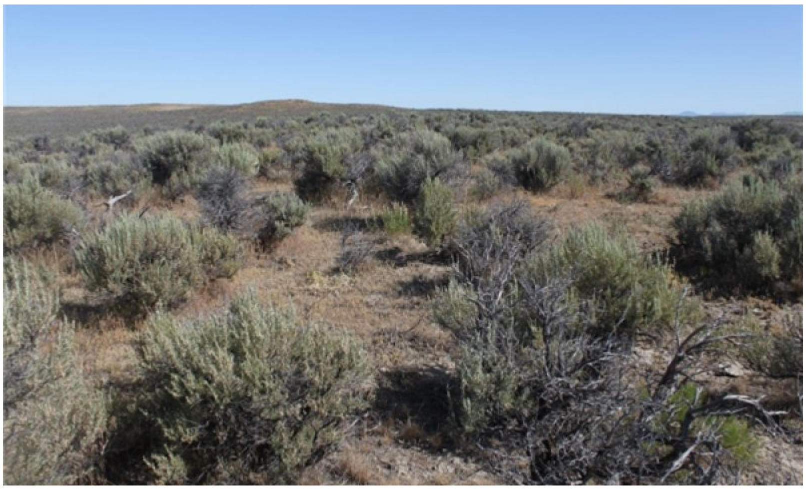

Figure 12. Ashy Loam (R025XY045NV) Phase 3.1 T. K. Stringham, July 2011

Figure 13. Ashy Loam (R025XY045NV) Phase 3.1 T. K. Stringham, July 2011

Decadent sagebrush dominates the overstory. Rabbitbrush may be a significant component. Deep-rooted perennial bunchgrasses may be present in trace amounts or absent from the community. Sandberg bluegrass and annual non-native species increase. Bare ground is significant. Utah juniper may be increasing due to lack of natural fire.

Community 3.2
Sandberg bluegrass/annual non-native species

Figure 14. Ashy Loam 8-10" (R025XY045NV) Phase 3.2 T. K. Stringham, June 2011

Bluegrass dominates the site; annual non-native species may be present but are not dominant. Trace amounts of sagebrush may be present. Sprouting shrubs such as rabbitbrush may increase.

Pathway 3.1a
Community 3.1 to 3.2

Shrubs/Sandberg bluegrass/annual non-native species (at risk)

Sandberg bluegrass/annual non-native species

Fire, heavy fall grazing causing mechanical damage to shrubs, and/or brush treatments with minimal soil disturbance, would greatly reduce the overstory shrubs to trace amounts and allow for Sandberg bluegrass to dominate the site.

Pathway 3.2a
Community 3.2 to 3.1

Sandberg bluegrass/annual non-native species

Shrubs/Sandberg bluegrass/annual non-native species (at risk)

Absence of disturbance over time would allow for sagebrush and other shrubs to recover. This pathway may take many years.

State 4
Annual State

This state has two community phases one dominated by annual non-native species and the other is a shrub dominated site. This community is characterized by the dominance of annual non-native species such as cheatgrass and tumble mustard (*Sisymbrium altissimum*) in the understory. Sagebrush and/or rabbitbrush may dominate the overstory.

Community 4.1
Annual non-native species

Annual non-native plants such as tumble mustard and cheatgrass dominate this site.

Community 4.2
Shrubs/annual non-native species

Rabbitbrush is typically the dominate overstory shrub. Sagebrush may be a significant component. Annual non-native species, likely cheatgrass and mustards, dominate the understory.

Pathway 4.1a
Community 4.1 to 4.2

Time and lack of fire allows for the sagebrush and/or rabbitbrush to establish. Probability of sagebrush establishment extremely low.

Pathway 4.2a
Community 4.2 to 4.1

Fire reduces or eliminates overstory brush component and allows for annual non-native species to dominate the site.

State 5
Tree State

This state has two community phases that are characterized by the dominance of Utah juniper in the overstory. Big sagebrush and perennial bunchgrasses may still be present, but they are no longer controlling site resources. Soil moisture, soil nutrients and soil organic matter distribution and cycling have been spatially and temporally altered.

Community 5.1
Utah juniper/Sandberg bluegrass

Figure 15. Ashy Loam 8-10” (R025Y045NV) Phase 5.1 T. K. Stringham, August 2011

Utah juniper dominates the overstory and site resources. Trees are actively growing with noticeable leader growth. Trace amounts of bunchgrasses may be found under tree canopies with trace amounts of Sandberg bluegrass and forbs in the interspaces. Sagebrush is stressed and dying. Annual non-native species are present under tree canopies. Bare ground interspaces are large and connected.

Community 5.2
Utah juniper

Figure 16. Ashy Loam 8-10” (R025Y045NV) Phase 5.2 T. K. Stringham, August 2011

Utah juniper dominates the site and tree leader growth is minimal; annual non-native species may be the dominant understory species and will typically be found under the tree canopies. Trace amounts of sagebrush may be present however dead skeletons will be more numerous than living sagebrush. Bunchgrass may or may not be present. Sandberg bluegrass or mat forming forbs may be present in trace amounts. Bare ground interspaces are large and connected. Soil redistribution is evident.

Pathway 5.1a
Community 5.1 to 5.2

Utah juniper/Sandberg bluegrass

Utah juniper

Time and lack of disturbance or management action allows Utah juniper to further mature and dominate site resources.

State 6
Seeded State

This state has three community phases: a grass-dominated phase, and grass-shrub dominated phase, and a shrub-dominated phase. This state is characterized by the dominance of seeded introduced wheatgrass species in the understory. Forage kochia and other desired seeded species including Wyoming big sagebrush and native and non-native forbs may be present. Soil nutrients and soil organic matter distribution and nutrient cycling are primarily driven by deep rooted bunchgrasses.

Community 6.1
Non-native perennial grasses and forb

Introduced wheatgrass species and other non-native species such as forage kochia dominate the community. Native and non-native seeded forbs may be present. Trace amounts of big sagebrush may be present, especially if seeded. Annual non-native species present.

Community 6.2
Sagebrush/seeded species/annual non-native species

Big sagebrush and seeded wheatgrass species co-dominate. Annual non-native species stable to increasing.

Community 6.3
Big sagebrush/rabbitbrush/annual non-native species

This community phase is at-risk of crossing a threshold to another state. Big sagebrush dominates. Rabbitbrush may be a significant component. Wheatgrass vigor and density reduced. Annual non-native species stable to increasing. Utah juniper may be present.

Pathway 6.1a
Community 6.1 to 6.2

Inappropriate grazing management particularly during the growing season reduces perennial bunchgrass vigor and density and facilitates shrub establishment.

Pathway 6.1b
Community 6.1 to 6.3

Fire

Pathway 6.2a
Community 6.2 to 6.1

Low severity fire, brush management, and/or Aroga moth infestation would reduce the sagebrush overstory and allow seeded wheatgrass species to become dominant.

Pathway 6.3a
Community 6.3 to 6.1

Fire eliminates/decreases the overstory of sagebrush and allows for the understory perennial grasses to increase. Fires would typically be low severity resulting in a mosaic pattern due to low fine fuel loads. A fire following an unusually wet spring or change in management favoring an increase in fine fuels, may be more severe and reduce the shrub component to trace amounts. A severe infestation of Aroga moth would also cause a large decrease in sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs. Brush treatments with minimal soil disturbance would also decrease sagebrush and release the perennial understory. Annual non-native species respond well to fire and may increase post-burn.

Pathway 6.3b
Community 6.3 to 6.2

A change in grazing management that decreases shrubs would allow for the perennial bunchgrasses in the understory to increase. Heavy late-fall/winter grazing may cause mechanical damage and subsequent death to sagebrush, facilitating an increase in the herbaceous understory. An infestation of Aroga moth would reduce some sagebrush overstory and allow perennial grasses to increase in the community. 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.

State 7
Eroded State

This state has one community phase that is dominated by Utah juniper. Abiotic factors including soil redistribution and erosion, soil temperature, soil crusting and sealing are primary drivers of ecological condition within this state. Soil moisture, soil nutrients and soil organic matter distribution and nutrient cycling are severely altered due to degraded soil surface conditions. Utah juniper dominates the overstory and herbaceous species may be present in trace amounts particularly under tree canopies. Regeneration of trees or herbaceous species is not evident.

Community 7.1
Utah juniper

Utah juniper dominates the overstory and herbaceous species may be present in trace amounts particularly under tree canopies. Dead sagebrush skeletons are prominent. Regeneration of trees or herbaceous species is not evident. Annual non-native species present primarily under tree canopies.

Transition T1A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass, mustards, halogeton (*Halogeton glomeratus*) and bur buttercup (*Ceratocephala testiculata*). Slow variables: Over time the annual non-native plants will increase within the community decreasing organic matter inputs from deep-rooted perennial bunchgrasses resulting in reductions in soil water availability for perennial bunchgrasses. Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual 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.

Transition T2A
State 2 to 3

Trigger: To Community Phase 3.1: Inappropriate, long-term grazing will decrease or eliminate deep rooted perennial bunchgrasses, increase Sandberg bluegrass and favor shrub growth and establishment. To Community Phase 3.2: Severe fire will remove sagebrush overstory, decrease perennial bunchgrasses and enhance Sandberg bluegrass. Slow variables: Long term decrease in deep-rooted perennial grass density resulting in a decrease in organic matter inputs and resulting in soil water decline. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and soil water storage.

Transition T2B
State 2 to 4

Trigger: To Community Phase 4.1: Severe fire. To Community Phase 4.2: Inappropriate grazing management that favors shrubs in the presence of non-native species. Slow variables: Increased production and cover of non-native annual species. Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs truncates, spatially and temporally, nutrient capture and cycling within the community. Increased, continuous fine fuels from annual non-native plants modify the fire regime by changing intensity, size and spatial variability of fires.

Transition T2C
State 2 to 5

Trigger: Time and lack of disturbance or management action allows for Utah Juniper to dominate. This may be coupled with grazing management that favors tree establishment by reducing understory herbaceous competition for site resources Slow variables: Over time the abundance and size of trees will increase resulting in reduced infiltration and increased runoff. Threshold: Trees dominate ecological processes and number of shrub skeletons exceed number of live shrubs.

Restoration pathway R3A
State 3 to 2

Brush management such as mowing, coupled with range seeding of deep-rooted native bunchgrasses. Restoration attempts causing soil disturbance will likely initiate a transition to an annual state.

Conservation practices

Brush Management
Range Planting

Transition T3A
State 3 to 4

Trigger: To Community Phase 4.1: Severe fire. To Community Phase 4.2: Inappropriate grazing management in the presence of annual non-native species. Slow variables: Increased production and cover of non-native annual species. Threshold: Increased, continuous fine fuels modify the fire regime by changing intensity, size and spatial variability of fires. Changes in plant community composition and spatial variability of vegetation due to the loss of perennial bunchgrasses and sagebrush truncate energy capture spatially and temporally thus impacting nutrient cycling and distribution.

Transition T3B
State 3 to 5

Trigger: Time and a lack of disturbance or management action allows for Utah Juniper to dominate site. This may be coupled with grazing management that favors tree establishment by reducing understory herbaceous competition for site resources. Slow variables: Over time the abundance and size of trees will increase reducing infiltration and increasing runoff. Threshold: Trees dominate ecological processes and number of shrub skeletons exceed number of live shrubs.

Restoration pathway R3B
State 3 to 6

Brush management such as mowing, coupled with seeding of deep rooted non-native wheatgrasses. Restoration attempts causing soil disturbance will likely initiate a transition to an annual state.

Conservation practices

Brush Management
Range Planting

Restoration pathway R4A
State 4 to 6

Seeding of deep-rooted bunchgrasses; may be coupled with brush management and/or herbicide. Probability of success is low to medium.

Conservation practices

Brush Management
Range Planting

Transition T5A
State 5 to 4

Trigger: Catastrophic fire causing a stand replacement event would transition Annual State 4.0. Inappropriate tree removal practices with soil disturbance would cause a transition to the Annual State 4. Slow variables: Increased production and cover of non-native annual species under tree canopies. Threshold: Closed tree canopy with non-native annual species dominant in the understory changes the intensity, size and spatial variability of fires. Changes in plant community composition and spatial variability of vegetation due to the loss of perennial bunchgrasses and sagebrush truncate energy capture and impact nutrient cycling and distribution.

Restoration pathway R5A
State 5 to 6

Tree removal and seeding of desired species. Tree removal practices that minimize soil disturbance are recommended. Probability of success declines with increased presence of non-native annual species (Community Phase 5.2).

Transition T5B
State 5 to 7

Trigger: Time and lack of disturbance allows for tree competition to eliminate herbaceous understory. Slow variables: Bare ground interspaces large and connected; water flow paths long and continuous; understory sparse, resulting in reduced infiltration and increased runoff. Threshold: Soil redistribution and erosion is significant and linked to vegetation mortality evidenced by pedestalling and burying of herbaceous species and / or lack of recruitment in the interspaces.

Transition AT6
State 6 to 5

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**			240–462	
	needle and thread	HECO26	*Hesperostipa comata*	120–210	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	90–150	–
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	12–48	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	12–48	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	12–30	–
2	**Secondary Perennial Grasses**			3–12	
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	3–12	–
	basin wildrye	LECI4	*Leymus cinereus*	3–12	–
	Sandberg bluegrass	POSE	*Poa secunda*	3–12	–
Forb					
3	**Perennial Forbs**			30–90	
	tufted wheatgrass	ELMA7	*Elymus macrourus*	12–48	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	3–18	–
	desertparsley	LOMAT	*Lomatium*	3–18	–
	globemallow	SPHAE	*Sphaeralcea*	3–18	–
Shrub/Vine					
4	**Primary Shrubs**			90–150	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	45–75	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	45–75	–
5	**Secondary Shrubs**			9–48	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	3–12	–
Tree					
6	**Evergreen**			3–12	
	Utah juniper	JUOS	*Juniperus osteosperma*	3–12	–

Animal community

Livestock/Wildlife Grazing Interpretations:
This site is suited for livestock grazing. Grazing management should be keyed to needleandthread grass and Indian ricegrass. Considerations for grazing management should include timing, intensity and duration of grazing.

Overgrazing leads to an increase in big sagebrush and a decline in understory plants like Indian ricegrass and needleandthread grass. Squirreltail and Sandberg bluegrass will increase temporarily with further degradation. Invasion of annual weedy forbs and cheatgrass could also occur, leading to a decline in squirreltail and an increase in bare ground. A combination of overgrazing and prolonged drought may lead to soil redistribution, increased bare ground and a loss in plant production.

Reduced bunchgrass vigor or density provides an opportunity for Sandberg bluegrass expansion and/or cheatgrass and other invasive species such as saltlover (Halogeton), bur buttercup (Certatocephala testiculata) and annual mustards to occupy interspaces. Sandberg bluegrass increases under grazing pressure (Tisdale and Hironaka 1981) and is capable of co-existing with cheatgrass. 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.

Needleandthread is a deep-rooted perennial bunchgrass which depends upon seed for reproduction; on drier sites where seed production is variable, it is easily removed by overgrazing (USDA 1988). Needleandthread is important to livestock, especially in the spring before fruits have developed. Needlegrasses are grazed in the fall only if the fruits are softened by rain.

Indian ricegrass is a preferred forage species for livestock and wildlife (Cook 1962, Booth et al. 2006). This species is often heavily utilized in winter because it cures well (Booth et al. 2006). It is also readily utilized in early spring as it is a source of green feed before most other perennial grasses have produced new growth (Quinones 1981). Booth et al. (2006) note that the plant does well when utilized in winter and spring. Cook and Child (1971), however, found that repeated heavy grazing reduces crown cover, which may reduce seed production, density, and basal area of these plants. Additionally, heavy early spring grazing reduces plant vigor and stand density (Stubbendieck 1985). In eastern Idaho, productivity of Indian ricegrass was at least 10 times greater in undisturbed plots than in heavily grazed ones (Pearson 1965). Cook and Child (1971) found significant reduction in plant cover after 7 years of rest from heavy (90%) and moderate (60%) spring use. The seed crop may be reduced where grazing is heavy (Bich et al. 1995). Tolerance to grazing increases after May, thus spring deferment may be necessary for stand enhancement (Pearson 1964, Cook and Child 1971); however, utilization of less than 60% is recommended.

Livestock browse Wyoming big sagebrush, but may use it only lightly when palatable herbaceous species are available. Basin big sagebrush is the least palatable of all the subspecies of big sagebrush. Basin big sagebrush may serve as emergency food during severe winter weather, but it is not usually sought out by livestock.

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:
Indian ricegrass is eaten by pronghorn in “moderate” amounts whenever available. In Nevada, it is consumed by desert bighorns. A number of heteromyid rodents inhabiting desert rangelands show preference for seed of Indian ricegrass. Indian ricegrass seed also provides food for many species. Doves, for example, eat large amounts of shattered Indian ricegrass seed lying on the ground.

Wyoming big sagebrush is preferred browse for wild ungulates. Pronghorn usually browse Wyoming big sagebrush heavily. Basin big sagebrush is browsed by mule deer from fall to early spring, but is not preferred. Sagebrush-grassland communities provide critical sage-grouse breeding and nesting habitats. Open Wyoming sagebrush communities are preferred nesting habitat. 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. Leks are often located on low sagebrush sites, grassy openings, dry meadows, ridgetops, and disturbed sites. Sage-grouse prefer mountain big sagebrush and Wyoming big sagebrush communities to basin big sagebrush communities. Many other wildlife species are dependent on the sagebrush ecosystem including the greater sage grouse, sage sparrow, pygmy rabbit and the sagebrush vole. Dobkin and Sauder (2004) identified 61 animal species, including 24 mammals and 37 birds, associated with the shrub-steppe habitats of the Intermountain West.

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 camping and hiking and has potential for upland and big game hunting.

Other products

Native Americans made tea from big sagebrush leaves. They used the tea as a tonic, an antiseptic, for treating colds, diarrhea, and sore eyes and as a rinse to ward off ticks. Big sagebrush seeds were eaten raw or made into meal. Some Native American peoples used the bark of big sagebrush to make rope and baskets. Indian ricegrass was traditionally eaten by some Native American peoples. The Paiutes used seed as a reserve food source.

Other information

Wyoming big sagebrush is used for stabilizing slopes and gullies and for restoring degraded wildlife habitat, rangelands, mine spoils and other disturbed sites. It is particularly recommended on dry upland sites where other shrubs are difficult to establish. Basin big sagebrush shows high potential for range restoration and soil stabilization. Basin big sagebrush grows rapidly and spreads readily from seed. Indian ricegrass is well-suited for surface erosion control and desert revegetation although it is not highly effective in controlling sand movement. Needleandthread grass is useful for stabilizing eroded or degraded sites.

Inventory data references

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

Soils and Physiographic features were gathered from NASIS.

Type locality

Location 1: Elko County, NV	
Township/Range/Section	T47N R69E S32
General legal description	Approximately 25 miles east of Jackpot, about 5 miles south of the Idaho/Nevada stateline and about 6 miles west of the Utah/Nevada stateline, Elko County, Nevada.

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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	05/14/2024
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

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

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial**

distribution on infiltration and runoff:

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-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:**

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17. **Perennial plant reproductive capability:**
